Joliet Army Ammunition Plant
Wilmington, Illinois

Final Five-Year Review Report
Soils Operable Unit

First Five-Year Review Report

Prepared for
U.S. Army Corps of Engineers
Louisville District
Louisville, Kentucky

Total Environmental Restoration Contract
DACW27-97-D-0015 Task Order 4014

April 2004

MWH

"1A1Y

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

MAY 06 2004

Mr. Arthur Holz
Commander's Representative
Joliet Army Ammunition Plant
29401 South Route 53
Wilmington, IL 60481-8879

REPLY TO THE ATTENTION OF S-6J

RE: Joliet Army Ammunition Plant (JOAAP) Five-Year Review Reports

Dear Mr. Holz:

The U.S. Environmental Protection Agency, Region 5 (USEPA) has reviewed the *Final Five-Year Review Report, Groundwater Operable Unit* and the *Final Five-Year Review Report, Soils Operable Unit*, dated April 2004, for JOAAP developed by MWH Americas, Inc. for the Army. These documents constitute the first five-year review for JOAAP.

USEPA concurs with Army's protectiveness determinations made for JOAAP. We also agree with the recommendations and follow-up actions suggested in the reports.

If you have any questions, please contact Diana Mally of my staff at (312) 886-7275.

Sincerely,

Richard C Karl

Richard C. Karl, Acting Director
Superfund Division

cc: N. Wilson, Illinois EPA
R. Walton, AEC
M. Thompson, USACE - Louisville
B. Evens, USACE - Louisville
K. Adams, MWH
R. Kwasneski, JADA
K. Minckler, USDA
B. Bowden, Joliet RAB

DEPARTMENT OF THE ARMY
JOLIET ARMY AMMUNITION PLANT
29401 S ROUTE 53
WILMINGTON IL 60481-8879

REPLY TO
ATTENTION OF
Site Manager

27 April 2004

Ms. Diana Mally
US Environmental Protection Agency
ATTN: SRF 5J
77 West Jackson Boulevard
Chicago, IL 60604-3590

SUBJECT: Five-year Review, Soil Operable Unit Final Report,
Joliet Army Ammunition Plant (JOAAP), IL

1. Forwarded for your approval and acceptance is the subject report.

2. The point of contact is the undersigned at 815/423-2870.

Sincerely,

Arthur M. Holz
Site Manager

Encl
CF: w/encl
ILEPA (Ms. Wilson)
CELRL-DL-B (Ms. Thompson)
JOAAP RAB (Mr. Bowden)
SFIM-AEC-CDP (Mr. Walton)

DEPARTMENT OF THE ARMY
JOLIET ARMY AMMUNITION PLANT
29401 S ROUTE 53
WILMINGTON IL 60481-5679

REPLY TO
ATTENTION OF
Site Manager

27 April 2004

Ms. Nicole Wilson
Illinois Environmental Protection Agency
1021 North Grand Avenue East
PO Box 19276
Springfield, IL 62794-9276

SUBJECT: Five-year Review, Soil Operable Unit Final Report, Joliet Army Ammunition Plant (JOAAP), IL

1. Forwarded for your approval and acceptance is the subject report.

2. The point of contact is the undersigned at 815/423-2870.

Sincerely,

Arthur M. Holz
Site Manager

Encl
CF: w/encl
USEPA (Ms. Mally)
CELRL-DL-B (Ms. Thompson)
JOAAP RAB (Mr. Bowden)
SFIM-AEC-CDP (Mr. Walton)

MWH
MONTGOMERY WATSON HARZA

April 27, 2004

Department of the Army
US Army Corps of Engineers, Louisville District
Rock Island Arsenal, Bldg. 102
1st Floor West Wing
ATTN: CELRL-CD-W-V (Don Peterson)
Rock Island, IL 61299

Subject: Final First Five-Year Review Report
Soils Operable Unit
Joliet Army Ammunition Plant (JOAAP)
Contract DACW27-97-D-0015, Task Order 4014

Dear Mr. Peterson:

MWH Americas, Inc. (MWH) is pleased to submit the Final First Five-Year Review Report for the Soils Operable Unit (SOU) at the Joliet Army Ammunition Plant (JOAAP) in Wilmington, Illinois. The First Five-Year Review of the SOU, pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section (§) 121 and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), was performed to evaluate the technical performance of the remedies implemented at the site and to assess the current and anticipated future protectiveness of human health and the environment at JOAAP. All comments from the USEPA and IEPA from the Draft Final Five-Year Review Report have been addressed in this document. Those comments and the Army responses are included in Appendix F.

According to the data reviewed, site inspections, interviews, and technical assessment, the selected remedies are functioning as intended by the *Record of Decision (ROD), Soil and Groundwater Operable Units, Manufacturing and Load-Assemble-Package Areas* (U.S. Army, October 1998). The remedial action (RA) activities have been implemented successfully as verified by confirmation sampling and routine inspections at the sites. There have been no changes in physical conditions at the sites that would affect the protectiveness of the remedies. Applicable or Relevant and Appropriate Requirements (ARARs) for soils sited in the October 1998 ROD are being met. There have been no significant changes in toxicity factors or exposure assumptions used to establish the baseline risk assessment for contaminants of concern (COCs) that would affect the protectiveness of the remedies. Institutional controls are being effectively implemented at the sites where RA activities have not been conducted. There were no O&M issues identified during the Five-Year Review that could affect the protectiveness of the selected remedies.

Copies of the Final First Five-Year Review Report - Soils Operable Unit, are also being distributed to the project team as indicated on the distribution list below.

Joliet Field Office
29407 South, Route 53
Wilmington, Illinois
60481

Tel: 815 423 6841
Fax: 815 423 6848

MWH
MONTGOMERY WATSON HARZA

If you have any comments or questions regarding this submittal, please do not hesitate to contact me.

Sincerely,

MWH AMERICAS, INC.

Kurt L. Adams
Task Order Manager

Enclosures: Final First Five-Year Review Report - Soils Operable Unit

Distribution:

AEC – Holz (3)
AEC - Mellema
AEC - Walton
USEPA – Mally (2)
Illinois EPA – Wilson (2)
USACE LRL – Thompson
USACE - Gerard
USACE-LRL – Evens
TechLaw – Uecker
JOAAP RAB – Bowden

NEC/nec/KLA
J:\5-Year Review\SOU 5-Year Review\Final 5-Year Review\CvrLtr - Final SOU 5-yr Review.doc
2440041.37070101

Joliet Field Office
29407 South, Route 53
Wilmington, Illinois
60481

Tel: 815 423 6841
Fax: 815 423 6848

Five-Year Review Report

First Five-Year Review Report

for

Joliet Army Ammunition Plant (JOAAP)
Soils Operable Unit

Will County, Illinois

April 2004

Prepared for:
United States Army Corps of Engineers
Louisville, Kentucky

Prepared by:

MWH Americas, Inc.
Wilmington, Illinois

Prepared by: _____ 4-26-2004
Neil E. Carney — Date
Project Engineer

Reviewed by: _____ 4-26-04
Vivek Agrawal — Date
ITR Team Member

Approved by: _____ 4/26/04
Kurt L. Adams — Date
Task Order Manager

TABLE OF CONTENTS

TABLE OF CONTENTS
(CONTINUED)

TABLE OF CONTENTS
(CONTINUED)

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ACRONYMS AND ABBREVIATIONS

AEHA	United States Army Environmental Hygiene Agency
AOP	Northern Ammonia Oxidation Plant
ARAR	Applicable or Relevant and Appropriate Requirement
AST	Aboveground Storage Tank
ATV	All Terrain Vehicle
BNA	Base Neutral Aromatic
BNSF	Burlington Northern Santa Fe
BTAG	Biological Technical Assistance Group
BTF	Bioremediation Treatment Facility
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CHPPM	United States Army Center for Health Promotion and Preventative Medicine
COC	Contaminants of Concern
CY	cubic yard
DNT	Dinitrotoluene
ft	feet/foot
FFA	Federal Facilities Agreement
FOST	Finding of Suitability to Transfer
FS	Feasibility Study
GMZ	Groundwater Monitoring Zone
GOU	Groundwater Operable Unit
HDPE	High Density Polyethylene
HMX	High Melting Point Explosive
HRS	Hazard Ranking System
IDOT	Illinois Department of Transportation
IEPA	Illinois Environmental Protection Agency
in	inch
IOC	Industrial Operations Command
JADA	Joliet Arsenal Development Authority
JOAAP	Joliet Army Ammunition Plant
LAP	Load-Assembly-Package
lbs	pound
LLDPE	Low Linear Density Polyethylene
MEC	Munitions and Explosives of Concern
MFG	Manufacturing
MWH	MWH Americas, Inc.
NCP	National Contingency Plan
NFA	No Further Action
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NT	Nitrotoluene
O&M	Operation & Maintenance
OU	Operable Unit(s)
PCB	Polychlorinated Biphenyl

ACRONYMS AND ABBREVIATIONS
(Continued)

PL	Public Law
ppm	parts per million
PRG	Preliminary Remediation Goals
PVC	Polyvinyl Chloride
RA	Remedial Action
RAB	Restoration Advisory Board
RAO	Remedial Action Objectives
RCRA	Resource Conservation and Recovery Act
RD/RA	Remedial Design/Remedial Action
RDX	Royal Demolition Explosive
R&D	Research and Development
RG	Remediation Goal
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
SAP	Sampling and Analysis Plan
sf	square foot (feet)
SOU	Soils Operable Unit
SRU	Soil Remediation Unit
TBCs	To Be Considereds
TCLP	Toxicity Characteristic Leaching Procedure
TERC	Total Environmental Restoration Contract
TNB	1,3,5-trinitrobenzene
TNT	Trinitrotoluene
TPH	Total Petroleum Hydrocarbons
TSCA	Toxic Substances Control Act
µg/g	microgram per gram
USACE	United States Army Corps of Engineers
USAEC	United States Army Environmental Center
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
UV	Ultraviolet
UXO	Unexploded Ordnance
VOC	Volatile Organic Compound
WCLF	Will County Landfill

EXECUTIVE SUMMARY

MWH Americas, Inc. (MWH), formerly known as Montgomery Watson Harza, has been contracted by the United States Army Corps of Engineers (USACE) to conduct the statutory First Five-Year Review of the Soils Operable Unit (SOU) at the Joliet Army Ammunition Plant (JOAAP) in Wilmington, Illinois. MWH completed the work on behalf of USACE between December 2003 and January 2004 under the Total Environmental Restoration Contract (TERC) DACW27-97-D-0015 Task Order 4014.

The First Five-Year Review of the SOU, pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section (§) 121 and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), was performed to evaluate the effectiveness of the remedies implemented at the site and to assess the current and anticipated future protectiveness of human health and the environment at JOAAP. The trigger action for this five-year review was the start of construction for the soil stockpile area at the Site M4 Bioremediation Facility on May 5, 1999.

The *Record of Decision (ROD), Soil and Groundwater Operable Units, Manufacturing and Load-Assemble-Package Areas, National Priority List Sites* (U.S. Army, October 1998) identified final remedial goals (RGs) and selected remedies for 19 sites within JOAAP. In addition, fourteen sites within JOAPP, also identified in the October 1998 ROD, are awaiting determination of final RGs and selected remedies.

The Phase 1 - Remedial Design/Remedial Action (RD/RA) workplan, submitted by USACE in April 1999, included technical design of remedial action (RA) activities to be conducted at the 19 contaminated sites with selected remedies and final RGs.

The following summarizes the current status of the 19 final RA, and fourteen interim sites identified in the October 1998 ROD:

- Six sites (L11, L16, L17, M5, M7, and, M8) have achieved closure status for soil-related contaminants of concern (COCs).

- Five sites (L1, L7, L8, L9, and L10) have achieved closure status for polychlorinated biphenyl (PCB)-related contaminants. Other forms of soil-related contamination exists at the sites and will be addressed once final RGs have been designated for lands intended for transfer to the United States Department of Agriculture (USDA).

- Site M6 is currently under going remediation for explosives and metals contamination.

- Implementation of RA activities at the six landfill sites (L3, L4, M1, M9, M11, and M13) is projected to begin in FY2006.

- Soils at Site L5 were characterized with PCB-related contaminants. Site L5 is scheduled for transfer to the USDA. Cost-effective implementation of the selected remedy for PCB-soils was not possible at Site L5 without determination of final RGs for the other COCs that exist

at the site. RA activities will be conducted for all COCs at Site L5 once final RGs are determined for the land intended for transfer to the USDA.

- Access controls in the form of fencing and security patrols are being effectively implemented at each interim remedial action site to minimize exposure to potential risks. Access controls will be monitored until the RA activities are complete at each respective site.

- No Further Action (NFA) sites (L6 and M16) with impacted soils that do not allow for unlimited use and unrestricted exposure have institutional controls (deed restrictions) effectively implemented at each site.

According to the data reviewed, site inspections, interviews, and technical assessment, the selected remedies are functioning as intended by the October 1998 ROD. RA activities have been implemented successfully as verified by confirmation sampling and routine inspections at the sites.

At sites where RA activities have been completed for soil-related COCs, RGs have been met and the selected remedies are protective of human health and the environment. Potential threats identified in the October 1998 ROD at these sites have been addressed. Applicable or Relevant and Appropriate Requirements (ARARs) for soils cited in the October 1998 ROD are being met. At sites where RA activities are complete and the land has been transferred, the new occupier submits certification of compliance for implementation of institutional controls, specified in the property deed, to the Army on an annual basis.

At sites where RA activities have not been completed or are ongoing, the selected remedies are expected to be protective of human health and the environment upon completion. In the interim, exposure pathways that could result in unacceptable risks are being controlled through access controls in the form of security patrols and fencing.

There have been no changes in physical conditions at JOAPP or toxicity factors or exposure assumptions used to establish the baseline risk assessment for COCs, that would affect the protectiveness of the selected remedies.

There were no operation and maintenance (O&M) issues identified during the Five-Year Review that could affect the protectiveness of the selected remedies. There is no other information that could call into question the protectiveness of the remedies.

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION

Site name: Joliet Army Ammunition Plant

EPA ID : IL7213820460 (Manufacturing Area)
IL0210090049 (Load-Assemble-Package Area)

Region: V	**State: IL**	**City/County: Wilmington / Will**

SITE STATUS

NPL status: ■ Final □ Deleted □ Other (specify)

Remediation status (choose all that apply): ■ Under Construction ■ Operating ■ Complete

Multiple OUs?* ■ YES □ NO	**Construction completion date:** N/A

Has site been put into reuse? ■ YES □ NO

REVIEW STATUS

Lead agency: □ EPA □ State □ Tribe ■ Other Federal Agency - **U.S. Army**

Author name: Neil E. Carney

Author title: Project Engineer	**Author affiliation: USACE Consultant**

Review period:** 05 / 05 / 1999 to 05 / 04 / 2004

Date(s) of site inspection:

L1 – March 9, 2004
L2 – March 9, 2004
L3 – March 9, 2004
L4 – March 9, 2004
L5 – March 9, 2004
L7 - March 9, 2004
L8 - March 9, 2004
L9 - March 9, 2004
L10 - March 9, 2004
L11 - March 9, 2004
L14 - March 9, 2004
L16 - March 9, 2004
L17 - March 9, 2004
L23A - March 9, 2004

M1 – January 14, 2004
M2 - March 9, 2004
M3 - March 9, 2004
M4 – January 14, 2004
M5 – March 9, 2004
M6 – January 14, 2004
M7 – March 9, 2004
M8 – March 9, 2004
M9 – January 14, 2003
M11 – March 9, 2004
M12 – March 9, 2004
M13 – March 9, 2004

Type of review:

■ Post-SARA □ Pre-SARA □ NPL-Removal only
□ Non-NPL Remedial Action Site □ NPL State/Tribe-lead
□ Regional Discretion

Review number: ■ 1 (first) □ 2 (second) □ 3 (third) □ Other (specify)

Triggering action:

■ RA Activities for soil stockpile construction at Site M4 □ Actual RA Start at OU#____
□ Construction Completion □ Previous Five-Year Review Report
□ Other (specify)

Triggering action date *(from WasteLAN)*: 05 / 05 / 1999

Due date *(five years after triggering action date)*: 05 / 04 / 2004

FIVE-YEAR REVIEW SUMMARY FORM
(Continued)

ISSUES:

The first Five-Year Review identified ten issues related to site operations, which are listed below. None of the issues identified affect the long-term protectiveness of the selected remedy at those sites. A summary of the issues is listed below.

1) **Site M1** - 24, ¼ inch diameter, holes in the low linear density polyethylene (LLDPE) liner were encountered during a routine site inspection on December 9, 2003. One, 3 inch diameter, hole from burrowing rodent (mouse) is located 11 panels to the east of the western edge of Ash pile on North side.

   Two split seams (3 inch tears) are located 7 panels to the east of the western edge of Ash pile on South side.

2) **Site M6** - Excavations below and around some of the building foundations were abandoned due to groundwater infiltration into the excavation area. Additional excavation activities will not be conducted at these locations to remove soils above RGs.

3) **Site M9** - Operation of leachate re-circulation system has been permanently discontinued due to technical problems and maintenance issues.

4) **Site M9** - One sinkhole (10ft diameter, 3ft depth) in the existing cap was observed during a site inspection conducted on January 14, 2004.

5) **Site M9** - One, ten inch diameter, hole in the existing cap created by a burrowing animal was observed during a site inspection conducted on January 14, 2004.

6) **Site L1** - Site perimeter fencing does not have a padlock on the main entrance gate. Observation noted during site inspection conducted on March 9, 2004.

7) **Site L3** - Rear entrance gate to the site has been destroyed. Observation noted during site inspection conducted on March 9, 2004.

8) **Site L9** - No gate is present at the entrance to the site. Observation noted during site inspection conducted on March 9, 2004.

9) **Site L10** - Gate along Victory Drive is open and unlocked. Observation noted during site inspection conducted on March 9, 2004.

10) **Site L11** - Site perimeter fencing does not have a padlock on the main entrance gate. Observation noted during site inspection conducted on March 9, 2004.

RECOMMENDATIONS AND FOLLOW-UP ACTIONS:

The following recommendations and follow-up actions are suggested for the issues identified during the Five-Year Review.

1) **Site M1** - Repair split seams and burrowing rodent hole. Monitor any increase in size of the 24, 1A inch diameter, holes in the liner. Monitoring of liner to be conducted during current routine inspections. Repairs to the exiting split seams and burrowing rodent hole to be conducted by July 1,2004.

2) **Site M6** - This scenario was anticipated and addressed in the Phase 1 - RD/RA Workplan. Excavations were backfilled in accordance with USEPA-approved workplan; no further action is necessary.

3) **Site M9** - The re-circulation system does not affect leachate collection. Maintain current leachate collection and disposal activities. Continue routine site inspections to monitor any new occurrences of leachate seepage from the existing cap.

4) **Site M9-a**) Establish roped area around the perimeter of the sinkhole as a preventative measure to keep site workers and visitors from falling into the sinkhole.

   Site M9-b) Monitor size and depth of sinkhole on a weekly basis. If increase in size or depth is observed, conduct activities to repair.

5) **Site M9** - Repair burrow hole in existing cap. Repairs to be conducted by July 1, 2004.

6) **Site L1** - Place a padlock on main entrance gate. To be conducted immediately.

7) **Site L3** - Replace gate and padlock at rear entrance to the site. Repairs to be conducted by July 1, 2004.

8) **Site L9** - Construct a gate/fencing or place "no entry" signs at entrance to site. Repairs to be conducted by July 1, 2004.

9) **Site L10** - Close gate and place padlock to secure site. To be conducted immediately.

10) **Site L11** - Place a padlock on main entrance gate. To be conducted immediately.

PROTECTIVENESS STATEMENTS:

SRU1 Soils - Bioremediation

Sites M5, M7, and L16

Remedial actions at Sites M5, M7, and L16 are complete. Potential threats at the sites have been addressed through excavation and bioremediation of explosives contaminated soils, and implementation of institutional controls in the form of deed restrictions, and/or access controls in the form of security patrols and fencing. Current data indicate that industrial RGs have been met and the sites are protective of human health and the environment.

Site M6

The remedy at Site M6 is expected to be protective of human health and the environment upon completion. In the interim, exposure pathways that could result in unacceptable risks are being addressed through access controls in the form of security patrols. RA activities will be implemented during FY2004 to address remaining contamination at the site. Current confirmation sampling results indicate that the selected remedy is functioning as required to achieve industrial RGs at the site. Potential threats at the site will be addressed through excavation and bioremediation of explosives contaminated soils, and implementation of institutional controls.

Sites L1, L7, L8, L9, L10, L14, M2, and M3 (SRU1 Interim Sites)

The remedy at Sites L1, L7, L8, L9, L10, L14, M2, and M3 is protective of human health and the environment in the short-term, through the implementation of access controls in the form of fencing and/or security patrols. However, in order for the remedy to be protective in the long-term, RA activities must be implemented to address SRU1 impacted soils at each site. Access controls will continue to be implemented at each site to minimize unacceptable risks until RA activities are complete.

SRU2 Soils - Excavation and Disposal

Site L11

Remedial action at Site L11 is complete. Potential threats at the site have been addressed through excavation and disposal of metals contaminated soils. Access controls in the form of security patrols and fencing are currently being implemented at the site. Current data indicate that industrial RGs have been met and the site is protective of human health and the environment.

Site L2, L3, L5, L23A, M3, M4, and M12 (SRU2 Interim Sites)

The remedy at Sites L2, L3, L5, L23A, M3, M4, and M12 is protective of human health and the environment in the short-term, through the implementation of access controls in the form of fencing and/or security patrols. However, in order for the remedy to be protective in the long-term, RA activities must be implemented to address SRU2 impacted soils at each site. Access controls will continue to be implemented at each site to minimize unacceptable risks until RA activities are complete.

SRU3 Soils - Bioremediation and Disposal, and Excavation and Disposal

Site M5

Remedial actions at Site MS are complete. Potential threats at the site have been addressed through excavation and bioremediation of metals and explosives contaminated soils, and implementation of institutional controls. Current data indicate that industrial RGs have been met and the site is protective of human health and the environment.

Site M6
The remedy at Site M6 is expected to be protective of human health and the environment upon completion. In the interim, exposure pathways that could result in unacceptable risks are being addressed through access controls in the form of security patrols. RA activities will be implemented during FY2004 to address remaining contamination at the site. Current confirmation sampling results indicate that the selected remedy is functioning as required to achieve industrial RGs at the site. Potential threats at the site will be addressed through excavation and bioremediation of explosives contaminated soils, and implementation of institutional controls.

Sites L2 and L3 (SRU3 Interim Sites)
The remedy at Sites L2, and L3 is protective of human health and the environment in the short-term, through the implementation of access controls in the form of fencing and security patrols. However, in order for the remedy to be protective in the long-term, RA activities must be implemented to address SRU3 impacted soils at each site. Access controls will continue to be implemented at each site to minimize unacceptable risks until RA activities are complete.

SRU4 Soils - Excavation/Incineration and Disposal
Site L17
Remedial action at Site L17 is complete. Potential threats at the site have been addressed through excavation and disposal of PCB-contaminated soils, and implementation of access controls in the form of security patrols and fencing. Current data indicate that industrial RGs have been satisfied and the site is protective of human health and the environment.

Sites L1, L7, L8, L9, and L10
The remedy for SRU4 soils at Sites L1, L7, L8, L9, and L10 is protective of human health and the environment. Potential threats associated with SRU4 soils have been addressed through excavation and disposal of PCB-contaminated soils, and implementation of access controls in the form of security patrols and fencing. Current data indicate that final RGs for PCBs have been met at the sites.

However, in order for the sites to be considered protective in the long-term, additional remedial actions must be implemented. Other forms of contamination, potentially harmful to human health and the environment, have been identified at the sites and must be addressed once final RGs are established. Access controls in the form of security patrols and fencing are currently implemented to minimize risk from potential hazards at the sites.

Site L5
The remedy for SRU4 soils at Site L5 is expected to be protective of human health and the environment upon completion. In the interim, exposure pathways that could result in unacceptable risks are being controlled through access controls in the form of security patrols and fencing. Potential threats associated with SRU4 soils at the site will be addressed through excavation and disposal of PCB-contaminated soils and implementation of institutional controls. RA activities will be implemented once final RGs are designated for other contaminants present at the site.

SRU5 Soils - Excavation and Disposal

Sites L1 and L5 (Interim Sites)

The remedy at Sites L1 and L5 is protective of human health and the environment in the short-term, through the implementation of access controls in the form of fencing and security patrols. However, in order for the remedy to be protective in the long-term, RA activities must be implemented to address SRU5 impacted soils at each site. Access controls will continue to be implemented at each site to minimize unacceptable risks until RA activities are complete.

SRU6 Soils - Capping or Excavation and Disposal

Sites L4, M1, M9, M11, and M13

The remedy for Sites L4, Ml, M9, M11, and M13 is expected to be protective of human health and the environment upon completion. In the interim, exposure pathways that could result in unacceptable risks are being controlled through access controls in the form of security patrols and/or fencing. Interim O&M activities have been successfully implemented at Sites M1 and M9 and are functioning to prevent unacceptable migration of contaminants from these sites. Threats associated with SRU6 soils at the sites will be addressed through capping or excavation and disposal of SRU6 soils and implementation of institutional controls.

Site L3

The remedy for SRU6 soils at Site L3 is expected to be protective of human health and the environment upon completion. In the interim, exposure pathways that could result in unacceptable risks are being controlled through access controls in the form of security patrols and fencing. Potential threats associated with SRU6 soils at the site will be addressed through capping of SRU6 soils and implementation of institutional controls. Other forms of contamination are present at Site L3 and will be addressed once final RGs are designated for the site.

SRU7 Soils - Removal and Recycle or Disposal

Site M8

Remedial action at Site M8 is complete. SRU7 impacted soils at the site have been addressed through excavation and disposal of surficial sulfur and implementation of institutional controls. Site M8 is considered to be protective of human health and the environment.

Site M12

The remedy for SRU7 soils at Site Ml2 is expected to be protective of human health and the environment upon completion. In the interim, exposure pathways that could result in unacceptable risks are being controlled through access controls in the form of security patrols. Potential threats associated with SRU7 soils at the site will be addressed through Removal and Recycle or Disposal of SRU7 soils, and implementation of institutional controls. Other forms of contamination are present at Site M12 and will be addressed once final RGs are designated for the site.

No Further Action Sites

Site L6

Removal actions at Site L6 are complete. Potential threats at the site have been addressed through excavation and disposal of impacted soils, and implementation of institutional controls. Deed restrictions limiting land use for industrial purposes are being enforced. Current data indicate that industrial RGs are satisfied and the site is protective of human health and the environment.

Site M16

Current data indicate that impacted soils at Site M16 satisfy industrial RGs. Deed restrictions limiting land use for industrial purposes are being enforced. Soils at Site Ml6 are protective of human health and the environment.

1.0 INTRODUCTION

The purpose of the five-year review is to determine whether the remedy at a site is protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in Five-Year Review reports. In addition, Five-Year Review reports identify issues found during the review, if any, and identify recommendations to address them.

The United States Army is the lead agency conducting this five-year review. MWH is preparing this Five-Year Review report on behalf of the USACE pursuant to CERCLA §121 and the NCP. CERCLA § 121 states:

> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

This requirement is further interpreted in the NCP; 40 Code of Federal Regulations (CFR) §300.430(f)(4)(ii) states:

> *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*

MWH conducted the five-year review for the remedies implemented at the JOAAP, Wilmington, Illinois. The site inspection and this review were conducted by the Project Engineer for JOAAP from December 10, 2003 through March 9, 2004. This report documents the results of the review.

This is the first five-year review for the JOAAP. The triggering action for this statutory review is the initiation of the remedial action on May 5, 1999. The five-year review is required due to the fact that hazardous substances, pollutants, or contaminants remain at sites within the SOUs at JOAAP above levels that allow for unlimited use and unrestricted exposure.

An additional Five-Year Review document is being prepared for the Groundwater Operable Units (GOUs) at JOAAP. The GOU five-year review will encompass all sites at JOAAP where groundwater monitoring/remediation has been conducted since the initiation of the remedial action on May 5, 1999.

2.0 SITE CHRONOLOGY

Event	Date
The JOAAP was constructed to manufacture, load, assemble, pack and ship bombs, projectiles, fuses and supplementary charges.	During World War II
Production of explosives halted; sulfuric acid and ammonium nitrate plants leased out; other production facilities put in layaway status.	1945
Production of explosives reactivated.	Korean and Vietnam Wars
Gradual decrease in production of explosives during the Vietnam War, then stopped completely.	1977
U.S. Army Environmental Center conducted	1978
Installation Assessment and reported potential environmental impacts at former industrial areas. Installation Restoration Survey conducted by Donohue and Associates and included soil, groundwater, surface water and sediment samples at the manufacturing (MFG) and load-assemble-packaging (LAP) areas.	1981-1982
Phase II investigation conducted by Donohue and Associates for additional data on previously sampled sites at MFG and LAP to assess off-site impacts. No off site contamination identified.	1983
Uniroyal (JOAAP's operating contractor) conducted a remedial action to remove contaminated surface water and sediments from Red Water Lagoon at M7.	1983-1985
Pre-remediation sampling at the Red Water Lagoon by Donohue.	1983
Post-remediation sampling at the Red Water Lagoon by Donohue.	1985
U.S. Army Environmental Hygiene Agency performed groundwater sampling at selected existing monitoring wells. This was part of JOAAP's Resource Conservation Recovery Act (RCRA) groundwater monitoring program at Site M13 and Red Water Lagoon M-7.	1983-1985
MFG Area at JOAAP proposed for listing on National Priorities List (NPL).	1984
LAP Area at JOAAP proposed for listing on NPL.	1985
Groundwater and surface water samples collected from previously sampled areas at MFG and LAP area.	1985 and 1986
Dames and Moore presented groundwater and surface water data in a Site Assessment Report which discussed feasibility and need for remediation.	1986
Final NPL Listing for MFG at JOAAP.	1987
Dames and Moore conducts Phase I and II RIs at MFG Area. Eighteen study areas identified for investigation.	1988-1993

Event	Date
Final NPL Listing for LAP at JOAAP.	1989
Federal Facilities Agreement (FFA) between the Army, United States Environmental Protection Agency (USEPA), and Illinois Environmental Protection Agency (IEPA) under CERCLA Section 120 and RCRA Sections 6001, 3008(h), and 3004(v). The FFA was to ensure investigations and remediation would be conducted.	1989
USACE investigated underground storage tanks (UST's) at JOAAP. One hundred seven USTs were identified, inventoried, and evaluated.	1989
Most USTs identified by USACE were removed.	1989-1993
Dames and Moore conducts Phase I and II Remedial Investigations (RI's) at MFG Area. Eighteen study areas identified for investigation.	1983-1993
Dames and Moore conducts Phase I and II RI's at LAP Area. Thirty-five study areas were investigated.	1991-1994
United States Army Center for Health Promotion and Preventative Medicine (CHPPM) conducted ecological risk assessments to evaluate if site contamination is impacting ecological receptors.	1993-1996
Baseline Risk Assessments conducted by Dames and Moore to quantify the potential human health risks posed by contamination identified by the RI's at the MFG and LAP areas.	1994 and 1995
United States Army CHPPM issues Phase I Ecological Risk Assessment Report.	1994
Field Screening of soil for explosives. Results included in feasibility studies (FS).	1995
United States Army CHPPM issues Phase II Aquatic Ecological Risk Assessment Report.	1996
Preliminary Remediation Goals (PRGs) established based on the risk assessments by OHM.	1996
USACE conducted removal action for wastes at study area L2.	1996
USACE conducted removal action for PCB switch boxes from MFG area.	1996
USACE conducted a removal action along Prairie Creek at Site L3.	1996
Public Law 104-106 of Fiscal Year 1996 Department of Defense Authorization Act legislated specific terms for conveyance of JOAAP to various entitles.	1996
USACE performed interim O&M activity at the southern ash pile at area M1.	1997
USACE conducted a removal action for organics and PCB contaminated soil at area L6.	1997
Separate FSs prepared for the GOU and SOU for both the LAP (Dames and Moore) and MFG (OHM) areas.	1997

Event	Date
Proposed Plan for SOU and Proposed Plan for GOU prepared by U.S. Army to provide rationale for proposed remedies.	1997
Proposed Plan for SOU and Proposed Plan for GOU presented at a public meeting.	January 1998
Predesign Investigation activities including soil and groundwater sampling at MFG and LAP areas by MWH.	1998
ROD for SOU and GOU at MFG and LAP Areas is submitted by U.S. Army	October 1998
Final RD/RA Workplan for SOU and GOU submitted by MW to USEPA and IEPA.	April 1999
Interim O&M activities conducted at Site M1 with cap replacement with an impermeable plastic liner.	April 28, 1999
Start of Construction for Site M4 Soil Stockpile Area	May 5, 1999
SOU and GOU Remedial Action Trigger (Start) Date. Site	May 5, 1999
RA activities by MW begin at MFG area Site M5.	July 7, 1999
RA activities by MW begins at MFG area Site M6	July 16, 1999
Site M6 - Soil excavation has occurred intermittently at the Site; however, bioremediation, confirmatory sampling, and disposal performed almost continuously.	1999 through 2004
Groundwater samples collected from identified site wells in the MFG and LAP Areas according to the RD/RA Workplan.	June through November 1999
RA Activities at Site M5 to remove SRU1 and SRU3 contaminated soils.	July through November 1999
Semi-annual Groundwater Monitoring Report - Spring 1999 - submitted to USEPA and IEPA.	September 1999
Leachate collection and disposal activities begin at Site M9 as part of leachate control system O&M activities.	November 1999
Thirty-six monitoring wells abandoned in the MFG and LAP Areas. Abandonment reports were submitted in the Semi-annual Groundwater Monitoring Report - Spring 2000.	December 1999, field activities. September 2000, reporting.
Ongoing soil bioremediation for explosives at Site M4.	1999 through 2004
Annual Groundwater Monitoring Report - Fall 1999 - submitted to USEPA and IEPA.	January 2000
Groundwater samples collected from identified site wells in the MFG and LAP Areas according to the RD/RA Workplan.	May and October 2000

Event	Date
Semi-annual Groundwater Monitoring Report - Spring 2000 - submitted to USEPA and IEPA.	September 2000
Submittal of Final Closure Report - Site M5	December 2000
Groundwater samples collected from identified site wells in the MFG and LAP Areas according to the RD/RA Workplan.	May 2001, semi-annual event. October 2001, annual event.
Soil excavation for bioremediation treatment for explosives from Site M7.	July through October 2001
An enhanced temporary landfill cap installed at Site M9 Landfill to promote run-off.	2001
Submittal of PCS Sites Final Closure Report. Sites L1, L7, L8, L9, L10 and L17.	December 2001
Annual Groundwater Monitoring Report - Fall 2000- submitted to USEPA and IEPA.	March 2001
Twenty-six monitoring wells abandoned from the MFG Area. Documentation is provided in Semi-annual Groundwater Monitoring Report - Spring 2001.	March to May 2001, field activities. September 2001, reporting.
Semi-annual Groundwater Monitoring Report - Spring 2001 - submitted to USEPA and IEPA.	September 2001
Eighteen monitoring wells installed to replace previously abandoned wells in the MFG and LAP Areas. Documentation is provided in the Annual Groundwater Monitoring Report - Fall 2001 .	September and October 2001, field activities. April 2002, reporting.
Groundwater samples collected by MW from site wells in the MFG and LAP Areas according to the RD/RA Workplan.	May 2001, semi-annual event. October 2001, annual event.
Soil excavation by MWH at Site M6 for bioremediation for explosives.	July through November 2002
Annual Groundwater Monitoring Report - Fall 2001 - submitted to USEPA and IEPA.	April 2002
Groundwater samples collected by MW from site wells in the MFG and LAP Areas according to the RD/RA Workplan.	May 2002, semi-annual event. October 2002, annual event.
Ordnance and explosives removed from LAP Area Sites L11 and L16.	August 2002
Three sumps and one concrete outflow removed from LAP Site L16.	August 2002

Event	Date
Arsenic contaminated soil excavated from LAP Area L11, confirmation samples collected, soil disposed of at Laraway Landfill in Elwood, Illinois.	October and November 2002
Explosives contaminated soil excavated by MWH at LAP Site L16 for bioremediation review of groundwater results.	October 2002
Semi-annual Groundwater Monitoring Report - Spring 2002 - submitted to USEPA and IEPA.	November 2002
Approved explanation of Significant Difference (ESD) prepared by USACE for Site M1 to modify the groundwater management zone (GMZ) boundaries, and submitted to USEPA and IEPA.	February 2003
Site M10 Final Closure Report submitted by MWH.	March 2003
Annual Groundwater Monitoring Report - Fall 2002 - submitted to USEPA and IEPA.	March 2003
Groundwater samples collected by MWH from site wells in the MFG and LAP Areas according to the RD/RA Workplan.	May 2003, semi-annual event. October 2003, annual event
Semi-annual Groundwater Monitoring Report - Spring 2003 - submitted to USEPA and IEPA.	October 2003
Submittal of Final Closure Report Site M7.	November 2003
Submittal of Final Closure Report Sites L11/L16.	December 2003
Well abandonment and replacement activities at Site Ml 3. Documentation included as Appendix D of Fall 2003 Groundwater Report.	January 2004, field activities Reporting - on-going
Annual Groundwater Monitoring Report - Fall 2003 submitted to USEPA and IEPA.	March 2004

3.0 BACKGROUND

3.1 GENERAL SITE BACKGROUND

This section describes the fundamental aspects of the site and provides a clear, succinct description of site characteristics. The purpose of this section is to identify the threat posed to the public and environment at the time of the October 1998 ROD, so that the performance of the remedy can be easily compared with the site conditions the remedy was intended to address.

3.1.1 Physical Characteristics

Joliet Army Ammunition Plant is a former U.S. Army munitions facility located on approximately 36 square miles (23,542 acres) of land in Will County, Illinois (see Figure 3-1). The site is located approximately three miles north of Wilmington, Illinois, a community of 5,134 residents.

3.1.2 Land and Resource Use

Joliet Army Ammunition Plant was constructed during World War II for the purpose of manufacturing, loading, assembling, packing, and shipping of bombs, projectiles, fuses, and supplementary charges. The production output at JOAAP varied with the demand for munitions. Although the plant was used extensively during World War II, in 1945 all production of explosives was halted, the sulfuric acid and ammonium nitrate plants were leased out; and the remaining production facilities were put in layaway status. The installation was reactivated during the Korean War, and again during the Vietnam War. Production at the plant gradually decreased until it was stopped completely in 1977. Since then, various defense contractors under facility-use contracts have utilized some areas of the installation. In April 1993, JOAAP property was declared as excess by the Army and is now being maintained by a small staff under liquidation status. The facility is not capable of explosives production and is undergoing transfer of use to other agencies and organizations in accordance with Public Law (PL) 104-106.

This law, entitled the Illinois Land Conservation Act of 1995, PL 104-106, Div. B, Title 2901-2932, Feb 10, 1996, stated that the Army will transfer JOAAP land to various Federal, local and state jurisdictions. Approximately 19,100 acres will be transferred to the USDA for establishing the Midewin National Tallgrass Prairie; 982 acres will be transferred to the Department of Veterans Affairs to establish a Veterans Cemetery; 455 acres will be transferred to Will County, Illinois to establish the Will County Landfill; and 3,000 acres will be transferred to the State of Illinois to establish two industrial parks. As of March 2004, the Army has already transferred 15,080 acres to the USDA, 982 acres to the Department of Veterans Affairs, 455 acres to Will County, Illinois, and 2,346 acres to the State of Illinois. Section 4.0 provides additional details regarding property transfer activities.

During the time when JOAAP was fully operational, it was divided into two main function areas: the LAP Area, located to the east of Route 53, and the MFG Area, located to the west of Route 53 (see Figure 3-2). The LAP Area, which covers approximately 22 square miles, is where munitions were loaded, assembled, and packaged for shipping. This area of JOAAP contained munitions, filling and assembly lines, storage areas, and a demilitarized area. The MFG Area, which covers

approximately 14 square miles, is where the chemical constituents of munitions, propellants, and explosives were manufactured. The production facilities were located in the northern part of the MFG Area. On the southern half of the MFG Area there were extensive explosives storage facilities.

3.1.3 History of Contamination

Due to the presence of contamination in both groundwater and soil at JOAAP, separate Operable Units (OUs) were established for each media to address remediation objectives at the site. In the Record of Decision , Soil and Groundwater Operable Units, Manufacturing and Load-Assemble-Package Areas (U.S. Army, October 1998), a total of 25 SOU sites were identified as requiring additional remediation of contaminated soils and debris. Seven Soil Remediation Units (SRUs) were established to classify the 25 SOU sites according to the nature of contaminants:

- SRU1 - Explosives in Soil
- SRU2 - Metals in Soil
- SRU3 - Explosives and Metals in Soil
- SRU4 - PCBs in Soil
- SRU5 - Organics in Soil
- SRU6 - Landfills
- SRU7 - Sulfur

The following table summarizes the COCs for each site based upon SRU designation. Due to the nature of activities conducted at many of the SOU sites, contaminants from more than one SRU may be present at any particular site.

SRU	Description	Final Remedial Action Sites	Interim Remedial Action Sites	Contaminants of Concern
1	Explosives	M5, M6, M7, L16	L1, L7, L8, L9, L10, L14, M2, M3	Dinitrotoluene (DNT), Nitrotoluene (NT), TNB, Trinitrotoluene (TNT), HMX, RDX, Tetryl
2	Metals	L11	L2, L3, L5, L23A, M3, M4, M12	Arsenic, Beryllium, Cadmium, Lead
3	Explosives and Metals	M5, M6	L2, L3	DNT, TNT, RDX, Arsenic, Beryllium, Lead
4	PCBs	L1, L5, L7, L8, L9, L10, L17		PCB 1254, PCB 1260
5	Organics		L1, L5	Total Petroleum Hydrocarbons
6	Landfills	M1, M9, M11, M13, L3, L4		Hazardous and Non-hazardous Wastes
7	Sulfur	M8, M12		Sulfur

In addition, twenty-eight (28) other sites plus one subarea, suspected as having contaminated soil, were investigated during the Phase 1 and Phase 2 Remedial Investigation/Feasibility Study (RI/FS) and determined to have either no historical evidence suggesting contamination potential, no contamination, or contaminant concentrations that do not pose a threat to human health or the environment. Soils at these sites exhibit no characteristic of hazardous wastes. Illinois Environmental Protection Agency and USEPA agree that, under CERCLA requirements, no further cleanup actions are required for these sites, and have been classified as NFA sites. Contaminant concentrations remaining at NFA sites (excluding Sites L6 and M16) are present at levels which allow for unlimited access and unrestricted use. Sites L6 and M16 have contaminant concentrations present at the sites which meet industrial RG designated in the October 1998 ROD.

A summary of initial responses at JOAAP, along with the general basis for taking actions at JOAAP, is presented in the following paragraphs.

Site-specific information describing the physical characteristics, source(s) and history of contamination, initial responses, and basis for taking action, is located in Section 3.2. The location of each individual site within the MFG and LAP areas is presented in Figure 3-2.

3.1.4 Summary of Initial Response

In 1978, the U.S. Army Environmental Center (USAEC, formerly the U.S. Army Toxic and Hazardous Materials Agency or USATHAMA) conducted an Installation Assessment of JOAAP (USATHAMA, 1978), which consisted of records search and interviews with employees. This document reported that environmental impacts might be present at former industrial areas and locations where waste disposal activities occurred.

In 1981 and 1982, an Installation Restoration Survey was conducted (Donohue and Associates, 1982). This study included sampling of soils, groundwater, surface water, and sediment, and identified the presence of contamination at nine study areas at the MFG Area and nine study areas at the LAP Area.

Subsequently, a Phase II study was conducted in 1983 (Donohue and Associates, 1983) to gather additional data on the previously sampled sites at the MFG and LAP Areas, and to evaluate the potential for off-site impacts. This investigation also included an assessment of several parcels of land near the edge of the MFG Area that were considered part of excess inventory. No off-site contamination was identified.

From 1983 through 1985, a response action was conducted by Uniroyal (JOAAP's operating contractor) at the Red Water lagoon located at Site M7. The purpose of this response action was to remove contaminated surface water and sediment from the lagoon. Following the removal of contaminated materials, a clay cap was installed over the lagoon. Pre- and post-remediation sampling documented the conditions before and after the remediation (Donohue and Associates, 1983, 1985).

Between 1983 and 1985, the U.S. Army Environmental Hygiene Agency (AEHA; now CHPPM) performed groundwater sampling of selected, existing monitoring wells. The sampling and monitoring were performed as part of JOAAP's RCRA groundwater monitoring program around a closed sanitary landfill located at site Ml3, and the Red Water lagoon at site M7.

In November 1984, because of the presence of contamination, the MFG Area of JOAAP was proposed by the USEPA for listing on the NPL based on the Hazard Ranking System (HRS) score of 32.08. The LAP Area was proposed for listing in April 1985 based on the HRS score of 35.23. Final listing on the NPL took place on July 21, 1987 for the MFG Area, and March 31, 1989 for the LAP Area.

During 1985 and 1986, additional groundwater and surface water samples were collected from previously sampled locations at the MFG and LAP Areas. These data were presented in an assessment report in which the feasibility and the need for remediation of the study areas were discussed (Dames & Moore, 1986).

In 1989, the Army, the USEPA and the IEPA entered into a FFA under CERCLA Section 120 and RCRA Sections 6001, 3008(h), 3004(u), and 3004(v) (USEPA, 1989). The purpose of this FFA was to ensure that environmental impacts at the site would be investigated and that remedial actions would be taken to protect public health, welfare, and the environment. Also during 1989, the USACE made an investigation of USTs throughout the JOAAP (USACE, 1989). One hundred seven USTs were identified, inventoried, and evaluated for possible leakage, in accordance with USEPA regulations for existing USTs. Most of the USTs were emptied and removed as of 1993.

From 1988 through 1993, Phase 1 and Phase 2 RIs were conducted at the MFG Area (Dames & Moore, 1991, 1993). The RIs were performed to identify the type, concentration, and extent of contamination throughout the MFG Area. A total of 18 study areas were identified for investigation, including nine areas originally investigated during previous studies. These reports were amended by the Oleum Plant RI report (Dames & Moore, 1996) that was added as a potentially contaminated area following the completion of the RI reports.

From 1991 through 1994, Phase 1 and Phase 2 RIs were conducted at the LAP Area for the same purposes as the MFG Area investigations (Dames & Moore, 1993; 1994). A total of 35 study areas were investigated, including nine sites investigated during the Installation Restoration Surveys at the LAP Area.

The RI reports were supplemented by baseline risk assessments conducted to quantify the potential human health risks posed by contamination identified at the study sites present at the MFG and LAP Areas (Dames & Moore, 1994; 1995). The assessments included an environmental fate and transport assessment, a toxicity assessment, an exposure assessment, and a risk characterization.

From 1993 through 1996, the CHPPM conducted an ecological risk assessment to evaluate the potential for site contamination to be impacting ecological receptors. Findings indicated limited impacts to terrestrial mammals, aquatic receptors, and avian species (birds). The results of these studies were presented in a Phase 1 Ecological Risk Assessment Report (CHPPM, 1994) and a Phase 2 Aquatic Ecological Risk Assessment Report (CHPPM, 1996). Potential risks posed to humans

from consuming deer tissue from JOAAP were also investigated and determined to be negligible (CHPPM, 1994).

Following the risk assessments, PRGs were established to identify the specific cleanup to remediate the sites (OHM, 1996). The cleanup levels were developed to be protective of human health and the environment.

In 1996 and 1997, the USACE conducted three removal actions to prevent the migration of contaminants from the source areas. Wastes present in the oil pits located at study area L2 were excavated and disposed to prevent the contaminants present in these wastes from migrating into the groundwater. During the same time period, Omaha District, Corps of Engineers, conducted a Removal Action along Prairie Creek at site L3. This action involved stabilizing the stream bank to prevent the erosion of the bank that contained buried debris and wastes. Also in 1996, USACE conducted the removal of the PCB switch boxes from the MFG Area. Soils around the switch boxes were sampled and subsequently removed if contamination was above RGs or if staining was noticeable. In 1997, USACE conducted a Removal Action at Site L6. This action involved the excavation and disposal of organics- and PCB-contaminated soil to protect human health and the environment. This action also was intended to facilitate the transfer of the land from the Army to Will County, in accordance with Public Law 104-106 for establishing a landfill.

Public Law 104-106 of the Fiscal Year 1996 Department of Defense Authorization Act legislated specific terms relating to the conveyance of JOAAP to various entities. This law is the governing document for the future land use at JOAAP. The majority of JOAAP is to be transferred to the USDA, with the U.S. Department of Veterans Affairs, Will County, and the State of Illinois receiving the remainder of the property.

In 1997, an interim O&M activity was conducted at the southern ash pile (Site M1). This project involved consolidating wastes that had migrated from the pile and covering the pile with a geosynthetic liner to prevent leaching of wastes from the pile.

Interim O&M activities were conducted at Site M9 during 1999 to install a leachate control, recirculation and collection system. The leachate control system was implemented to prevent leachate seepage from the existing cap into the surrounding environment.

Since the volume of explosives-contaminated soil may have a direct bearing on the selected remediation method, field screening soil sampling programs were conducted in 1995 to provide data to more accurately estimate the volume of explosives-contaminated soils on the MFG and LAP Areas. These programs were supplemented by sampling to help characterize the types of wastes present, and the results of the sampling programs were used in the FS for the MFG and LAP Areas. The purpose of the FS was to identify and evaluate alternative remedies for mitigating the risks posed by contamination at JOAAP. Separate FS were prepared for the Groundwater and Soil Operable Units for both the LAP (Dames & Moore, 1997) and MFG (OHM, 1997) Areas. Based on the information gathered and presented in the FS, the Army recommended, with USEPA and IEPA concurrence, the preferred remedies for the contaminated soil and groundwater at JOAAP. The rationale behind the selection of the remedies was released to the general public in the Proposed Plan for the Soil Operable Unit and the Proposed Plan for the Groundwater Operable Unit (U.S. Army,

1997 a, b), and presented at a public meeting on January 8, 1998.

Alliant Techsystems, Inc., under a facility-use contract to the U.S. Army, used a portion of the LAP Area. Alliant ceased operations in 1999 and demobilized from the LAP Area in 2000.

Plexus Scientific Corporation was contracted by the U.S. Army to conduct decontamination and demolition activities for buildings contaminated by historical activities in the LAP and MFG Areas. Decontamination and demolition activities began in January 2000 by Plexus at Site M6 and are currently ongoing.

3.1.5 General Basis For Taking Action

The human health risk assessments identified a total of 79 COCs in soil and sediment, 40 COCs in groundwater, and 45 COCs in surface water at JOAAP. Explosives (primarily TNT, DNT, RDX, HMX, and tetryl) were the most prevalent COCs in each of these media, although other

contaminants (metals, pesticides, PCBs, and volatile and semivolatile organic compounds) were also identified. The prevalent COCs are listed below.

Soil and Sediment

Explosives	Metals	Polychlorinated Biphenyls
2,4-Dinitrotoluene	Arsenic	Aroclor 1254
2,6-Dinitrotoluene	Beryllium	Aroclor 1260
Trinitrobenzene	Cadmium	
Trinitrotoluene	Lead	
Royal Demolition Explosive (RDX)		
High Melting Point Explosive (HMX)		
Nitrotoluene		

Groundwater

Explosives	Metals	VOCs
2,4-Dinitrotoluene	Iron	Tetrachloroethene
2,6-Dinitrotoluene	Antimony	Toluene
Trinitrobenzene	Cadmium	Benzene
Trinitrotoluene		
RDX		
Nitrotoluene		

According to Page 4-1, Paragraph 2 of the October 1998 ROD, although 45 COCs were identified in surface water, Risk Assessment studies determined that surface waters at JOAAP pose no risk to human health and the environment, and were therefore not addressed as a contaminated medium requiring remedial action.

Based on information presented in the human health risk assessments, the principal threat to human health results from potential exposure to explosives in soil. DNT is identified by USEPA as a probable human carcinogen, and both TNT and RDX are identified by USEPA as possible human carcinogens. Risks and hazards calculated for groundwater are based on the assumption that new wells are installed into areas of contaminated groundwater and then used. This scenario is unlikely to occur because the majority of the contaminated groundwater resides in the glacial drift aquifer that does not provide usable quantities of groundwater and is not used as a source of water supply at JOAAP.

Exposure levels for ecological resources for the land to be transferred to USDA are being developed. These lands will be protective of the environment and compatible with development of the tallgrass prairie. Exposure levels will be established by a site-specific biological technical assistance group (BTAG) that shall include, at a minimum, representatives of the Army, USEPA, IEPA, USDA, Illinois Department of Natural Resources, and Department of Interior/US Fish and Wildlife Service.

As a next step, the exposure levels established by the BTAG shall be compared to the human health risk-based remediation goals. Appropriate final remedial actions for future USDA soils have been developed, evaluated, selected, and presented in the *Proposed Plan for the Soil Operable Unit, Interim ROD Sites* (U.S. Army, February 2004). The selected remedies for interim sites will be formerly presented and approved by the appropriate regulatory agencies in accordance with the NCP, once the Final ROD for interim sites has been submitted. The submittal date for the Final ROD for interim sites is expected to be during FY2004.

3.2 SITE SPECIFIC BACKGROUND INFORMATION

This section provides a description of the individual sites of concern at JOAAP. Site-specific descriptions include the physical characteristics, land and resource use, history of contamination, initial responses, and basis for taking action at each site.

Summarized below is the status of each site as an active site (on-going remedial action[s]), completed site (where the site has achieved closure status), or a site where RA activities are pending.

Site	SRU	Completed Remedial Actions	Operating Remedial Actions	RA Activities Pending
L1	SRU1, SRU4, SRU5	✓ (SRU4)		✓ (SRU1 and SRU5)
L2	SRU2, SRU3			✓
L3	SRU2, SRU3, SRU6			✓
L4	SRU6			✓
L5	SRU2, SRU4, SRU5			✓
L7	SRU1, SRU4	✓ (SRU4)		✓ (SRU1)
L8	SRU1, SRU4	✓ (SRU4)		✓ (SRU1)
L9	SRU1, SRU4	✓ (SRU4)		✓ (SRU1)
L10	SRU1, SRU4	✓ (SRU4)		✓ (SRU1)
L11	SRU2	✓		
L14	SRU1			✓
L16	SRU1	✓		
L17	SRU4	✓		
L23A	SRU2			✓
M1	SRU6			✓
M2	SRU1			✓
M34	SRU1, SRU2			✓
M4	SRU2			✓
M5	SRU1, SRU3	✓		
M6	SRU1, SRU3		✓	
M7	SRU1	✓		
M8	SRU7	✓		
M9	SRU6			✓
M11	SRU6			✓
M12	SRU2, SRU7			✓
M13	SRU6			✓

3.2.1 Site L1

Site L1 was constructed in 1941 as part of the initial operations of the installation to support World War II efforts. This 80-acre site is centrally located in the northern portion of the LAP Area. Site L1 was the location of demilitarization and reclamation of various munitions. It was originally used for

crystallizing ammonium nitrates, but then extensively modified to function as a shell renovation and 1,3,5-trinitrobenzene (TNB) recovery plant until 1945. In April 1946, the facility was reactivated to reclaim TNT. Washout operations involving the larger munitions were performed outside Building 61-35, which is located southeast of Building 61-4. The solids that settled in the sump were sent to Site L2 (Explosive Burning Grounds), while the overflow from the sump (pink water) was discharged to an adjacent 4.3-acre ridge-and-furrow system (or evaporating bed).

Historical aerial photos revealed that by 1952 two rectangular pits or lagoons had been constructed southeast of the ridge-and-furrow system on either side of drainage ditch that flows south from the ridge-and-furrow system and empties into Prairie Creek.

Explosives contamination appears to be limited to the ridge-and-furrow system, the western lagoon south of the evaporation beds, and south of the washout building and around the sump building.

2,4,6-TNT is considered to be a contaminant in the sump surface water. The presence of 2,4,6-TNT in the sediment from the ditch indicates that runoff from the ridge-and-furrow system may have periodically transported contaminants to Prairie Creek.

Two transformers removed in August 1990 from an area east of Building 61-4 were suspected to have leaked oil-containing PCBs onto site soil; the spill was subsequently cleaned up.

Remedial action activities were conducted between August and October 1999 to remove PCS contaminated soil from Site L1. Remedial action activities resulted in excavation of 155CY of non-Toxic Substances Control Act (TSCA) regulated soil from Site LI. SRU4 soils above RGs from Site L1 have been excavated and disposed of. Remediation goals and Remedial Action Objectives (RAOs) set in the October 1998 ROD for SRU4 soils have been met.

No RCRA hazardous wastes were identified at Site L1.

Field reconnaissance identified petroleum-stained soils near aboveground storage tank (AST) locations west of Building 61-1 and north of Building 61-2. In the vicinity of the AST location at Building 61-1, samples were collected at the surface and at depths of 2.5 and 5 feet (ft). Total Petroleum Hydrocarbons (TPH) was detected in all samples at concentrations above the RGs. The surface area contaminated by TPH is estimated to be 2,500 SF and contamination is assumed to extend to a depth of 10 ft. This volume of soil is estimated to be 925 cubic yards (CY). In the vicinity of the ASTs located at Building 61-2, soils below the ASTs within the surrounding earthen berm are heavily saturated with petroleum products and presumably are contaminated with TPH above the cleanup levels. The hydrocarbon-stained soils are limited to the area within the earthen berm surrounding the tanks, which is approximately 900 SF based on field measurements. Therefore, the volume of soil north of Building 61-2 is estimated to be 350CY assuming contamination extends to a depth of approximately 10 ft below grade.

Site L1 is not located near a heavily populated area. The future land use of Site L1 is intended for development into the USDA Midewin National Tallgrass Prairie. According to the baseline risk assessment, soils and groundwater at the site were stated to pose an unacceptable risk to recreational users. Interim RGs presented in the October 1998 ROD were based upon risk-based models for

recreational exposure of humans to COCs. Within the SOU, the primary health threat at Site L1 was associated with SRU1, SRU4, and SRU5 soils. During RA activities, SRU4 related COCs above RGs were removed to minimize the risk to human health and the environment. According to the RAOs set in the October 1998 ROD, Site L1 has achieved closure status for SRU4 soils as documented in the *Final PCB Sites RA Closure Report* (MWH, December 2001). Remedial action activities will be conducted at Site L1 to remediate SRU1 and SRU5 soils once final RGs are designated for the site.

3.2.2 Site L2 (Explosive Burning Grounds)

Site L2 is located in the west-central portion of the LAP Area, adjacent to Prairie Creek and Kemery Lake. The operational area covers approximately 5 acres and consists of six east-west pads, each approximately 650 ft long and 50 ft wide, on which explosives and associated wastes from Sites L7 to L10, LI4, and LI, were burned. Three north-south burning pads were also present east of this area in 1952 aerial photographs. These pads were subsequently reconfigured into one pad, and the southern oil pits were constructed on the southern portion of these pads. Several parallel, elevated burning pads were constructed of gravel and fitted with electric igniters operated from a remote location. According to JOAAP personnel, spent carbon from the carbon units used in the TNT/ Composition B melt-load processes was also incinerated on the burning pads. Munitions and Explosives of Concern (MEC), formerly called Unexploded Ordnance (UXO), including fuzes and other items, have been identified to be present on the burning pads.

Three popping furnaces, where small ammunition was detonated, were located at the southwest corner of the site. During operations, metal waste from the furnaces was removed and sent to the Salvage Yard (Site L5). The Explosive Burning Grounds also contained three solvent and oil disposal pits (each less than 0.25 acre) located adjacent to the burning pads, which (according to JOAAP personnel) were occasionally used to burn waste oil. These pits were remediated in 1996 as part of a removal action conducted by the U.S. Army, and MEC were discovered to be buried in an area north of the burning pads. The MEC were disposed of properly as part of the removal action, although a complete MEC sweep was not performed and it is possible that additional MEC remain at the site in the vicinity of the removal action. Drainage features include two ditches, which flow from the northern portion of the burning pads to Kemery Lake, and a gully at the southwestern comer of the site, which receives runoff from the popping furnace area and southern portions of the site.

It is estimated that an area approximately 200 square ft surrounding and including the popping furnaces would require remedial actions for arsenic, cadmium, and lead. Surface soil contaminated with arsenic, cadmium, and lead has been estimated to extend to a depth of 1 ft, representing a volume of 1,480CY. Additionally, arsenic contamination in subsurface soils around the popping furnaces is estimated to occur to a depth of 3 ft, representing a volume of 2,960 CY.

Analytical results of soil samples collected at Site L2 indicate that the majority of the burning pads area (approximately 206,500 SF) is contaminated with 2,6-DNT, RDX, arsenic and lead, all above the respective RGs. The total volume of soil at this site that exceeds RGs for explosives and lead is estimated to be 16,350 CY.

Soils in the vicinity of the popping furnaces at Site L2 may be contaminated with RCRA characteristic hazardous wastes for cadmium (RCRA waste code D006) and lead (RCRA waste code D008).

Site L2 is not located near a heavily populated area. The future land use for Site L2 is intended for development into the USDA Midewin National Tallgrass Prairie. According to the baseline risk assessment, soils and groundwater at the site were stated to pose an unacceptable risk to recreational users. Interim RGs presented in the October 1998 ROD were based upon risk-based models for recreational exposure of humans to COCs. Within the SOU, the primary health threat at Site L2 was associated with SRU2 and SRU3 soils, and potential MEC waste. Once final RGs are designated for the site, RA activities will be conducted to excavate and dispose of all soil related COCs above designated RGs and remove any existing MEC waste at the site.

3.2.3 Site L3 (Demolition Area)

Site L3 is located directly southwest of the Explosive Burning Grounds, Site L2. Covering approximately 50 acres, Site L3 is bounded to the west by Prairie Creek, to the south by an unnamed tributary to Prairie Creek, and to the east by Star Grove Cemetery. The principal operation conducted in this area was the open burning of combustible refuse and munitions crates. An air curtain destructor, which facilitates combustion while reducing particulate emissions, was constructed at the site but never used. In addition, uncontaminated solid waste and some potentially low-level explosives-contaminated solid waste from JOAAP operations were burned in this area. A 1-acre fire training area is also located at the site.

The burning area consisted of U- and L-shaped bermed areas and a burning cage, which is a concrete pad surrounded by a steel mesh cage used to contain the burning debris. During the Phase 1 RI, geophysical techniques used to clear MEC from work areas indicated the presence of buried metallic debris in and around the U- and L-shaped bermed areas. The fire training area consisted of a small depression enclosed by an earthen berm, which contained burning and fire training areas. The demolition pits (less than 1 acre) were heavily vegetated, which suggests there has been no recent activity in this area.

A total of 185CY of soil is estimated to require a remedial action for lead. The volume of soil requiring a remedial action at the fire training pit is assumed to include the top 6 inches of surface soil over the entire fire training area (approximately 75 by 125 ft) and totals an estimated 175CY. Soil in the area east of the demolition pits requiring a remedial action is estimated to include an area 25 square feet (SF) to a depth of 6 inches of surface soil, totaling 10CY.

Results of sampling of Site L3 indicated contamination of RDX and lead that exceed RGs in the western portion of the bermed area with an approximate surface area of 170 SF from the western edge. Since samples from 2.5 ft depth did not exceed RGs for explosives or metals, soil contamination over the 170-foot square area has been assumed to extend 1 foot below grade. The volume of explosives and metals-contaminated soil within the bermed area of Site L3 is estimated to be 1,070CY. In addition, MEC were identified in this area.

The berms located along Prairie Creek are contaminated with lead, chlordane, 2,6-DNT and phosphate above the RGs for these constituents. The berms are present within an area measuring approximately 800 ft along Prairie Creek and 300 ft wide in the northwest portion of Site L3. The entire area between Prairie Creek and the easternmost access road is presumed to be filled with metallic debris and other wastes including MEC.

The extent of contamination in the berms along Prairie Creek appears to be related to the presence of fill material. Several assumptions were made to calculate fill volumes. Average berm heights are estimated to be 8 ft in the northern berms and 3 ft in the southern berms. The average depth of fill is estimated at 3 ft below ground surface in the northern area and 2 ft below ground surface in the southern area. The fill is believed to be deeper closer to Prairie Creek greater than 10 ft and pinches out east of the burning cage. The estimated volume of the material is 35.000CY. Site L3 may contain unexploded ordnance, which are classified as RCRA characteristic wastes (RCRA waste code D003) because of their reactivity.

Site L3 is not located near a heavily populated area. The future land use for Site L3 is intended for development into the USDA Midewin National Tallgrass Prairie. According to the baseline risk assessment, soils and groundwater at the site were stated to pose an unacceptable risk to recreational users. Interim RGs presented in the October 1998 ROD were based upon risk-based models for recreational exposure of humans to COCs. Within the SOU, the primary health threat at Site L3 was associated with SRU2, SRU3, SRU6 soils, and MEC waste. Remedial action activities will be conducted at Site L3 to excavate and dispose of all soil related COCs above designated RGs and remove any existing MEC waste at the site. Remedial action activities are projected to be conducted at Site L3 during FY2006 to construct a new landfill cap for SRU6 soils at the site.

3.2.4 Site L4 (Landfill Area)

Site L4 is located southwest of the Demolition Area (Site L3), on the northern side of Prairie Creek. Two former extraction pits excavated to bedrock are located in this area. The western extraction pit is partially filled with construction waste and sanitary sewage, and the eastern pit has been flooded by Prairie Creek. Operating from the early 1940s (World War II) until the late 1960s, the landfill associated with the western pit reportedly accepted various types of construction debris. In addition, 5-gallon pails containing unknown substances were reportedly disposed of in the landfill. The final cover, reportedly compacted clean fill, was placed in the 1970s.

Although this area is currently completely vegetated, several small sinkholes were observed where the fill materials had collapsed. Based on the depth to bedrock in the area, the fill is not anticipated to be more than 15 ft deep and may extend eastward to a small drainage ditch. No fill was identified in the southwestern portion of the site, and the exposed bedrock south of the fill area defines the southern boundary. Based on the real extent of the fill and estimated depth, it is calculated that the landfill contains 37,000CY of waste materials. No RCRA hazardous waste was identified at Site L4.

Site L4 is not located near a heavily populated area. The future land use for Site L4 is intended for development into the USDA Midewin National Tallgrass Prairie. According to the baseline risk assessment, no media pose a risk to recreational user based receptors. Interim RGs presented in the October 1998 ROD were based upon risk-based models for recreational exposure of humans to

COCs. Remedial action activities are projected to be conducted at Site L4 during FY2006 to excavate and dispose of SRU6 soils.

3.2.5 Site L5 (Salvage Yard)

Site L5 was used for salvage and open storage of miscellaneous materials from the installation. It is located in the northwestern corner of the LAP Area along Hoff Road. Metal waste from the popping furnaces at the Explosive Burning Grounds (Site L2) was reportedly sent to Site L5 when JOAAP was in operation. The area of contamination at the site include a 1,000 SF oil spill area near Building 26-3 and a 500-foot-long shallow ditch excavated in 1974 that is located south of the spill area. This ditch was used to store barrels of unknown substance(s). Other areas of contamination included several large piles of railroad ties (approximately 1 acre), and a large junk pile (less than 1 acre).

Metal contamination in the former open storage areas is primarily limited to surface soil. The concentration of lead in samples collected from the open storage area north of the junk pile exceeds the RGs. An estimated 1,070CY of soil is considered for a remedial action based on an affected surface area of 28,900 SF, and assuming contamination extends to a depth of 1 foot.

The 500-foot long shallow drainage ditch is an area at Site L5 that contains concentrations of metals (beryllium, lead, and arsenic) and organics (TPH) in soil at levels above the constituent-specific clean up levels for these constituents. The volume of contaminated soil in the ditch area is estimated to be 555CY, assuming soils in an area 25 ft wide and 500 ft long are contaminated to a depth of 1 foot and, an area 25 ft by 50 ft contaminated to a depth of 2 ft.

The former oil spill area adjacent to Building 26-3 contains surface soils that exceed the TPH RGs. The volume of TPH-contaminated soil in the oil spill area of Site L5 is estimated to be 30CY and is limited to soils 1 foot in depth between Buildings 26-3 and 26-4.

The large piles of railroad ties are located over approximately 1 acre in the south-central section of Site L5. Soil samples collected within this area identified concentrations of benzo(a) pyrene above the RGs. Based on the available data, the extent of organics contamination above RGs is assumed to be limited to the western half of the area of the piles of railroad ties (an area of 300 ft by 100 ft) to a depth of 6 inches. This area represents a volume of approximately 550CY.

The total volume of soil contaminated with organics at this site is estimated to be 1,135CY. The contaminants of concern found at Site L5 also include arsenic, beryllium, lead, and benzo(a) pyrene. The maximum concentrations of these compounds exceeded the RGs levels.

No RCRA hazardous wastes were identified in the ditch and oil stain areas at Site L5. RCRA hazardous wastes may be present in the area of the Junk Pile at Site L5 in the form of TCLP extractable lead (RCRA waste code D008) and TCLP extractable cadmium (RCRA waste code D006). The soils also contain PCBs, which are regulated as TSCA hazardous substances. No RCRA hazardous wastes were identified in the open storage area at Site L5.

Site L5 is not located near a heavily populated area. The future land use for Site L5 is intended for development into the USDA Midewin National Tallgrass Prairie. According to the baseline risk assessment, soils at the site were stated to pose an unacceptable risk to recreational users. Interim RGs presented in the October 1998 ROD were based upon risk-based models for recreational exposure of humans to COCs. Within the SOU, the primary health threat at Site L5 was associated with SRU2, SRU4 and SRU5 soils. Once final RGs for SRU2 and SRU5 soils are established, RA activities will be conducted at Site L5 to remove all soil-related COCs above designated RGs.

3.2.6 Site L6

Site L6, a storage and service area, is in the southwest portion of the LAP area. Miscellaneous buildings and structures at Site L6 included an electrical shop, a locomotive service building, carpenter shop, an AST, a motor pool, a laundry facility, and various equipment storage buildings. The locomotive service shop contained three repair pits and a 15-ton crane. An oil skimmer recovery system, which collected oil from the pits when JOAAP was in operation, was adjacent to the shop. According to JOAAP personnel, the spent oil was spread over local roads to minimize windblown dust. The electrical shop was used to repair and clean electrical equipment.

Historical aerial photo interpretation revealed that, in 1944, debris covered approximately 8 acres in the southwestern portion of the site, south of the railroad tracks. The contents of the material previously stored in this area are unknown.

During a site investigation in March 1988, JOAAP personnel identified and area between the receiving building and electrical shop where oil from transformers, containing PCBs, had been dumped. In addition, waste solvents and oils generated from the electrical and machine shops had reportedly been dumped in the area. During a September 1987 site reconnaissance, a low lying area with ponded water and vegetative stress was identified between the locomotive service building and electrical shop.

Several other potential areas of concern were identified during a July 1990 site reconnaissance. JOAAP personnel indicated that PCBs may have been used to fireproof clothing in the receiving building. According to JOAAP personnel, painting and lacquering operations were performed at the western end of the carpenters shop. Paint thinner was reportedly dumped onto soils in this area.

During the Phase 1 RI field investigation, soil, groundwater, surface water, and sediment samples were collected. Soil samples were collected to evaluate the extent of contamination from past activities. Groundwater samples were collected to assess site conditions and monitor potential migration of contaminants. Surface water samples were collected to determine the impact of contaminated soil via surface runoff on the drainage ditch south of the machine shop.

Based on the results of the Phase 1 RI, USACE conducted removal action at Site L6 in 1997 to remove organics and PCB-impacted soil that exceeded RGs. Polychlorinated Biphenyl (PCB) contaminated soils were remediated to levels below 1.0 mg/kg, which is the standard for unrestricted use. Remaining COCs at Site L6 that posed potential health and environmental hazards were removed to levels that meet the industrial RGs set in the October 1998 ROD. The removal action at Site L6 is documented in the *Final Report, Removal Action Site 16/Group 70 Area, Joliet Army*

Ammunition Plant, Wilmington, Illinois (U.S. Department of Defense, March 1998). Based upon the results of the removal action activities , Site L6 was identified as a NFA site in the October 1998 ROD.

3.2.7 Site L7

Site L7 is located in the southern portion of the LAP area. The basic processes and procedures involved in LAP operations are similar for all ammunition items. Explosives were melted and loaded into a projectile; process water containing explosives residue was discharged to sumps. The loaded projectiles were then transferred to another building for final assembly. Solids collected in the sump were reportedly sent to the Explosive Burning Grounds (Site L2) for disposal. Liquids from the sump were discharged to a storm sewer, which ultimately discharged to Site L12 (Doyle Lake) from Sites L7, L8, and L10, or to Prairie Creek from Site L9. According to JOAAP personnel, carbon treatment units were installed around 1976 in each melt-load building. Spent carbon units were disposed of at the Explosive Burning Grounds.

Explosives contaminants in soil at Site L7 include 2,4,6-TNT and RDX. Levels of explosives, up to 1.5 percent, were identified in soil from red-stained areas adjacent to buildings throughout the site. The total volume of affected soil for Site L7 is estimated to be approximately 1,850CY.

Remedial action activities were conducted between August and October 1999 to remove PCB-contaminated soil from Site L7. Remedial action activities resulted in excavation of 1,245CY of PCB-contaminated (Aroclor 1260) soil and concrete. Both TSCA and non-TSCA regulated soil and concrete were managed; 1,110CY was TSCA regulated and 135CY was non-TSCA regulated.

Site L7 is not located near a heavily populated area. The future land use for Site L7 is intended for development into the USDA Midewin National Tallgrass Prairie. According to the baseline risk assessment, soils at the site were stated to pose an unacceptable risk to recreational users. Interim RGs presented in the October 1998 ROD were based upon risk-based models for recreational exposure of humans to COCs. Within the SOU, the primary health threat at Site L7 was associated with SRU1 and SRU4 soils. During RA activities conducted in 1999, SRU4 soil related COCs above RGs were removed to minimize the risk to human health and the environment. According to the RAOs set in the October 1998 ROD, Site L7 has achieved closure status for SRU4 soils SOU, as documented in the *Final PCS Sites RA Closure Report* (MWH, December 2001). Remedial action activities will be conducted to remediate SRU1 soils, once final RGs are designated for the site.

3.2.8 Site L8

Site L8 is centrally located in the LAP Area, east of the intersection of Chicago and Central Roads. LAP operations performed at the site included melting and loading of Composition B into projectiles, subsequent cleaning and washdown operations that produced pink-water, and discharge of this waste water to external sumps and surface areas.

Explosives contaminants in soil at Site L8 include 2,4,6-TNT and 2,4-DNT. High levels of explosives, up to 1.6 percent, were identified in soil from red-stained areas adjacent to buildings throughout the site. In addition, high levels of explosives were detected beneath one washout

building (2-40B). Detectable concentrations of explosives occur in soils to a depth of 5 ft. The total volume of affected soil, including areas beneath building foundations, is estimated to be approximately 400CY. The volume of raw TNT is estimated to be ICY. Additionally, a total of 15CY of structural concrete in the sumps is estimated for disposal.

The only RCRA hazardous waste identified at Site L8 is raw TNT, which is hazardous based on its reactivity (waste code D003).

Remedial action activities were conducted between August and October 1999 to remove PCB contaminated soil from Site L8. Remedial action activities resulted in excavation of 631CY of PCB-contaminated (Aroclor 1260) material. Both TSCA and non-TSCA regulated materials were managed; 54CY was TSCA regulated and 577CY was non-TSCA regulated.

Site L8 is not located near a heavily populated area. The future land use for Site L8 is intended for development into the USDA Midewin National Tallgrass Prairie. According to the baseline risk assessment, soils at the site were stated to pose an unacceptable risk to recreational users. Interim RGs presented in the October 1998 ROD were based upon risk-based models for recreational exposure of humans to COCs. Within the SOU, the primary health threat at Site L8 was associated with SRU1 and SRU4 soils. During RA activities conducted at the site in 1999, SRU4 soils containing COCs above RGs were removed to minimize the risk to human health and the environment. According to the RAOs set in the October 1998 ROD, Site L8 has achieved closure status for SRU4 soils as documented in the *Final PCB Sites RA Closure Report* (MWH, December 2001). Remedial action activities will be conducted to remediate SRU1 soils, once final RGs are designated for the site.

3.2.9 Site L9

Site L9 is located in the central part of the LAP Area, 1 mile east of the intersection of Chicago and Central Roads. Operations were similar to those described for Sites L7 and L8.

Explosives contaminants of concern for soil at Site L9 include 1,3,5-TNB and 2,4,6-TNT. High levels of explosives, up to 4 percent, have been identified in soil from red-stained areas adjacent to buildings throughout the site. High levels of RDX contamination occur in a few locations beyond stained areas and are not as apparent as surrounding TNT contamination. The total volume of affected soil, including areas beneath building foundations, is estimated to be approximately 1,500CY. The volume of raw TNT is estimated to be ICY. Additionally, a total of 15CY of structural concrete in the sumps area is estimated for disposal.

The only RCRA hazardous waste identified at Site L9 is raw TNT which is hazardous based on its reactivity (waste code D003).

Remedial action activities were conducted between August and October 1999 to remove PCS contaminated soil from Site L9. Remedial action activities resulted in excavation of 694CY of PCB-contaminated (Aroclor 1260) material. Both TSCA and non-TSCA regulated materials were managed; 162CY was TSCA regulated and 532CY was non-TSCA regulated.

Site L9 is not located near a heavily populated area. The future land use for Site L9 is intended for development into the USDA Midewin National Tallgrass Prairie. According to the baseline risk assessment, soils at the site were stated to pose an unacceptable risk to recreational users. Interim RGs presented in the October 1998 ROD were based upon risk-based models for recreational exposure of humans to COCs. Within the SOU, the primary health threat at Site L9 was associated with SRU1 and SRU4 soils. During RA activities in 1999, SRU4 soil containing COCs above RGs were removed to minimize the risk to human health and the environment. According to the RAOs set in the October 1998 ROD, Site L9 has achieved closure status for SRU4 soils as documented in the *Final PCB Sites RA Closure Report* (MWH, December 2001). Remedial action activities will be conducted at Site L9 to remediate SRU1 soils, once final RGs are designated for the site.

3.2.10 Site L10

Site L10 is located in the central part of the LAP Area, between Sites L7 and L8. Load-assembly-package operations performed at Site L10 were similar to those described for Site L7.

Explosive contaminants of concern for soil at Site L10 are 2,4,6-TNT, 2,4-DNT, HMX, and RDX. High levels of explosives, up to 13.8 percent, have been identified in surface soil from visually stained areas adjacent to buildings and sumps throughout the site. High concentrations of RDX occur in some locations where staining is absent and vegetation is present. Explosives were detected in heavily contaminated surface areas, beneath the foundation of one sump building, 3A-53, and next to the manhole near Building 3A-12. The total volume of affected soil at Site L10 is estimated to be 915CY. Sediment contamination is assumed to be near the southern end of the Site L10 where the small drainage ditch flows into a tributary to Jordan Creek. The total volume of affected sediment at Site L10 is estimated to be 745 CY. The volume of raw TNT is estimated to be ICY. Additionally, a total of 58CY of structural concrete in the sumps area is estimated for disposal.

Six transformers are also located on-site. Around 1987, one of the transformers in the northeastern part of the site reportedly leaked approximately 4 gallons of PCB-containing oil (with concentrations of 41,000 parts per million [ppm] PCB) onto a concrete pad. "Oil dry" was placed on the concrete to remove the oil, and the pad was wiped with cloth soaked in LIX, a solvent containing volatile organic compounds (VOCs).

The only RCRA hazardous waste identified at Site L10 is raw TNT, which is hazardous based on its reactivity (waste code D003).

Remedial action activities were conducted between August and October 1999 to remove PCB contaminated soil from Site L10. SRU4 soils were removed from discrete locations not located near areas of explosives contaminated (SRU1) soils. Remedial action activities resulted in excavation of 1,147 of PCB-contaminated (Aroclor 1260) material. Both TSCA and non-TSCA regulated materials were managed (760CY was TSCA regulated and 387CY was non-TSCA regulated).

Site L10 is not located near a heavily populated area. The future land use for Site L10 is intended for development into the USDA Midewin National Tallgrass Prairie. According to the baseline risk assessment, soils at the site were stated to pose an unacceptable risk to recreational users. Interim RGs presented in the October 1998 ROD were based upon risk-based models for recreational

exposure of humans to COCs. Within the SOU, the primary health threat at Site L10 was associated with SRU1 and SRU4 soils. During RA activities conducted in 1999, SRU4 soil containing COCs above RGs were removed to minimize the risk to human health and the environment. According to the RAOs set in the October 1998 ROD, Site L10 has achieved closure status for SRU4 soils as documented in the *Final PCB Sites RA Closure Report* (MWH, December 2001). Remedial action activities will be conducted at Site L10 to remediate SRU1 soils once final RGs are designated for the site.

3.2.11 Site L11 (Test Site)

Site L11, covering approximately 33 acres, is located immediately south of Group 1 (Site L7). This area was developed to test the firing velocities and impact effectiveness of various munitions within a secured perimeter fence. Munitions were fired within this area into a downrange target area consisting of a coarse gravel detonation pad constructed over native soil.

According to JOAAP personnel, during normal operations, approximately 10 ordnance per month failed to explode. Munitions and Explosives of Concern clearance activities performed during the Phase 1 RI did not detect any MEC, although numerous fragments were detected.

Arsenic was found at a level above its RGs in all soil samples from the target area. The area affected by arsenic contamination, approximately 80 by 300 ft, was assumed to extend to a depth of 6 inches. No RCRA hazardous wastes were identified at Site L11.

During MEC site characterization activities, conducted in the summer of 2001, 31 acres of Site L11 were characterized for UXO/EO prior to removal activities. EOD Technologies (Knoxville, TN) identified one 40mm HE grenade M406 and 190 lbs. of non-MEC scrap. During MEC removal activities at L11 that same year, EOD Technologies removed a total of 5 MEC items, 10 pounds (lbs.) of MEC scrap, and 1 lb. of non-MEC scrap. Munitions and Explosives of Concern removal activities at Site L11 were conducted within an area of approximately 4 acres. The characterization could not be followed up with complete removal at the time due to funding constraints.

During RA activities conducted during 2002, excavation and confirmation sampling activities were conducted to remove all SRU2 soils above RGs. Munitions and Explosives of Concern clearance activities were also conducted to remove any MEC items that were not detected during historical clearance activities. During these RA activities approximately 15CY of arsenic contaminated (SRU2) soils and 152 lbs of MEC waste were excavated and properly disposed of from Site L11.

Site L11 is not located near a heavily populated area. The future land use for Site L11 is intended for development into the Island City Industrial Park. The development will include additional roadways for truck traffic and large areas reserved for warehouses. According to the baseline risk assessment, soils at the site were stated to pose an unacceptable risk to industrial users. Remediation goals presented in the October 1998 ROD were based upon risk-based models for industrial exposure of humans to COCs. Within the SOU, the primary health threat at Site L11 was associated with SRU2 soils and MEC waste. Following RA activities, soil-containing COCs above RGs and MEC waste were removed, thereby minimizing the risk to human health and the environment. According to the RAOs set in the October 1998 ROD, Site L11 has achieved closure status as part

of the SOU as documented in the *Final Closure Report - Sites L11/L16* (MWH, December 2003).

3.2.12 Site L14

Site L14 is a 33-acre site located in the southwestern corner of the LAP Area, near Sites L15 through L19. It was initially constructed to produce various types of fuses. Mercury fulminate, reportedly stored at Site L14, was loaded into the fuses in the assembly line building (Building 4-14). After 1945, Building 4-14 was used for repackaging smokeless powder. According to JOAAP personnel, a sump north of Building 4-5 periodically overflowed resulting in soil contamination in this area.

Explosives contaminants of concern include 2,4,6-TNT, and RDX. The highest concentrations of explosives (total concentrations of approximately 55,000 microgram per gram [µg/g]) were detected in surface soil near the large sump north of Building 4-5. Explosive concentrations decreased with depth, but were detectable in the deepest samples collected at 5 ft. Total explosives concentrations in soil samples from all other areas at Site L14 were below the RGs. The total volume of affected soil and sediment at Site L14 is estimated to be 420CY. An additional 20CY of structural concrete in the sump area is estimated for disposal. No RCRA hazardous wastes were identified at Site L14.

Site L14 is not located near a heavily populated area. The future land use for Site LI4 is intended for development into the USDA Midewin National Tallgrass Prairie. According to the baseline risk assessment, soils and groundwater at the site were stated to pose an unacceptable risk to recreational users. Interim RGs presented in the October 1998 ROD were based upon risk-based models for recreational exposure of humans to COCs. Within the SOU, the primary health threat at Site L14 was associated with SRU1 soils. Remedial action activities will be conducted at Site L14 to remediate SRU1 soils, once final RGs are designated for the site.

3.2.13 Site L16

Site L16 covers approximately 90 acres and is located in the southwestern corner of the LAP Area. Site L16 was initially constructed for the production of boosters for munitions. These sumps received wastewater during production activities at Buildings 6-2, 6-4, and 6-32, which then discharged into drainage ditches.

Explosives contaminants of concern included HMX and RDX, which occurred at high levels in soil, primarily in a drainage ditch north of Building 6-32 and at the outfall of the sump. Other areas of explosive contamination occurred around the sump at Buildings 6-32, at entrances/exits to Building 6-2, and along the tile flume which extends west from the sump at Building 6-4.

During site characterization activities conducted in the summer of 2001, EOD Technologies determined that fuzes and boosters were present around a railroad tie structure. The tie structure was disassembled and all residual MEC removed. During the removal activities, a total of 107 nose fuzes and fuze boosters were located. Approximately 292 lbs. of MEC waste and 89 lbs. of non-MEC waste were removed. Ninety percent of the total area of L16 was cleared. The remaining ten percent remained to be cleared due to a lack of funding. No RCRA hazardous wastes were identified at Site L16.

Remedial action activities were conducted in August 2002, to clear the remaining ten percent area and excavate existing SRU1 soils. During these RA activities, approximately 900 lbs. of MEC waste and 13CY of SRU1 soils were removed from Site LI6.

Site L16 is not located near a heavily populated area. The future land use for Site L16 is intended for development into the Island City Industrial Park. The development will include additional roadways for truck traffic and large areas reserved for warehouses. According to the baseline risk assessment, soils at the site were stated to pose an unacceptable risk to industrial users. RGs presented in the October 1998 ROD were based upon risk-based models for recreational exposure of humans to COCs. Within the SOU, the primary health threat at Site L16 was associated with SRU1 soils and MEC waste. Following RA activities, all soil containing COCs above RGs and MEC waste were removed, thereby minimizing the risk to human health and the environment. According to the RAOs set in the October 1998 ROD, Site LI6 has achieved closure status as part of the SOU as documented in the Final Closure Report - Sites L11/L16 (MWH, December 2003).

3.2.14 Site L17 (Group 7)

Site L17, a 90-acre site, is located in the southwestern corner of the LAP Area. It was initially constructed for the production of boosters for munitions. After termination of loading operations in 1945, Site L17 was used for repacking of lead azide. A sump is located at the southern end of Building 7-4; and a terra cotta flume drains to the west from the sump.

As identified for Site L17 (Group 7) in the October 1998 ROD, the north drainage ditch southwest of Building 7-6 contained PCB-contaminated soil and sediments. Remedial action activities were conducted between August and October 1999 to remove PCB contaminated soil from Site L17. Remedial action activities resulted in excavation of 78CY of TSCA regulated soil.

Site L17 is not located near a heavily populated area. The future land use for Site L17 is intended for development into the Island City Industrial Park. The development will include additional roadways for truck traffic and large areas reserved for warehouses. According to the baseline risk assessment, soils at the site were stated to pose an unacceptable risk to industrial users. Remediation goals presented in the October 1998 ROD were based upon risk-based models for recreational exposure of humans to COCs. Within the SOU, the primary health threat at Site L17 was associated with SRU4 soils. Following RA activities, all soil containing COCs above RGs were removed, thereby minimizing the risk to human health and the environment. According to the RAOs set in the October 1998 ROD, Site L17 has achieved closure status as part of the SOU as documented in the Final PCB Sites RA Closure Report (MWH, December 2001).

3.2.15 Site L23A (Disposal Pit)

Historic aerial photo-interpretation from 1946 identified a small (less than 0.5 acre) disposal pit located in the southwestern corner of Sites L23/L23A that is identified as Site L23A. It is not known what materials were placed in this pit; however, aerial photos from 1952 indicated that disposal activities had ceased.

Lead was detected in soil samples from the pit at concentrations exceeding its RG. Lead-contaminated soil is assumed to extend across the center of the disposal pit and the area north of the pit (approximately 100 ft north-south by 150 ft east-west), to a depth of 6 ft. The total affected volume of soil is estimated to be approximately 3,300CY. No RCRA hazardous wastes were identified at Site L23A.

Site L23A is not located near a heavily populated area. The future land use for Site L23A is intended for development into the USDA Midewin National Tallgrass Prairie. According to the baseline risk assessment, soils at the site were stated to pose an unacceptable risk to recreational users. Interim RGs presented in the October 1998 ROD were based upon risk-based models for recreational exposure of humans to COCs. Within the SOU, the primary health threat at Site L23A was associated with SRU2 soils. Remedial action activities will be conducted at Site L23 A to remediate SRU2 soils once final RGs are designated for the site.

3.2.16 Site M1 (Southern Ash Pile)

Site Ml is comprised of approximately 68 acres located in the southwestern part of the MFG Area. The Southern Ash Pile was used from 1965 through 1974 as a landfill for ash residues generated from the incineration of wastewater produced in the TNT manufacturing processes. The "red water ash" in the Southern Ash Pile is derived from K047-listed hazardous wastes. IEPA has notified the Army, by letter of July 24, 1998, that since the ash residues at Ml no longer exhibit the characteristic of reactivity (for which they were listed), they are not hazardous wastes regulated under 35 LAC 721.103(a)(2)(C). No RCRA hazardous waste was identified at Site M1.

The ash pile, measuring 800 ft by 450 ft, covers approximately 8 acres. The ash pile is 10 to 15 ft high and is estimated to contain 205,200CY of material. Upon closure, the ash pile was originally covered with polyvinyl chloride (PVC) barriers, 12 inches of fill, and 6 inches of topsoil. However, as a result of erosion, the Southern Ash Pile was re-covered in 1985 with an additional 12 inches of clay and 6 inches of topsoil. Due to continuing erosion, additional repairs to the ash pile cover were performed in 1993, and a temporary geosynthetic liner was installed in 1996 as part of O&M activities conducted by the U.S. Army.

MWH conducted an inspection for the temporary geosynthetic liner on November 10, 1998 to assess the condition of the covering materials. At the time, it was noted that approximately 40 to 50 percent of the existing liner had been removed by high winds. Following direction from USACE, MWH prepared preliminary estimates of the cost to either repair or replace the existing covering system. Following an inspection conducted on December 17, 1998, it was decided that the existing covering system could not be cost effectively repaired and a replacement covering system should be installed.

Covering system interim O&M activities were conducted from April 27 to July 1, 1999 which included removing and disposing of the existing High Density Polyethylene (HDPE) geomembrane cover materials; regrading and compacting the soil/ash subgrade; installing a new geomembrane cover system; installing a covering anchor system; and completing associated work activities. Construction activities for the interim cover are documented in the *Draft Final Construction Completion Report and Operation and Maintenance Plan, Site Ml Interim Cap* (Montgomery Watson, November 1999).

Site M1 is not located near a heavily populated area. The future land use for Site M1 is intended for development into USDA Midewin National Tallgrass Prairie. According to the baseline risk assessment, soils and groundwater at the site were stated to pose an unacceptable risk to recreational users. RGs presented in the October 1998 ROD were based upon risk-based models for recreational exposure of humans to COCs. Within the SOU, the primary health threat at Site M1 was associated with SRU6 soils. Remedial action activities are projected to be conducted during FY2006 to excavate and dispose of SRU6 soils at Site M1.

3.2.17 Site M2 (Explosive Burning Ground)

Site M2 covers approximately 25 acres in the south central part of the MFG Area. Open burning of explosive wastes was performed on a 4-acre burning pad until 1965. The burning pad consists of gravel placed over the topsoil. Multiple areas of explosives-stained soil and absence of vegetation, are visible in the northern portion of this site. Berms surround much of the burning pad area. A wetland area is present to the north of the burning pad area and along the eastern boundary of M2.

More than 400 tons of suspected "red water ash" were encapsulated in an impermeable membrane and buried at a shallow depth in the northern section of the explosives burning pad. The color, odor, texture, and apparent solubility of the buried waste are indicative of potentially untreated explosives sludge.

Explosives contaminants of concern for soil at Site M2 include 1,3,5-TNB, 2,4,6-TNT, 2,4-DNT, and 2,6-DNT. The volume of explosives-stained soil in M2 exceeding the RGs is estimated to be 830CY. The area of stressed vegetation in M2, without observable explosive, residue is estimated to represent an additional 500CY of soil. Additionally, there is an estimated 270CY of material in the "ash pillow." Soils at Site M2 may include the following RCRA characteristic waste: soil contaminated with Toxicity Characteristic Leaching Procedure (TCLP) extractable 2,4-DNT (RCRA waste code D030).

Site M2 is not located near a heavily populated area. The future land use for Site M2 is intended for development into the USDA Midewin National Tallgrass Prairie. According to the baseline risk assessment, soils at the site were stated to pose an unacceptable risk to recreational users. Interim RGs presented in the October 1998 ROD were based upon risk-based models for recreational exposure of humans to COCs. Within the SOU, the primary health threat at Site M2 was associated with SRU1 soils. Remedial action activities will be conducted at Site M2 to remediate SRU1 soils once final RGs are designated for the site.

3.2.18 Site M3 (Flashing Grounds)

Site M3 covers an area of approximately 66 acres located in the west central portion of the MFG Area adjacent to Grant Creek. From 1942 until 1988, the principal activity at Site M3 was the flash burning of equipment and demolition materials to remove explosives residues. The flash burning has been performed at two primary locations within a 6-acre fenced area. An area of explosives-stained soil, where trucks were washed after dumping explosives materials, is located between the primary burning pads and a dumping area/pad.

Four additional burning pads, located to the south of the fenced area of Site M3, were identified in aerial photographs. Each of these secondary burning pads in the central portion of Site M3 is estimated to be 2 acres. Numerous craters, located adjacent to the burning pads, may be indicative of TNT block testing. Later photographs indicate that the area containing these southernmost burning pads had been covered with a layer of soil by 1953 but portions of the pads are still visible.

Explosives contaminants of concern for soil at Site M3 include 1,3,5-TNB, 2,4,6-TNT, and 2,4-DNT. Based on the data collected at Site M3 and the non-intrusive nature of the flashing operation, the vertical extent of explosives contamination that exceeds the RGs is assumed to be limited to one ft. Aboveground storage tanks (ASTs) were present at Site M3 during historical site activities. Total petroleum hydrocarbons impacted soil may have been a result of incidental spills from the ASTs. Total petroleum hydrocarbons impacted soils are most likely co-mingled with SRU1 impacted soils and will be removed during RA activities to remediate SRU1 soils.

The total volume of explosives and TPH impacted soil is estimated to be 400CY. Approximately 150,000 of the 260,000 sf of topsoil within the 6-acre fenced area of Site M3 are estimated to contain lead at concentrations above the RGs. The vertical extent of lead contamination is assumed to be limited to 1 ft based upon the non-intrusive nature of flashing operations. The volume of lead-contaminated soil in Site M3 exceeding the RGs is estimated to be 5,600CY.

Soils at Site M3 may include the following RCRA characteristic wastes: TCLP-extractable 2,4-DNT (RCRA waste code D030) and TCLP-extractable lead (RCRA waste code D008).

Site M3 is not located near a heavily populated area. The future land use for Site M3 is intended for development into the USDA Midewin National Tallgrass Prairie. According to the baseline risk assessment, soils at the site were stated to pose an unacceptable risk to recreational users. Interim RGs presented in the October 1998 ROD were based upon risk-based models for recreational exposure of humans to COCs. Within the SOU, the primary health threat at Site M3 was associated with SRU1 and SRU2 soils. Remedial action activities will be conducted at Site M3 to remediate SRU1 and SRU2 soils once final RGs are designated for the site.

3.2.19 Site M4 (Lead Azide Area)

Site M4 (Lead Azide Area) is located in the west central part of the MFG Area and covers approximately 136 acres. Lead azide, a primary initiating explosive, was produced at Site M4 from the early 1940s through the Korean War, and again during the Vietnam War from 1966 into early 1968.

The principal feature located in the western part at Site M4 was the Lead Azide Lagoon. The Lead Azide Lagoon was used as a settling basin to store wastewater treatment sludge from the manufacturing and formulation of lead-based initiating compound prior to neutralization and subsequent discharge to Grant Creek. Any remaining lagoon sludge is classified as K046 hazardous waste.

The Lead Azide Lagoon covered an area of approximately 2,000 SF. In 1982, the production facility in the central portion of M4 was demolished with the wreckage being burned within the Lead Azide

Lagoon. At present, the only visible evidence of the lagoon is brick and concrete rubble in the surface soil.

Lead in excess of RGs was detected in 14 of 20 soil samples analyzed from Site M4. Lead was detected in an area covering approximately 47,500 SF, and extending to a depth of 3 ft. The volume of lead-contaminated soil at Site M4 exceeding the RGs is estimated to be 4,200CY.

Soils at Site M4 may contain RCRA characteristic hazardous wastes for TCLP extractable lead (RCRA waste code D008) and RCRA listed hazardous wastes for lead wastewater treatment sludges (RCRA waste code K046).

Bioremediation was the selected remedy for the treatment of a large percentage of the explosives-contaminated soils at JOAAP. A portion of Site M4 was selected as the site to construct the Bioremediation Treatment Facility (BTF). Construction of the BTF began in May 1999, and operations (stockpiling of soil) started in July 1999. Site M4 operations will remain active until the volume of explosives-contaminated soil excavated for treatment has reached the treatment goal at the facility.

Site M4 is not located near a heavily populated area. The future land use for Site M4 is intended for development into the USDA Midewin National Tallgrass Prairie. According to the baseline risk assessment, soils at the site were stated to pose an unacceptable risk to recreational users. Interim RGs presented in the October 1998 ROD were based upon risk-based models for recreational exposure of humans to COCs. Within the SOU, the primary health threat at Site M4 was associated with SRU2 soils. RA activities will be conducted at Site M4 to remediate SRU2 soils once final RGs are designated for the site.

3.2.20 Site MS (Tetryl Production Area)

Site M5 consisted of approximately 244 acres located in the central portion of the MFG Area. The principal activity at Site M5 during periods of operation was the production of tetryl. Tetryl was manufactured during World War II, the Korean War, and again during the Vietnam War until 1973. The Tetryl Ditch (oriented from north to south) bisected Site M5 with Production Lines 1 through 6 located west of the ditch and Productions Lines 7 through 12 constructed to the east of the ditch. Lines 1-6 were burned and removed. The Nitrating ("East-West") Ditch was located immediately to the north of the nitrating buildings in the tetryl production lines.

Each of the 12 tetryl production lines consisted of four separate "houses," oriented north to south, for nitrating, refining, wet storage ("lag-house") and drying. Wastewater from the tetryl manufacturing processes in the nitrating and refining houses flowed into settling boxes located on the west side of the buildings. Wastewater from the nitrating building was discharged into open drainage ditches that flowed to the north and into the Nitrating Ditch. The Nitrating Ditch drained into the Tetryl Ditch that ultimately drained into Grant Creek to the south of the Tetryl Production Area. Tetryl was visible within the settling boxes at the refining houses.

Wastewater from acid spills and daily floor cleaning was discharged from floor drains directly to the settling boxes at the nitrating and refining houses. Additionally, dust traps were constructed

outside of the eastern doors of these buildings to collect tetryl residues.

The primary wastewater from the tetryl drying process was discharged to a settling box constructed immediately to the west of each drying house. Tetryl was visible within these settling boxes for Production Lines 7 through 12. A concrete weir was constructed in the Nitrating Ditch that formed a settling basin to the south of the acid recovery building for Tetryl Production Lines 7 through 12. Crystalline explosives compounds were visible in the basin sediment where the wastewater from the AFR building and the nitrating buildings on Production Lines 10,11, and 12 collected.

Explosives contaminants of concern for soil at Site M5 included 1,3,5-TNB, 2,4,6-TNT, 2,4-DNT, tetryl, and 2,6-DNT. Results of sampling of Site M5 indicated contamination of Tetryl, 2,4,6-TNT, 2,4-DNT, 2,6-DNT, lead and beryllium in excess of compound-specific RGs.

Buildings in Site M5 West were removed in 1988, and the area was backfilled, regraded, and revegetated. Buildings in the Site M5 East Area were demolished in 1998 in conjunction with the liquidation activities at JOAAP. Unlike Site M5 West, the concrete floor slabs and footings within the Site M5 East Area remained in place prior to MWH's 1999 summer field activities. Also, various building debris components were left on site in and near these building features.

Remedial action activities were conducted from July to November 1999. Approximately 1,500CY of SRU1 soils and 4,100CY of SRU3 soils were excavated from Site M5 and delivered to the Site M4 BTF for biological treatment and disposal. Confirmation sampling verified that remaining soils did not exceed the SRU1 or SRU3 RGs established in the October 1998 ROD.

All SRU1 and SRU3 soils above RGs from Site M5 have been excavated, screened, transported and successfully treated at the Site M4 BTF to meet RGs, and RAOs set in the October 1998 ROD have been met. Treatment results for SRU3 soils excavated from Site M5 can be found in the *Draft 2003 Bioremediation Report* (currently under construction). Treatment results for SRU1 soils can be located in the *Draft Treatment Completion Report - SRU1 Tetryl Soils* (MWH, February 2004).

Site M5 is not located near a heavily populated area. The site is currently owned by Centerpoint Properties, a private entity, and has been developed into an intermodal rail system. The development includes a rail spur, additional roadways for truck traffic, and large areas reserved for warehouses.

According to the baseline risk assessment, soils and sediment at the site were stated to pose an unacceptable risk to industrial users. Remediation goals presented in the October 1998 ROD were based upon risk-based models for industrial exposure of humans to COCs. Within the SOU, the primary health threat at Site M5 was associated with SRU1 and SRU3 soils. Following RA activities, soil and sediment containing COCs above RGs were removed, thereby minimizing the risk to human health and the environment. According to the RAOs set in the October 1998 ROD, Site M5 has achieved closure status as part of the SOU as documented in the Final Site M5 Closure Report (MWH, December 2000).

3.2.21 Site M6 (TNT Ditch Complex)

Site M6 covers approximately 271 acres, located in the central part of the MFG Area. During World War II, the production of TNT and DNT were the major activities at Site M6. The TNT production lines were again operated at full capacity for the Korean and Vietnam Wars. During each of the inter-war periods, the plant mission was changed to a research and development (R&D) role in which explosive compounds, such as nitroxylenes, were produced. TNT production ceased in 1977.

Twelve parallel TNT "batch" production lines were initially constructed in the TNT Ditch Complex from south to north. The principal buildings in each TNT production line were oriented east to west. The batch production lines were constructed in pairs; each line began with a "mono-house," then a "bi-house," followed by a "tri-house" for the nitration of toluene.

The TNT process wastewater from each tri-house and wash house, known as "red-water," was initially discharged from wooden holding tanks to open clay-lined ditches that drained into the 9,100-foot-long "TNT Ditch." The original wastewater drainage system, specific to the wash houses, was replaced in 1965 by a system of wooden flumes constructed in the TNT Ditch. The wash house red water was then diverted to the Red Water Area for treatment. The Red Water Area, Site M7, was constructed at the southern end of the TNT Ditch Complex.

DNT-contaminated wastewater from the bi-houses and DNT sweating-and-graining buildings was discharged via wooden settling tanks into open troughs and ditches that flowed directly into the storm water sewer system and discharged into the TNT Ditch. Wastewater discharged directly to the TNT Ditch was not treated in the Red Water Area and flowed directly into Grant Creek.

Occasionally, operational problems developed during the nitrating processes. To avoid potential explosion hazards, the explosives batch in progress could be flooded in water stored in large wooden "drowning" tubs. During the period from March 16, 1972 through September 14, 1974, there were more than 30 recorded instances in which batches of explosives were drowned. The batch drownings primarily occurred at the tri-houses during the final nitration step.

Approximately 4,800 pounds of DNT "bi-oil," 5,600 pounds of Oleum (fuming sulfuric acid), and 2,800 pounds of nitric acid were released to the TNT Ditch with each event. Similar drowning tubs were located at each bi-house.

Explosives contaminants of concern for soil at Site M6 include 1,3,5-TNB, 2,4,6-TNT, 2,4-DNT, 2,6-DNT, 2-NT, and RDX. The areas of contamination exceeding clean up levels include soils adjacent to each of the TNT wash houses, bi-houses, tri-houses, between the wash houses and the TNT Ditch, at the APR Buildings, and around the perimeter of the laboratory building.

Results of sampling of Site M6 indicated that 2,4,6-TNT, 2,4-DNT, lead, arsenic, and beryllium exceeded compound-specific RGs. The volume of explosives (SRU1) and explosives and metals-contaminated (SRU3) soil in the TNT Ditch is 12,000CY.

Soils at M6 may include the following RCRA characteristic wastes: soils contaminated with TCLP extractable 2,4-DNT (RCRA waste code D030) and soils contaminated with TCLP extractable lead

(RCRA waste code D008). The soils at M6 may also contain RCRA-listed wastes if contaminated with red water (RCRA waste code K047) and DNT production waste waters (RCRA waste code Kill).

As part of 1999 field sampling activities, USACE conducted additional site investigations of locations within the Site M6 North (Continuous Lines Area) which were not previously covered in the RI/FS but suspected of containing soil contamination. The site investigation and characterization indicated that explosives contamination was limited to discrete locations and in suspected surface-level contaminated soil beneath the elevated red-water discharge pipe. During the 2000 construction season, the explosives contaminated soil was excavated and stockpiled at the BTF at Site M4 for subsequent treatment. Post-removal action confirmation sampling indicated that soils in excavation areas satisfied RGs for soils.

The main rail line and spurs are located on the eastern edge of Site M6 and extend the entire length of the site. The main rail line is approximately 6,000 ft long and has 35 rail spurs that run off at a slight angle to the southwest and are approximately 200 ft in length. The rail lines themselves were salvaged for scrap in 1998 prior to initiation of RA activities MWH in 1999. At the discretion of USACE, MWH conducted characterization sampling at rail lines and spurs at Site M6. Areas targeted for characterization by USACE were selected based on visual observations of stained soil and lack of vegetation. Based on the results of the 1999 characterization effort, USACE developed a comprehensive characterization plan in 2003 designed to locate and identify any additional or outstanding explosives-contaminated soil along the main rail line and spurs not identified during 1999 characterization sampling activities. Soil characterized above RGs was excavated and transported to the Site M4 BTF for treatment during 2003 and 2004 construction seasons.

Remedial action activities have been conducted at Site M6 to address SRU1 and SRU3 soils identified in the RI/FS. Construction and sampling activities for the excavation and disposal of SRU1 and SRU3 soils were conducted at Site M6 during the 1999, 2002 and 2003 construction seasons. Remedial action activities during the 1999, 2002, and 2003 construction seasons have resulted in the excavation of approximately 130,000 tons (1.3 tons/CY^3) of SRU1 and SRU3 soils.

Site M6 is not located near a heavily populated area. Site M6 will be transferred to the State of Illinois for inclusion into an industrial park. Developments within the industrial park are to include an intermodal rail system with a rail spur, additional roadways for truck traffic, large areas reserved for warehouses, and a coal-powered power plant. According to the baseline risk assessment, soils, sediment, and groundwater at the site were stated to pose an unacceptable risk to industrial users. RGs presented in the October 1998 ROD were based upon risk-based models for industrial exposure of humans to COCs. Within the SOU, the primary health threat at Site M6 was associated with SRU1 and SRU3 soils. According to Page 4-1, Paragraph 2 of the October 1998 ROD, Risk Assessment studies determined that surface waters at JOAAP pose no risk to human health and the environment, and were therefore not addressed as a contaminated medium. Remedial action activities are currently being executed to remove all soil and sediment containing COCs above RGs to minimize the risk to human health and the environment.

3.2.22 Site M7 (Red Water Area)

Site M7 covers approximately 49 acres located in the central part of the MFG Area immediately to the south of the TNT Ditch Complex. The TNT Ditch forms the eastern boundary of Site M7. Facilities within Site M7 include three separate groups of storage tanks, pumping stations, evaporators, and incinerators. Beginning in 1965, these facilities were used to treat wastewater (red water) containing explosives residues and derivatives produced in the TNT manufacturing process. At that time, red water from the TNT wash houses was diverted from the TNT Ditch into wooden flumes. The red water was collected in storage tanks to the south of the TNT Ditch Complex. Overflow of untreated red water was stored in the Red Water Lagoon, located in the northern portion of Site M7. This 3.3-acre lagoon, with a capacity of 4.1 million gallons, was remediated in 1985.

Explosives contaminants of concern for soil at Site M7 included 1,3,5-TNB, 2,4,6-TNT, 2,4-DNT, RDX, and 2,6-DNT. Soils at the M7 site were considered listed wastes if contaminated with red water (RCRA waste code K047) and DNT production waste water (RCRA waste code K111).

During RA activities conducted from July through October 2001, approximately 22,000 tons of SRU1 explosives contaminated soils were excavated from Site M7 and delivered to the Site M4 BTF for biological treatment and disposal. Confirmation sampling verified that remaining soils do not exceed explosives RGs established in the October 1998 ROD.

All explosives-contaminated soils from Site M7 have been excavated, screened, transported and successfully treated at the BTF to satisfy RGs. The SRU1 soils excavated from Site M7 were successfully treated in Windrows 60 through 85. A final inspection has been conducted, and RAOs set in the October 1998 ROD have been met.

Site M7 is not located near a heavily populated area. Site M7 will be transferred to the State of Illinois for inclusion into an industrial park. Developments within the industrial park are to include an intermodal rail system with a rail spur, additional roadways for truck traffic, large areas reserved for warehouses, and a coal-powered power plant. According to the baseline risk assessment, soils, sediment, and groundwater at the site were stated to pose an unacceptable risk to industrial users. RGs presented in the October 1998 ROD were based upon risk-based models for industrial exposure of humans to COCs. Within the SOU, the primary health threat at Site M7 was associated with SRU1 soils. According to Page 4-1, Paragraph 2 of the October 1998 ROD, Risk Assessment studies determined that surface waters at JOAAP pose no risk to human health and the environment, and were therefore not addressed as a contaminated medium. Following RA activities, soil-containing COCs above RGs were removed, thereby minimizing the risk to human health and the environment. According to the RAOs set in the October 1998 ROD, Site M7 has achieved closure status as part of the SOU as documented in the *Final Closure Report - Site M7* (MWH, November 2003).

3.2.23 Site M8 (Acid Manufacturing Area)

Site M8 covers an area of approximately 304 acres in the central portion of the MFG Area. The shape of M8 is an inverted "L" oriented lengthwise from north to south. Site M8 contains four areas in which nitric and sulfuric acids were produced and combined into various strength "mixes" for use in the manufacturing of DNT, TNT, and tetryl.

Acid Area 3 is located in the northeast comer of Site M8. The production of Oleum (fuming sulfuric acid), strong nitric acid, and other acids used in the production of explosives was the principal activity in Acid Area 3, which contained the Oleum Plant, the Northern Ammonia Oxidation Plant (AOP), and the Northern Acid Area.

The Oleum Plant was located in the northern portion of Acid Area 3. The southern half of the Oleum Plant consisted of concrete and brick pads for the receiving and storage of bulk sulfur. Raw sulfur was readily apparent throughout this area and along the southern railroad spur. No RCRA hazardous wastes were identified at Site M8.

During liquidation activities at the site, prior to the transfer of property to the State of Illinois, removal activities were conducted to remove sulfur from surficial soils. On August 10, 2000, the site was transferred to the State of Illinois. Following the land transfer, the State of Illinois sold the site to Centerpoint Properties. Subsequent site activities include the construction of an intermodal rail facility currently operated by Burlington Northern Santa Fe (BNSF). *According to the Finding of Suitability to Transfer (FOST), February 1999,* prepared by MWH on behalf of USACE, there were no exceedences of soil industrial remediation goals in all of Site M8.

Site M8 is not located near a heavily populated area. The current land use includes an intermodal rail system which includes a rail spur, roadways for truck traffic and large areas reserved for warehouses. Sulfur is not a CERCLA regulated waste, and was not identified in the October 1998 ROD as a risk to industrial receptors in any media at the site.

3.2.24 Site M9 (Northern Ash Pile)

Site M9 is comprised of approximately 20 acres located at the top of an escarpment in the north-central part of the MFC Area. The Northern Ash Pile was constructed during 1966 and 1967 as a landfill for ash residues from the incineration of TNT manufacturing wastes. The red water ash in the Northern Ash Pile is derived from K047-listed hazardous wastes. IEPA has notified the Army, by letter of July 24, 1998, that since the ash residues at M9 no longer exhibit the characteristic of reactivity (for which they were listed), they are not hazardous wastes regulated under at 35 IAC 721.103(a)(2)(C).

The ash pile measures more than 625 ft by 600 ft and covers approximately 5 acres. The ash pile is 10 to 15 ft high with a domed top and steep sides. The Northern Ash Pile is estimated to contain 124,000CY of material. Upon closure, the ash pile was originally covered with PVC barriers, 12 inches of fill, and 6 inches of topsoil. However, as a result of erosion, the Northern Ash Pile was recapped in 1985 with an additional 12 inches of clay and 6 inches of topsoil. Evidence of leaching from the eastern, southern and western edges of the Northern Ash Pile has been observed during site reconnaissance in the form of stressed vegetation. The presence of several collapsed features across the ash pile have been documented, some of which have breached the clay cap and exposed ash material. The cap was repaired again by the U.S. Army in 1993. No RCRA hazardous waste was identified at Site M9.

During routine inspections of the cap, a leachate seep from the south side of the Northern Ash Pile was stressing vegetation and staining soils in the drainage channel south of the ash pile. The IEPA

requested that interim measures be conducted to prevent the continued leachate seepage until permanent closure activities are initiated.

MWH conducted test excavations at Site M9 in August 1998 to assess the leachate elevations and the depths of cover at the site. Results of this investigation indicated that the leachate appeared to be generated from surface water infiltration percolating through the existing earthen and plastic cover system on the ash pile. Infiltration water coming into contact with the ash material was found to be migrating laterally along the ash material. It did not appear that the leachate was percolating through the ash mass. Therefore, it was proposed to install a collection system that intercepts the leachate near the location of the leachate seep, at the interface of the cover system and the ash material.

A conceptual design memorandum for the Site M9 Interim Leachate System was prepared by MWH for submittal to IEPA, USEPA Region 5 , USACE, and Army Industrial Operations Command (IOC) on October 28, 1998. Comments related to the conceptual design were received during a November 12, 1998 meeting among IEPA, USEPA, USACE, IOC, and MWH team members. It was established at that meeting that the conceptual design for Site M9 was satisfactory and that implementation activities for the project could proceed. MWH prepared and submitted a Work Plan for the interim leachate system for Site M9 dated December 23, 1999.

Interim O&M activities were performed at Site M9 from March 31 to May 10, 1999 and included installation of a leachate collection trench, which was installed within the ash pile; installation of a conveyance pipe to transport collected leachate to a central wetwell; installation of a pumping system to pump leachate to a higher elevation in the ash pile; installation of an infiltration trench to recirculate leachate into the ash pile at higher elevations in the ash pile; and installation of a power source.

Greater than anticipated leachate volume generation within the Northern Ash Pile, prompted MWH to conduct additional interim site activities during July and August 2001. An additional three to four feet of treated soil from Site M4 was spread and compacted over the existing ash pile surface. The additional soil capping activities resulted in a noted reduction in leachate volume generation and disposal costs.

Site M9 is not located near a heavily populated area. Site M9 will be transferred to the State of Illinois for inclusion into an industrial park. Developments within the industrial park are to include an intermodal rail system with a rail spur, additional roadways for truck traffic, large areas reserved for warehouses, and a coal-powered power plant. Within the SOU, the media of concern at Site M9 is associated with SRU6 soils. According to the baseline risk assessment, the media at Site M9 were not identified as a risk to industrial receptors. Remedial action activities are projected to be conducted at Site M9 during FY2006 excavate and dispose of SRU6 soils at the site.

3.2.25 Site M11 (Landfill)

Site M11 is located to the east and south of the Explosive Burning Ground (Site M2) and covers approximately 133 acres. While initially used as a source of gravel, this area was operated between 1952 and 1978 as an uncontrolled dump. Site Mil is divided into two sections by School House

Road. The Landfill is located on a ridge estimated to be 800 ft wide by 5,600 ft long and oriented northeast to southwest. The ridge rises 10 to 15 ft above the surrounding low plain.

A variety of waste materials are contained in the landfill. The materials include asbestos, insulation, and construction rubble. Numerous 55-gallon drums have also been identified; other debris includes creosote-treated wood, paint cans and scrap metal. Similar materials are believed to be buried in the Site M11 gravel pit excavations. An area covered with asphalt tar is located in the central part of the southern portion of Site M11. A gravel pile, covered with a white residue, is also present in this part of the Landfill. Samples of the waste detected concentrations of lead at levels exceeding the TCLP limits, indicating that some of the wastes present would be classified as RCRA hazardous wastes. The estimated volume of the material is 66,600CY. RCRA characteristic hazardous wastes may be present at Site M11 in the form of TCLP-extractable lead (RCRA waste code D008). RA activities are projected to be conducted at Site M11 during FY2006 to address SRU6 soils by constructing a RCRA Subtitle C landfill cap at the site.

Site M11 is not located near a heavily populated area. The future land use for Site M11 is intended for development into the USDA Midewin National Tallgrass Prairie. Within the SOU, the primary health threat at Site M11 was associated with SRU6 soils. According to the baseline risk assessment, the media at Site M11 were not identified as a risk to recreational user receptors. Remedial action activities are projected to be conducted at Site M11 during FY2006 to construct a new landfill cap for SRU6 soils at the site.

3.2.26 Site M12 (Sellite Manufacturing Area)

Site M12 is located to the west of the TNT Ditch Complex in the northwestern portion of the MFG Area. Sellite was manufactured for use in the purification of crude TNT. Sellite consists of a solution of sodium sulfite and sodium sulfate. M12 included two sellite production units, a wastewater lagoon, and associated drainage ditches.

No data were collected that directly identifies the vertical extent of lead contamination at Site Ml2. Based on patterns of lead concentrations in samples collected in other areas within the MFG Area, lead contamination in soils and sediments at the Sellite Manufacturing Area is presumed to be limited to a depth of 12 inches. The depth of contamination is based on high concentrations of sulfate throughout Site M12 and the insolubility of lead sulfate and other lead salts. The volume of lead-contaminated soil and sediment at Site M12 exceeding the RGs is estimated to be 3,700CY and includes both sediment in the lagoon and soils in the ditches.

The environmental impacts of raw sulfur on vegetation are observed at the wastewater outfall located to the north of the sellite manufacturing facility. The absence of vegetation in and immediately adjacent to surface deposits of sulfur is also noted in the former lagoon located in the northeast portion of Site M12. The volume of sulfate-contaminated soil is estimated to be 1,400CY. Soils at Site M12 may contain RCRA characteristic hazardous wastes for TCLP extractable lead (RCRA waste code D008).

Site M12 is not located near a heavily populated area. The future land use for Site M12 is intended for development into the USDA Midewin National Tallgrass Prairie. According to the baseline risk

assessment, sediment at the site was stated to pose an unacceptable risk to recreational users. Interim RGs presented in the October 1998 ROD were based upon risk-based models for recreational exposure of humans to COCs. Within the SOU, the primary health threat at Site M12 was associated with SRU2 and SRU7 soils. Remedial action activities will be conducted at Site M12 to excavate and dispose of the SRU7 soils of concern at the site. Remedial action activities will be conducted to remediate SRU2 soils once final RGs are designated at the site.

3.2.27 Site M13 (Gravel Pit)

Site M13 is located in the central portion of the MFG Area to the north of the Tetryl Production Area, to the east of the TNT Ditch Complex, and to the west of Acid Area 1. The Gravel Pits cover approximately 106 acres.

Four potential disposal areas have been identified within Site M13. Each of the disposal areas in Site Ml3 is less than 12 acres. Plant records and aerial photographs indicate that landfill activities at the Northern Gravel Pit began in 1966 and ceased in 1984. The topography in the vicinity of the Northern Gravel Pit is flat. The Northern Gravel Pit contains scrap metal, creosote-treated railroad ties and telephone poles, and a variety of construction and office debris. None of the other pits were identified as containing wastes posing potential threats to human health or the environment.

Site related soil contaminants include beryllium, lead, and benzo(a) pyrene. The material in the former disposal area requiring remedial action is estimated to be 222,000CY. No RCRA hazardous wastes were identified at Site M13. RA activities will be conducted at Site M13 to address SRU6 soils by constructing a RCRA Subtitle D landfill cap at the site.

Site Ml3 is not located near a heavily populated or area. Site M13 will be transferred to the State of Illinois for inclusion into an industrial park. Developments within the industrial park are to include an intermodal rail system with a rail spur, additional roadways for truck traffic, and large areas reserved for warehouses. Within the SOU, the media of concern at Site M13 is associated with SRU6 soils. According to the baseline risk assessment, the media at Site M13 were not identified as a risk to industrial receptors. Remedial action activities are projected to be conducted at Site M13 during FY2006 to construct a new landfill cap for SRU6 soils at the site.

3.2.28 Site M16

The Motor Pool Area (Area 16) is located along Hoff Road in the northern section of Site M8 and covered approximately 8 acres during historical site activities. During the most active period of operations in the MFG Area, a fleet of approximately 400 vehicles was serviced regularly at the Motor Pool Area. Wastewater was generated in this area from vehicle and floor washing and steam cleaning of engines.

During typical operations, several precautions were generally taken to keep oil and grease that were removed from serviced vehicles out of the wastewater drainage system. The floor drains were equipped with traps that collected oil, grease, and settled solids. These traps were periodically removed and emptied into 55-gallon drums kept onsite. In addition, spent oil and grease from vehicle maintenance were also containerized onsite. These wastes were eventually moved to the

10,000-gallon UST located in the Salvage Yard on the LAP side of JOAAP.

A site reconnaissance was conducted at the Motor Pool Area by Dames & Moore on June 10 and 11, 1991. No visible evidence of oil staining was observed on the ground surface. Also, there was no evidence of a storm water discharge point from the Motor Pool to the Acid Ditch. JOAAP personnel indicated that the sewer lines at the Motor Pool may have previously discharged into the old process sewer lines from the Acid Area, which discharged into the Tetryl Ditch rather than into the Acid Ditch. No drawings could be found to determine if the old process sewer lines ever received discharge from the Motor Pool; however, in past years, oil slicks have been reported in both the Tetryl Ditch and Grant Creek, which would support this scenario.

Based upon data collected during the Phase 2 RI, and discussed in Table 6-3 of the October 1998 ROD, COCs (TPHs, PCBs, and Base Neutral Acids [BNAs]) at Site M16 were present at concentrations that satisfy industrial RGs designated in the October 1998 ROD. Site M16 was designated as a NFA site in the October 1998 ROD and has since been transferred to the State of Illinois, and is currently owned by Centerpoint Properties, a private entity.

4.0 REMEDIAL ACTIONS

The ROD for JOAAP was finalized in October 1998. Remedial Action Objectives were developed as a result of RI and FS activities conducted at the site. Data and cost estimates from RI/FS activities aided in the development of and screening of remedial alternatives considered in the October 1998 ROD. The primary objective of the remedial actions at JOAAP is to effectively mitigate, minimize threats to, and provide adequate protection of human health and the environment. To meet this objective, the Army developed RAOs for both the soil and groundwater OUs.

The objectives of the final remedial actions are summarized as:

- Clean up contaminants to the site-specific and chemical-specific remediation goals;
- Prevent human and environmental exposure to contamination at concentrations above the remediation goals;
- Eliminate soil contamination as a continuing source of groundwater contamination;
- Prevent migration of contaminants; and
- Actions will not leave behind any characteristically hazardous RCRA wastes, except those contained within the capped landfills of SRU6.

The objectives of the interim remedial actions are summarized as follows:

- Eliminate soil contamination as a continuing source of groundwater contamination; and
- Prevent migration of contaminants.

The RGs for SOU sites at JOAAP were established from a risk-based model based on the final intended use of the lands following transfer of property. Further classification of SRU sites being remediated, based on the intended land use, was developed in the October 1998 ROD. This classification considered the RGs for the Industrial Park and Will County Landfill areas as "Final", while the RGs established for land intended for transfer to the USDA were classified as "Interim."

A summary of Final RGs and exceedences for COCs at each site (prior to any RA activities) is located in Table 4-1.

Appropriate final remedial actions for future USDA soils have been developed, evaluated, selected, and presented in the *Proposed Plan for the Soil Operable Unit, Interim ROD Sites* (U.S. Army, February 2004). The selected remedies for interim sites will be formerly presented and approved by the appropriate regulatory agencies in accordance with the NCP, once the Final ROD for interim sites has been submitted. The submittal date for the Final ROD for interim sites is expected to be during FY2004.

The following subsections give a description of the selected remedy for each designated SRU where final RGs have been established. Site-specific information describing remedy implementation, system operations, and O&M activities are described in detail in further subsections.

4.1 REMEDY SELECTION

The following subsections give a summary of the selected remedy for each designated SRU as described in the October 1998 ROD

4.1.1 SRU1 Soils - Bioremediation

Described below are the RA activities under the Bioremediation remedy for SRU1 soils as developed in the October 1998 ROD. The Bioremediation remedy includes:

- Building Demolition
- Soil Excavation, Transportation, and Confirmatory Sampling
- Soil Preparation
- Bioremediation
- Backfilling, Regrading, and Revegetating Excavated Areas
- Soil Disposal
- Treatment Area Decommissioning
- Institutional Controls - Deed Restrictions on Land and Soils

Building Demolition

Where appropriate, some existing building components and structures will be demolished prior to excavating contaminated soil. The RI/FS identifies these buildings. These buildings will be either removed or salvaged as part of the ongoing liquidation contract for JOAAP. If building debris cannot be salvaged, it will be disposed at the Will County Landfill (WCLF) or at an existing permitted facility. The disturbance to soil will be minimized during building demolition activities.

Soil Excavation for Treatment or Disposal

Contaminated soil will be excavated from the various subareas within each site, loaded into trucks, and transported to a central treatment area (Site M4) for stockpiling. Conventional earthmoving equipment will be used for excavation. Soil excavation at each area will continue until sampling confirms that concentration levels in the soil are below RG levels. If necessary, excavated areas will be backfilled, for safety reasons and to avoid ponding of surface runoff, with soil from an on-site borrow location. Some treated soil could potentially be used as clean backfill at any on-site location that does not require structural fill. Depending upon the time schedule for excavation, this may or may not be the same location from which the soil was removed. Backfilled areas will be regraded to conform to the surrounding topography. Most of these backfilled areas will be revegetated with plants consistent with the future use of the area.

Confirmatory Sampling

The limits of excavation will be determined primarily based on the RI/FS maps and data and by visual observation of stained soil. These limits will be confirmed using field screening tests, in accordance with a sampling plan approved by the USEPA and IEPA, with final confirmatory

samples (of contaminants of concern and TCLP analyses, as appropriate) analyzed at a laboratory.

Soil Transportation

It would be impractical and extremely expensive to establish a separate treatment area at each SRU site. Therefore, trucks will be used to haul the soil to a central treatment area established in the MFG Area (Site M4) to process and bio-treat explosives contaminated soils. Trucks transporting soil from the LAP Area to the treatment area in the MFG Area will fully comply with the Regulations of Illinois Department of Transportation (IDOT).

Soil Preparation for Treatment

After reaching the treatment area, contaminated soil will be stored in a stockpile area. Soil will be blended and screened within the stockpile area, and any large stones, debris, and raw TNT will be removed using a series of shaker/separator units. Blending of hot-spot soil with less contaminated soil will be conducted, as necessary, to obtain a homogenized soil for feed into the treatment system.

Debris and large stones will be stockpiled for possible pressure washing and reuse or properly disposed. Any raw TNT will be removed and stockpiled for open burn/detonation or incineration at a permitted facility, or processed to be blended back for treatment. All trucks used to transport soil will be routed through a wheel wash prior to exiting the treatment area. Wash water from the trucks and from the pressure wash operation will be containerized and used as makeup water in the treatment area or sent off-site for disposal. If MEC is encountered, it will be screened and removed for open burn/detonation or for off-site incineration at a permitted facility.

Bioremediation

The final selection of bioremediation technology was made based on several evaluation factors including cost, technical feasibility, performance time, environmental acceptability, and reuse of the final treated material. Following a technology and cost evaluation, windrow composting was selected as the preferred bioremediation treatment process. Composting is a treatment process where organic compounds are biologically degraded or transformed by mesophilic and thermophilic microorganisms. The composting process consists of mixing the waste material with an amendment or bulking agent to increase porosity, enhance air mass transfer into the system, and enhance the microbial population that degrades the contaminants. Windrow composting includes three major steps: (a) amendment materials preparation, (b) windrow construction, and (c) windrow operation. The bioremediation alternative is expected to treat the soil and reduce the explosive levels to below RGs.

One central treatment area will be constructed and soil from the different sites transported to that area. This treatment area will include a contaminated soil stockpile area, preparation area, treatment processes area, and a treated soil stockpile area. Run-off from rain and from the treatment itself will be controlled to prevent any contamination due to the treatment operation. Treated soil will be backfilled in excavated areas.

Backfilling, Regrading, and Revegetating Excavated Areas

Excavated areas will be backfilled as required for safety, to prevent ponding, and to promote surface drainage. The source of the backfill soil will be from an on-site borrow location. Some treated soil can also be used as clean backfill at any on-site location that does not require structural fill.

Depending upon the time schedule for excavation, this may or may not be the same location from which the soil was removed. Backfilled areas will be regraded to conform to the surrounding topography. Most of these backfilled areas will be revegetated with plants consistent with the future land use. For those areas designated to become part of the Midewin National Tallgrass Prairie, backfilling and reseeding of excavated areas and identifying sources of borrow will be done in consultation with USDA/FS. Surface water runoff from RA sites will be monitored at specified points to ensure compliance with National Pollutant Discharge Elimination System (NPDES) and Illinois water quality standards.

The substantive requirements of ARARs relating to jurisdictional wetlands will be met, where appropriate.

Soil Disposal

United States Army Corps of Engineers uses the following options that exist for disposal of treated or untreated soils. Soils are tested as appropriate and in accordance with procedures approved by USEPA and IEPA to determine whether the soils are RCRA hazardous wastes and whether RGs are exceeded. Based on the results of these tests, the disposal options for the soils are as follows:

1. All soils contaminated with RCRA hazardous wastes must be:
   - Disposed at a RCRA Subtitle C facility, or
   - Treated and disposed at a RCRA Subtitle C facility, or
   - Treated and disposed at a RCRA Subtitle D facility or may be used as subgrade or backfill, if the soils are not characteristically hazardous under RCRA, achieve RGs, and do not exceed LDRs under RCRA.

2. All soils which exceed RGs and are not RCRA hazardous waste must disposed as above or:
   - Disposed at a RCRA Subtitle D facility, or
   - Used as subgrade fill material in capped landfills at JOAAP.

3. All remaining soils can be disposed as above, or
   - Reused (e.g., as backfill).

These options are available for all soils except the PCB-contaminated soils in SRU4.

Treatment Area Decommissioning When the treatment of contaminated soil is completed, the treatment area and associated facilities will be disassembled, decontaminated, and salvaged. Any parts of the treatment facility that cannot be salvaged or are not desired by the future owner will be disposed at WCLF or at an existing permitted facility as construction debris. Any treatment residuals will also be sampled and reused or properly disposed.

Institutional Controls - Deed Restrictions on Land and Soils

Deed restrictions, and transfer documents (for lands to be transferred to the USDA), have been developed or are being developed separately from the October 1998 ROD by the Army, USEPA, IEPA and the future land users. These deed restrictions and transfer documents will run with the land until removed by mutual agreement of the Army, USEPA, IEPA and the current landowner. The

deed restrictions and transfer documents will be recorded with the Will County Recorder (302 N. Chicago Street, Joliet, IL 60432). Section 120(h)(3) of CERCLA defines precise requirements for the contents of deeds and transfer documents for property to be transferred from the Federal government, in which, hazardous or toxic substances were stored for greater than a year, or were released into the environment. Specifically, it states that: "in the case of any real property owned by the United States on which any hazardous substance was stored for one year or more, known to have been released, or disposed of, each deed entered into for the transfer of such property by the United States to any other person or entity shall contain—(A) to the extent such information is available on the basis of a complete search of agency files—(i) a notice of the type and quantity of such hazardous substances, (ii) notice of the time at which such storage, release, or disposal took place, and (iii) a description of the RA taken, if any, and (B) a covenant warranting that—(i) all remedial action necessary to protect human health and the environment with respect to any such substance remaining on the property has been taken before the date of such transfer, and (ii) any additional remedial action found to be necessary after the date of such transfer shall be conducted by the United States; and (C) a clause granting the United States access to the property in any case in which remedial action or corrective action is found to be necessary after the date of such transfer."

The objectives of these deed and transfer document restrictions is to protect human health and the environment by (i) ensuring that land use is consistent with the requirements of PL 104-106, and (ii) maintaining the integrity of the landfill caps at sites L3, M11 and M13 where caps have been placed. The restrictions that will be recorded to meet these objectives include but may not be limited to the following:

Land in the areas designated for industrial park can not be used for residential use. Land designated for the USDA cannot be used for industrial or residential use.

Interim vs. Final Remedial Actions

Remedial actions at Sites L16, M5, M6 and M7 for SRU1 soils are considered final. Remedial actions at Sites L1, L7, L8, L9, L10, L14, M2 and M3 for SRU1 soils are considered interim.

4.1.2 SRU2 Soils - Excavation and Disposal

Listed below are the RA activities under the Excavation and Disposal remedy for SRU2 soils as developed in the October 1998 ROD. The Excavation and Disposal remedy includes:

- Soil Excavation, Transportation, and Confirmatory Sampling
- Soil Preparation
- Backfilling, Regrading, and Revegetating Excavated Areas
- Soil Disposal
- Institutional Controls - Deed Restrictions on Land and Soils

All of the RA activity descriptions for SRU2 soils are common with SRU1 remedial actions. Refer to Section 4.1.1 for the appropriate remedy component descriptions.

Interim vs. Final Remedial Actions Remedial actions at Site L11 for SRU2 soils are considered final. Remedial actions at Sites L2, L3, L5, L23A, M3, M4 and M12 for SRU2 soils are considered interim.

4.1.3 SRU3 Soils - Bioremediation and Disposal, and Excavation and Disposal

Listed and described below are the RA activities under the Bioremediation and Disposal, and Excavation and Disposal remedy for SRU3 soils as developed in the October 1998 ROD. The Bioremediation and Disposal, and Excavation and Disposal remedy includes:

- Soil Excavation, Transportation, and Confirmatory Sampling
- Soil Preparation
- Treatment Determination
- Bioremediation
- Backfilling, Regrading and Revegetating
- Soil Disposal
- Treatment Area Decommissioning
- Institutional Controls - Deed Restrictions on Land and Soils

Treatment Determination
Explosives and metals-contaminated soil will be excavated from sites M5, M6, L2 and L3. The Army will determine whether or not these soils should be treated prior to disposal, based on metal concentrations and explosive characteristics and concentrations in the soil. The following decision rules will be followed in this treatment determination for soils containing both explosives and metals contamination:

1. The Army will treat all soils that are RCRA hazardous waste based on explosives contamination in the soil. (An example is soils with explosives concentrations (>100,000 ppm) so high that they are reactive).

2. The Army may treat all other soils. Treatment will be attractive if it improves the disposal options (such as allowing for disposal in a RCRA Subtitle D permitted landfill instead of a RCRA Subtitle C permitted landfill).

Applicable final rule-making under RCRA may amend this treatment determination process.

The remaining RA activity descriptions for SRU3 soils are common with SRU1 remedial actions. Refer to Section 4.1.1 for the appropriate remedy component descriptions.

Interim vs. Final Remedial Actions
Remedial actions at Sites M5 and M6 for SRU3 are considered final. Remedial actions at Sites L2 and L3 for SRU3 are considered interim.

4.1.4 SRU4 Soils - Excavation/Incineration and Disposal

Listed and described below are the RA activities under the Excavation/Incineration and Disposal

remedy for SRU4 soils as developed in the October 1998 ROD. The Excavation/Incineration and Disposal remedy includes:

- Structure Demolition
- Soil Excavation, Transportation, and Confirmatory Sampling
- Backfilling, Regrading, and Revegetating Excavated Areas
- Soil Incineration or Disposal
- Institutional Controls - Deed Restrictions on Land and Soils

Soil Incineration or Disposal

PCB-contaminated soil will be excavated and disposed of as described below. No raw TNT or MEC is expected to be present in the soil. Depending on confirmatory sampling results, there are three different disposal options:

- If PCB levels in soil are below 50 ppm, then the soil will be disposed at RCRA Subtitle D permitted facility.

- If PCB levels in the soil are between 50 ppm and 500 ppm, then the soil will be disposed at a TSCA permitted landfill.

- If PCB levels are greater than 500 ppm, then the soil will be disposed off-site in accordance with TSCA (e.g., treated off-site at a TSCA permitted incinerator).

The remaining RA activity descriptions for SRU4 soils are common with SRU1 remedial actions. Refer to Section 4.1.1 for the appropriate remedy component descriptions.

Interim vs. Final Remedial Actions

Remedial actions at all sites (L1, L5, L7, L8, L9, L10, and L17) for SRU4 are considered final.

4.1.5 SRU5 Soils - Excavation and Disposal

Listed and described below are the RA activities under the Excavation and Disposal remedy for SRU5 soils as developed in the October 1998 ROD. The Excavation and Disposal remedy includes:

- Structure Demolition
- Soil Excavation, Transportation, and Confirmatory Sampling
- Backfilling, Regrading, and Revegetating Excavated Areas
- Soil Disposal
- Institutional Controls - Deed Restrictions on Land and Soils

All of the RA activity descriptions for SRU5 soils are common with SRU1 remedial actions. Refer to Section 4.1.1 for the appropriate remedy component descriptions.

Interim vs. Final Remedial Actions

Remedial actions at Sites L1 and L5 for SRU5 are considered interim.

4.1.6 SRU6 Soils - Capping or Excavation and Disposal

Listed and described below are the RA activities under the Capping or Excavation and Disposal remedy for SRU6 soil's as developed in the October 1998 ROD. The Capping or Excavation and Disposal remedy includes:

- Soil Excavation, Transportation, and Confirmatory Sampling
- Capping
- Excavation and Disposal
- Institutional Controls

Soil Excavation, Transportation, and Confirmatory Sampling
The description for the soil excavation, transportation, and confirmatory sampling for SRU6 soils is common with the SRU1 remedial actions. Refer to Section 4.1.1 for the remedy component description.

Capping
The landfills in Sites L3, M11, and M13 will be capped. These landfill surfaces will be regraded and smoothed before the construction of the caps. Regrading may require fill soil from an on-site borrow location, the product of a treatment process (SRU1, SRU3), or suitable soils from the SRU2 disposal activities.

Resource Conservation and Recovery Act Subtitle D caps will be constructed over Site M13 landfills because these landfills contain non-hazardous wastes. Resource Conservation and Recovery Act Subtitle C caps will be constructed over the Site L3 and M11 landfills because they contain hazardous wastes.

Excavation and Disposal
The landfills in Sites L4, M1, and M9 will be excavated and disposed. Landfill materials will be excavated using conventional earthmoving equipment. Excavated areas will be graded and vegetated to be compatible with the intended land use. If necessary, excavated areas will be backfilled from an on-site borrow location. Excavated material will be tested prior to final disposal.

Based upon testing, excavated material will be classified and segregated as hazardous, non-hazardous, or recyclable. Based upon classification, lined trucks will transport the waste for ultimate disposal. If waste is considered hazardous then it will be disposed at a RCRA Subtitle C landfill disposed. The inert ash at Sites M1 and M9 is not a RCRA hazardous waste and may be disposed in a solid waste facility or otherwise offered for reuse. The Army is pursuing the option for reuse of the inert ash from Sites M1 and M9.

Institutional Controls
For the capped landfills, maintenance/repair and monitoring program will be required after capping and closing the landfills. A maintenance/repair program will be established to maintain the caps and prolong their life span. The monitoring program will be established to test and monitor if any contaminants are migrating from the landfills into the groundwater beneath and around the landfills. This program will be implemented in accordance with the IEPA requirements for closed landfills.

The monitoring and maintenance programs will be reviewed and approved by the USEPA and IEPA.

Legal restrictions on uncontrolled excavation and land use to minimize human contact with landfill materials will be specified in the deed, and transfer documents (for lands to be transferred to the USDA), for the landfills that will be capped on-site (L3, M11, and M13). In addition, Site M9, which will be excavated and disposed, and site M1, will also have some legal and excavation restrictions because it falls within the boundaries of a Groundwater Monitoring Zone (GMZ). Excavation that may cause plume migration or any other groundwater disturbance, especially well installation, will be restricted at these sites. These restrictions will be in the deed or leasing agreements.

Interim vs. Final Remedial Actions
Remedial actions at all sites for SRU6 soils are considered final. Prior to implementation of this remedy, the Army will continue to maintain existing landfills M1 and M9.

4.1.6.1 Site M1 Interim Cap

Listed and described below are the proposed O&M components as detailed in the Draft Final Construction Completion Report and Operation and Maintenance Plan, Site Ml Interim Cap, (Montgomery Watson, November 1999). The interim O&M activities consisted of the following:

- Removal of existing geosynthetic covering materials and disposal of the material at an off-site landfill;
- Removal of existing subgrade to prepare a uniform, compacted surface for placement of the geomembrane;
- Installation of geomembrane cover; and
- Verification of successful implementation of an anchor system for the new geomembrane cover.

The interim covering activities were designed to repair the damaged existing cover constructed during previous closure activities. Damages to the existing cover included wind and storm water erosion, sink holes, and breaches in the clay cover. Leaching from the western and northern edges of the ash pile left ash residue and stressed vegetation in the perimeter ditches.

Access controls were established at the site to prevent unauthorized public access. Access controls included barbed wire fencing with a padlocked access gate around the perimeter of the site. Routine monitoring and inspection of the liner are conducted to verify that the covering system remains effective and potential damages are promptly repaired as they occur.

4.1.6.2 Site M9 - Interim Leachate Control System

Listed and described below are the proposed O&M components as detailed in the *Draft Construction Completion Report, M9 Interim Leachate Control System* (Montgomery Watson, September 1999).

The proposed interim O&M activities included the installation of:

- Collection piping and sump;
- Transfer piping;
- Infiltration piping; and
- Power source.

The interim leachate control system is designed to collect leachate generated at the site to re-circulate back into the ash pile, and maintain a controlled transfer of leachate to a primary collection tank. These measures were designed to eliminate leachate seepage to the surrounding topography. Access controls, including barbed wire fencing with a padlocked access gate around the perimeter of the site, and a chain-linked fence with an enclosed housing system, were established to protect the power generation and pumping components of the system. Sampling and disposal of the leachate is conducted once the primary collection tank has reached 80% volume capacity. Weekly inspections are conducted at Site M9 to check leachate levels in the collection tanks, and to verify that there is no damage to, or leachate seepage from, the existing cap.

4.1.7 SRU7 Soils - Removal and Recycle and Disposal

Listed and described below are the RA activities under the Removal and Recycle and Disposal remedy for SRU7 soils as developed in the October 1998 ROD. The Removal and Recycle and Disposal remedy includes:

- Soil Excavation, Transportation, and Confirmatory Sampling
- Backfilling, Regrading, and Revegetating Excavated Areas
- Sulfur Recycle or Disposal
- Institutional Controls

Sulfur Recycle or Disposal

Raw sulfur will be excavated and hauled for recycling or disposal. The raw sulfur found on the surface and upper layers of soil in study areas M8 and M12 will be scraped and separated from the soils at the site. The sulfur may have some commercial salvage value. The U.S. Army is investigating the possibility of reuse of sulfur. However, if it is found that this sulfur has no commercial value, it will be disposed at the WCLF or at an existing permitted facility as a non-hazardous waste.

Institutional Controls

Legal restrictions on uncontrolled excavation and land use to minimize human contact with contaminated soil/sediment will be specified in the deed for Sites M8 and M12 because these sites fall within a GMZ. Although the GMZ will be established mainly for explosives and not for sulfur, institutional controls will still apply to these two sites. Excavation that may cause plume migration or any other groundwater disturbance, especially well installation, will be restricted at these sites. These restrictions will be in the deed or leasing agreements.

The remaining RA activity descriptions for SRU7 soils are common with SRU1 remedial actions. Refer to Section 4.1.1 for the appropriate remedy component descriptions.

Interim vs. Final Remedial Actions
Remedial actions at all sites for SRU7 are considered final.

4.1.8 Interim Remedial Action Sites

Interim remedial action sites, listed in the October 1998 ROD, are awaiting designation of final RGs that are protective of human health and the environment, for lands which will be transferred to the USDA. These sites currently implement access controls in the form of security patrols and/or fencing to minimize exposure to potential hazards present at each site. A summary of interim remedial action sites and their SRU designation is presented below.

Site	SRU	Interim Remedial Action Site
L1	SRU1, SRU5	✓
L2	SRU2, SRU3	✓
L3	SRU2, SRU3	✓
L5	SRU2, SRU5	✓
L7	SRU1	✓
L8	SRU1	✓
L9	SRU1	✓
L10	SRU1	✓
L14	SRU1	✓
L23A	SRU2	✓
M2	SRU1	✓
M3	SRU1, SRU2	✓
M4	SRU2	✓
M12	SRU2	✓

A summary of institutional and access controls that have been implemented at Final and Interim RA sites is presented in Table 4-5.

4.1.9 No Further Action Sites

Sites L6 and Ml6 were identified in the October 1998 ROD as NFA sites, but have soils present at the sites that do not allow for unlimited use and unrestricted exposure. Soils at each site meet the industrial RGs set in the October 1998 ROD. These NFA sites implement institutional controls in the form of deed restrictions to verify that current land use is consistent with industrial use objectives. A summary of the NFA sites and the COCs identified at each site during previous RI and

removal action activities is presented below.

Site	COCs	No Further Action Site
L6	TPHs, PCBs, BNAs, BNAs,	✓
M16	Pesticides, Metals	✓

4.2 REMEDY IMPLEMENTATION

The remedial design for RA activities was conducted between July 1998 and April 1999 with no substantial difficulties occurring during the design. *The Final Soils Operable Unit Remedial Design/ Remedial Action Workplan - Phase 1* (MWH, 1999) was approved and signed on April 7, 1999.

Several factors governed the order in which RA activities were conducted. The sites that posed the greatest risk to human health and the environment; based upon the baseline risk assessment, were generally the sites where RA activities were first initiated. Other factors affecting the order of RA activities included:

- Mitigating the highest potential for migration of COCs from soil to groundwater
- Necessity of quickly expediting property transfers
- Budgetary constraints

The following subsections describe, on a site-by-site basis, the implementation of the selected remedies based upon SRU designation.

Interim O&M activities were implemented during the review period to repair/enhance the existing capping systems at landfill sites in the MFG area which are included within Sites M1 and M9 descriptions.

4.2.1 SRU1 Soils

4.2.1.1 Site L16

RA activities for SRU1 soil and MEC removal were formally initiated at Site L16 on August 12, 2002 during the initial kick-off meeting for MEC clearance activities. The major components of the RA activities conducted at Site L16 included:

- Mobilization
- Site Preparation
- MEC Clearance
- Soil Excavation
- Sampling and Analysis
- Soil Transportation and Disposal
- Restoration and Revegetation
- Demobilization

USEPA and IEPA have verified that all RA activities were conducted in accordance with the *Final Soils Operable Unit Remedial Design/Remedial Action Workplan - Phase 1* (MWH, April 1999). During RA activities, approximately 900 lbs of MEC waste and 13 CY of SRU1 soils were removed, excavated, transported off-site and screened, and treated at the Site M4 BTF. The SRU1 soils were transported to Site M6, screened, then transported to the biotreatment facility and treated in Windrows 115,149, and 150.

Re-grading and backfilling of the site was performed only at the sump removal locations. Demobilization activities took place on August 28, 2002, after sump excavation, and on October 10, 2002, after sump backfilling and soil excavation/transporting.

Specific deed restrictions will be developed for Site L16, separate from the October 1998 ROD, by the Army, the USEPA, IEPA and the Joliet Arsenal Development Authority (JADA). The deed restriction covering the industrial park at Site L16 will limit future soil and groundwater use. The land in areas designated for the industrial park may not be used for residential purposes. Existing LAP area fencing serves as a deterrent to unauthorized entry to the site.

The selected remedy has successfully functioned to remove SRU1 soils above RGs and MEC waste from Site L16. The RAOs set in the October 1998 ROD have been satisfied for the site. Closure of Site L16 is documented in the *Final Closure Report - Sites L11/L16* (MWH, December 2003).

4.2.1.2 Site M6

The majority of soils at Site M6, as characterized in the RI/FS, were determined to be SRU1 soils, with the remainder being SRU3 soils. The selected remedy at Site M6, for both SRU1 and SRU3 soils, was the same - excavation and bioremediation. For these reasons, the discussion pertaining to SRU3 soils at Site M6 has been summarized under the SRU1 heading.

Remedial action activities for SRU1 and SRU3 soils removal were formally initiated at Site M6 on July 16, 1999 during the pre-construction kick-off meeting. The major components of the RA activities conducted at Site M6 since the start of construction have included:

- Site Preparation
- Preliminary Characterization
- Excavation Activities
- Confirmation Sampling
- Raw Product and MEC Support
- Soil Screening Activities
- Decontamination
- Site Restoration

Excavation activities within Site M6 commenced August 23, 1999 and were conducted using conventional excavation equipment. Based on the Phase 1 RD/RA Work Plan and the preliminary characterization sampling results, an excavation plan was prepared for each designated area. Excavation of contaminated soil began at Line 1 and preceded north, line by line. Excavated materials were loaded directly onto transport vehicles.

Excavation activities were conducted in a manner to segregate SRU1 soils from SRU3 soils based on delineation indicated on the design drawings from the Phase 1 RD/RA Workplan. Within Site M6, the Wash Houses were the only areas characterized with SRU3 soils. SRU1 soils were stockpiled separately from SRU3 soils at the Site M4 BTF. In addition, care was taken to segregate loads of demolition debris from those containing predominantly soil.

Visual field observation and confirmation sampling was used to verify that the remaining soils in excavated areas did not exceed the RGs and TCLP standards. Confirmation sampling for the excavated areas was conducted in accordance with the SOU Sampling and Analysis Plan (SAP) dated June 1999. Further, a visual inspection was completed in the remediated areas in the days immediately following the excavation activity. This delay allowed any soil contaminated with fugitive TNT or DNT to stain the soil red, reacting with the oxygen in the air and the sunlight.

When visual inspection and confirmation sampling indicated that clean-up goals had been achieved, excavation activities were considered complete. When confirmation sampling indicated that RGs and/or TCLP standards had not been met, additional excavation and additional confirmation sampling was completed until RGs were achieved.

With some exceptions, the excavation plan was completed as described in the Phase 1 RD/RA Work Plan. Overexcavation was required throughout Site M6 resulting in additional depth within and around most of the building excavations.

Backfilling and regrading activities for excavations at Site M6 were conducted in accordance with the Phase 1 - RD/RA Workplan. Excavations were backfilled and regraded to cover exposed groundwater, prevent ponding, blend excavations into existing topography, and verify that site safety was maintained. Excavations were either backfilled with clean off-site borrow material, or were regraded with soils from the surrounding topography. Soil from the sand and gravel pit located to the south of Site M6 was used as a borrow source for the restoration and backfilling activities. Any excavations not backfilled and regraded, had fencing constructed around its perimeter to prevent accidental entry by humans and wildlife.

The final conditions, prior the backfilling and regrading activities are considered to match the excavation figures presented in the summary below.

Year/Activity	Total Soil Volume Excavated (tons)	SRU1 Soil Volume (tons)	SRU3 Soil Volume (tons)	Truckloads
1999 M6 RA Excavation Volumes August 27 - December 17, 1999	62,807	57,840	4,967	4,626
2002 M6 RA Excavation Volumes August 9 - November 15, 2002	44,283	44,283	0	2,474
2003 M6 RA Excavation Volumes August 22 - November 14, 2003	24,013	8,580	15,434	1,470
1999 - 2003 TOTAL	**131,103**	**110,702**	**20,401**	**8,570**

Note: Conversion rate for tons to CY of soil = 1.3 tons/CY^3

A weekly account of excavation volumes transported to the Site M4 BTF is located in Table 4-2. Locations of yearly excavation areas where SRU1 and SRU3 soils have been remediated to satisfy RGs, and RAOs stated in the October 1998 ROD is located in Figure 4-1.

During the 2000 construction season, additional excavation activities and sampling activities were conducted at the Site M6 North Continuous Lines Area from June 14, 2000 to July 11, 2000. A total of 1,411 tons of soils was excavated and transported to the Site M4 BTF for treatment. Confirmation sampling activities verified that excavation areas satisfied RGs set in the October 1998 ROD. Site M6 North has attained closure status as documented in the *Final Site M6 North Closure Report* (Montgomery Watson, December 2000).

During the 2003 and 2004 construction seasons, excavation and confirmation sampling activities were conducted along the former main rail line and rail spurs at Site M6. Excavation and sampling activities indicate that all locations where SRU1 soils above RGs were detected, were excavated and transported to the Site M4 BTF. A summary of the railspur characterization and confirmation sampling locations and results are presented in Figure 4-la.

RA activities were conducted in accordance with the *Final Soils Operable Unit Remedial Design/ Remedial Action Workplan - Phase 1* (MWH, April 1999). No difficulties were encountered during the remedial design phase of the project. Remedial action activities have effectively functioned to meet RAOs at the sites where RGs have been satisfied. Deviations from the work plan due to difficulties encountered during excavation activities are summarized in Section 4.3.1.2.

Completion of RA activities at Site M6 is expected to occur during the FY2004 construction season.

The deed restriction covering Site M6 will limit future soil and groundwater use once RA activities are completed and the land has been transferred. Security patrols contracted by the Army function to deter unauthorized entry to the site and to apprehend trespassers. No trespassers have been apprehended since the start of construction activities at Site M6. The land in areas designated for the industrial park may not be used for residential purposes.

4.2.1.3 Site M7

Remedial action activities for SRU1 soils removal were formally initiated at Site M7 on July 10, 2001 with the commencement of construction mobilization activities. The major components of the RA activities conducted at Site M7 included:

- Mobilization
- Site Preparation
- Water Handling
- Soil Excavation
- Sampling and Analysis
- Soil Screening and Transportation
- Pipe and Sump Removal
- Site Restoration
- Demobilization

United States Environmental Protection Agency and IEPA have verified that all RA activities were conducted in accordance with the *Final Soils Operable Unit Remedial Design/Remedial Action Workplan - Phase 1* (MWH, April 1999). During RA activities, approximately 22,000 tons (1.3 tons/ CY^3) SRU1 soils were excavated, transported off-site and screened, and treated at the Site M4 BTF. Soils excavated from Site M7 were successfully treated in Windrows 65 through 85. All SRU1 soils from Site M7 have been excavated to meet RGs; and RAOs set in the October 1998 ROD have been satisfied. USACE conducted a final inspection on November 19, 2001 and the final inspection certificate of completion was received on November 27, 2001 by MWH. Site regrading and restoration activities have been conducted to the level appropriate, based upon future use of the property for industrial purposes. All equipment and materials involved with RA activities were demobilized from the site.

Specific deed restrictions will be developed for Site M7, separate from the October 1998 ROD by the Army, USEPA, IEPA, and JADA - the future land owner. The deed restriction covering Site M7 and the rest of the MFG Area limits future soil and groundwater use. These deed restrictions are listed in Section 9.1.1.6, Section 9.2.1.2, and Section 9.3 of the October 1998 ROD for the SOU and GOU.

The selected remedy has successfully functioned to remove SRU1 soils above RGs from Site M7, and the RAOs set in the October 1998 ROD have been satisfied. Closure of Site M7 is documented in the *Final Closure Report - Site M7* (MWH, November 2003).

4.2.2 SRU2 Soils

4.2.2.1 Site L11

Remedial action activities for SRU2 soils and MEC removal were formally initiated at Site L11 on August 12, 2002 during the initial kick-off meeting for MEC clearance activities. The major components of the RA activities conducted at Site L11 included:

- Mobilization
- Site Preparation
- MEC Clearance
- Soil Excavation
- Sampling and Analysis
- Soil Transportation and Disposal
- Restoration and Revegetation
- Demobilization

United States Environmental Protection Agency and IEPA have determined that all RA activities were conducted in accordance with the Final Soils Operable Unit Remedial Design/Remedial Action Workplan - Phase 1 (MWH, April 1999). During RA activities, approximately 152 lbs of MEC waste and 15 CY of arsenic contaminated SRU2 soils were excavated, transported off-site, and properly disposed.

Excavation depths did not exceed one foot in depth and the topography of the site is flat. Since the potential for soil erosion was minimal, regrading was not required. Due to the relatively small size of the excavation, no site revegetation or restoration of the excavation areas was required.

Specific deed restrictions will be developed for Site L11, separate from the October 1998 ROD, by the Army, the USEPA, IEPA, and JADA - the future land owner. The deed restriction covering the industrial park at Site L11 will limit future soil and groundwater use. Existing site fencing serves as a deterrent to unauthorized entry to the site. The land in areas designated for the industrial park may not be used for residential purposes.

On November 26, 2002, the roll-off containers were collected by Waste Management and disposed at the permitted Laraway Landfill located at 21101 W Laraway Rd, Elwood, IL. Upon removal of the roll-off containers, site demobilization was complete.

The selected remedy has successfully functioned to remove SRU2 soils above RGs and MEC waste from Site L11. The RAOs set in the October 1998 ROD have been satisfied for the site. Closure of Site L11 is documented in the *Final Closure Report - Sites L11/L16* (MWH, December 2003).

4.2.3 SRU3 Soils

4.2.3.1 Site M5

The majority of soils at Site M5, as characterized in the RI/FS, were determined to be SRU3 soils.

Furthermore, due to the relatively low concentrations of lead in the SRU3 soils, the selected remedy for SRU3 soils was designated as "Excavation and Bioremediation". For these reasons, the discussion pertaining to SRU1 soils at Site M5, has been summarized under the SRU3 heading.

Remedial action activities for SRU3 and SRU1 soil removal were formally initiated at Site M5 on July 7, 1999 upon commencement of site preparation activities. The major components of the RA activities conducted at Site M5 included:

- Site Preparation
- Excavation Activities
- Sampling and Analysis
- Soil Transportation and Disposal
- Restoration and Revegetation

United States Environmental Protection Agency and IEPA have verified that all RA activities were conducted in accordance with the *Final Soils Operable Unit Remedial Design/Remedial Action Workplan - Phase 1* MWH, April 1999). During RA activities, approximately 4,100CY of SRU3 soils, and 1,500CY of SRU1 soils were excavated, transported off-site and screened, and treated at the Site M4 BTF. SRU3 soils were successfully treated in Windrows 152-153, 157-159, 163-166, and 169. Active treatment of SRU1 soils utilizing bioremediation was not required based upon confirmation sampling of the stockpile of SRU1 tetryl soils. Confirmation sampling results verified that ultraviolet (UV) radiation successfully degraded tetryl soils to meet RGs. Documentation of the confirmation sampling plan and results is presented in the *Draft Treatment Completion Report - SRU1 Tetryl Soils* (MWH, February 2004).

Treated SRU3 and SRU1 soils will remain stockpiled at Site M4 pending disposal method determination.

Regrading and Restoration activities were completed following verification that remaining soils at Site M5 were below RGs and TCLP standards. Vegetative cover has been established at Site M5. Demobilization of RA activities is complete.

The selected remedy has successfully functioned to remove SRU3 and SRU1 soils above RGs from Site M5. The RAOs for the site set in the October 1998 ROD have been satisfied. Closure of Site M5 is documented in the *Final Site MS Closure Report* (MWH, December 2000).

The State of Illinois acquired the deed for land area of Site M5 in August 2000. The site has been developed into an intermodal rail facility and is currently owned by Centerpoint Properties, a private entity. Centerpoint Properties submits certification of compliance for implementation of institutional controls, specified in the property deed, to the Army on an annual basis. Copies of the annual certification are included as Appendix E.

4.2.4 SRU4 Soils

4.2.4.1 Sites L1, L7, L8, L9, L10, and L17

Six SRU4 sites within the LAP Area (L1, L7, L8, L9, L10, and L17) were targeted for cleanup in 1999. PCB contamination at five of the six sites (Site L17 is the exception) resulted from leaks and spills associated with formerly used transformers. The execution of the selected remedy for SRU4 soils at each site was similar, (excavation and disposal). All SRU4 related COCs above RGs for soils have been removed from each site; and all sites have achieved closure status for SRU4 soils. Because of these factors, the discussion below is pertinent to implementation of the selected remedy for all sites with SRU4 soils.

RA activities for SRU4 soil removal at Sites L1, L7, L8, L9, L10, and L17 were formally initiated in July 1999 upon commencement of site preparation activities. The major components of the RA activities conducted at the SRU4 sites included:

- Preliminary Characterization
- Contamination Delineation
- Mobilization/Site Preparation
- Soil Excavation, Transportation, and Disposal
- Sampling and Analysis
- Site Restoration

United States Environmental Protection Agency and IEPA have determined that all RA activities were conducted in accordance with the *Final Soils Operable Unit Remedial Design/Remedial Action Workplan - Phase 1* (MWH, April 1999). During RA activities at the SRU4 sites, approximately 3,950 CY of SRU4 soils were excavated, transported and disposed of an appropriate off-site disposal facility. SRU4 soils with PCB concentrations greater than 50 ppm were disposed of at RCRA Subtitle C landfill by Wayne Disposal, Belleville, Michigan. SRU4 soils with PCB concentrations less than 50 ppm were disposed of at the permitted Laraway Landfill located at 21101 W Laraway Rd, Elwood, IL. A summary of site-specific SRU4 soil excavation quantities is located in Table 4-3.

Deed restrictions have been developed or are being developed separately from the October 1998 ROD by the Army, USEPA, IEPA, USDA, and JADA. These deed restrictions will run with the land until removed by mutual agreement of the Army, USEPA, IEPA, USDA and JADA. Land in the areas designated for industrial park (Site L17) cannot be used for residential use. Land designated for the USDA (Sites L1, L5, L7, L8, L9, L10) cannot be used for industrial or residential use.

Following RA activities, the sites were backfilled and graded to facilitate surface water drainage, consistent with the surrounding topography. Vegetative cover has been established at the SRU4 sites. Demobilization of RA activities is complete.

The selected remedy has successfully functioned to remove SRU4 soils above RGs from the sites. The RAOs set in the October 1998 ROD have been satisfied for the site as pertaining to the removal of SRU4 soils. Closure of Sites L1, L7, L8, L9, L10, and L17 for SRU4 soils is documented in the *Final PCB Sites RA Closure Report* (MWH, December 2001).

Soil related COCs for additional SRUs still exist at Sites L1, L5, L7, L8, L9, and L10. RA activities will be conducted at those sites to address the COCs once final RGs have been designated.

4.2.4.2 Site L5

Site L5 is the only site where PCB-contaminated soils are co-mingled with other COCs. Because no final RGs exist for metals and organics at Site L5, effective remediation could not be completed without the potential for remobilizing to the site and having to overexcavate backfill from PCB RA activities. RA activities at Site L5 were therefore postponed pending approval of final RGs for metals and organics related contaminants.

Once final RGs have been established, the major components of the Excavation/Incineration and Disposal remedy for SRU4 soils will include:

- Structure Demolition
- Soil Excavation, Transportation, and Confirmatory Sampling
- Backfilling, Regrading, and Revegetating Excavated Areas
- Soil Incineration or Disposal
- Institutional Controls - Deed Restrictions on Land and Soils

Remedial action activities will be conducted to satisfy the final RGs for SRU4 soils and RAOs stated in the October 1998 ROD. Upon designation of final RGs for this site, RA activities will be conducted in accordance with the decision documents developed by USEPA, IEPA, and USACE to effectively implement the selected remedy for SRU2 and SRUS soils.

Deed restrictions have been developed or are being developed separately from the October 1998 ROD by the Army, USEPA, IEPA and USDA - the future land user. These deed restrictions will run with the land until removed by mutual agreement of the Army, USEPA, IEPA and USDA. Land designated for the USDA cannot be used for industrial or residential use.

No SRU5 sites have final remedies or RGs determined for the SOU at JOAAP, therefore no active implementation of RA activities has been conducted during this first five-year review period. Access controls in the form of security patrols and fencing have been implemented to minimize exposure to potential threats at SRU5 sites.

4.2.6 SRU6 Soils

4.2.6.1 Sites L3, M11, and M13

No RA activities have been formerly initiated at Sites L3, M11 or Ml3.

The tentative time frame for initiation of RA activities at the sites is listed below:

Site	Projected RA Activities Time Frame
L3	FY2006
M11	FY2006-FY2007
M13	FY2007

The major components of the selected remedy for SRU6 soils at Sites L3, M11, and M13 will include:

- Capping
- Institutional Controls

Remedial action activities will be conducted in accordance with the *Final Soils Operable Unit Remedial Design/Remedial Action Workplan - Phase 1* (MWH, April 1999). Remedial action activities will be conducted at Sites L3, Mil, and M13 to satisfy the final RGs for SRU6 soils and RAOs stated in the October 1998 ROD. RA activities will also be conducted at Site L3 to address SRU2 and SRU3 soils once final RGs are established for the site. Refer to the following figures for the proposed RA activities at each site:

Site	**Figure**
Site M11	Figure 4-2, Figure 4-3, Figure 4-4
Site M13	Figure 4-5, Figure 4-6, Figure 4-7

Upon designation of final RGs for Site L3, RD/RA activities will be conducted in accordance with the decision documents developed by USEPA, IEPA, and USACE to effectively design and implement the selected remedies for SRU2 and SRU3 soils.

Deed restrictions have been developed or are being developed separately from the October 1998 ROD by the Army, USEPA, IEPA, USDA, and JADA. These deed restrictions will run with the land until removed by mutual agreement of the Army, USEPA, IEPA, USDA and JADA. Land in the areas designated for industrial park (Sites M11, M13) cannot be used for residential use. Land designated for the USDA (Site L3) cannot be used for industrial or residential use.

4.2.6.2 Sites L4, M1, and M9

No RA activities have been formerly initiated at Sites L4, M1 or M9. The tentative time frame for initiation of RA activities at the sites is listed below:

Site	Projected RA Activities Time Frame
L4	FY2008
M1	FY2008
M9	FY2007

2
The major components of the selected remedy for SRU6 soils at Sites L4, Ml, and M9 will include:

- Soil Excavation, Transportation, and Confirmatory Sampling
- Excavation and Disposal
- Institutional Controls

Remedial action activities will be conducted in accordance with the *Final Soils Operable Unit Remedial Design/Remedial Action Workplan - Phase 1* (MWH, April 1999). Remedial action activities will be conducted at Sites L4, Ml, and M9 to satisfy the final RGs for SRU6 soils and RAOs stated in the October 1998 ROD. Refer to the following figures for the proposed RA activities at each site:

Site	**Figure**
Site L4	Figure 4-8 and Figure 4-9
Site M1	Figure 4-10 and Figure 4-11
Site M9	Figure 4-12 and Figure 4-13

Deed restrictions have been developed or are being developed separately from the October 1998 ROD by the Army, USEPA, IEPA, USDA and JADA. These deed restrictions will run with the land until removed by mutual agreement of the Army, USEPA, IEPA, USDA and JADA. Land in the areas designated for industrial park (Site M9) cannot be used for residential use. Land designated for the USDA (Sites L4, M1) cannot be used for industrial or residential use.

4.2.6.2.1 Site M1 Interim Cap

Remedial design of the interim covering system was conducted between January and March 1999. Construction activities were completed between April 28, 1999 and July 1, 1999. Construction activities performed during this time period included:

- Existing Cover Removal
- Subgrade Preparation
- Covering System Installation
- Gas Vent Installation
- Fence Installation
- Decontamination
- Silt Fence Installation
- Seeding

Figures 4-14 through Figure 4-17 show the final conditions and site controls following construction completion. A final inspection was conducted on July 1, 1999 by USACE and MWH.

The interim covering system has performed according to the design specifications set in the Project Work Plan for the Site M1 (Southern Ash Pile) Cap Replacement Activities (Montgomery Watson, March 1999). The interim cover has successfully functioned to repair the damaged existing cover constructed during previous closure activities. The covering activities have also prevented further

occurrences of leaching from the western and northern edges of the ash pile. Site controls remain enforced, and wind and storm water runoff erosion have been minimized. No instances of leeching have been observed, and the constructed covering and anchoring system has remained structurally intact.

4.2.6.2.2 Site M9 Interim Leachate Control System

Remedial design of the leachate collection system was conducted between December 1998 and February 1999. Construction activities were completed between March 31, 1999 to May 10, 1999. Construction activities performed during this time period included:

- Installation of a leachate collection trench, which was installed within the ash pile;
- Installation of a conveyance pipe to transport collected leachate to a central wetwell;
- Installation of a pumping system to pump leachate to a higher elevation in the ash pile;
- Installation of an infiltration trench to recirculate leachate into the ash pile at higher elevations in the ash pile; and
- Installation of a power source.

Figures 4-18 through Figure 4-21 show the final conditions and site controls following construction completion. Start-up activities and system verifications were completed between May and June 1999. Operation and maintenance training, emergency shut-downs, and inspections were conducted during this period. In June 1999, the interim leachate control system commenced operation to re-circulate and collect leachate at the site. A final inspection was conducted on July 13, 1999 by USACE and MWH.

Leachate collection and disposal activities have been conducted since the start of system operations at Site M9. A summary of monthly leachate disposal volumes since system start-up is located in Table 4-4.

Since the start of implementation, the leachate collection system has successfully functioned to prevent additional leachate seepage from the ash pile into the environment. Although the operation of the re-circulation system has been discontinued permanently due to maintenance issues, the collection and disposal system, and subsequent cap maintenance activities, have prevented additional seep occurrences. Site activities will be continued to dispose of leachate generated at the site. Weekly inspections are conducted at the site to check leachate levels in the collection tank and to observe any new cap erosion or damages, and occurrences of seepage from the existing cap.

4.2.7 SRU7 Soils

4.2.7.1 Site M8

During liquidation activities at the site, prior to the transfer of property to the State of Illinois, removal activities were conducted to remove sulfur from surficial soils. On August 10, 2000, the site was transferred to the State of Illinois for inclusion into an industrial park facility. Following the land transfer, the State of Illinois sold the site to Centerpoint Properties. Subsequent site activities have included the construction of an intermodal rail facility currently operated by BNSF. According to the POST, February 1999, there were no exceedences of soil industrial remediation goals at Site M8. This site is closed. Centerpoint Properties submits certification of compliance for implementation of institutional controls, specified in the property deed, to the Army on an annual basis. Copies of the annual certification are included as Appendix E.

4.2.7.2 Site M12

Site M12 is the only SRU7 site that has multiple SRU designations (SRU2 soils are also present at the site) for the soil based COCs. Because no final RGs exist for metals, effective remediation of Site M12 could not be completed without the potential for remobilizing to the site and having to overexcavate backfill from sulfur removal activities. RA activities at Site M12 were therefore postponed pending approval of final RGs for SRU2 related contaminants.

Once final RGs have been established, the major components of the Removal and Reuse or Disposal remedy for SRU7 soils will include:

- Soil Excavation, Transportation, and Confirmatory Sampling
- Backfilling, Regrading, and Revegetating Excavated Areas
- Sulfur Recycle or Disposal
- Institutional Controls

RA activities will be conducted to satisfy the final RGs for SRU7 soils and RAOs stated in the October 1998 ROD. Upon designation of final RGs for this site, RA activities will also be conducted in accordance with the decision documents developed by USEPA, IEPA, and USACE to effectively implement the selected remedy for SRU2 soils.

Deed restrictions have been developed or are being developed separately from the October 1998 ROD by the Army, USEPA, IEPA and the USDA - the future land user. These deed restrictions will run with the land until removed by mutual agreement of the Army, USEPA, IEPA and USDA. Land designated for the USDA cannot be used for industrial or residential use.

4.2.8 Site M4 Bioremediation Facility

Bioremediation is the selected remedy for treatment of SRU1 and SRU3 soils at JOAAP. Bioremediation has proven to be an effective means to reduce contaminant concentrations in explosives-contaminated soil to levels below RGs. In general, composting and bioslurry processes have received the widest acceptance for treatment of explosives such as TNT, HMX, RDX, and DNT. Economic considerations and ease of implementation of this technology has warranted its implementation at JOAAP and has been critical to the overall success of project operations.

Remedial design of the BTF was conducted between March 1999 and July 1999. Construction activities were completed between May 1999 and July 1999, and included construction of the following components:

- Decontamination building
- Amendment storage building
- Blending and Processing Area
- Storm water Retention Basin/Process Water Reservoir (SB1 and SB2)
- Bioremediation Buildings
- Treatment Material Storage Area
- Internal Roads
- Office/Laboratory

Figure 4-22 illustrates the final layout of the BTF at the conclusion of construction activities.

In an effort to further refine the windrow composting process, a field demonstration was performed in August/September 1999. Objectives of the field demonstration included:

- Re-confirm the effectiveness of the composting operation in meeting the RGs.
- Refine composting process performance.
- Refine field-monitoring methods.
- Collect physical characteristic data of treated compost.
- Refine optimum amendment blend.
- Refine optimum soil loading rate.

A total of 9 windrows, each approximately 36 ft long, 16 ft wide, and 6 ft high were constructed as part of the field demonstration. To evaluate different composting methods, several variables were selected as test parameters to evaluate their impact on the compost process performance. These variables included:

- Amendment recipe
- Soil loading rate
- Amendment pre-blending
- Turning frequency

Following the field demonstration, it was determined that the amendment blending ratio of 52% stable bedding, 30% wood chips, and 18% com processing waste provided the most advantageous environment for microbial activity to flourish when mixed with explosives-contaminated soil. This amendment blend proved to be most effective when pre-blended and mixed at a ration of 70 to 30 amendments to soil (by volume). The amendments selected for use in composting soils at JOAAP include corn-processing waste, wood chip mulch, and stable bedding. Factors evaluated in selecting the amendments included nutrient content (C: N ratio), moisture content, structure, porosity, texture, and availability.

Prior to amendment addition, pretreatment sampling of the soil is conducted to collect sufficient data to consistently quantify explosive concentrations in the soil prepared for treatment.

Post-treatment sampling was conducted in accordance with the SAP Addendum for Bioremediation Post Treatment Sampling (Montgomery Watson, July 2000), which describes the protocol to confirm that treated soils do not exceed RGs. Post-treatment sampling for explosives was performed on SRU1 soils, and explosives and lead on SRU3 soils, to verify that explosives (and lead) concentrations in each windrow were reduced to below the RGs. Each windrow was managed as a single remediation unit. At such time that field measurements indicated adequate biotreatment, post-treatment sampling was conducted across the entire windrow. Because the windrows were constructed from pre-segregated material (i.e., segregated by SRU, contaminant type, and site), it was reasonable to consider that each windrow would contain relatively consistent material following treatment. This was further supported by the rigorous mechanical mixing that took place as part of windrow composting where soil was repeatedly augered, intermixed, and redistributed in freshly formed rows. Therefore, composite sampling at several stations within each windrow was the selected method for post-treatment sample collection.

Composite samples were collected from 12 windrow stations, randomly selected along the entire length of each windrow. In May 2002, the Army proposed a reduction of post treatment samples from 12 to 8 samples per windrow, in an effort to reduce costs. The proposal was accepted by both the IEPA and USEPA and is currently implemented by sampling personnel at the Site M4 BTF. Sampling stations are identified using the structural steel ribs of each treatment building as station markers. The building ribs were numbered from 1 (at the north) to 17 (at the south), and sample identification and collection locations were based on that numbering scheme to provide concise, repeatable, sample station locations. Post-treatment sample results are compared to the RGs to evaluate the effectiveness of the treatment process.

Several supplemental sampling and/or analysis activities were completed during treatment to provide better characterization and assure proper treatment. These included:

- Sample analysis for TCLP 2,4-DNT when total 2,4-DNT concentrations are less than the RG (8.4 mg/kg), but greater than 2.0 mg/kg. This ensures no characteristically hazardous 2,4-DNT remains.

- Analysis of samples from two randomly selected (SRU1) windrow stations for total lead to verify that lead impacted soils were properly delineated in the field and segregated into SRU3 stockpiles.

The analytical results presented are based on the entire sample, which includes soil and amendments. However, based on the following qualitative description, it was determined that the dilution effects were negligible. The weight ratio of soils to amendment is 1:1. During the bioremediation process, a significant amount of the amendment is consumed. At the laboratory, rocks, wood chips and straw are removed to prepare the sample prior to the extraction process. As a result of these events, the residual sample that is used for analysis is primarily soil with a small amount of corn waste and horse manure.

A windrow (or windrow station) was removed from the treatment building to the treated soil stockpile when analytical results indicated all RGs had been achieved. Figure 4-23 presents the locations of the treated soil stockpile areas at the Site M4 treatment facility.

A windrow station failing to meet RGs was isolated from "clean" stations and resampled or incorporated into the subsequent windrow for additional treatment. Windrow stations were isolated half the distance north and south to the next "clean" sample station. When a station not sampled was isolated due to adjacent station failure, that the non-sampled station was managed in the same manner as the failing station.

A yearly summary for soil treated at the Site M4 BTF is presented below.

FY	Tons of Soil Treated (dry)	SRU	Site	Primary COC
2000	12,151	1	M6	TNT/DNT
2001	35,660	1	M6	TNT/DNT
2001	4,500	1	M7	TNT
2002	15,040	1	M7	TNT
2002	21,616	1	M6	TNT/DNT
2003	27,850	1	M6	TNT/DNT
2003	2,585	3	M6	TNT/DNT
2003	6,367	3	M5	Tetryl

A summary of pre-treatment and post-treatment sample concentrations since the start of operations is located in the below-listed Bioremediation Reports:

Year	Report	Submittal Date
2000	*Final FY2000 Bioremediation Report, Bioremediation Facility*	November 2001
2001	*Final FY2001 Bioremediation Report, Bioremediation Facility*	January 2004
2002	*Draft FY2002 Bioremediation Report, Bioremediation Facility*	January 2004
2003	*Draft FY2003 Bioremediation Report, Bioremediation Facility*	(Currently Under Production)

4.2.9 Interim Remedial Action Sites

Access controls in the form of security patrols and/or fencing have been successfully implemented at each of the interim RA sites to minimize exposure to potential risks. A summary of implemented institutional and access controls for Final and Interim RA sites is included as Table 4-5.

Perimeter fencing surrounds the LAP area prohibiting unauthorized access. A security service is contracted by the Army to conduct daily patrols on all Army-owned lands. The security patrols provide surveillance at sites on the MFG and LAP areas to prevent and report unauthorized entry or activities at sites where public access is prohibited.

Site inspections were conducted to assess the current conditions of access controls at each interim site and found that fencing in good condition at the sites. Copies of the site inspection observation

forms are located in Appendix B5. Deficiencies and recommendations noted during the site inspections will be discussed in Section 8.0 and Section 9.0 of this report.

4.2.10 No Further Action Sites

No Further Action sites have effectively implemented institutional controls in the form of deed restrictions to verify that current land use is consistent with specifications stated in the deed. Land in the areas designated for industrial park have not been used or transferred for residential purposes.

For Site Ml6, the new owner of the property is required to submit certification of compliance for implementation of institutional controls, specified in the property deed, to the Army on an annual basis.

4.3 SYSTEM OPERATION/OPERATION AND MAINTENANCE

4.3.1 SRU1 Soils

4.3.1.1 Site L16

Maintenance costs are not anticipated at Site L16 Short-term maintenance such as erosion controls measures and seeding was not necessary at Site L16 due to site conditions following the RA. Long-term O&M activities are not required at Site L16. Monitoring of soil at Site L16 is not necessary since the RGs set in the October 1998 ROD have been met.

4.3.1.2 Site M6

Site conditions at Site M6 have been consistent with industrial use objectives following the RA, therefore maintenance costs are limited to short-term O&M costs and surface water monitoring. Surface water monitoring will continue, in accordance with the specifications stated in SOU SAP, until construction activities at the MFG area are completed and the RGs set in the October 1998 ROD have been met. Erosion control measures such as silt fencing and hay bails around soil stockpiles and areas of concentrated storm water runoff are being utilized at the site.

It is estimated that four to six months following RA activities, sufficient vegetative growth will be established at the site to discontinue monitoring of erosion control measures. Costs associated with implementation of surface water monitoring and erosion control measures were lumped into the costs of RA activities, therefore, specific costs could not be isolated for the five-year review. The projected cost to complete RA activities at Site M6 is $2,163,000 through the 2004 construction season.

<u>Difficulties Encountered During RA Activities</u>

- Excavation depths below and around some building foundations were deeper than anticipated due to sample exceedences and visible staining.

- Excavations below and around some building foundations were abandoned due to sample exceedences, budgetary constraints and cold weather factors. Subsequent excavations were conducted in later to satisfy the RGs for soils at these locations.

- Excavations below and around some of the building foundations were abandoned due to groundwater infiltration into the excavation. In accordance with the Phase 1 RD/RA Workplan and SSHP, excavation activities were terminated due to lack of effectiveness and to prevent excavation wall collapse. Once groundwater was encountered at the base of the excavation, confirmation samples were collected and the excavations were backfilled in accordance with USEPA-approved RD/RA Workplan. Additional excavation activities will not be conducted at these locations to remove soils above RGs. No further action is required at these locations.

These difficulties encountered during RA activities did not have a significant impact on the total cost of operations at Site M6.

4.3.1.3 Site M7

Site conditions at Site M7 were consistent with industrial use objectives following construction, therefore maintenance costs are not anticipated at Site M7. Surface water monitoring will be continued, in accordance with the specifications stated in SOU SAP until construction activities at the MFG area are completed. Site M7 SOU RGs set in the October 1998 ROD have been met. Other short and long-term monitoring at the time of construction completion was limited to maintenance of erosion control measures. Sufficient vegetative growth has been established at the site to discontinue monitoring of erosion control measures. Costs associated with implementation of surface water monitoring and erosion control measures were lumped into the costs of RA activities, therefore the specific costs could not be determined during the five-year review. There is no construction documentation to indicate that there were excessive costs associated with the implementation of short-term monitoring and maintenance activities.

4.3.2 SRU2 Soils

4.3.2.1 Site L11

Maintenance costs are not anticipated at Site L11. Short-term maintenance such as erosion control measures was not necessary at Site L11 due to site conditions following RA activities. Long-term O&M activities are not required at Site L11. Site L11 SOU RGs set in the October 1998 ROD have been met.

4.3.3 SRU3 Soils

4.3.3.1 Site M5

Maintenance costs associated with the SOU are not anticipated at Site M5. SRU3 and SRU1 soils have been successfully remediated to satisfy RGs, and the site has achieved closure status. Sufficient vegetative growth has been established at the site to discontinue surface water sampling and

maintenance of erosion control measures.

4.3.4 SRU4 Soils

4.3.4.1 Sites L1, L7, L8, L9, L10, and L17

Maintenance costs associated with the SOU are not anticipated at Sites L1, L7, L8, L9, L10, and L17. SRU4 soils have been successfully remediated to satisfy RGs, and the sites have achieved closure status for SRU4 soils. Sufficient vegetative growth has been established at the sites to discontinue erosion control maintenance and inspection activities.

4.3.4.2 Site L5

Maintenance costs associated with the SOU are considered negligible at Site L5 and will be limited to implementation of short-term O&M and erosion control measures.

Within four to six months following completion of RA activities, sufficient vegetation is expected to be established, which will allow for discontinuation of erosion control maintenance and inspection activities. Once RA activities have been completed, remaining SRU4 soils at the site will meet the RGs, therefore eliminate the need for future actions.

4.3.5 SRU5 Soils

Final remedies or RGs have not been estimated for SRU5 soils at JOAAP, therefore no system operation or O&M activities have been conducted during this first five-year review period. Projected O&M costs will be determined once final RGs and the selected remedy are designated.

4.3.6 SRU6 Soils

4.3.6.1 Sites L3, M11, and M13

Long term O&M costs associated with the SOU at Sites L3, M11, and M13 will be limited to long term care, as identified in 35 IAC 724.217, and inspection activities. Long-term care of the landfill caps will include quarterly inspections of the cap, vegetation, and drainage structures for the first five years and annual inspections for the remaining years. The integrity of the cap will be maintained by repairing depressions due to settling and subsidence, and repairing eroded surfaces.

Costs associated with for long-term O&M activities are projected to be $10,000 per year.

Erosion control measures will be implemented immediately following capping activities to minimize soil erosion and to facilitate revegetation in affected areas. Refer to the following figures for locations of erosion control measures during and following construction:

Site	**Figure**
Site M11	Figure 4-2 and Figure 4-3
Site M13	Figure 4-5 and Figure 4-6

Within four to six months following completion of RA activities, sufficient vegetation is expected to be established, which will allow for discontinuation of erosion control maintenance and inspection activities.

4.3.6.2 Sites L4, M1, and M9

Long-term O&M costs associated with RA activities at Sites L4, M1, and M9 are anticipated to be negligible.

Short-term O&M costs are expected to include inspection and maintenance of erosion control measure during and following construction activities. Erosion control measures will be implemented immediately following excavation and disposal activities to minimize soil erosion and to facilitate revegetation in excavation areas. Refer to the following figures for locations of erosion control measures during and following construction:

Site	**Figure**
Site L4	Figure 4-8
Site M1	Figure 4-10
Site M9	Figure 4-12

Within four to six months following completion of RA activities, sufficient vegetation is expected to be established which will allow for discontinuation of erosion control maintenance and inspection activities.

4.3.6.2.1 Interim O&M Capping Activities at Site M1

The goal of operation and maintenance of Site M1 is to monitor the integrity of the geosynthetic cover over the ash pile until final RA activities are implemented to address SRU6 soils.

Operation activities for the interim cap consist of inspections of the geosynthetic cover system and drainage system. Maintenance activities consist of any repairs to the cover system or cleaning necessary for proper drainage. A summary of the tasks and inspections as detailed in the *Draft Final Construction Completion Report and Operation and Maintenance Plan, Site M1 Interim Cap* (Montgomery Watson, November 1999) are summarized as follows:

Visual Inspection and Evaluation

Inspections occur on a monthly basis and after each major storm event for the duration of the O&M period. The inspector walks the entire site and checks the geosynthetic cover system for defects, holes, or damage due to weather conditions or other activities. Dust, mud, or foreign matter, that may inhibit inspection, are removed. Each suspect location is non-destructively tested. Each location that fails is repaired according to Specification Section 02780, Part 3.3 J, located in Appendix F of the of the *Draft Final Construction Completion Report and Operation and Maintenance Plan, Site M1 Interim Cap* (Montgomery Watson, November 1999).

The geomembrane anchor tires and the steel cable connecting the tires are checked for breakage and movement. The anchor trench/drainage channel is checked for debris and washout of the aggregate.

Maintenance

Maintenance is performed on an as-need basis. If tires have moved, the connecting cabling is tightened and the tire replaced to its correct position. The geomembrane, if torn, is repaired in accordance with the Geomembrane Specification, Section 02780, Part 3.3J and additional tires are placed over the repaired area to anchor properly.

The trench/drainage channel is cleaned of debris as needed. If washout of aggregate occurs, existing aggregate is regraded or additional aggregate is brought in and placed.

Costs to date for the implementation of construction activities and routine inspection activities is approximately $394,000. This cost was anticipated for interim activities and remains within budget. No initial estimates or annual break down of O&M costs were available during the five-year review.

O&M Implementation Problems

The interim capping system has functioned as intended by the design documents. There have been incidences of minor tears in the LLDPE liner, which is common occurrence for capping liners of similar nature. Small burrowing rodents have also created holes in the liner that have been required repairs.

The anchoring system required maintenance activities, due to the snapping of the high tensile fiber rope connecting the tires within the anchor system. Shifting of the tires caused by settling and wind movement created excessive strain on the rope. The anchoring system was refurbished with steel cabling to connect the tires. Since the refurbishment activities, the anchoring system has remained intact with only minor O&M activities required for cable tightening and tire re-positioning.

4.3.6.2.2 Site M9 Interim Leachate Control System

The goal of O&M activities at Site M9 was to keep the interim leachate control system operating properly such that leachate generation at the site can be properly managed until the final RA activities are conducted at the site to excavate and dispose of SRU6 soils.

The leachate recirculation system operated intermittently between August 1999 and autumn 2002. Following start-up, operation activities consisted of routine inspections of the power system, controls, the generator, system piping, and the sump to assure proper operation. Maintenance activities consisted of any repairs to the piping and power system, or cleaning necessary for proper transfer of leachate. A summary of the tasks and inspections as detailed in the *Operations and Maintenance Plan, Site M9 Leachate Control System* (Montgomery Watson, December 1999) are summarized as follows:

Daily Inspections

- On a daily basis the power system that operates the pumping system is checked for proper operation. The daily inspection includes entering the equipment building and reviewing the power control panel to determine if electrical charge is being delivered to the pumping system.

- Gate locks and door locks on the perimeter fencing and the equipment building, respectively, are inspected on a daily basis to deter unwarranted entrance into the facility.

- The collection piping cleanouts and wetwell sump are inspected on a daily basis to ensure that leachate is not leaking from the annular space around the conduits and existing ground surface.

Weekly Inspections

- On a weekly basis the fuel level in the propane storage tank is checked. If the fuel level falls below 25 percent capacity, an order for delivery of propane is placed.

Monthly Inspections

- The solar array is checked monthly for problems and for build up of dirt. If there is excessive dirt, the glass surface is cleaned. The support structure is examined for loose mechanical connections, loose cabling, signs of abrasion on wires, and corrosion.

- The battery cell is checked for level of electrolyte. All interconnections are checked for tightness and corrosion. The wooden structure is inspected to verify that no electrolyte leaked from the battery bank, or that the integrity of the wooden structure has been compromised.

- The backup generator located in the equipment building is inspected on a monthly basis for the crankcase oil level, air filter fouling or unusual dirt buildup, and fuel line obstructions or leaks.

Quarterly Inspections

- Cleanouts for the collection trench and infiltration trench are inspected to verify that no damage occurred since the previous inspection.

- The collection piping cannot be directly inspected; however, inspection of flow into the wetwell is monitored to assess if leachate flow from the collection piping appears to be entering the wetwell. If it appears that leachate flow into the wetwell is being impeded, corrective actions such as flushing and cleaning of the collection piping are considered to verify that no restrictions exist in the collection piping.

- The infiltration piping cannot be directly inspected; however the ground surface around the discharge piping is inspected to determine if any unusual surface leakage is prevalent that might be indicative of fouling within the infiltration piping.

- The leachate transfer piping is inspected by lifting the cap from the inspection pipe located at the inlet of the infiltration piping.

- The integrity of the perimeter security fence is checked on a quarterly basis and repairs made as needed. Vegetation around the facilities is checked and mowing of

the site ordered, if necessary. In addition, if areas of deficient vegetation are noted, they were cultivated and re-seeded.

Annual Inspection

- The power system charge controller and inverter are inspected annually.
- The battery bank is inspected for corrosion.
- The propane generator is inspected.

O&M Implementation Problems

MWH performed intermittent leachate re-injection activities at Site M9 during July and August 1999. To quantify the impact that leachate re-injection activities had on the level of liquid in the wetwell sump, a controlled re-injection evaluation was performed on July 27, 28, 29, and 30, 1999. During the re-injection evaluation, leachate was discharged from a leachate collection tank into the monitoring point at the head of the infiltration trenches.

Over the course of the re-injection testing, a total of 820 gallons of leachate was re-injected. Based on the rate of re-injection and the corresponding water level rise in the collection trench cleanouts and wetwell sump, it appeared as though much of the re-injected leachate was flowing directly from the infiltration trenches to the collection trenches.

The original design criteria for the infiltration trenches assumed that liquid present in the infiltration trenches would percolate back into the ash pile mass at a rate consistent with the permittivity of the ash mass. The findings of the investigation indicated that the ash mass has a lower than anticipated permittivity, and water introduced at the infiltration trenches appeared to be flowing along the top of the ash mass, directly back to the collection trenches.

Based on the results of the re-injection evaluation, MWH was directed to assess the economic feasibility of re-injecting the collected leachate versus disposal of the leachate. Based on the cost analysis developed by MWH, off-site disposal was determined to be the most cost-effective alternative.

The leachate recirculation system operated intermittently between August 1999 and autumn 2002. Maintenance problems developed during periods of operation in the form of clogging within the leachate conveyance piping, and system shutdown due to pumping malfunctions. During scheduled maintenance events, it was frequently observed that the sodium sulfate component of the leachate readily crystallized and adhered to the inner wall of the conveyance piping. This occurrence, coupled with the caustic effects of the leachate on the generator components, caused frequent pumping system malfunctions and shutdowns.

Due to frequent mechanical problems and greater than expected O&M costs, the operation of the leachate recirculation system was discontinued permanently during the spring months of 2003. All leachate collection tanks, excluding the primary tank, were removed from the site.

The leachate recirculation system will remain permanently inoperable. During scheduled RA activities to excavate and dispose of the SRU6 soils, the components of the leachate control system will be disassembled. Components that cannot be salvaged will be properly disposed.

During normal operations at Site M9, greater than anticipated volumes of leachate were generated, collected and disposed of. It was observed that the existing cap allowed for a relatively high rate of rainwater infiltration and was conducive to greater volumes of leachate generation within the ash pile. During July and August 2001, approximately three to four feet (thickness) of bioremediated soil from Site M4 was spread and compacted over the existing cap in an attempt to reduce the infiltration rate. The resultant volume of leachate generation and corresponding disposal costs were effectively reduced as a result of these cap maintenance activities. A summary of monthly leachate disposal volumes and yearly disposal costs are located in Table 4-4. No information was available during the five-year review for the original estimate for O&M costs for the leachate control system. The leachate collection system has remained operable since the construction completion and will utilized until RA activities are conducted at Site M9 to remove SRU6 soils.

4.3.7 SRU7 Soils

4.3.7.1 Site M8

There are no future costs associated with the SOU at Site M8. On August 10, 2000, the site was transferred to the State of Illinois for inclusion into an industrial park facility. Following the land transfer, the State of Illinois sold the site to Centerpoint Properties. Subsequent site activities included the construction of an intermodal rail facility currently operated by BNSF. According to the POST, February 1999, there were no exceedences of soil industrial RGs at Site M8, therefore, no remedial action was required prior to the land transfer. The new owner submits certification of compliance for implementation of institutional controls, specified in the property deed, to the Army on an annual basis.

4.3.7.2 Site M12

Maintenance costs associated with the SOU are considered negligible at Site Ml2 and will be limited to implementation of short-term O&M and erosion control measures. Erosion control measures will be implemented immediately following excavation and disposal activities to minimize soil erosion and to facilitate revegetation in excavation areas. Costs associated with erosion control measures are included in the cost for RA activities. Within four to six months following completion of RA activities, sufficient vegetation is expected to be established which will allow for discontinuation of erosion control maintenance and inspection activities.

4.3.8 Site M4 Bioremediation Facility

Maintenance costs associated with Site M4 BTF include all operating expenses incurred as a result of the treatment of SRU1 and SRU3 soils. Components of the BTF incurring operating costs include:

- Windrow Composting (Bioremediation)
- Analytical Testing
- Operations Oversight
- Water Management
- Management
- Treated Soil Disposal

Windrow Composting Windrow Composting is the selected method of bioremediation used to treat SRU1 and SRU3 soils. This includes the preparation, handling, and blending of all soil and amendments, the management of compost during treatment to insure RGs are met, and the handling of treated soil.

Analytical Testing
Analytical testing includes all pre-treatment, interim (during treatment), post treatment, and contact water sampling necessary to meet the requirements of the 1999 Soils Operable Unit RD/RA Workplan - Phase I and the October 1998 ROD.

Operations Oversight
Operations oversight includes the full time staff necessary to manage day to day operations and insure all requirements for treatment are being met. This also includes general site maintenance, health and safety, and quality control.

The primary liner system (asphaltic concrete surfaces) within the untreated material stockpile area, basin SB1, and the soil staging/processing area, is evaluated semi-annually for wear and damage. If excessive wear (scrapes or gouges) is noted, additional applications of asphaltic concrete may be applied to mitigate the wear. The observation well for the secondary liner system is also checked on a semi annual basis and after storm events to assess the accumulation of water. During inspections, no water has been observed; this indicates the primary liner system has not been compromised.

Based upon visual observation sediment removal from SB-1 has not been necessary to date. Sufficient capacity exists within the sediments basis to contain storm water runoff during and after storm events. Storm water is treated with and activated carbon treatment unit and sand filter prior to discharge to the surrounding topography at Site M4. No Illinois surface water quality standards have been exceeded during operation of the treatment system at SB-1.

During June and July 2000, an emergency controlled discharge from SB-1 was conducted by members of MWH and USACE, to reduce the elevated water levels created by heavy rains and large volumes of storm water runoff. This discharge event was approved by USEPA, IEPA, and USACE prior to implementation. Analytical results of the untreated discharge water indicated exceedences for 2,4-DNT and 2,6-DNT based on Illinois Surface Water Quality Standards. Following the results indicating an exceedence, the IEPA was contacted by MWH to develop and approve an appropriate preliminary corrective action plan. Record of the June and July 2000 event and follow-up actions were documented in a letter dated July 31, 2000 to Mr. Al Scalzo of USACE, and forwarded to members of USEPA and IEPA.

During May 2001, an unplanned discharge of untreated storm water from SB-1 occurred during an unauthorized pumping event. Analytical results collected directly from SB-1 near the intake pipe to the treatment system, on the day the unauthorized pumping was observed, indicated no exceedences of Illinois Surface Water Quality Standards. Corrective action was implemented to enforce more strict security measures at the Site M4 Bioremediation Facility to prevent future occurrences. To date no further unauthorized pumping events have occurred. Record of the May 2001 event and follow-up actions were documented in a letter dated August 10, 2001 to Mr. Donald Peterson of USACE, and forwarded to members of USEPA and IEPA.

Due to cracking and wear to the asphalt in Site M4 treatment areas, repairs were made during FY2003. During routine operations, observations of cracking and wear were noted by facility personnel. In 2003, the upper three to four inches of damaged asphalt were removed and replaced with a new four inch layer. These new layer of asphalt were applied in the Untreated soil stockpile areas and amendment process areas.

Soil stockpiles are inspections to verify that erosion control measures are in-place and effective. Soil stockpiles are sloped and compacted to mitigate storm water erosion and promote safety by minimizing slope instability and creep.

A security force is hired by the Army to patrol Site M4. The security force conducts a daily patrol for all Army properties on the MFG and LAP area to document and prevent unauthorized use or entry to the sites.

Water Management

This includes the handling and treatment of all contact (potentially contaminated) water prior to discharge offsite.

Management

Management includes monthly reporting, staff coordination, budget and schedule control, and other miscellaneous administrative activities as necessary.

Treated Soil Stockpile Management

Prior to the conclusion of FY01 bioremediation, treated soil stockpile locations within the bioremediation facility complex were nearing capacity. During the September and October 2001 JOAAP Project Management Meetings, an additional location for stockpiling treated soil was identified, discussed, and agreed upon by the entire project team. The south west corner of Site M4 was selected due to the available are of land, close proximity to the treatment buildings and internal access road, and the flat, even, low lying topography in that location. Also, from field observations, surface water does not drain offsite from this area. This due to the manmade berm running adjacent to (north) of Blodgett Rd. and the berm created by the internal access road running from the Bioremediation Facility. Also, a drainage culvert running under West Patrol Rd. (from the southwest corner of Site M4) immediately north of Blodgett Rd. is 2ft above grade and would only carry water during extreme storm events. Topographic maps and aerial photographs support these observations. The only site improvements necessary, prior to the stockpiling of treated soil, was the installation of silt fence and internal access road maintenance. The target area for the southwest stockpile is thirty (30) acres with a capacity of 900,000 cubic yards (assuming a 20ft stockpile height).

Construction of the southwest stockpile began in January 2002 of this year with treated soils from windrow 66. To date, approximately 82,500 tons of SRU1, SRU3, and tetryl treated soil has been stockpiled. Figure 4-23 presents the locations of the treated soil stockpile areas at the Site M4 bioremediation facility. The actual quantity of material in the southwest stockpile is greater due to the amendments added during treatment. Stockpile construction activities started with the installation of a haul road running due west off the south end of the internal access road to the far southwest comer of the field at Site M4. This road was constructed with 3-5ft lifts of treated soil compacted with a bulldozer during installation. Stockpile construction will continue from south to north in the southwest corner of the field over a 2-3 acre area. Height of the stockpile will be determined by MWH in the field as construction continues or as directed by USACE. At no time will the stockpile exceed 20ft in height. Both the haul road and the stockpile are crowned to prevent the pooling of water and to promote drainage. Silt fence has been installed along the entire length of the haul road and around the perimeters of the soil stockpiles. Silt fence is inspected weekly in accordance with the Site M4 Storm Water Pollution Prevention Plan.

Treated Soil Disposal

Provided a beneficial reuse cannot be found, treated soil disposal will be necessary following completion of all bioremediation activities.

A summary of O&M costs and projected soil disposal costs are summarized below:

Costs	FY2004	FY2005	FY2006	FY2007
Bioremediation Facility	$3,600,000	$3,600,000	$3,600,000	—
O&M Treated Soil Disposal	—	—	—	$5,000,000

4.3.9 Interim Remedial Action Sites

Long-term O&M costs associated with access controls at interim RA sites are considered negligible. The Army conducts inspections on fencing during daily patrols of the LAP and MFG areas. When deficiencies are noted corrective action is promptly conducted.

4.3.10 No Further Action Sites

There are no long term O&M costs associated with the implementation of institutional controls at NFA sites.

5.0 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

This document presents the First Five-Year Review Report for the SOU at JOAAP. No other reviews have occurred since the implementation of the remedial action on May 5, 1999.

6.0 FIVE-YEAR REVIEW PROCESS

6.1 ADMINISTRATIVE COMPONENTS

Representatives from the USEPA and IEPA were notified of the initiation of the five-year review during project management meetings conducted monthly at the JOAAP site office. Ms. Diana Mally of the USEPA and Ms. Nicole Wilson of the IEPA assisted in the review as representatives for the support agencies. Discussion with the community and interviews pertaining to the five-year review were held during the Restoration Advisory Board (RAB) meetings conducted at the Wilmington, Illinois - City Hall.

The First Five-Year Review of the SOU at JOAAP was performed by MWH, on behalf of USACE between December 2003 and January 2004. The review team included members from the MWH project management and technical advisory staff with expertise in construction management, engineering, hydrology, chemistry, environmental regulations, and risk assessment. The team established a review schedule that extended from December 10, 2003 to January 30, 2004. Components of the Five-Year Review are discussed below.

6.2 COMMUNITY INVOLVEMENT

Activities to involve the community in the First Five-Year Review were initiated through interviews and discussions held during RAB meetings at the Wilmington, Illinois - City Hall. The RAB meetings are held on a bi-monthly basis and are voluntarily attended by members of the surrounding community and other potentially interested parties. Historical, current and future site operations at JOAPP are the topic of discussion and serve as the main contact point for interested parties in the community. Members of USACE, USEPA, IEPA, and MWH are present at the RAB meetings to answer any questions fielded by those attending. The RAB board consists of twelve people representing seven communities from the surrounding area.

Notification of the commencement of the Five-Year Review was given to the community during a RAB meeting conducted on January 7, 2004. Discussion pertaining to the content and purpose of the Five-Year Review was discussed. Further notification was given during interviews with the RAB co-chair, Reverend Alan Abbott. Discussion was directed toward the impacts on, and concerns of, the community in relationship to the historical, current and future activities at the site.

6.3 DOCUMENT REVIEW

The First Five-Year Review consisted of a review of relevant documents including remedial design reports, closure reports, work plans, O&M records, facility records, and the October 1998 ROD. Applicable soil clean-up standards, as listed in the October 1998 ROD, were also reviewed. A list of documents that were reviewed during the First Five-Year Review is presented in Appendix A.

6.4 DATA REVIEW

6.4.1 Data Review for Soils Operable Unit RA Activities

Preliminary characterization and confirmation sampling activities have been conducted throughout the duration of RA activities within the SOU. Preliminary characterization sampling was conducted during the RI/FS to delineate the horizontal and vertical extent of contamination at each site. Subsequent RA activities were conducted to remediate soils at the locations where COCs above RGs were identified during the RI/FS process. Confirmation sampling was used to verify that the remaining soils in excavated areas did not exceed the RGs or TCLP standards set in the October 1998 ROD. Confirmation sampling for the excavated areas was conducted in accordance with the SOU SAP dated June 1999.

Data from confirmation sampling results was reviewed for individual RA activities and/or sites. Data from USEPA and IEPA approved closure reports, construction completion reports, work plans, and data validation reports were used in the review to assess that RA activities satisfied RGs at each site. Results of the confirmation sampling activities are summarized in the closure reports developed during the RA operations at JOAAP. For detailed information pertinent to the implementation of interim O&M activities, excavation locations, confirmation sampling results, RA activities, and data validation, refer to the below-listed documents.

Site	**Closure Report/Construction Completion Report**	**Submittal Date**
M9	*Draft Construction Completion Report, M9 Interim Leachate Control System*	September 1999
M1	*Draft Final Construction Completion Report and Operations and Maintenance Plan, Site M1 Interim Cap*	November 1999
M5	*Final Site MS Closure Report, Former Tetryl Production Area*	December 2000
M6 North	*Final Site M6 North Closure Report*	December 2000
L1, L7, L8, L9, L10 and L17	*Final PCB Sites M Closure Report*	December 2001
M7	*Final Closure Report - Site M7*	November 2003
L11 and L16	*Final Closure Report - Sites L11/L16*	December 2003

6.4.2 Data Review for Site M4 Bioremediation Facility Operations

Data reviewed for the development of this Five-Year Review is inclusive of information presented in the FY2000, FY2001, FY2002, and FY2003 (currently under production) Bioremediation Reports prepared by MWH. Data included in the Bioremediation Reports relevant to the five-year review includes explosives concentrations in soil prior to, and following, treatment. Consistent with

confirmation sampling at sites where RA activities have been conducted, pretreatment sample results indicate explosives concentrations in soil greater than the designated RGs for SRU1 and SRU3 soils.

Approximately 126,000 tons of SRU1 and SRU3 soils have been successfully treated from May 2000 to December 2003. Post treatment sample results indicate SRU1 and SRU3 soils are being successfully treated to meet RGs. Based upon observations at the site, it is anticipated that the selected bioremediation remedy will continue to successfully treat SRU1 and SRU3 soils to levels at or below RGs. For detailed treatment information for all soils treated at the BTF, refer to refer to the below-listed Bioremediation Reports.

Year	**Report**	**Submittal Date**
2000	*Final FY2000 Bioremediation Report, Bioremediation Facility*	November 2001
2001	*Final FY2001 Bioremediation Report, Bioremediation Facility*	January 2004
2002	*Draft FY2002 Bioremediation Report, Bioremediation Facility*	January 2004
2003	*Draft FY2003 Bioremediation Report, Bioremediation Facility*	(Currently Under Production)

6.5 SITE INSPECTION

Representatives from MWH and USACE conducted site inspections on December 9, 2003, January 14, 2004, and March 9, 2004. The purpose of the inspections was to assess the current site conditions, evaluate the integrity of historical and current RA activities, evaluate current access controls and use restrictions, and evaluate the feasibility of proposed RA activities at each respective site.

Site inspections were conducted at Sites M1, M4, M6, and M9 in accordance with the "Five-Year Review Site Inspection Checklist", dated June 2002. These sites currently have active RA activities or interim O&M operations at the sites. Inspections of the active sites resulted in comprehensive overview of each site's operations and effectiveness of the implemented remedy or O&M activity. Results of the site inspections at the active sites indicated that the sites are being maintained in generally good conditions and the selected remedies are functioning as intended. Issues identified during the site inspection are discussed in Section 8.0. Copies of the site inspection checklist for Sites M1, M4, M6, and M9 are included in Appendices B1 through Appendix B4.

Results of the site inspections for all other sites in the SOU indicated that the sites where RA activities are complete have not been altered in a manner that could affect the protectiveness of the implemented remedy. Access controls have been effectively implemented at each interim RA site and are in good condition. The access controls will effectively function to minimize interim risk at each site until RA activities are conducted to remove COC impacted soils. Issues identified during the site inspection of the interim RA sites are discussed in Section 8.0. Site inspection observation forms for interim RA sites, sites that have achieved closure status, and sites where RA activities have not been initiated, are located in Appendix B5.

6.6 INTERVIEWS

Interviews were conducted with various parties affiliated with the JOAAP project and sites.

An interview was conducted on January 7, 2004 with the RAB co-chair, Reverend Alan Abbott. Discussion was directed toward the impacts on, and concerns of, the community in relationship to the historical, current and future activities at JOAAP. Specific comments are summarized below:

- The community is concerned about the future increased truck traffic affiliated with the opening of the Will County Landfill. Additional streetlights will be installed to compensate for the increased traffic.

- A concern was raised about the site security and lack of access restrictions. Rev. Abbott felt that all terrain vehicle (ATV) users could enter areas where RA activities are active. Current site restrictions may not be stringent enough to be protective of the community.

- A comment was raised about the formulation of RGs as pertaining to USDA workers. Rev. Abbott made a comment that this issue forced a revision in RGs as the interim ROD was being developed.

- Reports give a comprehensive view of site operations, but site visits, presentations, slide shows, and pictures are more effective means of communication to the public about the on-going site operations at JOAAP.

- Rev. Abbott highly commended the project teams and regulatory staff for the effective execution of project tasks and teamwork since the start of operations at JOAAP.

A copy of the interview questions and responses from Rev. Abbott are included in Appendix C1.

An interview was also conducted with JOAAP Site Manager, Mr. Arthur Holz. The interview was conducted in the form of a hard-copy handout of interview questions developed during the five-year review. Interview questions/discussion were directed toward the performance and management of the JOAAP project. Comments/responses from the handout are summarized below:

- In the first five years, this project has met or exceeded expectations. As compared to projections made in FY-2000, the project has reduced the expected Cost-to-Complete by over $29 million and shortened the project life by three years.

- The project has met with some unforeseen difficulties. Bioremediation of DNT-contaminated soil has taken far longer than expected. The volume of contaminated soil requiring excavation at Site M6 is far greater than anticipated. Each of these adversities has been overcome and the project has remained on track.

- The bioremediation technology has been under constant improvement. The per-unit cost of treating soil has been reduced by more than 50% over the 4 plus years of operation.

- This project team has functioned very well so far. Outsiders have been impressed with the progress that we have accomplished and the successful way in which we have established positive working relationships among the parties.

A copy of the interview questions and responses from Mr. Holz are included in Appendix C2.

An interview was conducted on April 19, 2004 with the Waste Services Manager for Will County Waste Services, Mr. Dean Olson. Discussion and questions were directed toward assessing new information regarding site operations, evidence of contamination, or changes regarding enforcement of institutional and access controls at the Will County Landfill. Specific comments are summarized below:

- Will County Landfill is in contact with the Army regarding activities involving building demolition, development activities, and road easements. The Army conducted and documented historical remediation activities for asbestos in buildings that are currently within the boundaries of the WCLF. A removal action was conducted during 1997 to address an oil spill area in a portion of the land that is now part of the WCLF.

- To date, there have been no violations, incidents, or complaints filed against the WCLF.

- There have been no changes regarding or concerns about institutional or access controls at the site. The site remains used for WCLF purposes only, except for a small portion of the site which is authorized for farming use. The entrances to the WCLF are locked in the evening. All secondary entrances are padlocked and routinely checked when not in use.

- The WCLF will remain in operation for the next 23 years. After the 23 year period has expired, the land area will be transferred to the State of Illinois to create a recreational area.

- There has been no evidence of remaining contamination at the site.

7.0 TECHNICAL ASSESSMENT

This section presents the technical assessment of the final remedies selected in the October 1998 ROD for SOU sites at JOAAP in accordance with the Comprehensive Five-Year Review Guidance (USEPA, 2001).

7.1 QUESTION A: IS THE REMEDY FUNCTIONING AS INTENDED BY THE DECISION DOCUMENTS?

7.1.1 SRU1 Soils

7.1.1.1 Site L16

The excavation and bioremediation remedy selected for Site L16 (SRU1) is identified as a completed remedial action at the site where RGs have been achieved for soil media affected by the COCs. Remedial action activities have also removed all MEC waste from the site. The results of the five-year review indicate that the remedy functioned to satisfy the intended RAOs stated in the October 1998 ROD.

Costs or issues associated with monitoring and performance are not anticipated. RA activities are complete, RGs for soil have been met, and MEC items have been cleared.

Existing site fencing serves as a deterrent to unauthorized entry to the site and has prevented exposure by ingestion or dermal contact, to impacted media. Entry to the site will remain restricted until the property transfer to the future owners is complete.

7.1.1.2 Site M6

The majority of soils at Site M6, as characterized in the RI/FS, were determined to be SRU1 soils. The selected remedy at Site M6, for both SRU1 and SRU3 soils, was the same excavation and bioremediation. For these reasons, the discussion pertaining to SRU3 soils at Site M6 has been summarized under the SRU1 heading.

The excavation and bioremediation remedy selected for Site M6 (SRU1 and SRU3) is identified as an operating remedial action where the remedial action has not been completed at the site and RGs have not been achieved for soil media affected by the COCs. RA activities are currently being implemented at the site to address soils above RGs, as characterized in the RI/FS. The results of the five-year review indicate that the excavation and bioremediation activities will successfully function to satisfy the intended RAOs stated in the October 1998 ROD, upon implementation at the site.

Costs or issues associated with monitoring and performance at Site M6 are expected to include the implementation and inspection of erosion control measures and surface water monitoring. Erosion control measures at the site have remained effective and intact at the locations where implemented. Additional erosion control measures will be implemented or replaced as necessary during RA activities. Surface water monitoring at Site M6 will be conducted until the conclusion of RA activities at the site.

Monitoring activities have been optimized at the site; there are no opportunities to further reduce costs for monitoring or sampling at the site. Potential equipment breakdowns or changes, do not pose a threat to the protectiveness of the remedy.

Perimeter fencing does not exist at Site M6. Chain-linked fence has been constructed around open excavation areas that were not backfilled following construction. Vehicular access points to the site have "warning" and "government property" signs clearly visible. Access to the site at vehicular access points is restricted, when not in use, by posting warning signs mounted on a rope across the site entrance/exit. Any persons entering the construction zone must be 40-hour OSHA (or HAZWOPER) safety certified. A check-in/check-out sheet is present at the Site M6 construction office; all personnel must sign this sheet as they enter and exit the site. A security patrol service has been hired by the Army to patrol the site on a daily basis to prevent and report unauthorized entry or activities.

Entry to the site will remain restricted until RA activities are complete and the property is transferred to the future owners.

7.1.1.3 Site M7

The excavation and bioremediation remedy selected for Site M7 (SRU1) is identified as a completed remedial action at the site and RGs have been achieved for soil media affected by the COCs. The results of the five-year review indicate that the excavation and bioremediation activities successfully functioned to satisfy the intended RAOs stated in the October 1998 ROD.

Costs or issues associated with monitoring and performance at Site M7 are not anticipated. Remedial action activities are complete and RGs for soil have been met, therefore further costs associated with additional soil removal will not be incurred. Erosion control measures implemented at the site have remained effective and intact since the completion of RA activities. Replacement of erosion control measures in the future is not anticipated. Surface water monitoring at Site M7 is conducted in coordination with Site M6 surface water sampling activities. Costs associated with surface water sampling at Site M7 are included in the O&M cost discussion for Site M6.

Perimeter fencing does not exist at Site M7. Entry to the site will remain restricted until the property transfer to the future owners is complete.

7.1.2 SRU2 Soils

7.1.2.1 Site L11

The Excavation and Disposal remedy selected for Site L11 (SRU2) is identified as a completed remedial action at the site and RGs have been achieved for soil media affected by the COCs. Remedial action activities have also removed all MEC waste from the site. The results of the five-year review indicate that the excavation and disposal activities successfully functioned to satisfy the intended RAOs stated in the October 1998 ROD.

Costs or issues associated with monitoring and performance are not anticipated. Remedial action activities are complete, RGs for soil have been met, and MEC items have been cleared.

Existing site fencing serves as a deterrent to unauthorized entry to the site and has prevented exposure by ingestion or dermal contact, to impacted media. Entry to the site will remain restricted until the property transfer to the future owners is complete.

7.1.3 SRU3 Soils

7.1.3.1 Site M5

The majority of soils at Site M5, as characterized in the RI/FS, were determined to be SRU3 soils. Furthermore, due to the relatively low concentrations of lead in the SRU3 soils, the selected remedy for SRU3 soils was designated as "Bioremediation and Disposal". For these reasons, the discussion pertaining to SRU1 soils at Site M5, has been summarized under the SRU3 heading.

The bioremediation and disposal remedy selected for Site M5 (SRU3 and SRU1) is identified as a completed remedial action at the site and RGs have been achieved for soil media affected by the COCs. The results of the five-year review indicate that the bioremediation and disposal activities successfully functioned to satisfy the intended RAOs stated in the October 1998 ROD.

Costs or issues associated with monitoring and performance at Site M5 are not anticipated. Remedial action activities are complete and RGs for soil have been met, therefore further costs associated with additional soil removal and monitoring will not be incurred. The State of Illinois acquired the deed for the land area of Site M5 in August 2000. Following the land transfer, the State of Illinois sold the site to Centerpoint Properties. The site has been developed into an intermodal rail facility and is currently operated by BNSF. Access to the site is restricted by fencing installed by BNSF.

7.1.4 SRU4 Soils

7.1.4.1 Sites L1, L7, L8, L9, L10, and L17

The Excavation and Disposal remedy selected for Sites L1, L7, L8, L9, L10, and L17 (SRU4) is identified as a completed remedial action at the site and RGs have been achieved for soil media affected by the SRU4 COCs. The results of the five-year review indicate that the excavation and disposal activities successfully functioned to satisfy the intended RAOs stated in the October 1998 ROD.

Costs or issues associated with monitoring and performance are not anticipated. Remedial action activities are complete, and RGs for soil have been met.

Existing site fencing at the LAP area serves as a deterrent to unauthorized entry to the site and has prevented exposure by ingestion or dermal contact, to impacted media. Entry to the sites will remain restricted until the property transfer to the future owners is complete.

7.1.4.2 Site L5

The Excavation and Disposal remedy selected for Site L5 is identified as a remedial action that has not been initiated. The results of the five-year review indicate that the excavation and disposal activities for SRU4 soils will successfully function to satisfy the RAOs stated in the October 1998 ROD once the selected remedy implementation has been completed.

Finalization of RGs for SRU2 and SRU5 soils is necessary prior to any implementation of the selected remedy for SRU4 soils. Following RA activities for SRU4 soils, soil monitoring will not be necessary other than inspection of erosion control measures. Equipment breakdowns should not create any protectiveness issues. Soil grading, berming, and silt fencing will be implemented to minimize migration of contaminants in surface water runoff from excavation areas.

In the interim, existing site fencing at the LAP area serves as a deterrent to unauthorized entry to the site and has prevented exposure by ingestion or dermal contact, to impacted media. Entry to the site will remain restricted until RA activities are completed and the property transfer to the future owners is finalized.

7.1.5 SRU5 Soils

The Excavation and Disposal remedy selected for SRU5 sites is identified as a remedial action that has not been initiated. The results of the five-year review indicate that the excavation and disposal activities for SRU5 soils will successfully function to satisfy the RAOs stated in the October 1998 ROD once the selected remedy implementation has been completed.

Finalization of RGs for interim sites is necessary prior to any implementation of the selected remedy for SRU5 soils. Following RA activities for SRU5 soils, soil monitoring will not be necessary other than inspection of erosion control measures. Equipment breakdowns should not create any protectiveness issues. Soil grading, berming, and silt fencing will be implemented to minimize migration of contaminants in surface water runoff from excavation areas.

Existing site fencing at the LAP area serves as a deterrent to unauthorized entry to the site and has prevented exposure by ingestion or dermal contact, to impacted media. Entry to the sites will remain restricted until RA activities are completed and the property transfer to the future owners is finalized.

7.1.6 SRU6 Soils

7.1.6.1 Sites L3, M11, and M13

The Capping and Institutional Controls remedy selected for Sites L3, M11, and M13 is identified as an RA activity that has not been initiated.

Finalization of RGs for SRU2 and SRU3 soils is necessary prior to any implementation of the selected remedy for SRU6 soils at Site L3. Following RA activities for SRU6 soils at the sites, soil monitoring will not be necessary other than inspection of erosion control measures. Long-term

O&M costs will include landfill cap inspection and maintenance costs. Equipment breakdowns should not create any protectiveness issues. Soil grading, berming, and silt fencing will be implemented to minimize migration of contaminants in surface water runoff from excavation areas.

Existing site fencing at the MFG and LAP areas serve as a deterrent to unauthorized entry to the site. Entry to the site will remain restricted until RA activities are completed and the property transfer to the future owners is finalized.

7.1.6.2 Sites L4, M1, and M9

The Soil Excavation and Disposal and Institutional Controls remedy selected for Sites L4, M1, and M9 is identified as an RA activity that has not been initiated. .

Following RA activities for SRU6 soils at the sites, soil monitoring will not be necessary other than inspection of erosion control measures. Equipment breakdowns should not create any protectiveness issues. Soil grading, berming, and silt fencing will be implemented to minimize migration of contaminants in surface water runoff from excavation areas.

In the interim, existing site fencing at the MFG and LAP areas serve as a deterrent to unauthorized entry to the sites and has prevented exposure by ingestion or dermal contact to impacted media Entry to the sites will remain restricted until RA activities are completed and the property transfer to the future owners is finalized.

7.1.6.2.1 Site M1 Interim Cap

The Site Ml interim cap is considered an interim O&M activity necessary to mitigate conditions at the site that are not protective of human health and the environment. Although the interim cap was not identified in the October 1998 ROD as a final remedy for SRU6 soils, the O&M activities conducted at the site were conducted to establish conditions that satisfy the following applicable RAOs in the October 1998 ROD:

- Prevent human and environmental exposure to contamination
- Prevent migration of contaminants

The Site Ml interim cap is identified as an operating O&M system where the system has been constructed and O&M objectives have been achieved. Results of the five-year review indicate that the interim cap is functioning as intended by the design documents, as outlined in the *Draft Final Construction Completion Report, Site M1 Interim Cap* (Montgomery Watson, November 1999).

The interim cap has successfully functioned to repair the damaged existing cap constructed during previous closure activities. The capping activities have also prevented further occurrences of leaching from the western and northern edges of the ash pile. Site inspections will continue and repairs made to new tears or holes in the liner. Also, new occurrences of leaching from the capping system will be noted.

Costs associated with inspections and O&M activities are currently within budget. Site O&M activities have been optimized, and potential issues resolved, to provide a cost-effective method of operation for the system. Access controls at the site are sufficient to minimize unauthorized public access and exposure to conditions at the site.

7.1.6.2.2 Site M9 Leachate Control System

The Site M9 leachate control system is considered an interim O&M activity necessary to mitigate conditions at the site that are not protective of human health and the environment. Although the leachate control system was not identified in the October 1998 ROD as a final remedy for SRU6 soils, the O&M activities were conducted to establish conditions that satisfy the following applicable RAOs in the October 1998 ROD:

- Prevent human and environmental exposure to contamination
- Prevent migration of contaminants

The Site M9 leachate control system is identified as an operating interim O&M system where the system has been constructed and O&M objectives have been achieved. Results of the five-year review indicate that the leachate control system is functioning as intended by the design documents, as outlined in the *Draft Construction Completion Report M9 Leachate Control System* (Montgomery Watson, September 1999).

The leachate collection system constructed at the interface of the cover system and ash pile has successfully functioned to prevent additional leachate seepage from the ash pile into the environment. Although the active operation of the re-circulation system has been discontinued permanently due to maintenance issues, the collection and disposal system and subsequent cap maintenance activities have prevented additional seep occurrences. Site activities will be continued to dispose of leachate generated at the site, and inspections will be conducted to observe any new occurrences of seepage from the existing cap.

Costs associated with system operation and O&M activities are currently within budget. Site O&M activities have been optimized, and potential issues resolved, to provide a cost-effective method of operation for the system. Access controls at the site are sufficient to minimize unauthorized public access and exposure to conditions at the site.

Final RA activities will be conducted at Site M9 to excavate and dispose of SRU6 soils to satisfy the RAOs set in the October 1998 ROD.

7.1.7 SRU7 Soils

7.1.7.1 Site M8

The Excavation and Disposal remedy selected for Site M8 is identified as a completed remedial action where SRU7 (raw surficial sulfur) soils have been removed from the site. The surficial sulfur was removed during liquidation activities, prior to the transfer of the property to the State of Illinois.

This site is considered protective of human health and the environment.

According to the POST, February 1999, there were no exceedences of soil industrial RGs in all of Site M8. On August 10, 2000, the site was transferred to the State of Illinois for inclusion into an industrial park facility. Following the land transfer, the State of Illinois sold the site to Centerpoint Properties. Subsequent site activities included the construction of an intermodal rail facility currently operated by BNSF. Existing site fencing, constructed by BNSF, serves as a deterrent to unauthorized entry and prevents exposure by ingestion or dermal contact, to impacted media. Centerpoint Properties submits certification of compliance for implementation of institutional controls, specified in the property deed, to the Army on an annual basis. Copies of the annual certification are included as Appendix E.

7.1.7.2 Site M12

The Excavation and Disposal remedy selected for Site M12 is identified as an RA activity that has not been initiated.

Finalization of RGs for SRU2 soils is necessary prior to any implementation of the selected remedy for SRU7 soils. Once the RGs are finalized for SRU2 soils, the excavation and disposal remedy will be implemented. Following RA activities for SRU7 soils, soil monitoring will not be necessary other than inspection of erosion control measures. Equipment breakdowns should not create any protectiveness issues. Soil grading, berming, and silt fencing will be implemented to minimize migration of contaminants in surface water runoff from excavation areas.

No site fencing is currently constructed at the site. The Army contracts a local security force to routinely patrol the MFG area. The routine patrols serve as an effective means to apprehend and visually deter potential trespassers. Entry to the site will remain restricted until RA activities are completed and the property transfer to the future owners is finalized.

7.1.8 Site M4 Bioremediation Facility

The bioremediation remedy selected for SRU1 and SRU3 soils is functioning as intended by the October 1998 ROD. SRU1 and SRU3 soils from Sites M5, M6 and M7 have been successfully treated to achieve RGs for the soil media affected by the COCs. The results of the five-year review indicate that the bioremediation remedy continues to satisfy the RAOs as stated in the October 1998 ROD. The operation and maintenance of the BTF has proceeded as designed. Efficiencies realized during the operation and maintenance of the BTF include:

- Pre-blending of the 3 amendments components
- Post treatment sample frequency reduction for Site M6 SRU1 soil (from 12 to 8)
- Increase space available for treatment by 33%
- Increased and refined physical/chemical monitoring of windrows during active treatment to insure optimal conditions exist for bio-activity

Bioremediation of SRU1 and SRU3 JOAAP soils is anticipated to continue through 2006.

7.1.9 Interim Remedial Action Sites

The implementation of access controls at interim RA sites has functioned as intended by the October 1998 ROD, by minimizing exposure to potential threats at each site. Implementation of access controls will continue until RA activities are complete at each interim RA site and the site has been transferred to a future owner.

7.1.10 No Further Action Sites

Institutional controls in the form of deed restrictions to limit land use to industrial purposes are being effectively implemented at NFA Sites (L6 and M16) where COCs are present at levels that do not allow for unlimited use and unrestricted access.

7.2 QUESTION B: ARE THE EXPOSURE ASSUMPTIONS, TOXICITY DATA, CLEANUP LEVELS, AND REMEDIAL ACTION OBJECTIVES (RAOS) USED AT THE TIME OF THE REMEDY SELECTION STILL VALID?

There have been no changes in the physical conditions at JOAAP that would affect the protectiveness of the remedies.

There have been no changes to the ARARs and no new standards or TBDs enforced that would affect the protectiveness of the remedies. A summary of ARARs identified in the October 1998 ROD is located in Table 7-1.

A summary of assumptions, methodologies, and conclusions for the review of exposure pathways and toxicity factors used to develop industrial RGs is included in Appendix D. There have been no significant changes to the exposure pathways or toxicity factors for the COCs used in the baseline risk assessment. The assumptions used to develop the baseline risk assessment are considered conservative, reasonable and appropriate for evaluating and developing site-specific, risk-based cleanup levels. The sites reviewed during this Five-Year review report have been categorized with the industrial RGs set in the October 1998 ROD. No change to the assumptions used to generate the industrial RGs is warranted. There has been no significant change in the standardized risk-assessment methodology that could affect the protectiveness of the selected remedies.

The original assumptions regarding current and future land use for interim and NFA sites, where institutional and/or access controls are currently implemented, are still valid. Remedial goals and final remedies are currently being developed and will be presented in the Final ROD for interim sites.

7.3 QUESTION C: HAS ANY OTHER INFORMATION COME TO LIGHT THAT COULD CALL INTO QUESTION THE PROTECTIVENESS OF THE REMEDY?

No additional ecological targets were identified during five-year review process. Weather related events are not expected to affect the protectiveness of the remedies. At Site M6, where RA activities

are currently active, migration of contaminants in storm water runoff have been minimized through implementation of erosion control measures, and therefore will not affect the protectiveness of the remedy. There is no other information that calls into question the protectiveness of the remedies.

7.4 TECHNICAL ASSESSMENT SUMMARY

According to construction and O&M records, data reviewed, site inspections, and interviews, the selected remedies at all sites discussed in this Five-Year Review have functioned as intended by the October 1998 ROD. There have been no changes to physical conditions that would affect the protectiveness of the remedies. Site-specific ARARs stated in the October 1998 ROD at each site have been met or are expected to be met upon completion. There have been no significant changes to the toxicity factors for the COCs that were used in the baseline risk assessment, and there have been no significant changes to the standardized risk assessment methodology that could affect protectiveness of the remedies. There is no other information that calls into question the protectiveness of the remedies.

8.0 ISSUES

Issued identified during the five-year review for RA activities and interim O&M activities are listed in Table 8-1. Issues were identified during site inspections, interviews, data review, and document review.

9.0 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Refer to Table 9-1 for the suggested improvements to current operations, activities, remedy, or site conditions based upon issues identified in Section 8.0.

10.0 PROTECTIVENESS STATEMENTS

10.1 SRU1 SOILS - BIOREMEDIATION

Sites M5, M7, and L16

Remedial actions at Sites M5, M7, and L16 are complete. Potential threats at the sites have been addressed through excavation and bioremediation of explosives contaminated soils, and implementation of institutional controls in the form of deed restrictions, and/or access controls in the form of security patrols and fencing. Current data indicate that industrial RGs have been met and the sites are protective of human health and the environment.

Site M6

The remedy at Site M6 is expected to be protective of human health and the environment upon completion. In the interim, exposure pathways that could result in unacceptable risks are being addressed through access controls in the form of security patrols. Remedial action activities will be implemented during FY2004 to address remaining contamination at the site. Current confirmation sampling results indicate that the selected remedy is functioning as required to achieve industrial RGs at the site. Potential threats at the site will be addressed through excavation and bioremediation of explosives contaminated soils, and implementation of institutional controls.

Sites L1, L7, L8, L9, L10, L14, M2, and M3 (SRU1 Interim Sites)

The remedy at Sites L1, L7, L8, L9, L10, L14, M2, and M3 is protective of human health and the environment in the short-term, through the implementation of access controls in the form of fencing and/or security patrols. However, in order for the remedy to be protective in the long-term, RA activities must be implemented to address SRU1 impacted soils at each site. Access controls will continue to be implemented at each site to minimize unacceptable risks until RA activities are complete.

10.2 SRU2 SOILS - EXCAVATION AND DISPOSAL

Site L11

Remedial action at Site L11 is complete. Potential threats at the site have been addressed through excavation and disposal of metals contaminated soils. Access controls in the form of security patrols and fencing are currently being implemented at the site. Current data indicate that industrial RGs have been met and the site is protective of human health and the environment.

Site L2, L3, L5, L23A, M3, M4, and M12 (SRU2 Interim Sites)

The remedy at Sites L2, L3, L5, L23A, M3, M4, and M12 is protective of human health and the environment in the short-term, through the implementation of access controls in the form of fencing and/or security patrols. However, in order for the remedy to be protective in the long-term, RA activities must be implemented to address SRU2 impacted soils at each site. Access controls will continue to be implemented at each site to minimize unacceptable risks until RA activities are complete.

10.3 SRU3 SOILS - BIOREMEDIATION AND DISPOSAL, AND EXCAVATION AND DISPOSAL

Site M5

Remedial actions at Site M5 are complete. Potential threats at the site have been addressed through excavation and bioremediation of metals and explosives contaminated soils, and implementation of institutional controls. Current data indicate that industrial RGs have been met and the site is protective of human health and the environment.

Site M6

The remedy at Site M6 is expected to be protective of human health and the environment upon completion. In the interim, exposure pathways that could result in unacceptable risks are being controlled through access controls in the form of security patrols. RA activities will be implemented during FY2004 to address remaining contamination at the site. Current confirmation sampling results indicate that the selected remedy is functioning as required to achieve industrial RGs at the site. Potential threats at the site will be addressed through excavation and bioremediation of explosives contaminated soils, and implementation of institutional controls.

Sites L2 and L3 (SRU3 Interim Sites)

The remedy at Sites L2, and L3 is protective of human health and the environment in the short-term, through the implementation of access controls in the form of fencing and security patrols. However, in order for the remedy to be protective in the long-term, RA activities must be implemented to address SRU3 impacted soils at each site. Access controls will continue to be implemented at each site to minimize unacceptable risks until RA activities are complete.

10.4 SRU4 SOILS - EXCAVATION/INCINERATION AND DISPOSAL

Site L17

Remedial action at Site L17 is complete. Potential threats at the site have been addressed through excavation and disposal of PCB-contaminated soils, and implementation of access controls in the form of security patrols and fencing. Current data indicate that industrial RGs have been satisfied and the site is protective of human health and the environment.

Sites L1, L7, L8, L9, and L10

The remedy for SRU4 soils at Sites L1, L7, L8, L9, and L10 is protective of human health and the environment. Potential threats associated with SRU4 soils have been addressed through excavation and disposal of PCB-contaminated soils, and implementation of access controls in the form of security patrols and fencing. Current data indicate that final RGs for PCBs have been met at the sites.

However, in order for the sites to be considered protective in the long-term, additional remedial actions must be implemented. Other forms of contamination, potentially harmful to human health and the environment, have been identified at the sites and must be addressed once final RGs are established. Access controls in the form of security patrols and fencing are currently

Site L5

The remedy for SRU4 soils at Site L5 is expected to be protective of human health and the environment upon completion. In the interim, exposure pathways that could result in unacceptable risks are being controlled through access controls in the form of security patrols and fencing. Potential threats associated with SRU4 soils at the site will be addressed through excavation and disposal of PCB-contaminated soils and implementation of institutional controls. RA activities will be implemented once final RGs are designated for other contaminants present at the site.

10.5 SRU5 SOILS - EXCAVATION AND DISPOSAL

Sites L1 and L5 (Interim Sites)

The remedy at Sites L1 and L5 is protective of human health and the environment in the short-term, through the implementation of access controls in the form of fencing and security patrols. However, in order for the remedy to be protective in the long-term, RA activities must be implemented to address SRU5 impacted soils at each site. Access controls will continue to be implemented at each site to minimize unacceptable risks until RA activities are complete.

10.6 SRU6 SOILS - CAPPING OR EXCAVATION AND DISPOSAL

Sites L4, M1, M9, M11, and M13

The remedy for Sites L4, M1, M9, M11, and M13 is expected to be protective of human health and the environment upon completion. In the interim, exposure pathways that could result in unacceptable risks are being controlled through access controls in the form of security patrols and/or fencing. Interim O&M activities have been successfully implemented at Sites M1 and M9 and are functioning to prevent unacceptable migration of contaminants from these sites. Threats associated with SRU6 soils at the sites will be addressed through capping or excavation and disposal of SRU6 soils and implementation of institutional controls.

Site L3

The remedy for SRU6 soils at Site L3 is expected to be protective of human health and the environment upon completion. In the interim, exposure pathways that could result in unacceptable risks are being controlled through access controls in the form of security patrols and fencing. Potential threats associated with SRU6 soils at the site will be addressed through capping of SRU6 soils and implementation of institutional controls. Other forms of contamination are present at Site L3 and will be addressed once final RGs are designated for the site.

10.7 SRU7 SOILS - REMOVAL AND RECYCLE OR DISPOSAL

Site M8

Remedial action at Site M8 is complete. SRU7 impacted soils at the site have been addressed through excavation and disposal of surficial sulfur and implementation of institutional controls. Site M8 is considered to be protective of human health and the environment.

SiteM12

The remedy for SRU7 soils at Site Ml2 is expected to be protective of human health and the environment upon completion. In the interim, exposure pathways that could result in unacceptable

risks are being controlled through access controls in the form of security patrols. Potential threats associated with SRU7 soils at the site will be addressed through Removal and Recycle or Disposal of SRU7 soils, and implementation of institutional controls. Other forms of contamination are present at Site Ml2 and will be addressed once final RGs are designated for the site.

10.8 NO FURTHER ACTION SITES

Site L6

Removal actions at Site L6 are complete. Potential threats at the site have been addressed through excavation and disposal of impacted soils, and implementation of institutional controls. Deed restrictions limiting land use for industrial purposes are being enforced. Current data indicate that industrial RGs are satisfied and the site is protective of human health and the environment.

Site M16

Current data indicate that impacted soils at Site M16 satisfy industrial RGs. Deed restrictions limiting land use for industrial purposes are being enforced. Soils at Site M16 are protective of human health and the environment.

11.0 NEXT REVIEW

The next five-year review period for the SOU will begin on May 5, 2004. The next Five-Year Review Report will be due five years after this date.

12.0 REFERENCES

CHPPM, November 1994. *Final Ecological Risk Assessment, Joliet Army Ammunition Plant*, Volume 1, Phase 1.

CHPPM, 1996. *Final, Phase 2 Aquatic Ecological Risk Assessment*, No. 32-EE-1420-93, Joliet Army Ammunition Plant, Joliet, Illinois.

CHPPM, 1994. *Health Risk Assessment for Consumption of Deer Muscle and Liver from Joliet Army Ammunition Plant, Joliet, Illinois*.

Dames & Moore, November 1986. *Midwest Site Confirmatory Survey Assessment Report for Joliet Army Ammunition Plant,* Prepared for USATHAMA, Aberdeen Proving Ground, Maryland.

Dames & Moore, March 1991. *Phase 1 Results Report, Remedial Investigation, Manufacturing Area, Joliet Army Ammunition Plant, Illinois,* Volumes 1 and 2, prepared for USATHAMA, Report No. CETHA-IR-CR-90127.

Dames & Moore, May 1993. *Phase 2 Remedial Investigation, Manufacturing (MFC) Area, Joliet Army Ammunition Plant, Joliet, Illinois*, Volumes 1 and 2, prepared for USAEC, Report No. ENAEC-IR-CR-93065.

Dames & Moore, July 1993. *Phase 1 Remedial Investigation, Load-Assemble-Package (LAP) Area, Joliet Army Ammunition Plant, Joliet, Illinois*, Volumes 1 and 2, prepared for USAEC, Report No. ENAEC-IR-CR-93097.

Dames & Moore, December 1994. *Phase 2 Remedial Investigation, Load-Assemble-Package (LAP) Area, Joliet Army Ammunition Plant, Joliet, Illinois, Volumes 1 and 2*, prepared for USAEC, Report No. SFIM-AEC-IR-CR-95023.

Dames & Moore, December 1994. *Baseline Risk Assessment, Manufacturing (MFC) Area, Joliet Army Ammunition Plant, Joliet, Illinois, Volumes 1-3*, prepared for USAEC, Report No. SFIM-AEC-IR-CR-95034.

Dames & Moore, February 1995. *Baseline Risk Assessment, Load-Assemble-Package (LAP) Area, Joliet Army Ammunition Plant, Joliet, Illinois, Volumes 1-3*, prepared for USAEC.

Dames & Moore, July 1996. *Oleum Plant Remedial Investigation, Addendum No. 1 to the Phase 2 Remedial Investigation and Baseline Risk Assessment, Manufacturing (MFC) Area, Joliet Army Ammunition Plant, Joliet, Illinois,* prepared for USAEC.

Dames & Moore, August and September l997. *Feasibility Study, Soil and Groundwater Operable Units, Load-Assemble-Package (LAP) Area, Joliet Army Ammunition Plant, Joliet, Illinois,* Volumes 1-3, prepared for USAEC.

Donohue & Associates, November 1982. *Installation Restoration Surveys: Joliet Army Ammunition Plant (JOAAP)*, Volumes 1 and 2, submitted to USATHAMA, Aberdeen Proving Ground, Maryland.

Donohue & Associates, August 1983. *Joliet Army Ammunition Plant-- Phase II Technical Report*, Volumes 1 and 2, Prepared for USATHAMA, Aberdeen Proving Ground, Maryland.

Human Health Work Group, September 2000. *Joliet Army Ammunition Plant Human Health Preliminary Remedial Goals Midewin National Tallgrass Prairie*.

Montgomery Watson, February 1999. *Finding of Suitability to Transfer (FOST), Joliet Army Ammunition Plant, Wilmington, Illinois.*

Montgomery Watson, *April 1999. Final Remedial Design/Remedial Action Workplan - Phase I, Soils Operable Unit*, Joliet Army Ammunition Plant, Wilmington, Illinois.

Montgomery Watson, June 1999. *Operation and Maintenance Plan, Bioremediation Facility - Phase I*, Joliet Army Ammunition Plant, Wilmington, Illinois.

Montgomery Watson, June 1999. *Finding of Suitability to Transfer (FOST)*, Joliet Army Ammunition Plant, Wilmington, Illinois.

Montgomery Watson, September 1999. *Draft Construction Completion Report, M9 Interim Leachate Control System, Load-Assemble-Package Area/Manufacturing Area*, Joliet Army Ammunition Plant, Wilmington, Illinois.

Montgomery Watson, September 1999. *Draft Operations and Maintenance Plan, Site Ml Interim Cap*, Joliet Army Ammunition Plant, Wilmington, Illinois.

Montgomery Watson, December 1999. *Final Work Plan Site M9 Interim Leachate Control System*, Joliet Army Ammunition Plant, Wilmington, Illinois.

Montgomery Watson, July 2000. *Final Sampling and Analysis Plan Addendum for Bioremediation Post Treatment Sampling*, Joliet Army Ammunition Plant, Wilmington, Illinois.

Montgomery Watson, December 2000. *Final Site M5 Closure Report, Former Tetryl Production Area*, Joliet Army Ammunition Plant, Wilmington, Illinois.

Montgomery Watson, December 2000. *Final Site M6 North Closure Report*, Joliet Army Ammunition Plant, Wilmington, Illinois.

Montgomery Watson, January 2001. *Finding of Suitability to Transfer (FOST)*, Joliet Army Ammunition Plant, Wilmington, Illinois.

Montgomery Watson, November 2001. *Final FY2000 Bioremediation Report, Bioremediation Facility*, Joliet Army Ammunition Plant, Wilmington, Illinois.

Montgomery Watson, December 2001. *Final PCB Sites RA Closure Report, Load-Assemble Package Area,* Joliet Army Ammunition Plant, Wilmington, Illinois.

MWH, August 2002. *Final FY2002 M6 Work Plan, Joliet Army Ammunition Plant*, Wilmington, Illinois.

MWH, February 2003. *Finding of Suitability to Transfer (FOST)*, Joliet Army Ammunition Plant, Wilmington, Illinois.

MWH, November 2003. *Final Closure Report-Site M7, Joliet Army Ammunition Plant*, Wilmington, Illinois.

MWH, December 2003. Final Closure Report - Sites L11/L16, Joliet Army Ammunition Plant, Wilmington, Illinois.

MWH, December 2003. *Finding of Suitability to Transfer (FOST)*, Joliet Army Ammunition Plant, Wilmington, Illinois.

MWH, January 2004. *Final FY2001 Bioremediation Report, Bioremediation Facility*, Joliet Army Ammunition Plant, Wilmington, Illinois.

MWH, January 2004. *Draft FY2002 Bioremediation Report, Bioremediation Facility*, Joliet Army Ammunition Plant, Wilmington, Illinois.

MWH, February 2004. *Draft Treatment Completion Report - SRU1 Tetryl Soils*, Joliet Army Ammunition Plant, Wilmington, Illinois.

OHM Remediation Services Corp., April 1996. *Final Report - Preliminary Remediation Goals, Joliet Army Ammunition Plant, Manufacturing (MFG) Area, Load-Assemble-Package (LAP) Area,* Will County, Illinois.

OHM Corporation, September 1997. *Feasibility Study, Soil and Groundwater Operable Units, Manufacturing (MFG) Area, Joliet Army Ammunition Plant, Will County, Illinois*, Volumes 1-3, prepared for USAEC.

U.S. Army, 1997a. *Proposed Plan for the Soils Operable Unit*, Joliet Army Ammunition Plant, Will County, Illinois.

U.S. Army, 1997b. *Proposed Plan for the Groundwater Operable Unit*, Joliet Army Ammunition Plant, Will County, Illinois.

U.S. Army, October 1998, *Record of Decision for the Soil and Groundwater Operable Units on the Manufacturing and Load-Assemble-Package Areas*, National Priority List Sites, Joliet Army Ammunition Plant, Wilmington, Will County, Illinois.

U.S. Army, December 2003. *Installation Action Plan*, Joliet Army Ammunition Plant.

U.S. Army, February 2004. *Proposed Plan for the Soil Operable Unit*, Interim ROD Sites, Joliet Army Ammunition Plant, Wilmington, Illinois.

USACE, September 1989. *Joliet AAP, Joliet, Illinois: Investigation and Evaluation of Underground Storage Tanks*, prepared for USACE, Huntsville, Alabama by USACE, Omaha, Nebraska.

USATHAMA, September 1978. *Installation Assessment of Joliet Army Ammunition Plant*, Office of the Project Manager for Chemical Demilitarization and Installation Restoration; record Evaluation Report No. 128, Aberdeen Proving Ground, Maryland.

USEPA, July 1989. *Guidance on Preparing Superfund Decision Documents: The Proposed Plan, The Record of Decision, Explanation of Significant Differences, The Record of Decision Amendment*, Publication EPA/540/G-89/007.

USEPA, June 2001. Comprehensive Five-Year Review Guidance. EPA 540-R-01-007, OSWER No. 9355.7-03B-P.

U.S. Department of Defense, March 1998. *Final Report, Removal Action Site 16/Group 70 Area*, Joliet Army Ammunition Plant, Wilmington, Illinois.

TABLES

Figures and Appendices can be obtained from the Site File (s)