F I N A L

ENVIRONMENTAL LAND USE CONTROL PLAN

Crab Orchard National Wildlife Refuge NPL Site
Marion, Illinois

U.S. Fish & Wildlife Service
Crab Orchard National Wildlife Refuge
Marion, Illinois

April 2008

F I N A L

STAND-ALONE SECTION FOR FIELD AND CONSTRUCTION PERSONNEL ENVIRONMENTAL LAND USE CONTROL PLAN

Crab Orchard National Wildlife Refuge NPL Site, Marion, Illinois
April 2008

I. Purpose and Instructions

Purpose

Because of past industry at the Refuge, there is some remaining contamination that results in various land use controls (LUCs) to some areas within the former Illinois Ordnance Plant (IOP).[1] These LUCs apply to all individuals conducting field and construction work on the Refuge. The purpose of this stand-alone section is to provide these personnel with a method for quickly and accurately identifying potential site restrictions. Note that this section contains information designed to be used, if necessary, as a stand-alone document, separate from the remaining body of the Environmental Land Use Control Plan (Plan). However, the source Plan should be checked periodically for updates.

Instructions

There are two IOP-wide restrictions: (1) the installation of production water wells is prohibited and (2) residential use and camping are prohibited. Exceptions to the IOP-wide restrictions will be enumerated in future versions of this Plan, as appropriate. Some sites may have restrictions in addition to the IOP-wide restrictions including, for example, digging restrictions. To determine if a site in question has any additional restrictions, follow these instructions:

- find the site on the following Overview Map of the former IOP;
- if the site in question has additional restrictions, the site will be outlined on the Overview Map and shown with a reference to review an associated figure (also included in the stand-alone section), which will include a summary of additional restrictions; and,
- if the site in question is not shown on the Overview Map, only the two IOP-wide restrictions (noted above) apply.

II. Personal Protective Equipment Guidelines

Until the nature and extent of contamination has been fully delineated throughout the entire site and appropriate final remedies are in place, interim guidelines for personal protective equipment (PPE) at various areas throughout the Refuge are necessary in an order to protect human health from potential exposure to site-related contamination. PPE guidelines are also shown on the figures.

[1] There are on-going investigations at most of the sites and additional information may be available. CERCLA staff can be contacted for up-to-date information. Also, this is a list of sites requiring use restrictions and is not to be considered a complete inventory of all CERCLA sites on the Refuge.

III. Agency and Facility Points-of-Contact

Illinois Environmental Protection Agency
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Crab Orchard National Wildlife Refuge
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CERCLA Program Manager
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Crab Orchard National Wildlife Refuge Environmental Land Use Control Overview Map

February 2007

- AUS OU
- MISCA OU
- Metals OU
- PCB OU
- EMMA OU
- Water Tower OU
- Detailed Reference Figure
- Former Illinois Ordinance Plant
- Crab Orchard National Wildlife Refuge

N

0 0.5 1 2 Miles

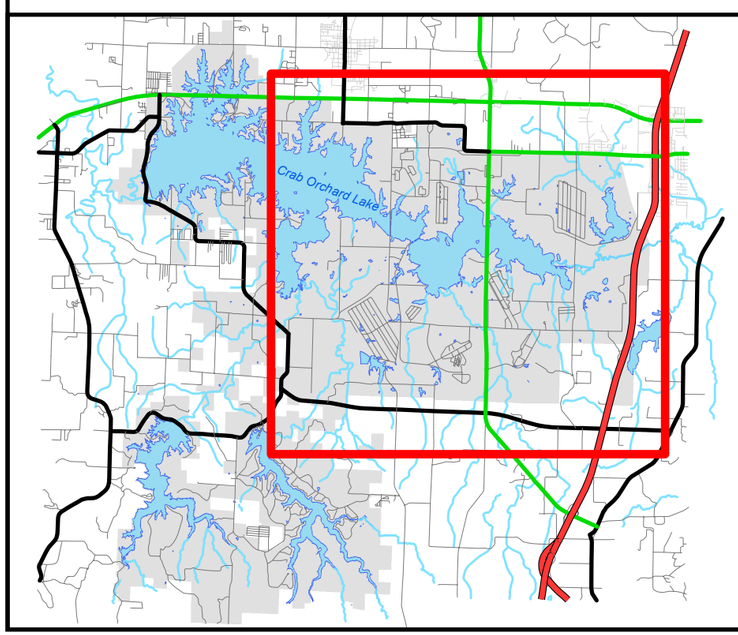


Figure 14-1
Figure 3-5
Figure 3-2
Figure 3-1
Figure 3-3
Figure 3-4
Figure 4-1
Figure 6-1
Figure 5-1
Figure 7-1
Figure 17-1
Figure 17-1
Crab Orchard Lake
Figure 10-1
Figure 10-2
Figure 11-1
Figure 13-1
Figure 8-1
Figure 12-1
Figure 9-1
ILLINOIS 13
ILLINOIS 148
57

AUS-0A2B Figure 3-1

IOP Wide Restrictions

-No production water wells shall be installed.
-Residential use and camping are prohibited.

AUS-0A2B Restrictions

-Access to this area is restricted to personnel with a specific need to be at the site.
-No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers.
-Agricultural uses are prohibited at this site.
-Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts.
-Soil from this site should not be used for borrow material.
-CERCLA staff should be consulted at the time any earthmoving activities are planned or scheduled.

AUS-0A2B Personal Protective Equipment (PPE) Recommendations

Level C*
-Full or half-face, air purifying respirator (NIOSH approved).
-Hooded or non-hooded (based on task-specific potential for splashing and/or dust generation) Chemical-resistant clothing (overalls with long-sleeved jacket; coveralls; or one or two-piece splash suit; disposable chemical-resistant overalls).
-Coveralls (optional, as applicable).
-Gloves, outer, chemical-resistant.
-Gloves, inner, chemical-resistant.
-Boots, chemical-resistant, protective steel toe and shank.
-Hard hat (under suit, optional, as applicable).
-Face shield (optional, as applicable).

Level D1*
-Dust mask, snug-fitting.
-Hooded chemical-resistant clothing (overalls with long-sleeved jacket; coveralls; or one or two-piece splash suit; disposable chemical-resistant overalls) if potentially exposed to groundwater at bottom of trench or excavation.
-Coveralls (optional, as applicable).
-Gloves, outer, chemical-resistant.
-Gloves, inner, chemical-resistant.
-Boots, chemical-resistant, protective steel toe and shank.
-Hard hat (optional, as applicable).
-Face shield (optional, as applicable).

Level D2*
-Same as Level D1 without the dust mask.

*Applies only if there are excavation activities in the area.

Area 2D
B-2-16
B-2-23
B-2-27
Area 2F
*Level C PPE recommended for workers in an excavation.
*Level D1 PPE recommended for workers outside excavated area if airborne dust is visible.
*Level D2 PPE recommended for workers outside excavated area if airborne dust is not visible.
*Level C PPE Recommended for Workers in an Excavation
AUS 0A2B
B-2-1
B-2-2
Area 2B
B-2-10
Wolf Creek Road

AUS-0A2B
February 2007
PPE Recommendations
AUS RIFS Boundaries
Area 2B Buildings
Roads and Parking
0 50 100 200 Feet
N

IOP Wide Restrictions

-No production water wells shall be installed.
-Residential use and camping are prohibited.

AUS-0A2D Restrictions

-Access to this area is restricted to personnel with a specific need to be at the site.
-No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers.
-Agricultural uses are prohibited at this site.
-Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts.
-Soil from this site should not be used for borrow material.
-CERCLA staff should be consulted at the time any earthmoving activities are planned or scheduled.

AUS-0A2D Personal Protective Equipment (PPE) Recommendations

Level C*
-Full or half-face, air purifying respirator (NIOSH approved).
-Hooded or non-hooded (based on task-specific potential for splashing and/or dust generation) Chemical-resistant clothing (overalls with long-sleeved jacket; coveralls; or one or two-piece splash suit; disposable chemical-resistant overalls).
-Coveralls (optional, as applicable).
-Gloves, outer, chemical-resistant.
-Gloves, inner, chemical-resistant.
-Boots, chemical-resistant, protective steel toe and shank.
-Hard hat (under suit, optional, as applicable).
-Face shield (optional, as applicable).

Level D1*
-Dust mask, snug-fitting.
-Hooded chemical-resistant clothing (overalls with long-sleeved jacket; coveralls; or one or two-piece splash suit; disposable chemical-resistant overalls) if potentially exposed to groundwater at bottom of trench or excavation.
-Coveralls (optional, as applicable).
-Gloves, outer, chemical-resistant.
-Gloves, inner, chemical-resistant.
-Boots, chemical-resistant, protective steel toe and shank.
-Hard hat (optional, as applicable).
-Face shield (optional, as applicable).

Level D2*
-Same as Level D1 without the dust mask.

*Applies only if there are excavation activities in the area.

Post Oak Road
Wolf Creek Road

AUS 0A2D

D-1-35
D-1-36
D-1-13
D-1-6
D-1-7
D-1-8
D-1-90
D-1-4
D-1-11
D-1-25
D-1-27P

*Level C PPE recommended for Workers in an Excavation

Area 2B
Area 2D
Area 2F

*Level C PPE recommended for workers in an excavation.

*Level D1 PPE recommended for workers outside excavated area if airborne dust is visible.

*Level D2 PPE recommended for workers outside excavated area if airborne dust is not visible.

AUS-0A2D
February 2007
PPE Recommendations
AUS RIFS Boundaries
Area 2D Buildings
Streams
Roads and Parking
0 100 200 Feet
N

AUS-0A2F
Figure 3-3

AREA 2B

*Level C PPE Recommended for Workers in an Excavation.

AUS 0A2F

F-2-2
F-2-10
F-2-45
F-2-11
F-2-9
F-2-12
F-2-1

Area 2F

*Level C PPE recommended for workers in an excavation.

*Level D1 PPE recommended for workers outside excavated area if airborne dust is visible.

*Level D2 PPE recommended for workers outside excavated area if airborne dust is not visible.

IOP Wide Restrictions

-No production water wells shall be installed.
-Residential use and camping are prohibited.

AUS-0A2F Restrictions

-Access to this area is restricted to personnel with a specific need to be at the site.
-No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers.
-Agricultural uses are prohibited at this site.
-Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts.
-Soil from this site should not be used for borrow material.
-CERCLA staff should be consulted at the time any earthmoving activities are planned or scheduled.

AUS-0A2F Personal Protective Equipment (PPE) Recommendations

Level C*
-Full or half-face, air purifying respirator (NIOSH approved).
-Hooded or non-hooded (based on task-specific potential for splashing and/or dust generation) Chemical-resistant clothing (overalls with long-sleeved jacket; coveralls; or one or two-piece splash suit; disposable chemical-resistant overalls).
-Coveralls (optional, as applicable).
-Gloves, outer, chemical-resistant.
-Gloves, inner, chemical-resistant.
-Boots, chemical-resistant, protective steel toe and shank.
-Hard hat (under suit, optional, as applicable).
-Face shield (optional, as applicable).

Level D1*
-Dust mask, snug-fitting.
-Hooded chemical-resistant clothing (overalls with long-sleeved jacket; coveralls; or one or two-piece splash suit; disposable chemical-resistant overalls) if potentially exposed to groundwater at bottom of trench or excavation.
-Coveralls (optional, as applicable).
-Gloves, outer, chemical-resistant.
-Gloves, inner, chemical-resistant.
-Boots, chemical-resistant, protective steel toe and shank.
-Hard hat (optional, as applicable).
-Face shield (optional, as applicable).

Level D2*
-Same as Level D1 without the dust mask.

AUS-0A2F
February 2007
PPE Recommendations
AUS RIFS Boundaries
Area 2F Buildings
Streams
Roads and Parking
0 100 200 Feet
N

AUS-0A2P and MISCA OU Site 10 Figure 3-4

IOP Wide Restrictions

-No production water wells shall be installed.
-Residential use and camping are prohibited.

AUS-0A2P Restrictions

-Access to this area is restricted to personnel with a specific need to be at the site.
-No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers.
-Agricultural uses are prohibited at this site.
-Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts.
-Soil from this site should not be used for borrow material.
-CERCLA staff should be consulted at the time any earthmoving activities are planned or scheduled.

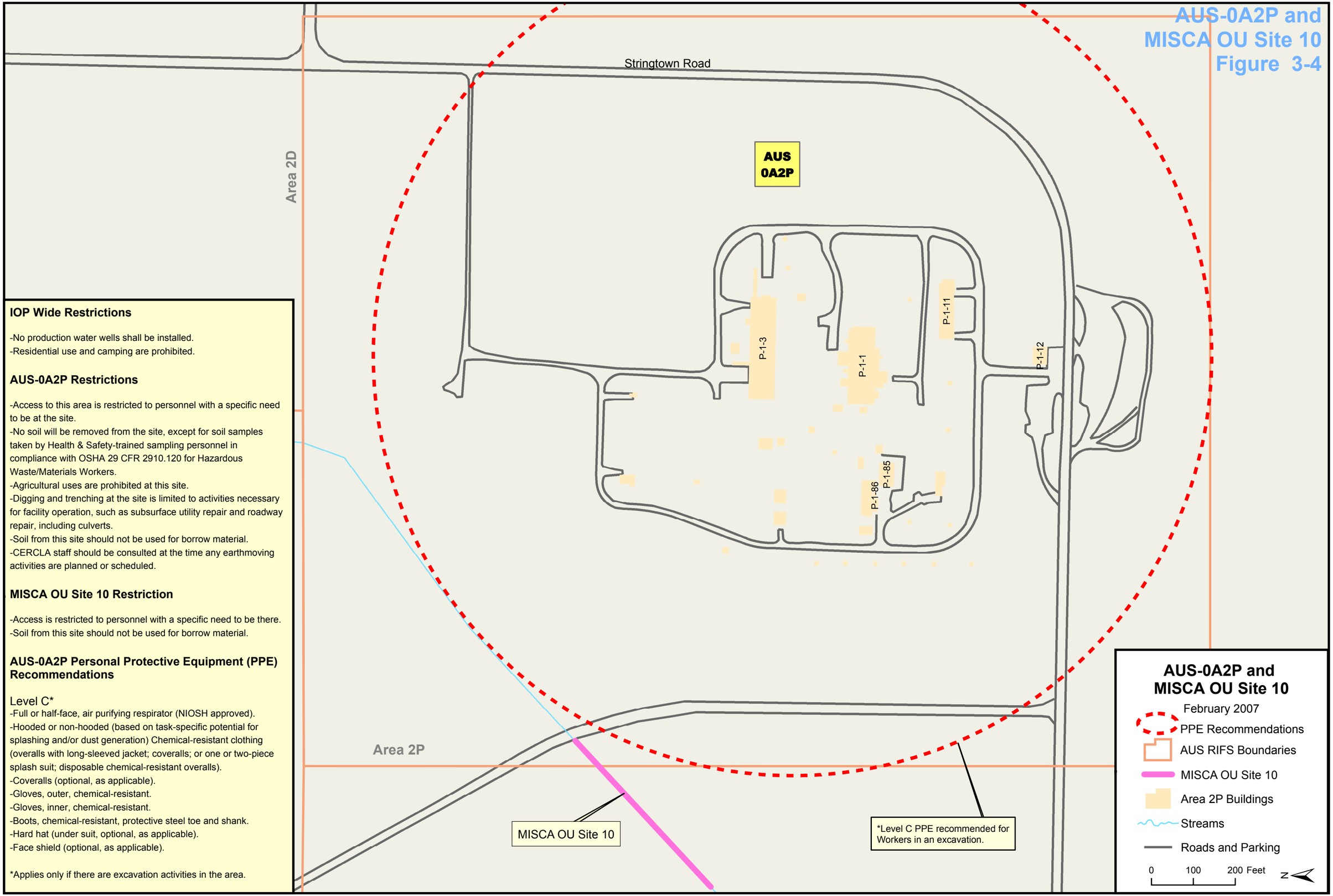
MISCA OU Site 10 Restriction

-Access is restricted to personnel with a specific need to be there.
-Soil from this site should not be used for borrow material.

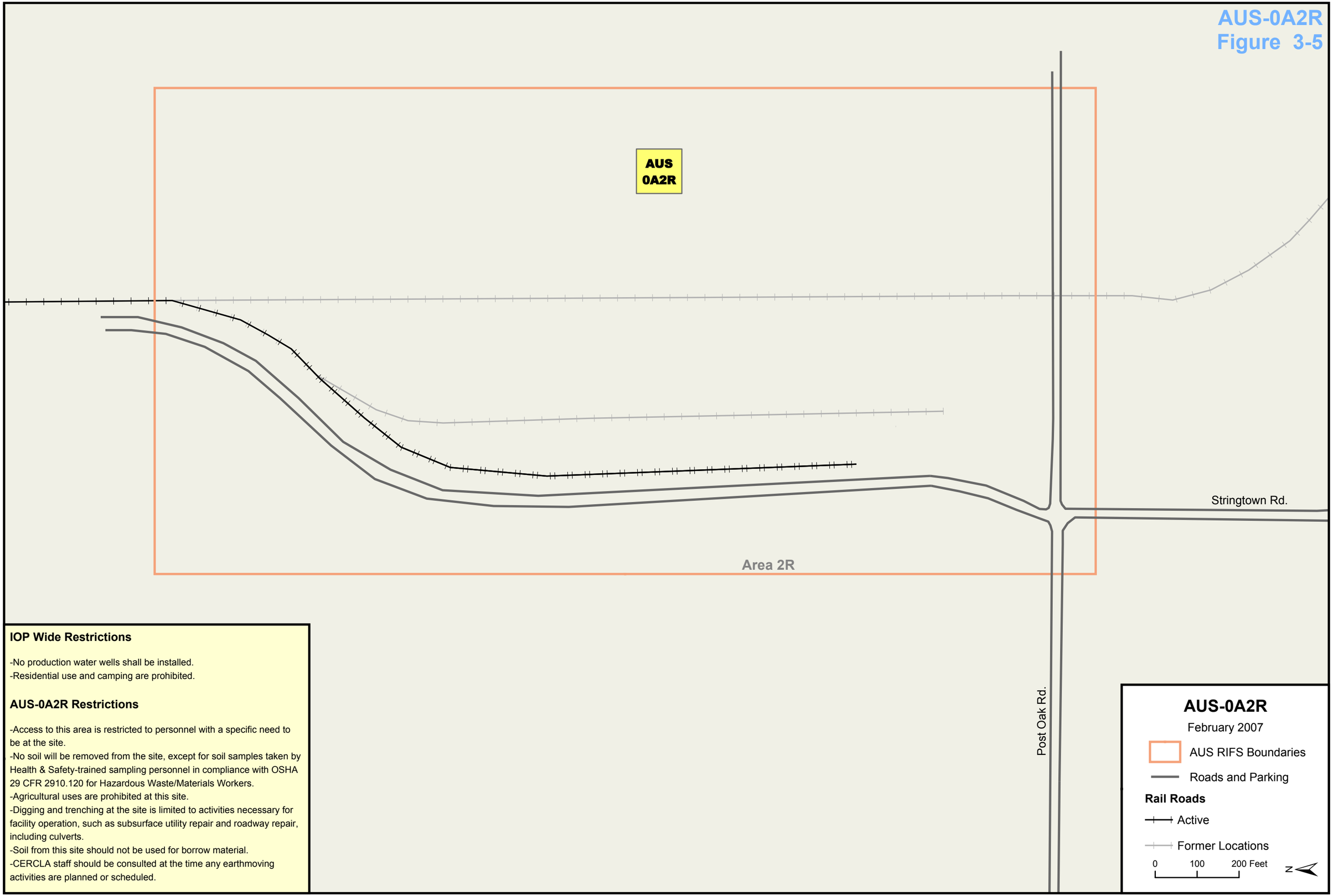
AUS-0A2P Personal Protective Equipment (PPE) Recommendations

Level C*
-Full or half-face, air purifying respirator (NIOSH approved).
-Hooded or non-hooded (based on task-specific potential for splashing and/or dust generation) Chemical-resistant clothing (overalls with long-sleeved jacket; coveralls; or one or two-piece splash suit; disposable chemical-resistant overalls).
-Coveralls (optional, as applicable).
-Gloves, outer, chemical-resistant.
-Gloves, inner, chemical-resistant.
-Boots, chemical-resistant, protective steel toe and shank.
-Hard hat (under suit, optional, as applicable).
-Face shield (optional, as applicable).

*Applies only if there are excavation activities in the area.



AUS-0A2R
Figure 3-5



IOP Wide Restrictions

-No production water wells shall be installed.
-Residential use and camping are prohibited.

AUS-0A2R Restrictions

-Access to this area is restricted to personnel with a specific need to be at the site.
-No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers.
-Agricultural uses are prohibited at this site.
-Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts.
-Soil from this site should not be used for borrow material.
-CERCLA staff should be consulted at the time any earthmoving activities are planned or scheduled.

AUS-0A2R

February 2007

AUS RIFS Boundaries

Roads and Parking

Rail Roads

Active

Former Locations

0 100 200 Feet

N

AUS-0A03
Figure 4-1

Pigeon Creek Rd.

FAM 4-6 FAM 4-5 FAM 4-4 FAM 4-3 FAM 4-2 FAM 4-1

FAM 3-7 FAM 3-6 FAM 3-5 FAM 3-4 FAM 3-3 FAM 3-2 FAM 3-1

FAM 2-7 FAM 2-6 FAM 2-5 FAM 2-4 FAM 2-3 AUS 0A03 FAM 2-2 FAM 2-1

FAM 1-7 FAM 1-6 FAM 1-5 FAM 1-4 FAM 1-3 FAM 1-2 FAM 1-1

Area 3

Area 2P

Stringtown Rd.

Crab Orchard Lake

IOP Wide Restrictions

-No production water wells shall be installed.
-Residential use and camping are prohibited.

AUS-0A03 Restrictions

-No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers.
-Agricultural uses are prohibited at this site.
-Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts.
-Soil from this site should not be used for borrow material.
-CERCLA staff should be consulted at the time any earthmoving activities are planned or scheduled.

AUS-0A03

February 2007

AUS RIFS Boundaries

Finished Ammunition (FAM)

Area Structures

Building

Concrete Pad

Roads

Former RR Locations

Lakes

0 200 400 Feet

N

AUS-0A4E and AUS-0A4W
Figure 5-1

IOP Wide Restrictions

-No production water wells shall be installed.
-Residential use and camping are prohibited.

AUS-0A4E and AUS-0A4E Restrictions

-No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous waste/Materials Workers.
-Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts.
-Agricultural uses are prohibited at this site.
-Access to this area is restricted to personnel with a specific need to be at the site.

S-2-4 Restrictions

-Lawn mowing in this area is prohibited.
-Note warning signs that have been placed in the area.

S-2-5 Restrictions

-Access to Building S-2-5 is strictly limited to personnel who are OSHA-trained and certified.
-Workers in this building are required to wear respiratory protection, in conjunction with dust monitoring, to insure that OSHA levels are not exceeded. All OHSA-trained personnel should have received instructions in selection of appropriate respirators and cartridges.
-Lawn mowing in this area is prohibited.
-Note warning signs that have been placed in the area.

AUS-0A04 Personal Protective Equipment (PPE) Recommendations

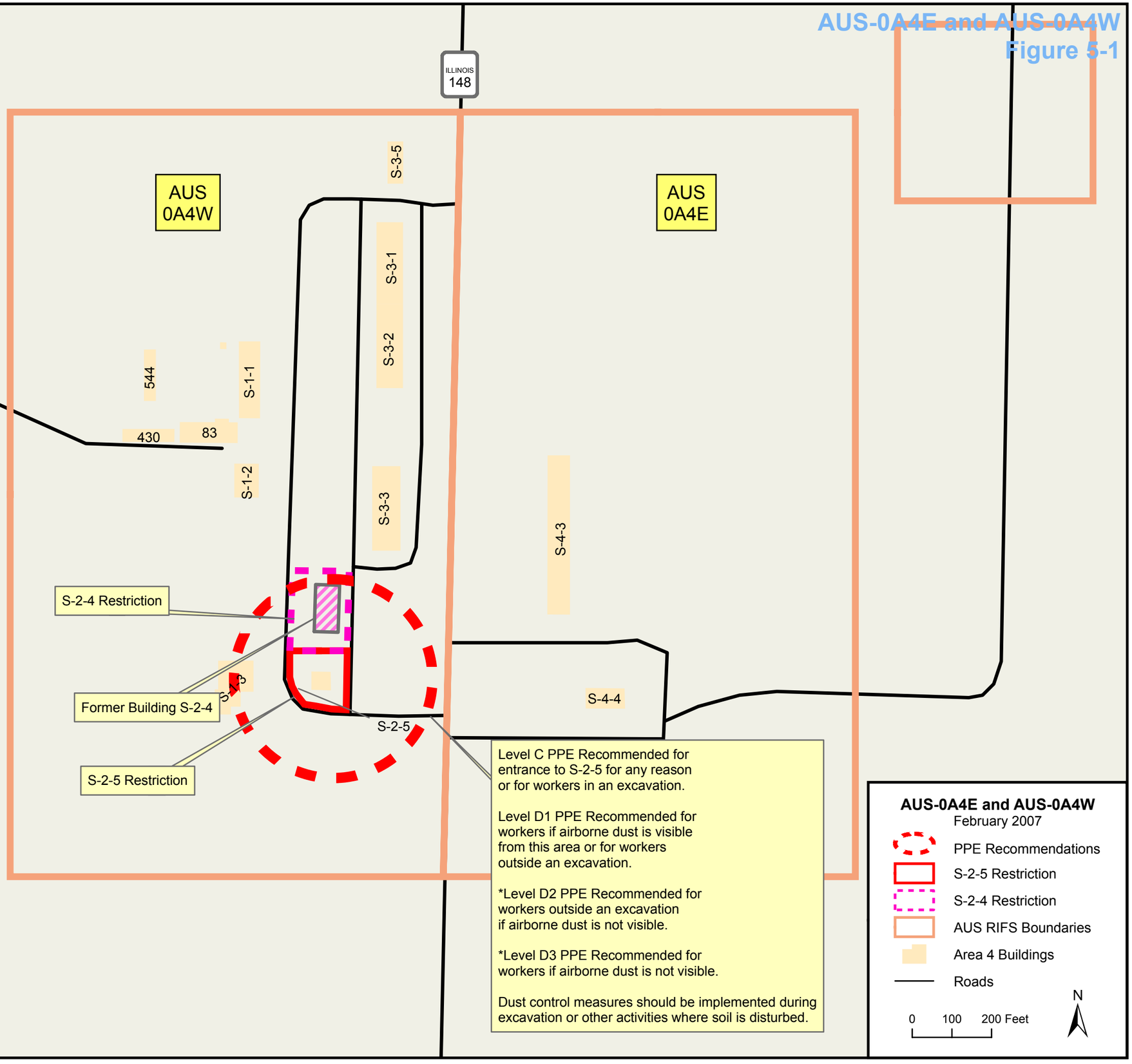
Level C
-Full or half-face, air purifying respirator (NIOSH approved).
-Hooded or non-hooded (based on task-specific potential for splashing and/or dust generation) Chemical-resistant clothing (overalls with long-sleeved jacket; coveralls; or one or two-piece splash suit; disposable chemical-resistant overalls).
-Coveralls (optional, as applicable).
-Gloves, outer, chemical-resistant.
-Gloves, inner, chemical-resistant.
-Boots, chemical-resistant, protective steel toe and shank.
-Hard hat (under suit, optional, as applicable).
-Face shield (optional, as applicable).

Level D1
-Dust mask, snug-fitting.
-Hooded chemical-resistant clothing (overalls with long-sleeved jacket; coveralls; or one or two-piece splash suit; disposable chemical-resistant overalls) if potentially exposed to groundwater at bottom of trench or excavation.
-Coveralls (optional, as applicable).
-Gloves, outer, chemical-resistant.
-Gloves, inner, chemical-resistant.
-Boots, chemical-resistant, protective steel toe and shank.
-Hard hat (optional, as applicable).
-Face shield (optional, as applicable).

Level D2*
-Same as Level D1 without the dust mask.

Level D3*
-Dust mask, snug-fitting if airborne dust is visible.
-Long pants (i.e., no shorts).
-Short or long-sleeve shirts.
-Work gloves (optional, as applicable).
-Boots, chemical-resistant, protective steel toe and shank.

*Applies only if there are excavation activities in the area.



AUS-0018
Figure 6-1

ILLINOIS 148

Old Hwy 13

Johns Ln.

Mullins Ln.

Stanley Ln.

Sitter Ln.

Noble Ln.

AUS 0018

ESDA Rd.

Area 5

Area 4W

Area 4E

IOP Wide Restrictions

-No production water wells shall be installed.
-Residential use and camping are prohibited.

Area 5 Restrictions

- Access to this area is restricted to personnel with a specific need to be at the site.
-No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers.
-Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts.
-Agricultural uses are prohibited at this site.
-Soil from this site should not be used for borrow material.

AUS-0018
February 2007

AUS RIFS Boundaries
Roads

Rail Roads

Active
Former Locations
Crab Orchard NWR

0 250 500 Feet

N

AUS-0A06
Figure 7-1

HE 7-12 HE 7-11 HE 7-10 HE 7-9 HE 7-8 HE 7-7 HE 7-6 HE 7-5 HE 7-4 HE 7-3 HE 7-2 HE 7-1

HE 6-12 HE 6-11 HE 6-10 HE 6-9 HE 6-8 HE 6-7 HE 6-6 HE 6-5 HE 6-4 HE 6-3 HE 6-2 HE 6-1

Old Chamnestown Road

HE 5-12 HE 5-11 HE 5-10 HE 5-9 HE 5-8 HE 5-7 HE 5-6 HE 5-5 HE 5-4 HE 5-3 HE 5-2 HE 5-1

AUS 0A06

HE 4-12 HE 4-11 HE 4-10 HE 4-9 HE 4-8 HE 4-7 HE 4-6 HE 4-5 HE 4-4 HE 4-3 HE 4-2 HE 4-1

HE 3-12 HE 3-11 HE 3-10 HE 3-9 HE 3-8 HE 3-7 HE 3-6 HE 3-5 HE 3-4 HE 3-3 HE 3-2 HE 3-1

HE 2-12 HE 2-11 HE 2-10 HE 2-9 HE 2-8 HE 2-7 HE 2-6 HE 2-5 HE 2-4 HE 2-3 HE 2-2 HE 2-1

HE 1-12 HE 1-11 HE 1-10 HE 1-9 HE 1-8 HE 1-7 HE 1-6 HE 1-5 HE 1-4 HE 1-3 HE 1-2 HE 1-1

Area 6

IOP Wide Restrictions

-No production water wells shall be installed.
-Residential use and camping are prohibited.

AUS-0A06 Restrictions

- Access to this area is restricted to personnel with a specific need to be at the site.
-No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers.
-Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts.

AUS-0A06
February 2007

- AUS RIFS Boundaries
- High Explosives (HE) Igloos
  - Current
  - Former Locations
- Roads
- Former RR Locations
- Lakes
- Streams

0 250 500 Feet

N

AUS-0A07 and MISCA OU Site 16 Figure 8-1

IOP Wide Restrictions

-No production water wells shall be installed.
-Residential use and camping are prohibited.

AUS-0A07 and Site 16 Restrictions

-Access to this area is restricted to personnel with a specific need to be at the site.
-No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers.
-Agricultural uses are prohibited at this site.
-Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts.
-Soil from this site should not be used for borrow material.
-CERCLA staff should be consulted at the time any earthmoving activities are planned or scheduled.

Buildings IN-1-3, IN-1-4, IN-1-5, and IN-1-6 and the area surrounding these buildings.

- Minimize exposure as much as practicable.
- Mowing is prohibited around these buildings.

Note, warning signs have been placed around the affected areas.

AUS-0A07 Personal Protective Equipment (PPE) Recommendations

Level D1**
-Dust mask, snug-fitting.
-Hooded chemical-resistant clothing (overalls with long-sleeved jacket; coveralls; or one or two-piece splash suit; disposable chemical-resistant overalls) if potentially exposed to groundwater at bottom of trench or excavation.
-Coveralls (optional, as applicable).
-Gloves, outer, chemical-resistant.
-Gloves, inner, chemical-resistant.
-Boots, chemical-resistant, protective steel toe and shank.
-Hard hat (optional, as applicable).
-Face shield (optional, as applicable).

Level D2*
-Same as Level D1 without the dust mask.

*Applies only if there are excavation activities in the area.

Buildings IN-1-3, IN-1-4, IN-1-5, and surrounding area restrictions.

Level D1 PPE Recommended for workers or short time site visitors in buildings IN-1-3, IN-1-4, IN-1-5, or IN-1-6.

IN-1-6 IN-1-5 IN-1-4 IN-1-3 IN-1-2 IN-1-1
IN-2-6 IN-2-5 IN-2-3 IN-2-2 IN-2-1
IN-3-6 IN-3-4 IN-3-3 IN-3-2
IN-4-6 IN-4-5 IN-4-3 IN-4-2 IN-4-1
IN-5-6 IN-5-4 IN-5-1
IN-6-5 IN-6-2 IN-6-1

AUS 0A07

Area 7

Level D1 PPE Recommended for workers and short term site visitors if airborne dust is visible or for workers in an excavation.

*Level D2 PPE Recommended for workers outside an excavation if airborne dust is not visible.

Dust control measures should be implemented during excavation or other activities where soil is disturbed.

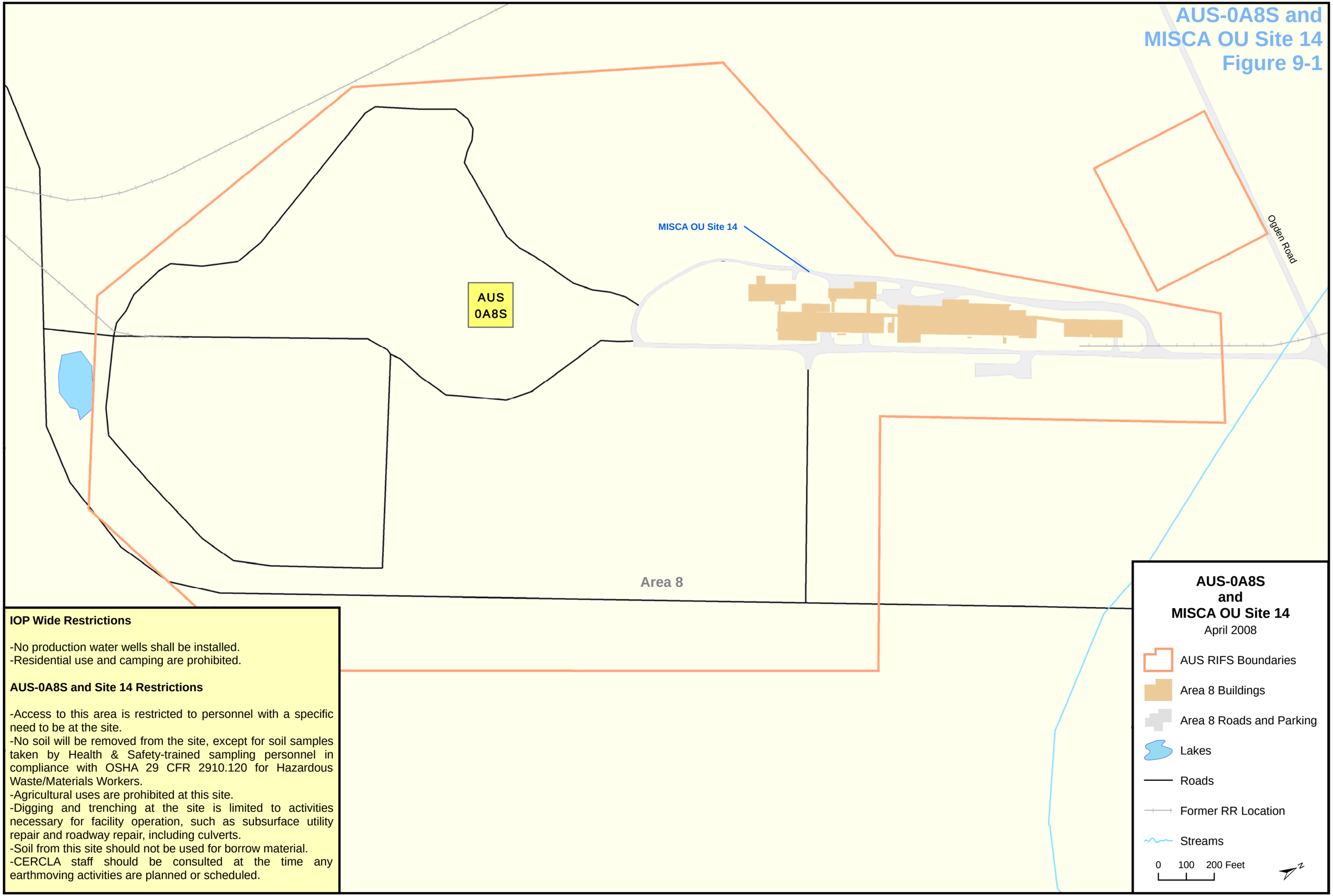
AUS-0A07 and MISCA OU Site 16
February 2007

- PPE Recommendations
- Pesticide Access Restriction
- AUS RIFS Boundaries
- Area 7 Buildings
- MISCA OU Site 16
- Roads
- Former RR Locations
- Streams

0 100 200 Feet

N

AUS-0A8S and MISCA OU Site 14 Figure 9-1



IOP Wide Restrictions

-No production water wells shall be installed.
-Residential use and camping are prohibited.

AUS-0A8S and Site 14 Restrictions

-Access to this area is restricted to personnel with a specific need to be at the site.
-No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers.
-Agricultural uses are prohibited at this site.
-Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts.
-Soil from this site should not be used for borrow material.
-CERCLA staff should be consulted at the time any earthmoving activities are planned or scheduled.

AUS-0A8S and MISCA OU Site 14
April 2008

- AUS RIFS Boundaries
- Area 8 Buildings
- Area 8 Roads and Parking
- Lakes
- Roads
- Former RR Location
- Streams

0 100 200 Feet

N

AUS-0A09 (North) and PCB OU Sites 32&33 Figure 10-1

IOP Wide Restrictions

-No production water wells shall be installed.
-Residential use and camping are prohibited.

AUS-0A09 (North) including PCB OU Sites 32 & 33 Restrictions

-Access to this area is restricted to personnel with a specific need to be at the site.
-No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials workers.
-Agricultural uses are prohibited at this site.
-Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts.
-Soil from this site should not be used for borrow material.
-CERCLA staff should be consulted at the time any earthmoving activities are planned or scheduled.
-Personnel mowing should wear a long sleeve shirt and pants, a dust mask, a head covering such as a baseball cap, and protective eyewear, as well as any other protective gear they would normally wear.

PCB OU Personal Protective Equipment (PPE) Recommendations

Level C
-Full or half-face, air purifying respirator (NIOSH approved).
-Hooded or non-hooded (based on task-specific potential for splashing and/or dust generation) Chemical-resistant clothing (overalls with long-sleeved jacket; coveralls; or one or two-piece splash suit; disposable chemical-resistant overalls).
-Coveralls (optional, as applicable).
-Gloves, outer, chemical-resistant.
-Gloves, inner, chemical-resistant.
-Boots, chemical-resistant, protective steel toe and shank.
-Hard hat (under suit, optional, as applicable).
-Face shield (optional, as applicable).

Level D1*
-Dust mask, snug-fitting.
-Hooded chemical-resistant clothing (overalls with long-sleeved jacket; coveralls; or one or two-piece splash suit; disposable chemical-resistant overalls) if potentially exposed to groundwater at bottom of trench or excavation.
-Coveralls (optional, as applicable).
-Gloves, outer, chemical-resistant.
-Gloves, inner, chemical-resistant.
-Boots, chemical-resistant, protective steel toe and shank.
-Hard hat (optional, as applicable).
-Face shield (optional, as applicable).

Level D2*
-Same as Level D1 without the dust mask.

Level D3*
-Dust mask, snug-fitting if airborne dust is visible.
-Long pants (i.e., no shorts).
-Short or long-sleeve shirts.
-Work gloves (optional, as applicable).
-Boots, chemical-resistant, protective steel toe and shank.

*Applies only if there are excavation activities in the area.

*Level C PPE Recommended for workers in an excavation.

I-1-23

I-1-20

I-1-12

I-1-88

AUS-0A09 (North)

Area 9

*Level D1 PPE Recommended for workers in excavation.

*Level D1 PPE Recommended for workers outside excavation if airborne dust is visible.

*Level D2 PPE Recommended for workers outside excavation if airborne dust is not visible.

*Level D3 PPE Recommended if airborne dust is not visible.

Dust control measures should be implemented during excavation or other activities where soil is disturbed.

AUS-0A09 (North) and PCB OU Sites 32 and 33
February 2007

- PPE Recommendations
- AUS RIFS Boundaries
- I Area Buildings
- Hydrants
- Waterlines
- Manholes
- Sewer Lines
- PCB Repository
- PCB Structures
- Roads
- Lakes
- Streams

0 250 500 Feet

AUS-0A09 (South) and PCB OU sites 32&33 Figure 10-2

IOP Wide Restrictions

-No production water wells shall be installed.
-Residential use and camping are prohibited.

AUS-0A09 (South) including PCB OU Sites 32 & 33 Restrictions

-Access to this area is restricted to personnel with a specific need to be at the site.
-No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials workers.
-Agricultural uses are prohibited at this site.
-Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts.
-Soil from this site should not be used for borrow material.
-CERCLA staff should be consulted at the time any earthmoving activities are planned or scheduled.
-Personnel mowing should wear a long sleeve shirt and pants, a dust mask, a head covering such as a baseball cap, and protective eyewear, as well as any other protective gear they would normally wear.

PCB OU Personal Protective Equipment (PPE) Recommendations

Level C1*
-Full or half-face, air purifying respirator (NIOSH approved).
-Hooded or non-hooded (based on task-specific potential for splashing and/or dust generation) Chemical-resistant clothing (overalls with long-sleeved jacket; coveralls; or one or two-piece splash suit; disposable chemical-resistant overalls).
-Coveralls (optional, as applicable).
-Gloves, outer, chemical-resistant.
-Gloves, inner, chemical-resistant.
-Boots, chemical-resistant, protective steel toe and shank.
-Hard hat (under suit, optional, as applicable).
-Face shield (optional, as applicable).

Level D1*
-Dust mask, snug-fitting.
-Hooded chemical-resistant clothing (overalls with long-sleeved jacket; coveralls; or one or two-piece splash suit; disposable chemical-resistant overalls) if potentially exposed to groundwater at bottom of trench or excavation.
-Coveralls (optional, as applicable).
-Gloves, outer, chemical-resistant.
-Gloves, inner, chemical-resistant.
-Boots, chemical-resistant, protective steel toe and shank.
-Hard hat (optional, as applicable).
-Face shield (optional, as applicable).

Level D2*
-Same as Level D1 without the dust mask.

Level D3*
-Dust mask, snug-fitting if airborne dust is visible.
-Long pants (i.e., no shorts).
-Short or long-sleeve shirts.
-Work gloves (optional, as applicable).
-Boots, chemical-resistant, protective steel toe and shank.

*Applies only if there are excavation activities in the area.

*Level D1 PPE Recommended for workers in excavation.

*Level D1 PPE Recommended for workers outside excavation if airborne dust is visible.

*Level D2 PPE Recommended for workers outside excavation if airborne dust is not visible.

*Level D3 PPE Recommended if airborne dust is not visible.

Dust control measures should be implemented during excavation or other activities where soil is disturbed.

AUS-0A09 (South)

I-1-88

I-1-3

I-1-2

I-1-1

Area 9

*Level C PPE Recommended for workers in an excavation.

AUS-0A09 (South) and PCB OU Sites 32 and 33
February 2007

- PPE Recommendations
- AUS RIFS Boundaries
- I Area Buildings
- Hydrants
- Waterlines
- Manholes
- Sewer Lines
- Roads
- Streams

0 150 300 Feet

AUS-0A10 and AUS-0043
Figure 11-1

IOP Wide Restrictions

-No production water wells shall be installed.
-Residential use and camping are prohibited.

AUS-0A10 and AUS-0043 Restrictions

-Access to this area is restricted to personnel with a specific need to be at the site.
-No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers.
-Agricultural uses are prohibited at this site.
-Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts.
-Soil from this site should not be used for borrow material.
-CERCLA staff should be consulted at the time any earthmoving activities are planned or scheduled.

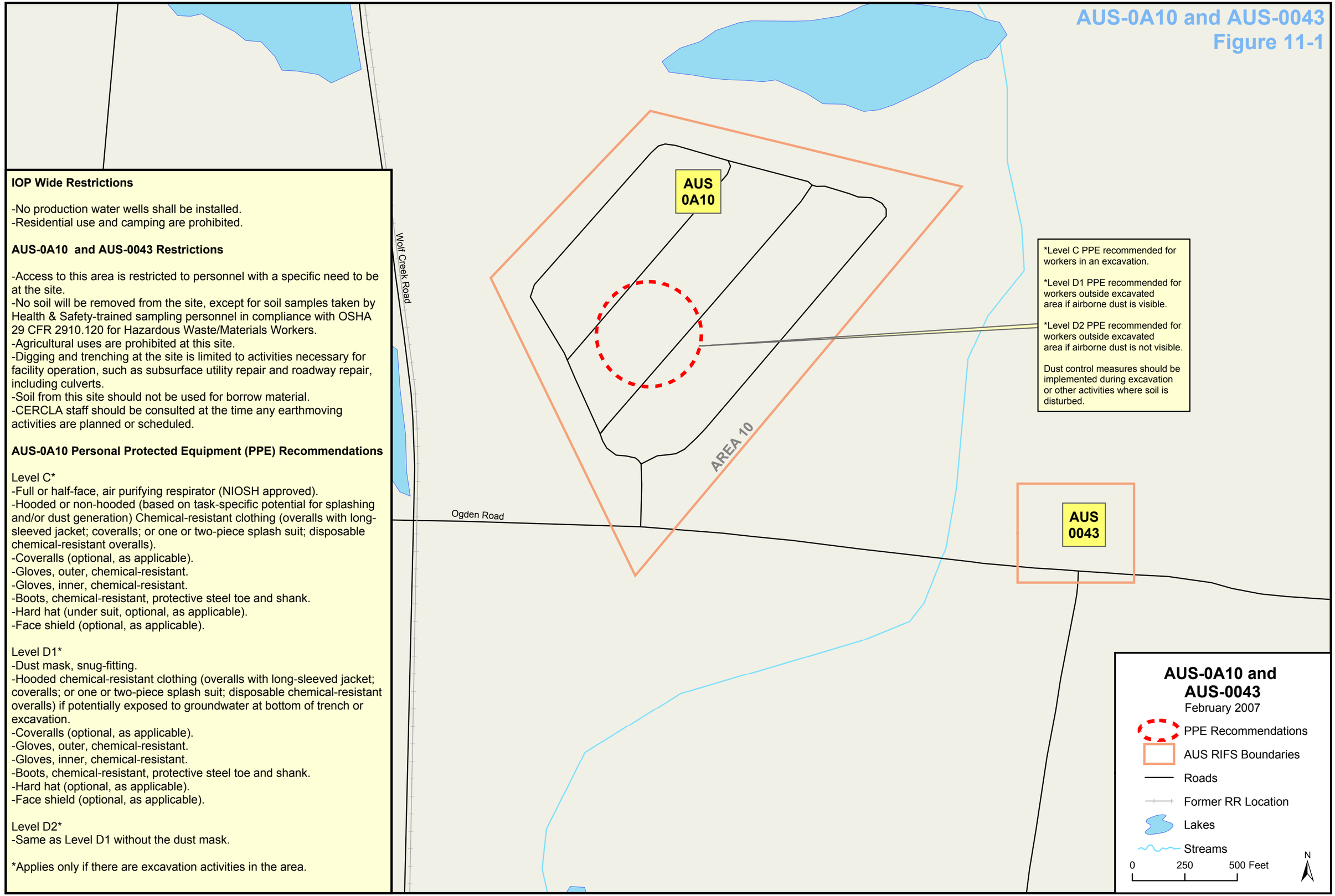
AUS-0A10 Personal Protected Equipment (PPE) Recommendations

Level C*
-Full or half-face, air purifying respirator (NIOSH approved).
-Hooded or non-hooded (based on task-specific potential for splashing and/or dust generation) Chemical-resistant clothing (overalls with long-sleeved jacket; coveralls; or one or two-piece splash suit; disposable chemical-resistant overalls).
-Coveralls (optional, as applicable).
-Gloves, outer, chemical-resistant.
-Gloves, inner, chemical-resistant.
-Boots, chemical-resistant, protective steel toe and shank.
-Hard hat (under suit, optional, as applicable).
-Face shield (optional, as applicable).

Level D1*
-Dust mask, snug-fitting.
-Hooded chemical-resistant clothing (overalls with long-sleeved jacket; coveralls; or one or two-piece splash suit; disposable chemical-resistant overalls) if potentially exposed to groundwater at bottom of trench or excavation.
-Coveralls (optional, as applicable).
-Gloves, outer, chemical-resistant.
-Gloves, inner, chemical-resistant.
-Boots, chemical-resistant, protective steel toe and shank.
-Hard hat (optional, as applicable).
-Face shield (optional, as applicable).

Level D2*
-Same as Level D1 without the dust mask.

*Applies only if there are excavation activities in the area.



AUS OU Sites in Areas 11 and 12 & COP-4 Figure 12-1

IOP Wide Restrictions

-No production water wells shall be installed.
-Residential use and camping are prohibited.

COP-4 Restrictions

-Agricultural uses are prohibited within the COC ELUC area.
-Digging and trenching or other disturbance of the soil is prohibited within the COC ELUC area except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers.
-Controlled burns will not be conducted within the COC ELUC area.

AUS OU Sites in Areas 11 and 12 Restrictions

-Access to this area is restricted to personnel with a specific need to be at the site.
-No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers.
-Agricultural uses are prohibited at this site.
-Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts.
-Soil from this site should not be used for borrow material.
-CERCLA staff should be consulted at the time any earthmoving activities are planned or scheduled.
-Hunting is not allowed in this area.
-Controlled burns will not be conducted in this area.

AUS OU Sites in Areas 11 and 12 Personal Protective Equipment (PPE) Recommendations

Level C*
-Full or half-face, air purifying respirator (NIOSH approved).
-Hooded or non-hooded (based on task-specific potential for splashing and/or dust generation) Chemical-resistant clothing (overalls with long-sleeved jacket; coveralls; or one or two-piece splash suit; disposable chemical-resistant overalls).
-Coveralls (optional, as applicable).
-Gloves, outer, chemical-resistant.
-Gloves, inner, chemical-resistant.
-Boots, chemical-resistant, protective steel toe and shank.
-Hard hat (under suit, optional, as applicable).
-Face shield (optional, as applicable).

Level D1*
-Dust mask, snug-fitting.
-Hooded chemical-resistant clothing (overalls with long-sleeved jacket; coveralls; or one or two-piece splash suit; disposable chemical-resistant overalls) if potentially exposed to groundwater at bottom of trench or excavation.
-Coveralls (optional, as applicable).
-Gloves, outer, chemical-resistant.
-Gloves, inner, chemical-resistant.
-Boots, chemical-resistant, protective steel toe and shank.
-Hard hat (optional, as applicable).
-Face shield (optional, as applicable).

Level D2*
-Same as Level D1 without the dust mask.

*Applies only if there are excavation activities in the area.

Dust control measures should be implemented during excavation or other activities where soil is disturbed.

AUS A11S
AUS A11A
AUS A11P
Area 11
*Level C PPE recommended for workers in an excavation.
*Level D1 PPE recommended for workers outside excavated area if airborne dust is visible.
*Level D2 PPE recommended for workers outside excavated area if airborne dust is not visible.
*Level C PPE recommended for workers in an excavation.
AUS A11N
AUS 106A
AUS A11H
ILLINOIS 148
AUS 0A12
COP-4
Area 12

COP-4

PPE Recommendations
COP-4 Boundary
COP-4 Monitoring Wells
Roads
0 25 50 Feet
N

AUS OU Sites in Areas 11 and 12 & EMMA OU COP-4
February 2007
PPE Recommendations
AUS RIFS Boundaries
Roads
Former RR Location
Lakes
0 250 500 Feet
N

AUS-0A13
Figure 13-1

FAI-7-1 FAI-7-2 FAI-7-3 FAI-7-4 FAI-7-5 FAI-7-6 FAI-7-7 FAI-7-8
FAI-7-9 FAI-7-10 FAI-7-11 FAI-7-12

FAI-6-1 FAI-6-2 FAI-6-3 FAI-6-4 FAI-6-5 FAI-6-6 FAI-6-7
FAI-6-8 FAI-6-9 FAI-6-10 FAI-6-11 FAI-6-12 FAI-6-13 FAI-6-14

FAI-5-1 FAI-5-2 FAI-5-3 FAI-5-4 FAI-5-5 FAI-5-6 FAI-5-7 FAI-5-8
FAI-5-9 FAI-5-10 FAI-5-11 FAI-5-12 FAI-5-13 FAI-5-14 FAI-5-15

FAI-4-1 FAI-4-2 FAI-4-3 FAI-4-4 FAI-4-5 FAI-4-6 FAI-4-7
FAI-4-8 FAI-4-9 FAI-4-10 FAI-4-11 FAI-4-12 FAI-4-13 FAI-4-14 FAI-4-15 FAI-4-16

FAI-3-1 FAI-3-2 FAI-3-3 FAI-3-4 FAI-3-5 FAI-3-6 FAI-3-7 FAI-3-8
FAI-3-9 FAI-3-10 FAI-3-11 FAI-3-12 FAI-3-13 FAI-3-14 FAI-3-15

AUS 0A13

FAI-2-1 FAI-2-2 FAI-2-3 FAI-2-4 FAI-2-5 FAI-2-6 FAI-2-7
FAI-2-8 FAI-2-9 FAI-2-10 FAI-2-11 FAI-2-12 FAI-2-13 FAI-2-14

FAI-1-1 FAI-1-2 FAI-1-3 FAI-1-4 FAI-1-5 FAI-1-6 FAI-1-7 FAI-1-8 FAI-1-9 FAI-1-10 FAI-1-11 FAI-1-12 FAI-1-13 FAI-1-14

Area 13

IOP Wide Restrictions

-No production water wells shall be installed.
-Residential use and camping are prohibited.

AUS 0A13 Restrictions

-Access to this area is restricted to personnel with a specific need to be at the site.
-No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers.
-Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts.
-Soil from this site should not be used for borrow material.
-CERCLA staff should be consulted at the time any earthmoving activities are planned or scheduled.

AUS-0A13
February 2007

AUS RIFS Boundaries
Finished Ammunition Igloos (FAI)
Finished
Demolished
Former RR Location
Lakes
Streams
Roads

0 250 500 Feet

AUS OU Sites 0001, 0002, 0060 and 0061 Figure 14-1

Area 2D

Area 2B

Wolf Creek Road

AUS 0001

AUS 0002

AUS 0061

AUS 0060

Area 14

IOP Wide Restrictions

-No production water wells shall be installed.
-Residential use and camping are prohibited.

AUS-0001, 0002, 0060, & 0061 Restrictions

- Access to these areas are restricted to personnel with a specific need to be there.
-No soil will be removed from these sites, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers.
-Digging and trenching at these sites are limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts.
-Agricultural uses are prohibited at these sites.
-Soil from these sites should not be used for borrow material.

AUS-0001, 0002, 0060, & 0061

February 2007

AUS RIFS Boundaries

Roads

Lakes

0 250 500 Feet

N

Hampton Cemetery Area
Figure 17-1

*Modified Level D2 PPE Recommended for sampling or handling water from cistern.

Crab Orchard Lake

Wolf Creek Road

AUS 0067

COC-6

Hampton Cemetery

COC 3

COC-5

COC-4

Old Carterville Road

COC 9

COC-1

Hampton Cemetery Road

COC 15

IOP Wide Restrictions

-No production water wells shall be installed.
-Residential use and camping are prohibited.

Caution

Because live munitions have been found in this area in the past, there is a likelihood of finding them in this area in the future.

COC ELUC Restrictions

-Agricultural uses are prohibited within the COC ELUC area.
-Digging and trenching or other disturbance of the soil is prohibited within the COC ELUC area except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers.
-Controlled burns will not be conducted within the COC ELUC area.

AUS-0067 Personal Protective Equipment (PPE) Recommendations

Level D2*
(Modified for Protection against Splashing)

-Waterproff coveralls if water from cistern is to be sampled or handled in any way.
-Gloves, waterproof.
-Boots, waterproof.
-Hard hat (optional, as applicable).
-Face shield (optional, as applicable).

COC-15

0 100 200 Feet

Wolf Creek Road

Hampton Cemetary Road

Hampton Cemetery Area

February 2007

- EMMA OU ELUC Area
- Reforestation Area
- UXO Removal Sites
- PPE Recommendations
- COC3 Remediation Area
- Settling Basin
- COC-3 Monitoring Wells
- Roads
- AUS RIFS Boundaries
- Lakes
- Streams

0 500 1,000 Feet

F I N A L

ENVIRONMENTAL LAND USE CONTROL PLAN

Crab Orchard National Wildlife Refuge NPL Site
Marion, Illinois

U.S. Fish & Wildlife Service
Crab Orchard National Wildlife Refuge
Marion, Illinois

April 2008

TABLE OF CONTENTS

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ATTACHMENTS

FINAL
ENVIRONMENTAL LAND USE CONTROL PLAN

I. BACKGROUND

A number of environmental investigative and remediation activities have been undertaken at the National Priority List (NPL) Site known as the Sangamo Dump/Crab Orchard National Wildlife Refuge (CONWR or Refuge), Carterville, Illinois (Site) pursuant to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 U.S.C. §9601 *et. seq.*, and the National Contingency Plan (NCP), 40 C.F.R. Part 300. The Refuge is administered by the U. S. Department of the Interior (DOI), Fish and Wildlife Service (FWS). These investigative activities have revealed and may in the future reveal certain areas of environmental contamination, where hazardous substances, hazardous wastes or hazardous constituents, or their derivatives were released into the environment as a result of activities conducted over the history of the facility. The Site does not include the entire refuge, but only sites within the area of the former Illinois Ordnance Plant (IOP).[1] Such sites may generally be categorized as follows:

1. Those that have been fully investigated and specific remedy(ies) previously implemented (the Metals Areas Operable Unit (MAOU), the Explosives/Munitions Manufacturing Operable Unit (EMMA OU), Sites 14, 22A and 36 of the Miscellaneous Areas Operable Unit (MISCA OU), the Water Towers Operable Unit (WTOU), and most of the PCB [polychlorinated-biphenyl] Areas Operable Unit (PCB OU).

2. Those that have been fully investigated and remedy(ies) have been selected but have not yet been implemented;

3. Those that have been fully investigated but final remedy selection decisions have not yet been made;

4. Those in need of further investigative activities before the appropriate final remedy(ies) can be selected and implemented (the AUS OU); and,

5. Those sites which have been investigated and for which it has been determined that no active remedy is needed (most of the MISCA OU).

II. DEFINITIONS

For the purposes of this document, the term "Environmental Land Use Control" or "ELUC" means a restriction or control that limits exposure to contaminated media (e.g., soils, surface water, groundwater, etc.) arising from the need to protect human health and/or the environment at any site within the NPL Site**.** ELUCs may be necessary when contamination is first discovered, when CERCLA response actions are ongoing, or when some amount of contamination remains on-site as part of a CERCLA remedy. The term includes controls on access (e.g., engineered barriers, such as caps, and non-engineered mechanisms, such as fences

[1] Note that upper-case "Site" (when not used as a proper name, such as Site 36) refers to the NPL Site as defined in the first paragraph. Lower-case "site" refers to one of the sites within the NPL Site (listed in Attachment A).

or signs). Additionally, the term encompasses both affirmative measures to achieve the desired control (e.g., security patrols) and prohibitive directives (e.g., no drilling of drinking water wells).

III. APPLICABILITY

This Plan applies to each site for which remedial action has been determined to be necessary following investigative activities conducted in accordance with CERCLA and the NCP, and has not been or will not be remediated to allow for unrestricted use. The provisions of the Plan also temporarily apply to sites currently under investigation, such as the AUS OU sites.

Note that for sites under investigation, in accordance with the NCP and EPA guidance, the site-wide and site-specific ELUCs will not be considered when conducting Baseline Risk Assessments (BRAs). See further discussion in Appendix B.

Due to factors arising from federal ownership of real property, this Plan along with remedy decision documents (e.g. Record of Decision (ROD)) will be deemed to fulfill ELUC recording requirements until such time a property interest in any site with ELUCs on CONWR is transferred out of federal ownership. At the time of such transfer, all ELUC requirements that apply to that site will be articulated in land transfer documents (e.g. deed) that must be observed by the new owner. Additional detail about written requirements for future property conveyances is provided in Section VIII.

IV. PURPOSE

By adopting this plan, the FWS intends to accomplish the following specific objectives:

1. To implement a process to ensure appropriate long-term maintenance of those ELUCs that have already or may be selected as part of the chosen remedy for any site on CONWR and documented in a remedy decision document by elevating the general level of awareness among CONWR personnel, tenants, and visitors regarding the ELUCs;

2. To implement a process for the FWS to periodically advise the U.S. Environmental Protection Agency (USEPA) and the Illinois Environmental Protection Agency (IEPA) representatives of the continued maintenance of ELUCs at CONWR and of any planned changes in land use impacting any site remedy that includes ELUCs based on the assumption that land usage would be controlled, (e.g., restricted to industrial use);

3. To implement procedures for integrating all site remedies that include ELUCs into the Crab Orchard National Wildlife Refuge land use planning process;

4. To satisfy FWS' obligation to comply with those ELUCs deemed necessary by FWS in consultation with USEPA or IEPA as part of a selected remedy and provided for in a remedy selection document (e.g. ROD), until such time as FWS, USEPA and IEPA

determine that those ELUCs are no longer necessary for the protection of human health and the environment;

5. To satisfy FWS's obligations as land manager and steward of CONWR, to implement temporary ELUCs during the pendency of ongoing CERCLA investigations (e.g. Remedial Investigation/Feasibility Study), prior to implementation of a remedy pursuant to a remedy selection document (e.g. ROD).

In accordance with the NCP and EPA risk assessment guidance, the site-wide and site-specific ELUCs will not be considered when conducting a Baseline Risk Assessment (BRA) for any site at CONWR.

V. ATTACHMENTS

The following two attachments are part of this Plan as further specified below:

1. The CONWR site listing (Attachment A) for those presently known sites covered under the terms of this Plan. Attachment A will be updated annually by FWS to reflect any additions or deletions of sites as may hereafter be agreed to by the Parties. Copies of each annual update will be promptly distributed to USEPA and IEPA. If no site additions or deletions have been made during the previous year, then no updated attachment will be prepared or distributed for that period.

2. Attachment B, the CONWR Environmental Land Use Control Implementation Plan (ELUCIP). This Plan includes background information for all the sites and a discussion of the screening values used to assess whether sites may pose unacceptable risk without land use controls. The ELUCIP includes IOP-wide ELUCs prohibiting residential use and the installation of potable wells in the upper aquifer. The ELUCIP also includes individual Environmental Land Use Control Implementation Plans ("site ELUCIPs") for all known sites to be covered under the terms of this Plan. Each site ELUCIP: (1) identifies the site's location by reference to the facility's land use plan or by other means sufficient to enable the Parties to readily locate the site; (2) includes the basis for the ELUC, if needed (chemical results from previous investigations); (3) identifies both the ELUC objective for the site being addressed as well as those particular ELUCs to be relied upon to achieve the objective; (3) specifies what must be done in order to implement and maintain the specific ELUCs required for the site; and (5) contains a cross-reference to whatever decision document(s) apply to the site. As future decisions involving ELUCs are made at sites on CONWR, these sites will become covered under this Plan and listed in Attachment A, and a new ELUCIP appropriate to each such newly covered site will be added to Attachment B. In conjunction with the CONWR Comprehensive Conservation Plan (CCP), these plans should serve as a central ELUC reference source to assist CONWR personnel with completing periodic site inspections, review, and certifications required under Paragraph VI of this Plan.

VI. SITE INSPECTION/REVIEW/CERTIFICATION

Within thirty (30) days of finalizing the ELUC Plan attachments identified in Section V or sixty (60) days after execution of this Plan, whichever occurs first, CONWR shall initiate the following specific actions:

1. Conduct the first of annual visual inspections of all sites with site ELUCIPs included in Attachment A to this Plan. These inspections will be for the purposes of verifying all necessary ELUCs have been implemented and are being properly maintained. The CONWR Superfund Manager will be responsible for: (1) ensuring all required inspections are performed; (2) providing USEPA and IEPA with thirty (30) days advance notice of, and opportunity to participate in, the annual inspection conducted each calendar year; (3) notifying USEPA and IEPA of any deficiencies noted within thirty (30) days, and; (4) ensuring that corrective measures are undertaken as soon as practicable to correct any such deficiency(ies) with timely notification to USEPA and IEPA detailing corrective actions taken or providing a timetable outlining future corrective actions. Note that some sites do not need ELUCs besides the global restrictions on potable wells and residential use identified in Attachment B.

2. Whenever a five-year review is preformed, FWS will coincide an ELUC certification inspection with the review, and then restart the annual clock at that time.

3. Prepare and forward an annual report to USEPA and IEPA signed by the CONWR Superfund Manager or the CONWR Refuge Manager certifying the continued retention of all implemented ELUCs associated with those Sites identified in Attachment A to this Plan (as last updated). The first annual report will be due within 90 days of initiating the annual inspections.

VII. AGENCY COORDINATION

CONWR agrees to implement the following agency coordination procedures:

1. Except under circumstances reasonably determined by the FWS to be an emergency, FWS shall provide at least sixty (60) days notice prior to implementation of any Land Use Change (as defined in Section VII.3.) at any site subject to ELUCs. The FWS will provide notification of any such change to USEPA and IEPA. If USEPA or IEPA has program authority over particular ELUC(s) within affected site(s)**,** FWS will seek concurrence from either USEPA or IEPA with a FWS determination as to whether the contemplated change will prompt a re-evaluation of the selected remedy that includes specific ELUC(s) to ensure continued protection of human health and the environment.

2. Except in the case of an emergency where FWS personnel reasonably believe it is not practicable to give notice to USEPA and IEPA prior to implementation of a Land Use Change, any Land Use Change that will not be implemented until USEPA or IEPA

have been given requisite notice and comment period of 30 days, consistent with Section VII.3 below. Each notification must include:

a. An evaluation of whether the anticipated Land Use Change will negatively impact the effectiveness of the selected site remedy, including the effectiveness of existing ELUCs;

b. An evaluation of the potential need for additional CERCLA response action(s), which may include additional ELUC(s), resulting from implementation of the anticipated Land Use Change; and,

c. A proposal for changes to the remedy decision document (e.g. ROD) that would result in changes to the selected site remedy.

3. Upon being notified by CONWR of an anticipated Land Use Change at a site, USEPA or IEPA or both shall evaluate the information provided pursuant to paragraph 2 above, and may provide comments within 30 days to such Land Use Change.

   Any of the following will constitute a Land Use Change:

   a. Any change in land use that is not consistent with the exposure assumptions for human health and/or ecological receptors upon which site risks to human health and the environment are based, as well as the specific remedy, including specific ELUCs, implemented at the site to address human and ecological risks identified during the BRA;

   b. Site activities that disrupt or otherwise reduce the effectiveness of the implemented ELUC as part of a selected remedy. Examples include excavation at a landfill, groundwater pumping impacting a groundwater pump and treat system, a construction project impacting ecological habitat protected by the remedy, removal of a fence that is part of the ELUC, unlocking of a gate when the lock is required by the ELUC, or removal of warning signs that are part of the ELUC, or,

   c. Any site activity that will negate the need for the specific ELUC(s) implemented at the site.

4. Upon discovery, FWS will immediately notify USEPA and IEPA of any Land Use Change at any site with an implemented ELUC which has not been previously reviewed and concurred in by USEPA or IEPA. Such notifications will provide all pertinent information as to the nature and extent of the change and describe any measures implemented or to be implemented (to include a timetable for future completion) to reduce or prevent human health or ecological impacts.

A list of the appropriate agency and facility points-of-contact is included in the Stand-Alone Section for Field and Construction Personnel at the beginning of this ELUC Plan.

VIII. FUTURE PROPERTY CONVEYANCE

After CERCLA response actions memorialized in the remedy selection document (e.g. ROD), including those that include ELUC(s), have been implemented at a particular site within CONWR, FWS may choose to transfer a property interest in that site to a non-PRP agency, private person or entity. Should the decision be made to transfer a property interest in such site to any other non-PRP agency, private person or entity, either title to, or an easement or right of way in, any site on CONWR with an existing ELUC(s), then the FWS shall ensure:

1. The written instrument (e.g. deed) transferring a property interest contains a covenant pursuant to CERCLA §120(h) that "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."

2. USEPA and IEPA are provided with notice at least sixty (60) days prior to any such intended conveyance. Such notice must: (1) indicate the mechanism(s) to be used to reasonably ensure any ELUC(s) will be the maintained by the transferee after the conveyance has occurred; and (2) include an assurance that CONWR has recorded in the land records that the transfer of the property interest includes the ELUC(s) (e.g. in the form of a deed restriction).

3. Any ELUC(s) included as part of the transfer of a property interest is/are reviewed and incorporated into those documents transferring the property interest and copies of such documents are recorded in the land records as required by applicable federal requirements (CERCLA §120(h)) and state law.

4. Each transferee is given adequate notice of past releases of hazardous substances in accordance with CERCLA §120(h) and 40 CFR §373 as well as existing site condition(s) and agrees to maintain any ELUCs contained as part of the property interest that has been transferred. The notice will indicate that if the ELUCs are not maintained, risk based scenarios based on the ELUCs may no longer be valid.

The planned transfer of any site with ELUCs to a public or private entity may prompt USEPA or IEPA to re-evaluate the continued appropriateness of any previously agreed upon ELUC(s) based upon the level of assurance provided that all necessary ELUCs will be adequately maintained.

IX. CHANGE IN APPLICABLE REGULATIONS OR CONTAMINANT CONCENTRATIONS

The FWS may propose the removal of any site from coverage under the terms of this Plan if either: (i) a post-remedy implementation increase to applicable federal or state risk-based cleanup regulations that may affect the cleanup goals in a remedy decision document (e.g. ROD),

or (ii) a reduction in previously documented contaminant concentration levels that may affect selected remedy (e.g. reduce or eliminate the need for ELUCs). FWS will consult with both USEPA and IEPA regarding any change in the ongoing need for ELUCs as part of a selected remedy articulated in a remedy selection document (e.g. ROD) prior to consideration of potentially removing a site from the ELUC Plan.

The FWS may propose changes to ELUCs for sites covered under this Plan if either: (i) a post-remedy implementation strengthening of applicable federal or state risk-based cleanup regulations that may result in stricter cleanup goals, or (ii) an increase in previously documented contaminant concentration levels that may result in the need for additional CERCLA response action(s) (e.g. affect the need for and type of ELUCs). FWS will consult with both USEPA and IEPA regarding these types of changes that may ultimately affect remedy decisions.

FINAL

ATTACHMENT A

CONWR SITE LISTING

Crab Orchard National Wildlife Refuge NPL Site Marion, Illinois

U.S. Fish & Wildlife Service
Crab Orchard National Wildlife Refuge
Marion, Illinois

April 2008

- **METALS AREA OPERABLE UNIT** (MAOU)
  - Site 15 – Plating Pond
  - Site 22 – Old Refuge Shop Channel
  - Site 29 – Fire Station Landfill

- **PCB AREAS OPERABLE UNIT** (PCB OU)
  - Site 17 – Job Corps Landfill
  - Site 28 – Water Tower Landfill
  - Site 32 – Area 9 Landfill
  - Site 33 – Area 9 Building Complex

- **EXPLOSIVES/MUNITIONS MANUFACTURING OPERABLE UNIT** (EMMA OU)
  - COC-1
  - COC-2
  - COC-3
  - COC-4
  - COC-5
  - COC-6
  - COC-7
  - COC-8
  - COC-9
  - COC-10
  - COP-1
  - COP-2
  - COP-3
  - COP-4
  - BUNKER 1-3

- **MISCELLANEOUS AREAS OPERABLE UNIT** (MISCA OU)
  - Site 7 – D Area Southeast Drainage Channel
  - Site 7A – D Area North Lawn
  - Site 8 – D Area Southwest Drainage Channel
  - Site 9 – P Area Northwest Drainage Channel
  - Site 10 – Waterworks North Drainage Channel
  - Site 11 – P Area Southeast Drainage
  - Site 11A – P Area North
  - Site 12 – Area 8 Impoundment
  - Site 13 – Area 8 change House
  - Site 14 – Area 8 Solvent Storage Drainage Ditch
  - Site 16 – Area 7 Industrial Site
  - Site 18 – Area 13 Loading Platform
  - Site 20 – D Area South Drainage Channel
  - Site 21 – Southeast Corner Field
  - Site 22A – Former Post Treating Facility
  - Site 24 – Pepsi Plant West Drainage Ditch
  - Site 25 – Crab Orchard Creek at Marion Landfill

- Site 26 – Crab Orchard Creek Below Marion Sewage
- Site 27 – Crab Orchard Creek Below I-51 Dredge Area
- Site 30 – Munitions Control Site
- Site 31 – Refuge Control Site
- Site 34 – Crab Orchard Lake
- Site 35 – Area 9 East Waterway
- Site 36 – Refuge Wastewater Treatment Plant

- **WATER TOWERS OPERABLE UNIT** (WTOU)
  - Water Tower No. 1
  - Water Tower No. 2
  - Water Tower No. 3
  - Water Tower No. 4
  - Cedar Point Water Tower
  - Visitor Center

- **ADDITIONAL AND UNCHARACAERIZED SITES OPERABLE UNIT** (AUS OU)
  - AUS-0A2B Booster Loading Line
  - AUS-0A2D Detonator Loading Line
  - AUS-0A2F Fuse Loading Line
  - AUS-0A2P Artillery Primer Loading Line
  - AUS-0A2R Railroad Spur
  - AUS-0A03 Finished Ammunition – Group I
  - AUS-0A4E East Shop Area
  - AUS-0A4W West Shop Area
  - AUS-0A06 Ammonium Nitrate High Explosive & Smokeless Powder Storage Area
  - AUS-0A07 Inert Storage
  - AUS-0A8S Load Line III
  - AUS-0A09 Load Line I
  - AUS-0A10 Fuse and Booster Storage Magazines
  - AUS-A11A Acid & Ammonium Nitrate Area (part of Load Line II)
  - AUS-A11H High Explosives Area (part of Load Line II)
  - AUS-A11N Nitroglycerin Area
  - AUS-A11P Pilot Propellant Plant/CAP Production Area
  - AUS-A11S Support Area (part of Load Line II)
  - AUS-0A12 Former Ammonium Nitrate Plant
  - AUS-0A13 Finished Ammunition Igloos
  - AUS-0062 COC (Mounds and Pits)
  - AUS-0063 COC (Fenced Area West of COC-1)
  - AUS-0064 COC (Mounds and Brick Pit)
  - AUS-0065 COC (Foundations Northeast of COC-1)
  - AUS-0066 COC (Berm with Red Brick Rubble)
  - AUS-0067 COC (Fence with Contaminated Area Sign – Northwest of COC-6)
  - AUS-0069 COC (Dump Near South Shore of Crab Orchard Lake)
  - AUS-0109 COC (Possible Former Explosives Detonation Area)
  - AUS-0001 Fire and Police Headquarters
  - AUS-0002 Wastewater Treatment Plant

- AUS-0018 Railroad Classification Yard
- AUS-0019 Former Railroad Spur (North of Area 4E)
- AUS-0021 Area 7 Fire Station
- AUS-0022 Small Arms Training Facility
- AUS-0043 Areas 11 & 12 Fire Station
- AUS-0060 Fulminate Storage Igloos
- AUS-0061 Detonation & Disposal Area
- AUS-106A Drum Disposal Area East of Area 11
- AUS-0107 Possible Former Disposal Area Located Just Northwest of Area 8
- AUS-0108 Possible Disposal Area East of COC-10

F I N A L

ATTACHMENT B

ENVIRONMENTAL LAND USE CONTROL IMPLEMENTATION PLAN

Crab Orchard National Wildlife Refuge NPL Site
Marion, Illinois

U.S. Fish & Wildlife Service
Crab Orchard National Wildlife Refuge
Marion, Illinois

April 2008

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1.1 INTRODUCTION

This attachment contains the individual environmental Land Use Control Implementation Plans (LUCIPs) for sites at the Crab Orchard National Wildlife Refuge National Priority List (NPL) Site (CONWR or Refuge) (**Figure 1-1**). For ease of use, the sites are organized by area on the Refuge. Refer to the table of contents for the area of interest.

All but four of the sites are within that part of the CONWR that had been the Illinois Ordnance Plant (IOP) during World War II. The IOP area was leased to industrial tenants after the war.

Because of these past uses, many sites may not be appropriate for certain uses, and therefore IOP-wide restrictions are placed on land usage. These following IOP-wide LUCIPs are included in Section 2 of this document:

- A LUCIP prohibiting installation of production wells.
- A LUCIP prohibiting residential use and camping.

Most of the sites also have restrictions on digging and have Land Use Controls (LUCs) beyond these IOP-wide LUCs and digging restrictions. Refer to the individual areas for more information. Sections 3 through 17 include the individual LUCIPs for all identified sites, categorized first by Refuge area (i.e., Area 2, Area 3, etc.), then by site/operable unit.

Of the four sites outside the IOP, three are outside the Refuge and not under the control of the U.S. Fish and Wildlife Service (FWS), and are therefore not included in the LUCIPs. These are Sites 24, 25, and 26 of the Miscellaneous Areas Operable Unit (MISCA OU) (see Subsection 1.2.3 below). The fourth site that is outside the IOP boundary is the Cedar Point Water Tower. Based on sampling in 2000, lead concentrations at the Cedar Point Water Tower averaged 16 milligrams per kilogram (mg/kg), well below levels of concern for human health. Therefore, the site does not require LUCs and is not included in this document.

Section 18 includes a list of references.

Note that for sites under investigation, in accordance with the NCP and EPA guidance, the site-wide and site-specific ELUCs will not be used when conducting Remedial Investigations/Baseline Risk Assessments (RI/BRA). To do so would be contrary to the NCP and USEPA guidance documents warning against presuming the best remedy prior to going through the remedy selection process. In responses to comments on conducting BRAs (Final NCP Rulemaking, Federal Register, Vol.55, no.46, March 8, 1990, page 8709) EPA disagreed that institutional controls should be considered in the BRA:

> *The role of the baseline risk assessment is to address the risk associated with a site in the absence of any remedial action or control, including institutional controls. The baseline assessment is essentially an evaluation of the no-action alternative. Institutional controls, while not actively cleaning up the contamination at the site can control exposure and, therefore, are considered to be limited action alternatives. The effectiveness of the institutional controls in controlling risk may appropriately be considered in evaluating the effectives of a particular remedial alternative, but not as part of the baseline risk assessment.*

In order to obtain unbiased sampling data for use in a BRA, RIs also must be conducted without consideration for any existing or anticipated institutional controls.

1.2 CONWR OPERABLE UNITS

Since the CONWR was put on the NPL in 1987, seven different operable units (OUs) have been created to address the different types of contamination that have been found:

- PCB [polychlorinated-biphenyl] Areas Operable Unit (PCB OU)
- Metals Area Operable Unit (MAOU)
- Miscellaneous Areas Operable Unit (MISCA OU)
- Explosives/Munitions Manufacturing Areas Operable Unit (EMMA OU)
- Water Towers Operable Unit (WTOU)
- Lake Monitoring Operable Unit (LMOU)
- Additional and Uncharacterized Sites Operable Unit (AUS OU)

The OUs are in various phases of cleanup: investigation, remediation, and long term monitoring, as discussed below. This section identifies the area or part of the Refuge where the each site is found; figures showing site locations are included in Sections 3 through 17, with the individual LUCIPs.

1.2.1 PCB Areas Operable Unit (PCB OU)

The PCB OU consists of four sites with PCB and metals contamination (**Figure 1-2**):

- Site 17, the Job Corps Landfill, located north of Crab Orchard Lake (Section 15.7).
- Site 28, the Water Tower Landfill, located south of Crab Orchard Lake (Section 16.4).
- Site 32, the Area 9 Landfill (Section 10.1.3).
- Site 33, the Area 9 Building Complex (Section 10.1.3).

Remediation for these sites for PCBs and metals was completed in 1996, under a record of decision (ROD) signed in 1990.[1] During remediation, chlorinated volatile organic (CVOC) contamination was found in soils and groundwater at Site 32 and 33 in Area 9. Further investigation was conducted. In August 2003, a feasibility study for remediation of the CVOC contamination was submitted.

1.2.2 Metals Area Operable Unit (MAOU)

The MAOU consisted of three sites with metals contamination in soils and sediments (**Figure 1-3**):

- Site 15, the "Plating Pond," located near Area 7
- Site 22, the Old Refuge Shop Channel, located near Area 4 (Section 5.1.4)
- Site 29, the Fire Station Landfill, located near Area 4 (Section 5.1.5)

Site 15 was a pond south of Area 7 that received waste from an operation in Area 7. The primary contaminant was chromium, which was required to be remediated to the background level for chromium, then considered to be 35 mg/kg. Groundwater was investigated and no detected constituents exceeded federal maximum contaminant levels (MCLs). The remediation was completed in 1996. The cleanup objective was achieved.[2] Because the site was cleaned up to levels that allow unrestricted use, and no exceedances of MCLs were found in the groundwater, no LUCs are needed for Site 15 and it is not included in this document

Site 29 was contaminated primarily with lead and was remediated to 450 mg/kg. Site 22 was contaminated with cadmium, chromium, lead, and cyanide. It was required to be remediated to 10 mg/kg for cadmium, but the ROD (1990) did not specify numeric values for cleanup for the other constituents[3]. For confirmation sampling, the level of 450 mg/kg for lead and 35 mg/kg for chromium were used. Cyanide was rarely detected in confirmation samples, and when it was the concentration was near the detection limit. Both sites 29 and 22 had exceedances of MCLs in groundwater. LUCIPs are included for both.[4]

[1] U.S. Environmental Protection Agency, 1990. Declaration for the Record of Decision, Crab Orchard National Wildlife Refuge, PCB Areas Operable Unit, August 1, 1990.
[2] U.S. Fish and Wildlife Service, November 1997. Closeout Report for the Metals Areas Operable Unit, Crab Orchard National Wildlife Refuge Superfund Site, Marino, Illinois (Williamson County).
[3] USEPA, Region V, Declaration for the Record of Decision, Crab Orchard National Wildlife Refuge, Metals Areas Operable Unit, March 30, 1990.
[4] U.S. Fish and Wildlife Service, November 1997. Closeout Report for the Metals Areas Operable Unit, Crab Orchard National Wildlife Refuge Superfund Site, Marino, Illinois (Williamson County).

1.2.3 Miscellaneous Areas Operable Unit (MISCA OU)

The Refuge-wide 1988/89 Remedial Investigation/Feasibility Study (RI/FS) by O'Brien & Gere[5] identified 22 sites as requiring no further work or needing further investigation, monitoring, or maintenance. The DOI, the Department of the Army, the U.S. Environmental Protection Agency (USEPA), and the Illinois Environmental Protection Agency (IEPA) entered into a Federal Facilities Agreement (FFA) in 1991[6] which designated these 22 sites, plus Site 36, the CONWR wastewater treatment plant, as the MISCA OU. The DOI added another site, Site 22A, to the MISCA OU. The sites comprising the MISCA OU are summarized in **Table 1-1**, which also references the Sections of this document where the LUCIP for each site can be found (see also **Figure 1-4**).

DOI completed a Remedial Investigation/Baseline Risk Assessment[7] of these 24 sites in two phases from 1993 to 1995, however, only 13 sites (Sites 7, 7A, 8, 9, 10, 11, 11A, 12, 14, 16, 20, 22A and 36) were investigated. The remaining 11 sites (13, 18, 21, 24, 25, 26, 27, 30, 31, 34, and 35) were excluded from the investigation during the planning process as follows:

- Sites 21, 24, 25, 26, 27, 30, 31, and 35 were determined to require no action.
- Sites 13 and 18 were incorporated into the AUS OU.
- Site 34 became the LMOU.

Of the 13 sites that were investigated, the RI determined that eight sites did not pose an unacceptable risk to human health or the environment (7, 7A, 8, 9, 11, 11A, 12, and 20), while three sites required further action (14, 22A, and 36). The remaining two sites, 10 and 16, required institutional controls to appropriately restrict human access. As noted previously, Sites 24, 25, and 26 of the MISCA OU are located outside the Refuge boundaries, and are therefore not included in this document. Because Sites 13, 18, and 34 were incorporated into other OUs, they also are not included. Sites 30 and 31 were reference sites and no LUCs are needed.

1.2.4 Explosives/Munitions Manufacturing Areas Operable Unit (EMMA OU)

The FFA identified the EMMA OU, with the Department of the Army as lead agency. Many of the sites were in the Hampton Cemetery Area (or Crab Orchard Cemetery, hence the COC-designation). Sites COC-1 through COC-10, Bunker 1-3, and COP-1 through COP-4 were investigated for chemical contamination; of these, only sites COC-3 and COP-4 were remediated. Sites COC-11 through COC-15 were investigated for ordnance only. The sites

[5] O'Brien & Gere, 1988. Remedial Investigation, Crab Orchard National Wildlife Refuge, August.

[6] U.S. Environmental Protection Agency, Region V, and the Illinois Environmental Protection Agency, and the United States Department of the Interior, and the United States Department of the Army, 1991. Federal Facilities Agreement Under CERLCA Section 120, in the Matter of the U.S. Department of the Interior's Crab Orchard National Wildlife Refuge. September 1991.

[7] Woodward-Clyde (W-C). 1996. Final RI Report, Remedial Investigation Miscellaneous Areas Operable Unit, Crab Orchard National Wildlife Refuge, Marion, Illinois (Williamson County).

comprising the EMMA OU are summarized in **Table 1-2**, which also references the sections of this document where the LUCIP for each site can be found (see also **Figure 1-5**).

1.2.5 Water Towers Operable Unit (WTOU)

The WTOU consisted of the following sites with contamination from lead paint (**Figure 1-6**):

- Water Tower Number 1, located in Area 2
- Water Tower Number 2, located in Areas 11/12
- Water Tower Number 3, located south of Crab Orchard Lake
- Water Tower Number 4, located in Area 4
- Cedar Point Water Tower, located south of the IOP
- Visitors' Center, located north of Crab Orchard Lake (Section 15)

All water towers have been removed, as has the structure of the Visitors' Center that contained the lead paint.

A cleanup goal of 450 mg/kg was identified in the *Action Memorandum for the Water Towers Operable Unit at the Crab Orchard National Wildlife Refuge (Refuge) Superfund site* (WTOU), 1992. At the time of the cleanup, that level was considered protective for residential use. However, USEPA Region 9 has recently published a residential preliminary remediation goal (PRG) of 150 mg/kg for lead. Even so, the average lead concentrations of confirmation sampling at the water tower sites, which are all less than ½ acre in size, are well below that preliminary remediation goal (PRG). Average lead concentrations for the water towers that have been removed are as follows: Water Tower No. 1, 83 mg/kg; Water Tower No. 2, 97 mg/kg; Water Tower No. 3, 85.6 mg/kg; Water Tower No. 4, 48 mg/kg; and Cedar Point Water Tower, 16 mg/kg. Therefore these sites are suitable for unrestricted use and are not included in this document. However, soil from these sites should not be used for borrow material.

1.2.6 Lake Monitoring Operable Unit (LMOU)

The Lake Monitoring OU was established by FWS in 1997 and included the entire lake within the CONWR, but aside from its mention here in the introduction, further discussion of this OU is not included in this document since FWS issued a Final Risk Management Decision Memorandum[8,9] in October 2001, explaining the basis for the discontinuation of the LMOU. It identified areas of potential risk to be further evaluated as part of other OUs. As investigations continue at these other OUs, any human health risk identified will addressed at that time and as part of those OUs.

[8] 2001, April 11. Letter from U.S. Fish and Wildlife Service to the U.S. Environmental Protection Agency re Final Risk Management Decision Memorandum and Subsequent Activities for the LMOU.
[9] 2001. Final Risk Management Decision Memorandum, Lake Monitoring Operable Unit, October.

1.2.7 Additional and Uncharacterized Sites Operable Unit (AUS OU)

Thirty-nine sites were investigated for chemical contamination in a preliminary assessment/site inspection done in 2000.[10] Thirty-one of these were retained for an RI/FS, and an additional site, AUS-0A03, will be included in the RI/FS. Of the 8 sites not included in the RI/FS, one site, AUS-0021, was combined with Site AUS-0A07. AUS-0063 was determined to require no further action after it was determined that it was actually part of EMMA OU COC-9.[11,12,13] The sites comprising the AUS OU are summarized in **Table 1-3**, which also references the sections of this document where the LUCIP for each site can be found (see also **Figure 1-7**).

Six sites were judged to have sufficiently low human health and ecological risk such that no further investigation or action under CERCLA[14] was warranted. The justification for each is detailed in the Preliminary Assessment/Site Inspection (PA/SI) report[15] and summarized here.

AUS-0019 - Former Railroad Spur North of Area 4 East. Analytical results for Site AUS-0019 indicated there were no chemicals present at levels of potential human health or ecological concern warranting further evaluation. This was based on organic results that did not exceed screening criteria, and inorganic results that did not exceed both project screening criteria and Refuge background.

AUS-0022 - Probable IOP Small Arms Training Range. Analytical results for Site AUS-0022 indicated there were no chemicals present at levels of potential human health concern warranting further evaluation. One inorganic compound (boron) in soil slightly exceeded an ecological screening value and background, however, it was an estimated result and was not considered a significant concern. The remaining inorganic detections did not exceed both background and screening criteria, nor were there any organic results that exceeded screening criteria.

AUS-0064 - Mounds and Brick Pit Near AUS-0063 (Former COC-13). Two inorganic compounds (barium and cadmium) detected in soil at Site AUS-0064 slightly exceeded background and the Region 9 migration to groundwater criteria for DAF 1. Neither exceeded the screening values for the soil component of the groundwater ingestion route for State of Illinois Class I groundwater. The Region 9 DAF 1 factor assumes that groundwater is at the surface, an

[10] U.S. Fish and Wildlife Service, 2003. *Preliminary Assessment/Site Inspection Report, Additional and Uncharacterized Sites Operable Unit, Crab Orchard National Wildlife NPL Site*.
[11] Based on the findings for COC-9 of the EMMA OU Baseline Risk Assessment, COC-9 was recommended for no further action in the EMMA OU ROD.
[12] U.S. Army Corps of Engineers, April 1996. Record of Decision (ROD), for Crab Orchard National Wildlife Refuge Explosives/Munitions Manufacturing Area (EMMA) Operable Unit (OU).
[13] Environmental Science and Engineering, Inc., September 1994. Draft Final Remedial Investigation/ Baseline Risk Assessment Report, Explosives/Munitions Manufacturing Areas Operable Unit, Crab Orchard National Wildlife Refuge, Marion, Illinois, Volumes III – Baseline Risk Assessment.
[14] Comprehensive Environmental Response, Compensation, and Liability Act
[15] U.S. Fish and Wildlife Service, 2003. *Preliminary Assessment/Site Inspection Report, Additional and Uncharacterized Sites Operable Unit, Crab Orchard National Wildlife NPL Site*. June.

unnecessarily conservative assumption for this site, which is located on the side of a hill. At the Refuge, groundwater is not expected to rise to the surface on hillsides.

Iron and zinc slightly exceeded ecological screening and background values for soil, but were not at levels considered to be significant ecological concerns. Mercury in soil did not exceed ecological screening values, but is considered a potential bioaccumulative constituent. However, its potential to bioaccumulate is less pronounced in terrestrial systems as compared to aquatic systems, and was judged not to warrant further evaluation at this site.

The remaining inorganic detections did not exceed both background and screening criteria, nor were there any organic results that exceeded screening criteria. Based on the above, Site AUS-0064 was judged to have sufficiently low human health and ecological risk such that no further investigation was warranted.

AUS-0107—Possible Disposal Area Northwest of Area 8. Some inorganic compounds detected in a trench water sample exceeded the MCL/Class I groundwater standard. This sample, however, was obtained to evaluate potential contaminants that may have migrated to groundwater, and was not intended for use in screening. Additionally, inorganic results in this sample are not considered significant because of the high suspended solids content of the trench water.

Zinc in soil slightly exceeded background and an ecological screening value, but was not at a level considered to be a significant ecological concern. A detection of magnesium in soil exceeded background and an ecological screening value as well, however, magnesium is an essential nutrient and is generally not a toxic constituent in soils. Mercury was detected in soil, however, its potential to bioaccumulate is less pronounced in terrestrial systems as compared to aquatic systems, and was judged not to warrant further evaluation at this site.

The remaining inorganic detections did not exceed both background and screening criteria, nor were there any organic results that exceeded screening criteria. Based this and the above, no further investigation was warranted at this site.

AUS-0108 - Possible Disposal Area East of COC-10). Cadmium at Site AUS-0108 exceeded the Region 9 migration to groundwater criteria for DAF 1 and the Refuge background value. It did not, however, exceed the screening value for the soil component of the groundwater ingestion route for State of Illinois Class I groundwater. The Region 9 DAF 1 factor assumes that groundwater is at the surface, a somewhat conservative assumption for Site AUS-0108.

Bis(2ethylhexyl)phthalate was detected at this site, and is considered to be a potential bioaccumulative constituent. However, it is readily metabolized and therefore is not likely to biomagnify in food chains.

The remaining inorganic detections did not exceed both background and screening criteria, nor were there any other organic results that exceeded screening criteria. No further investigation at Site AUS-0108 was warranted.

AUS-0109 - Possible Former Explosives Detonation Area. Mercury at Site AUS-0109 slightly exceeded background and the Illinois TACO Class I migration to groundwater screening value. This site is very small and any area of elevated mercury concentrations was expected to be very limited. No other screening values were exceeded. Based on this information, and the fact that the screening criterion was only slightly exceeded, mercury was not considered a significant human health concern.

Iron and slightly exceeded background and an ecological screening value, but was not detected at a level considered to be a significant ecological concern. Mercury did not exceed ecological screening values, but was considered a potential bioaccumulative constituent. However, its potential to bioaccumulate is less pronounced in terrestrial systems as compared to aquatic systems, and was judged not to warrant further evaluation at Site 0109.

Based on the above information, no further investigation at Site AUS-0109 was warranted.

Because residential screening criteria and migration to groundwater criteria (when the size of these six sites is considered) were not exceeded, even the IOP-wide LUCs are not needed for these sites, and they are therefore not included in this document.

1.3 BASIS FOR EVALUATION

The Refuge as a whole and all seven OUs within the Refuge were evaluated with the purpose of identifying sites that are not currently appropriate for unrestricted human use and/or unlimited human exposure. Sites within the OUs are in various stages from sites that are closed to sites that have had only preliminary evaluations. At some remediated and No-Action sites, the cleanup may not have allowed for unrestricted use and unlimited exposure. Other sites are in various stages of remediation and investigation, and, as such, some restrictions are appropriate, at least until investigations and any required remediation are complete. Each site for which analytical data have been collected was evaluated. For sites which were included in baseline human health risk assessments, the results and assumptions of the risk assessments were evaluated to determine if certain exposure scenarios were excluded.

1.3.1 Soil and Sediment

For all sites, analytical data from soil and sediment that was not remediated were compared with the following values (refer to **Table 1-4**):

- *Background soil and sediment contaminant levels*. These are background levels established during the PA/SI of the AUS OU.[16]

- *TACO[17] Tier 1 Soil Remediation Objectives for Residential Properties*.[18] Results were compared with both the ingestion and inhalation exposure route-specific values.

- *TACO Tier 1 Soil Remediation Objectives for Industrial/Commercial Properties (construction worker).*[19] Results were compared with both the ingestion and inhalation exposure route-specific values.

- *U.S. EPA Region 9 Preliminary Remediation Goals (PRGs) for Residential Soil[20]*. PRGs were modified using the approach recommended by USEPA.[21] As identified in the USEPA guidance, carcinogens are to be screened using the standard PRG, based on a target cancer risk of 1E-6 per chemical. Non-carcinogens are to be screened using one tenth the PRG (e.g., based on a target hazard index of 0.1 per chemical) to address the concern of potential additive effects of multiple chemicals. If only one chemical of concern is present, the actual PRG is used for screening for non-carcinogens.

1.3.2 Surface Water

For all sites, analytical data from surface water that was not remediated were compared with the following values:

- *Background surface water contaminant levels*. These are background levels established during the PA/SI of the AUS OU.[22]

- *State of Illinois General Use Water Quality Standards for Human Health[23]* (35 IAC 302), as well as any site-specific human health standards established by the State of Illinois.

[16] USFWS, June 2003. Final Preliminary Assessment/Site Inspection Report, Additional and Uncharacterized Sites Operable Unit, Crab Orchard National Wildlife Refuge NPL Site, Marion, Illinois, Volume I, Table 2-14.
[17] TACO refers Tiered Approach to Corrective Action under the Illinois Environmental Protection Agency, Illinois Pollution Control Board - Title 35 of the Illinois Administrative Code, Subtitle G, Chapter I, Subchapter f, Part 742.
[18] 35 IAC, Section 742, Appendix B, Table A.
[19] 35 IAC, Section 742, Appendix B, Table B.
[20] U.S. Environmental Protection Agency, Region 9 at http://www.epa.gov/region09/wate/prg/index.htm.
[21] U.S. Environmental Protection Agency, 2001. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment).
[22] USFWS, June 2003. Final Preliminary Assessment/Site Inspection Report, Additional and Uncharacterized Sites Operable Unit, Crab Orchard National Wildlife Refuge NPL Site, Marion, Illinois, Volume I, Table 2-14.
[23] These values were derived from a compilation of Illinois General Use Water Quality Standards for Site 36 of the MISCA OU (Table 2-2 of the FSP) and Sites 32/33 of the PCB OU (Table 7-1 of the Ecological Risk Assessment).

1.4 LAND USE CONTROL DETERMINATION

Based on the above review, for each site a determination was be made as to whether land use controls are needed. In general, if results exceed the listed standards or criteria, land use controls are needed. Exceptions are if TACO inhalation or ingestion exposure values or Region PRGs are exceeded for specific chemicals, and a baseline risk assessment evaluated those same chemicals and concluded that the site is acceptable for unrestricted use and unlimited exposure, then the baseline risk assessment results will control.

1.4.1 Personal Protective Equipment Guidelines

Until the nature and extent of contamination has been fully delineated throughout the entire site and appropriate final remedies are in place, interim guidelines for personal protective equipment (PPE) at various areas throughout the Refuge are necessary in an order to protect human health from potential exposure to site-related contamination. These guidelines are based upon current knowledge of the site and are subject to modification as the nature and extent of contamination is characterized further and final remedies are selected and implemented. Furthermore, site-specific Health & Safety Plans, in accordance with OSHA standards, should include contingencies for upgrading to an appropriate PPE level if unanticipated contamination is discovered during any intrusive activities.

These guidelines do not replace United States Occupational Safety and Health Administration (OSHA) worker protection standards (29 CFR 1910) or the need for company and site-specific Health & Safety and Respiratory Protection Plans in accordance with all appropriate OSHA requirements.

PPE Definitions

The PPE guidelines in this document are based on the OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) Standard (29 CFR 1926.120) as follows:

- Level A
  - Positive-pressure, full-face self-contained breathing apparatus (SCBA), or positive pressure supplied air respirator with escape SCBA, approved by the National Institute for Occupational Safety and Health (NIOSH)
  - Totally-encapsulating chemical-protective suit
  - Coveralls (optional, as applicable)
  - Gloves, outer, chemical-resistant
  - Gloves, inner, chemical-resistant
  - Boots, chemical-resistant, protective steel toe and shank
  - Hard hat (under suit, optional, as applicable)

- Level B
  - Positive-pressure, full-face self-contained breathing apparatus (SCBA), or positive pressure supplied air respirator (NIOSH approved)
  - Hooded chemical-resistant clothing (overalls with long-sleeved jacket; coveralls; or one or two-piece splash suit; disposable chemical-resistant overalls)
  - Coveralls (optional, as applicable)
  - Gloves, outer, chemical-resistant
  - Gloves, inner, chemical-resistant
  - Boots, chemical-resistant, protective steel toe and shank
  - Hard hat (under suit, optional, as applicable)
  - Face shield (optional, as applicable)

- Level C
  - Full or half-face, air purifying respirator (NIOSH approved)
  - Hooded or non-hooded (based on task-specific potential for splashing and/or dust generation) chemical-resistant clothing (overalls with long-sleeved jacket; coveralls; or one or two-piece splash suit; disposable chemical-resistant overalls)
  - Coveralls (optional, as applicable)
  - Gloves, outer, chemical-resistant
  - Gloves, inner, chemical-resistant
  - Boots, chemical-resistant, protective steel toe and shank
  - Hard hat (under suit, optional, as applicable)
  - Face shield (optional, as applicable)

- Level D1
  - Dust mask, snug-fitting
  - Coveralls (optional, as applicable)
  - Hooded chemical-resistant clothing (overalls with long-sleeved jacket; coveralls; or one or two-piece splash suit; disposable chemical-resistant overalls) if potentially exposed to groundwater at bottom of trench or excavation
  - Gloves, outer, chemical-resistant
  - Gloves, inner, chemical-resistant
  - Boots, chemical-resistant, protective steel toe and shank
  - Hard hat (optional, as applicable)
  - Face shield (optional, as applicable)

- Level D1*
  - Same as Level D1 with the addition of chemical-protective boot covers

- Level D2
  - Same as Level D1 but without the dust mask

- Level D3 - Strictly limited to short-time site worker and/or visitor conducting non-invasive activities
  - Dust mask, snug-fitting if airborne dust is visible
  - Long pants (i.e., no shorts)
  - Short or long-sleeve shirts
  - Work gloves (optional, as applicable)
  - Boots, chemical-resistant, protective steel toe and shank

Applicability

These PPE guidelines (Table 1-5) are intended to serve as a starting point for FWS personnel responsible for evaluating and approving intrusive activities at the site. These guidelines do not replace the requirements set forth in Section 2.3 of this Attachment, which requires a site-specific risk-based screening for all potential activities involving digging, excavation, or major soil disturbance (e.g., grading). It should be noted that various contaminants (VOCs, SVOCs, inorganics, etc.) have been detected in groundwater throughout the site and groundwater is relatively shallow (0-20 feet below ground surface); therefore, any time groundwater is encountered during excavation activities, PPE should be upgraded to Level C at a minimum in order to offer workers protection from exposure to groundwater via dermal contact, incidental ingestion, and inhalation of vapors.

Reference Documents

The PPE guidelines in Table 1-5 are based on a review of the following information:

- U.S. Fish and Wildlife Service, 2003. Final Preliminary Assessment/Site Inspection Report. Additional and Uncharacterized Sites Operable Unit. Crab Orchard National Wildlife Refuge NPL Site. Marion, Illinois. June.
- URS Corporation, 2006. Final Technical Memorandum of the Baseline Human Health Risk Assessment Technical Approach for the Additional and Uncharacterized Sites Operable Unit. Crab Orchard National Wildlife Refuge NPL Site. Marion, Illinois. Prepared by: URS Corporation. April.
- U.S. Occupational Safety and Health Administration, 2006. OSHA Standards 29 CFR 1910 Subpart I – Personal Protective Equipment. and 29 CFR 1910.134 – Respiratory Protection.
- U.S. Environmental Protection Agency, 2004. Region 9 Preliminary Remediation Goals. http://www.epa.gov/region09/waste/sfund/prg/index.html.

1.5 COMPREHENSIVE CONSERVATION PLAN

The FWS is required to prepare and then manage the CONWR consistent with a Comprehensive Conservation Plan (CCP). The CCP provides guidance for Refuge management and boundary modification, and when used in conjunction with the ELUC Plan, provide a framework for

adaptive management of the Refuge, especially as it relates to Refuge land use. Both the CCP and the ELUC Plan should serve as a central ELUC reference source to assist CONWR personnel with completing periodic site inspections, review, and certifications required under Paragraph VI of this Plan.

TABLE 1-1

SITES SUMMARY
MISCELLANEOUS AREAS OPERABLE UNIT

CRAB ORCHARD NATIONAL WILDLIFE REFUGE
MARION, ILLINOIS

SITE NUMBER	LOCATION	SITE NAME	ACTION IDENTIFIED IN THE ROD[1]
7	Area 2 (Sec. 3.2.2)	D Area Southeast Drainage Channel	No Action
7A	Area 2 (Sec. 3.2.3)	D Area North Lawn	No Action
8	Area 2 (Sec. 3.2.4)	D Area Southwest Drainage Channel	No Action
9	Area 2 (Sec. 3.4.2)	P Area Northwest Drainage Channel	No Action
10	Area 2 (Sec. 3.4.3)	Waterworks North Drainage Channel	Institutional Controls
11	Area 2 (Sec. 3.4.4)	P Area Southeast Drainage Channel	No Action
11A	Area 2 (Sec. 3.4.5)	P Area North	No Action
12	Area 8 (Sec. 9.1.2)	Area 8 Impoundment	No Action
13	Area 8	Area 8 Change House	Transferred to AUS OU
14	Area 8 (Sec. 9.1.3)	Area 8 Solvent Storage Drainage Ditch	Remedial Action Needed
16	Area 7 (Sec. 8.1.2)	Area 7 Industrial Site	Institutional Controls
18	Area 13	Area 13 Loading Platform	Transferred to AUS OU
20	Area 2 (Sec. 3.3.2)	F Area South Drainage Channel	No Action
21	South of Area 7 (Sec. 16.2)	Southeast Corner Field	No Action
22A	Area 4 (Sec. 5.1.3)	Former Post Treating Facility	No Further Action
24	Located outside Refuge	Pepsi Plant West Drainage Ditch (Site Located Outside Refuge)	No Action
25	Located outside Refuge	Crab Orchard Creek at Marion Landfill (Site Located Outside Refuge)	No Action
26	Located outside Refuge	Crab Orchard Creek Below Marion Sewage Treatment Plant (Site Located Outside Refuge)	No Action
27	Crab Orchard Creek (Sec. 15.4)	Crab Orchard Creek Below I-57 Dredge Area	No Action
30	Area 13	Munitions Control Site (Background)	No Action

[1] USFWS, April 2002. Record of Decision, Site 36 of the Miscellaneous Areas Operable Unit, Crab Orchard National Wildlife Refuge NPL Site, Marion, Illinois.

TABLE 1-1

SITES SUMMARY
MISCELLANEOUS AREAS OPERABLE UNIT

CRAB ORCHARD NATIONAL WILDLIFE REFUGE
MARION, ILLINOIS

SITE NUMBER	LOCATION	SITE NAME	ACTION IDENTIFIED IN THE ROD[1]
31	Adjacent to Refuge Headquarters	Refuge Control Site (Background)	No Action
34	Crab Orchard Lake	Crab Orchard Lake	Lake Monitoring OU
35	East of Area 9 (Sec. 10.1.2)	Area 9 East Waterway	No Action
36	North of Area 3 (Sec. 15.5)	Refuge Wastewater Treatment Plant	Remedial Action Needed

TABLE 1-2

SITES SUMMARY
EXPLOSIVES/MUNITIONS MANUFACTURING AREA OPERABLE UNIT

CRAB ORCHARD NATIONAL WILDLIFE REFUGE
MARION, ILLINOIS

SITE NAME/NUMBER	LOCATION	ACTION IDENTIFIED IN THE ROD[1] OR EE/CA[2]
COC-1 (Section 17.6)	Near Hampton Cemetery	UXO Removal[2]
COC-2 (Not Applicable)	Near Hampton Cemetery	No Further Action[1,2]
COC-3 (Section 17.6)	Near Hampton Cemetery	Remedial Action Needed[1]
COC-4 (Section 17.6)	Near Hampton Cemetery	UXO Removal[2]
COC-5 (Section 17.6)	Near Hampton Cemetery	UXO Removal[2]
COC-6 (Section 17.6)	Near Hampton Cemetery	UXO Removal[2]
COC-7 (Not Applicable)	Near Hampton Cemetery	No Further Action[1]
COC-8 (Not Applicable)	Near Hampton Cemetery	No Further Action[1]
COC-9 (Section 17.6)	Near Hampton Cemetery	UXO Removal[2]
COC-10 (Section 16.3)	East of Area 10, Northwest of Area 11	No Further Action[1]
COC-11 (Section 17.7)	Near Hampton Cemetery	No Further Action[2]
COC-12 (Not Applicable)	Near Hampton Cemetery	No Further Action[2]
COC-13 (Not Applicable)	Near Hampton Cemetery	No Further Action[2]
COC-14 (Not Applicable)	Near Hampton Cemetery	No Further Action[2]
COC-15 (Section 17.6)	Near Hampton Cemetery	UXO Removal[2]
COP-1 (Not Applicable)	Near Area 11	No Further Action[1,2]
COP-2 (Not Applicable)	Near Area 11	No Further Action[1,2]
COP-3 (Not Applicable)	Near Areas 11 and 12	No Further Action[1,2]
COP-4 (Section 12.2)	Area 12	Remedial Action Needed[1]
BUNKER 1-3 (Not Applicable)	Area 13	No Further Action[1,2]

[1] U.S. Army Corps of Engineers, April 1996. Record of Decision (ROD), for Crab Orchard National Wildlife Refuge Explosives/Munitions Manufacturing Area (EMMA) Operable Unit (OU).

[2] Parsons Engineering Science, Inc., October 1997. Engineering Evaluation and Cost Analysis, Final Report Former Illinois Ordnance Plant, Marion, Illinois.

TABLE 1-3

SITES SUMMARY
ADDITIONAL AND UNCHARACTERIZED SITES OU

CRAB ORCHARD NATIONAL WILDLIFE REFUGE
MARION, ILLINOIS

Site	Location	Approx. Size (Acres)	Site Name
AUS-0A2B (Section 3.1.1)	Area 2	125	IOP Booster Load Line
AUS-0A2D (Section 3.2.1)	Area 2	150	IOP Detonator Load Line
AUS-0A2F (Section 3.3.1)	Area 2	125	IOP Fuse Load Line
AUS-0A2P (Section 3.4.1)	Area 2	150	IOP Primer Load Load
AUS-0A2R (Section 3.5.1)	Area 2	30	Railroad Spur
AUS-0A03 (Section 4.1.1)	Area 3	150	IOP Finished Ammunition Group I Area
AUS-0A4E (Section 5.1.1)	Area 4	60	East Shop Area
AUS-0A4W (Section 5.1.2)	Area 4	80	West Shop Area
AUS-0A06 (Section 7.1.1)	Area 6	550	Ammonium Nitrate High Explosive and Smokeless Powder Storage Area
AUS-0A07 (Section 8.1.1)	Area 7	100	Inert Storage
AUS-0A8S (Section 9.1.1)	Area 8	150	Southern Portion of IOP Load Line III
AUS-0A09 (Section 10.1.1)	Area 9	100	Western Portion of IOP Load Line I
AUS-0A10 (Section 11.1.1)	Area 10	40	Fuse & Booster Storage Magazines
AUS-A11A (Section 12.1.1)	Area 11	50	Part of IOP Load Line II - later Acid and Ammonium Nitrate Area
AUS-A11H (Section 12.1.2)	Area 11	70	Part of IOP Load Line II - later High Explosives Area
AUS-A11N (Section 12.1.3)	Area 11	30	Part of IOP Load Line II - later Nitroglycerin Area
AUS-A11P (Section 12.1.4)	Area 11	30	Part of IOP Load Line II - later Pilot Propellant Plant/CAP Production Area
AUS-A11S (Section 12.1.5)	Area 11	50	Part of IOP Load Line II - later Support Area
AUS-0A12 (Section 12.1.6)	Area 12	100	Former Ammonium Nitrate Plant
AUS-0A13 (Section 13.1.1)	Area 13	500	Finished Ammunition Igloos
AUS-0062 (Section 17.1)	Near Hampton Cemetery	2	Mounds & Pits West of COC-1
AUS-0063 (Section 1.2.7)	Near Hampton Cemetery	<1	Fenced Area West of COC-11
AUS-0064 (Section 1.2.7)	Near Hampton Cemetery	<1	Mounds and Brick Pit Near AUS-0063
AUS-0065 (Section 17.2)	Near Hampton Cemetery	1/2	Foundations Northeast of COC-1
AUS-0066 (Section 17.3)	Near Hampton Cemetery	1/2 to 1	Berm with Red Brick Rubble
AUS-0067 (Section 17.4)	Near Hampton Cemetery	1/4	Fence with "Contaminated Area" Sign Northwest of COC-6
AUS-0069 (Section 17.5)	Near Hampton Cemetery	15+	Dump near South Shore of Crab Orchard Lake

TABLE 1-3

SITES SUMMARY
ADDITIONAL AND UNCHARACTERIZED SITES OU

CRAB ORCHARD NATIONAL WILDLIFE REFUGE
MARION, ILLINOIS

Site	Location	Approx. Size (Acres)	Site Name
AUS-0109 (Section 1.2.7)	Near Hampton Cemetery	<1	Possible Former Explosives Detonation Area
AUS-0001 (Section 15.1)	West of Area 1	1.5	Fire and Police Headquarters
AUS-0002 (Section 15.2)	West of Area 1	1.5	Wastewater Treatment Plant
AUS-0018 (Section 6.1.1)	Area 5	7	Railroad Classification Yard
AUS-0019 (Section 1.2.7)	South of Area 5	<1	Former Railroad Spur North of Area 4 East
AUS-0021 (Section 1.2.7)	South of Area 7	<1	Area 7 Fire Station
AUS-0022 (Section 1.2.7)	Southeast of Area 7	1/4	Probably IOP Small Arms Training Range
AUS-0043 (Section 16.1)	Northwest of Area 11 East of Area 10	1/2	Areas 11 and 12 Fire Station
AUS-0060 (Section 14.1.1)	Area 14	6	Fulminate Storage Igloos
AUS-0061 (Section 15.3)	West of Area 2	1/2	IOP Detonation and Disposal Area
AUS-106A (Section 12.1.7)	Southeast of Area 11 West of Area 8	0.1	Drum Disposal Area East of Area 11
AUS-0107 (Section 1.2.7)	Northwest of Area 8 South of Area 9	<1	Possible Disposal Area Northwest of Area 8
AUS-0108 (Section 1.2.7)	North of Area 11 East of Area 10	<1	Possible Disposal Area East of COC-10

TABLE 1-4
SCREENING VALUES

LAND USE CONTROL IMPLEMENTATION PLAN
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

	BACKGROUND CONTAMINENT LEVELS[1]			IEPA SOIL REMEDIATION OBJECTIVES FOR RESIDENTIAL PROPERTIES[2]		IEPA SOIL REMEDIATION OBJECTIVES FOR CONSTRUCTION WORKER[3]		PRGs FOR RESIDENTIAL SOIL[4]		ILLINOIS GENERAL USE WATER QUALITY STANDARDS[5]
Matrix	Soil	Sediment	Surface Water	Ingestion	Inhalation	Ingestion	Inhalation	Human Health = nc Cancer = ca		Human Health Criteria
	(mg/kg)	(mg/kg)	(ug/L)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)		(ug/L)
CONSTITUENT										
1,1,1,2-Tetrachloroethane								3.19	ca	
1,1,1-Trichloroethane					1,200		1,200	198.24	nc	
1,1,2,2-Tetrachloroethane								0.41	ca	
1,1,2-Trichloroethane				310	1,800	8,200	1,800	0.73	ca	
1,1,2-Trichloropropane								1.51	nc	
1,1-Biphenyl								300	nc	
1,1-Dichloroethane				7,800	1,300	200,000	130	506.40	nc	
1,1-Dichloroethylene				700	1,500	1,800	300	12.35	nc	
1,1'-Sulfonylbis (4-chlorobenzene)								78.21	nc	
1,2,3-Trichloropropane								0.01	ca	
1,2,3-Trichloropropene								1.15	nc	
1,2,4,5-Tetrachlorobenzene								18.33	nc	
1,2,4-Tribromobenzene								30.55	nc	
1,2,4-Trichlorobenzene				780	3,200	2,000	920	65	nc	
1,2,4-Trimethylbenzene								5.16	nc	
1,2-Dibromo-3-chloropropane				0.46	11	89	0.11	0.15	nc	
1,2-Dibromoethane				0.0075	0.17	1.5	0.45	0.01	ca	
1,2-Dichlorobenzene				7,000	560	18,000	310	110.33	nc	5500
1,2-Dichloroethane (Ethylene dichloride)				7	0.4	1,400	0.99	0.28	ca	
1,2-Dichloroethylene (cis)				780	1,200	20,000	1,200	4.29	nc	
1,2-Dichloroethylene (trans)				1,600	3,100	41,000	3,100	6.95	nc	34000
1,2-Dichloropropane				9	15	1,800	0.5	0.34	ca	
1,2-Dinitrobenzene								6.11	nc	
1,2-Diphenylhydrazine								0.61	ca	
1,2-Epoxybutane								34.83	nc	
1,3,5-Trimethylbenzene								2.13	nc	
1,3,5-Trinitrobenzene								183.31	nc	
1,3-Butadiene								0.01	ca	
1,3-Dichlorobenzene								15.94	nc	
1,3-Dichloropropene				6.4	1.1	1,200	0.39	0.78	ca	

TABLE 1-4
SCREENING VALUES

LAND USE CONTROL IMPLEMENTATION PLAN
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

	BACKGROUND CONTAMINENT LEVELS[1]			IEPA SOIL REMEDIATION OBJECTIVES FOR RESIDENTIAL PROPERTIES[2]		IEPA SOIL REMEDIATION OBJECTIVES FOR CONSTRUCTION WORKER[3]		PRGs FOR RESIDENTIAL SOIL[4]		ILLINOIS GENERAL USE WATER QUALITY STANDARDS[5]
Matrix	Soil	Sediment	Surface Water	Ingestion	Inhalation	Ingestion	Inhalation	Human Health = nc Cancer = ca		Human Health Criteria
	(mg/kg)	(mg/kg)	(ug/L)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)		(ug/L)
1,3-Dinitrobenzene								6.11	nc	
1,4-Dibromobenzene								611.03	nc	
1,4-Dichloro-2-butene								0.01	ca	
1,4-Dichlorobenzene					11000		340	3.45	ca	
1,4-Dinitrobenzene								6.11	nc	
1,4-Dioxane								44.22	ca	
1,4-Dithiane								611.03	nc	
1,6-Hexamethylene diisocyanate								0.02	nc	
1-Butanol								6103.52	nc	
1-Chloro-1,1-difluoroethane (HCFC-142b)								340.00	sat	
1-Chlorobutane								71.00	nc	
2-(2,4,5-Trichlorophenoxy) propionic acid				630		1,600		48.88	nc	
2-(2-Methyl-1,4-chlorophenoxy) propionic acic								6.11	nc	
2-(2-Methyl-4-chlorophenoxy) propionic acic								0.61	nc	
2,3,4,6-Tetrachlorophenol								183.31	nc	
2,3,7,8-TCDD (Dioxin)								0.0000039	ca	
2,3-Dichloropropanol								18.33	nc	
2,4,5-Trichlorophenol				7,800		200,000		611.03	nc	
2,4,5-Trichlorophenoxyacetic Acid								61.10	nc	
2,4,6-Trichloroaniline								14.31	ca	
2,4,6-Trichloroaniline hydrochloride								16.77	ca	
2,4,6-Trichlorophenol				58	200	11,000	540	0.61	nc	
2,4,6-Trinitrotoluene								3.06	nc	
2,4-Dichlorophenol				230		610		18.33	nc	
2,4-Dichlorophenoxyacetic Acid (2,4-D)				780		2,000		68.61	nc	
2,4-Dimethylaniline								0.65	ca	
2,4-Dimethylaniline hydrochloride								0.84	ca	
2,4-Dimethylphenol				1,600		41,000		1222.06	nc	740
2,4-Dinitrophenol				160		410		122.21	nc	
2,4-Dinitrotoluene				0.9		180		0.72	ca	
2,6-Dimethylphenol								36.66	nc	

TABLE 1-4
SCREENING VALUES

LAND USE CONTROL IMPLEMENTATION PLAN
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

	BACKGROUND CONTAMINENT LEVELS[1]			IEPA SOIL REMEDIATION OBJECTIVES FOR RESIDENTIAL PROPERTIES[2]		IEPA SOIL REMEDIATION OBJECTIVES FOR CONSTRUCTION WORKER[3]		PRGs FOR RESIDENTIAL SOIL[4]		ILLINOIS GENERAL USE WATER QUALITY STANDARDS[5]
Matrix	Soil	Sediment	Surface Water	Ingestion	Inhalation	Ingestion	Inhalation	Human Health = nc Cancer = ca		Human Health Criteria
	(mg/kg)	(mg/kg)	(ug/L)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)		(ug/L)
2,6-Dinitrotoluene				0.9		180		0.72	ca	
2-Chloro-1,3-butadiene								0.36	nc	
2-Chloroacetophenone								0.00	nc	
2-Chlorophenol				390	53,000	10,000	53,000	6.34	nc	130
2-Chloropropane								17.02	nc	
2-Ethoxyethanol								2443.69	nc	
2-Ethoxyethanol acetate								1833.09	nc	
2-Mercaptobenzothiazole								16.77	ca	
2-Methoxy-5-nitroaniline								10.57	ca	
2-Methoxyethanol								6.11	nc	
2-Methoxyethanol acetate								12.22	nc	
2-Methyl-4-chlorophenoxyacetic acid								3.06	nc	
2-Methyl-5-nitroaniline								14.74	ca	
2-Methylaniline (o-toluidine)								2.03	ca	
2-Methylaniline hydrochloride								2.70	ca	
2-Methylnaphthalene										
2-Methylphenol (o-Cresol)				3,900		100,000		305.52	nc	
2-Nitroaniline								1.75	nc	
2-Phenylphenol								250.71	ca	
3,3'-Dichlorobenzidine				1		280		1.08	ca	
3,3'-Dimethoxybenzidine								34.74	ca	
3,3'-Dimethylbenzidine								0.05	ca	
3,4-Dimethylphenol								61.10	nc	
3-Methylphenol								305.52	nc	
4-(2,4-Dichlorophenoxy)butyric Acid								48.88	nc	
4-(2-Methyl-4-chlorophenoxy) butyric acid								61.10	nc	
4,4'-DDD				3		520		2.44	ca	0.00027
4,4'-DDE				2		370		1.72	ca	0.00019
4,4'-DDT				2		100	2,100	1.72	ca	0.00019
4,4'-Dichlorobenzophenone								1833.09	nc	
4,4'-Methylene bis(2-chloroaniline)								3.74	ca	

TABLE 1-4
SCREENING VALUES

LAND USE CONTROL IMPLEMENTATION PLAN
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

	BACKGROUND CONTAMINENT LEVELS[1]			IEPA SOIL REMEDIATION OBJECTIVES FOR RESIDENTIAL PROPERTIES[2]		IEPA SOIL REMEDIATION OBJECTIVES FOR CONSTRUCTION WORKER[3]		PRGs FOR RESIDENTIAL SOIL[4]		ILLINOIS GENERAL USE WATER QUALITY STANDARDS[5]
Matrix	Soil	Sediment	Surface Water	Ingestion	Inhalation	Ingestion	Inhalation	Human Health = nc Cancer = ca		Human Health Criteria
	(mg/kg)	(mg/kg)	(ug/L)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)		(ug/L)
4,4'-Methylene bis(N,N'-dimethyl)aniline								10.57	ca	
4,4'-Methylene diphenyl diisocyanate								1.04	nc	
4,4'-Methylenebisbenzeneamine								1.95	ca	
4,6-Dinitro-o-cyclohexyl phenol								122.21	nc	
4-Aminopyridine								0.12	nc	
4-Chloro-2-methylaniline								0.84	ca	
4-Chloro-2-methylaniline hydrochloride								1.06	ca	
4-Chloroaniline								24.44	nc	
4-Chloroaniline (p-Chloroaniline)				310		820		122.21	nc	
4-Methylphenol								30.55	nc	
Acenaphthene				4,700		120,000		36.82	nc	
Acephate								24	nc	
Acetaldehyde								5	nc	
Acetochlor								120	nc	
Acetone				7,800	100,000	200,000	100,000	160	nc	
Acetone cyanohdrin								4.9	nc	
Acetonitrile								42	nc	
Acrolein								0.01	nc	
Acrylamide								0.11	ca	
Acrylic acid								2904.52	nc	
Acrylonitrile								0.21	ca	
Alachlor				8		1,600		6.04	ca	
Alar								916.55	nc	
Aldicarb				78		200		6.11	nc	
Aldicarb sulfone								6.11	nc	
Aldrin				0.04	3	6.1	9.3	0.03	ca	0.000046
Ally								1527.58	nc	
Allyl alcohol								30.55	nc	
Allyl chloride								303.95	nc	
Alpha-HCH (alpha-BHC)				0.1	0.8	20	2.1	0.09	ca	
Aluminum	28800	11241	200					7614.20	nc	

TABLE 1-4
SCREENING VALUES

LAND USE CONTROL IMPLEMENTATION PLAN
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

	BACKGROUND CONTAMINENT LEVELS[1]			IEPA SOIL REMEDIATION OBJECTIVES FOR RESIDENTIAL PROPERTIES[2]		IEPA SOIL REMEDIATION OBJECTIVES FOR CONSTRUCTION WORKER[3]		PRGs FOR RESIDENTIAL SOIL[4]		ILLINOIS GENERAL USE WATER QUALITY STANDARDS[5]
Matrix	Soil	Sediment	Surface Water	Ingestion	Inhalation	Ingestion	Inhalation	Human Health = nc Cancer = ca		Human Health Criteria
	(mg/kg)	(mg/kg)	(ug/L)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)		(ug/L)
Aluminum phosphide								3.13	nc	
Amdro								1.83	nc	
Ametryn								54.99	nc	
Amitraz								15.28	nc	
Ammonium sulfamate								1222.08	nc	
Aniline								42.74	nc	
Anthracene				23,000		610,000		2189.61	nc	35000
Antimony	0.83	1.9	6	31		82		3.13	nc	
Antimony pentoxide								3.91	nc	
Antimony potassium tartrate								7.04	nc	
Antimony tetroxide								3.13	nc	
Antimony trioxide								3.13	nc	
Apollo								79.43	nc	
Aramite								19.46	ca	
Aroclor 1016								3.93	nc	
Aroclor 1221								0.22	ca	
Aroclor 1232								0.22	ca	
Aroclor 1242								0.22	ca	
Aroclor 1248								0.22	ca	
Aroclor 1254								0.11	nc	
Aroclor 1260								0.22	ca	
Arsenic	13.5	10.3	10		750	61	25,000	0.39	ca	
Arsine								0.39	ca	
Assure								54.99	nc	
Asulam								305.52	nc	
Atrazine				2700		7,100		2.19	ca	
Avermectin B1								2.44	nc	
Azobenzene								4.42	ca	
Barium	195	196	22.7	5,500	690,000	14,000	870,000	537.49	nc	
Baygon								24.44	nc	
Bayleton								183.31	nc	

TABLE 1-4
SCREENING VALUES

LAND USE CONTROL IMPLEMENTATION PLAN
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

	BACKGROUND CONTAMINENT LEVELS[1]			IEPA SOIL REMEDIATION OBJECTIVES FOR RESIDENTIAL PROPERTIES[2]		IEPA SOIL REMEDIATION OBJECTIVES FOR CONSTRUCTION WORKER[3]		PRGs FOR RESIDENTIAL SOIL[4]		ILLINOIS GENERAL USE WATER QUALITY STANDARDS[5]
Matrix	Soil	Sediment	Surface Water	Ingestion	Inhalation	Ingestion	Inhalation	Human Health = nc Cancer = ca		Human Health Criteria
	(mg/kg)	(mg/kg)	(ug/L)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)		(ug/L)
Baythroid								152.76	nc	
Benefin								1833.09	nc	
Benomyl								305.52	nc	
Bentazon								183.31	nc	
Benz[a]anthracene				0.9		170		0.62	ca	0.1
Benzaldehyde								611.03	nc	
Benzene				12	0.8	2,300	2.2	0.60	ca	
Benzidine								0.0021	ca	
Benzo[a]pyrene				0.09		17		0.06	ca	0.01
Benzo[b]fluoranthene				0.9		170		0.62	ca	0.1
Benzo[k]fluoranthene				9		1,700		6.21	ca	
Benzoic Acid				310,000		820,000		24441.24	nc	
Benzotrichloride								0.04	ca	
Benzyl alcohol								1833.09	nc	
Benzyl chloride								0.89	ca	
Beryllium	0.8	1.6	5	160	1,300	410	44,000	15.44	nc	
beta-Chloronaphthalene								493.66	nc	
Bidrin								0.61	nc	
Biphenthrin (Talstar)								91.65	nc	
Bis(2-chloro-1-methylethyl)ether								2.88	ca	
Bis(2-chloroethyl)ether				0.6	0.2	75	0.66	0.21	ca	
Bis(2-chloroisopropyl)ether								2.88	ca	
Bis(2-ethylhexyl)phthalate				46	31,000	4,100	31,000	34.74	ca	
Bis(chloromethyl)ether								0.00019	ca	
Bisphenol A								305.52	nc	
Boron	5.3			7,000		18,000	1,000,000	1562.84	nc	
Bromate								31.29	nc	
Bromobenzene								2.78	nc	
Bromodichloromethane				10	3,000	2,000	3,000	0.82	ca	
Bromoform				81	53	16,000	140	61.57	ca	
Bromophos								30.55	nc	

TABLE 1-4
SCREENING VALUES

LAND USE CONTROL IMPLEMENTATION PLAN
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

	BACKGROUND CONTAMINENT LEVELS[1]			IEPA SOIL REMEDIATION OBJECTIVES FOR RESIDENTIAL PROPERTIES[2]		IEPA SOIL REMEDIATION OBJECTIVES FOR CONSTRUCTION WORKER[3]		PRGs FOR RESIDENTIAL SOIL[4]		ILLINOIS GENERAL USE WATER QUALITY STANDARDS[5]
Matrix	Soil	Sediment	Surface Water	Ingestion	Inhalation	Ingestion	Inhalation	Human Health = nc Cancer = ca		Human Health Criteria
	(mg/kg)	(mg/kg)	(ug/L)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)		(ug/L)
Bromoxynil								122.21	nc	
Bromoxynil octanoate								122.21	nc	
Butanol				7,800	10,000	200,000	10,000			
Butyl benzyl phthalate				16,000	930	410,000	930	1222.06	nc	
Butylate								3055.15	nc	
Butylphthalyl butylglycolate								6110.31	nc	
Cacodylic acid								0.18	nc	
Cadmium	0.19	1.6	5	78	1,800	200	59,000	3.70	nc	
Calcium	2497	1448	7197							
Caprolactam								3055.15	nc	
Captafol								12.22	nc	
Captan								138.97	ca	
Carbaryl								611.03	nc	
Carbazole				32		6,200		24.32	ca	
Carbofuran				390		1,000		30.55	nc	
Carbon disulfide				7,800	720	20,000	9	35.53	nc	
Carbon tetrachloride				5	0.3	410	0.9	0.22	nc	
Carbosulfan								61.10	nc	
Carboxin								611.03	nc	
Chloramben								91.65	nc	
Chloranil								1.21	ca	
Chlordane				1.8	72	100	22	1.62	ca	0.00019
Chlorimuron-ethyl								122.21	nc	
Chloroacetic acid								12.22	nc	
Chlorobenzene				1,600	130	4,100	1.3	15.07	nc	
Chlorobenzilate								1.80	ca	
Chlorodifluoromethane								340.00	sat	
Chloroethane								3.03	ca	
Chloroform				100	0.3	2,000	0.76	0.36	nc	
Chloromethane								1.23	ca	
Chlorothalonil								44.22	ca	

TABLE 1-4
SCREENING VALUES

LAND USE CONTROL IMPLEMENTATION PLAN
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

	BACKGROUND CONTAMINENT LEVELS[1]			IEPA SOIL REMEDIATION OBJECTIVES FOR RESIDENTIAL PROPERTIES[2]		IEPA SOIL REMEDIATION OBJECTIVES FOR CONSTRUCTION WORKER[3]		PRGs FOR RESIDENTIAL SOIL[4]		ILLINOIS GENERAL USE WATER QUALITY STANDARDS[5]
Matrix	Soil	Sediment	Surface Water	Ingestion	Inhalation	Ingestion	Inhalation	Human Health = nc Cancer = ca		Human Health Criteria
	(mg/kg)	(mg/kg)	(ug/L)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)		(ug/L)
Chlorpropham								1222.06	nc	
Chlorpyrifos								18.33	nc	
Chlorpyrifos-methyl								61.10	nc	
Chlorsulfuron								305.52	nc	
Chlorthiophos								4.89	nc	
Chromium III				120,000		310,000		11729.39	nc	210
Chromium VI				230	270	4,100	690	22.31	nc	11
Chromium, Total	25.2	17.2	10	230	270	4,100	690	210.68	ca	
Chrysene				88		17,000		62.15	ca	10
Cobalt	21.7	9.1	50	4,700		12,000		138.03	nc	
Copper	11.3	16.8	10	2,900		8,200		312.86	nc	12
Crotonaldehyde								0.005	ca	
Cumene (isopropylbenzene)								57.21	nc	
Cyanazine								0.58	ca	
Cyanide	0.41			1,600		4,100		122.21	nc	
Cyanogen								12.75	nc	
Cyanogen bromide								28.69	nc	
Cyanogen chloride								15.94	nc	
Cyclohexane								140.00	sat	
Cyclohexanone								30551.55	nc	
Cyclohexylamine								12220.62	nc	
Cyhalothrin/Karate								305.52	nc	
Cypermethrin								611.03	nc	
Cyromazine								458.27	nc	
Dacthal								611.03	nc	
Dalapon				2,300		6,100		1833.09	nc	
Danitol								1527.58	nc	
Decabromodiphenyl ether								611.03	nc	
Demeton								2.44	nc	
Di(2-ethylhexyl)adipate								405.32	ca	
Diallate								7.97	ca	

TABLE 1-4
SCREENING VALUES

LAND USE CONTROL IMPLEMENTATION PLAN
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

	BACKGROUND CONTAMINENT LEVELS[1]			IEPA SOIL REMEDIATION OBJECTIVES FOR RESIDENTIAL PROPERTIES[2]		IEPA SOIL REMEDIATION OBJECTIVES FOR CONSTRUCTION WORKER[3]		PRGs FOR RESIDENTIAL SOIL[4]		ILLINOIS GENERAL USE WATER QUALITY STANDARDS[5]
Matrix	Soil	Sediment	Surface Water	Ingestion	Inhalation	Ingestion	Inhalation	Human Health = nc Cancer = ca		Human Health Criteria
	(mg/kg)	(mg/kg)	(ug/L)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)		(ug/L)
Diazinon								54.99	nc	
Dibenz[ah]anthracene				0.09		17		0.06	ca	
Dibenzofuran								290.53	nc	
Dibromochloromethane				1,600	1,300	41,000	1,300	1.11	ca	
Dicamba								1833.09	nc	
Dichlorodifluoromethane								93.88	nc	
Dichlorvos								1.68	ca	
Dicofol								1.11	ca	
Dicyclopentadiene								0.05	nc	
Dieldrin				0.04	1	7.8	3.1	0.03	ca	
Diethyl phthalate				63,000	2,000	1,000,000	2,000	4888.25	nc	
Diethylene glycol, monobutyl ether								61.10	nc	
Diethylene glycol, monomethyl ether								365.87	nc	
Diethylformamide								24.44	nc	
Diethylstilbestrol								0.00	ca	
Difenzoquat (Avenge)								488.82	nc	
Diflubenzuron								122.21	nc	
Diisononyl phthalate								122.21	nc	
Diisopropyl methylphosphonate								488.82	nc	
Dimethipin								122.21	nc	
Dimethoate								1.22	nc	
Dimethyl phthalate								61103.10	nc	
Dimethyl terephthalate								6110.31	nc	
Dimethylamine								0.01	nc	
Dimethylphenethylamine								61.10	nc	
Di-n-butyl phthalate				7,800	2,300	200,000	2,300	6110.31	nc	
Di-n-octyl phthalate				1,600	10,000	4,100	10,000	2444.12	nc	
Dinoseb				78		200		61.10	nc	
Diphenamid								1833.09	nc	
Diphenyl sulfone								183.31	nc	
Diphenylamine								1527.58	nc	

TABLE 1-4
SCREENING VALUES

LAND USE CONTROL IMPLEMENTATION PLAN
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

	BACKGROUND CONTAMINENT LEVELS[1]			IEPA SOIL REMEDIATION OBJECTIVES FOR RESIDENTIAL PROPERTIES[2]		IEPA SOIL REMEDIATION OBJECTIVES FOR CONSTRUCTION WORKER[3]		PRGs FOR RESIDENTIAL SOIL[4]		ILLINOIS GENERAL USE WATER QUALITY STANDARDS[5]
Matrix	Soil	Sediment	Surface Water	Ingestion	Inhalation	Ingestion	Inhalation	Human Health = nc Cancer = ca		Human Health Criteria
	(mg/kg)	(mg/kg)	(ug/L)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)		(ug/L)
Diquat								134.43	nc	
Direct black 38								0.06	ca	
Direct blue 6								0.06	ca	
Direct brown 95								0.05	ca	
Disulfoton								2.44	nc	
Diuron								12.22	nc	
Dodine								24.44	nc	
Dysprosium								1564.24	nc	
Endosulfan				470		1,200		36.66	nc	
Endothall				1,600		4,100		122.21	nc	
Endrin				23		61		1.83	nc	
Endrin Aldehyde										0.26
Epichlorohydrin								0.76	nc	
EPTC (S-Ethyl dipropylthiocarbamate)								152.76	nc	
Ethephon (2-chloroethyl phosphonic acid)								30.55	nc	
Ethion								3.06	nc	
Ethyl acetate								1870.98	nc	
Ethyl acrylate								0.21	ca	
Ethyl chloride								3.03	ca	
Ethyl ether								6755.28	nc	
Ethyl methacrylate								208.09	nc	
Ethyl p-nitrophenyl phenylphosphorothioate								0.06	nc	
Ethylbenzene				7,800	400	20,000	58	8.92	ca	
Ethylene cyanohydrin								1833.09	nc	
Ethylene diamine								122.21	nc	
Ethylene glycol								12220.62	nc	
Ethylene glycol, monobutyl ether								3055.23	nc	
Ethylene oxide								0.14	ca	
Ethylene thiourea (ETU)								0.49	nc	
Ethylphthalyl ethyl glycolate								18330.93	nc	
Express								48.88	nc	

TABLE 1-4
SCREENING VALUES

LAND USE CONTROL IMPLEMENTATION PLAN
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

	BACKGROUND CONTAMINENT LEVELS[1]			IEPA SOIL REMEDIATION OBJECTIVES FOR RESIDENTIAL PROPERTIES[2]		IEPA SOIL REMEDIATION OBJECTIVES FOR CONSTRUCTION WORKER[3]		PRGs FOR RESIDENTIAL SOIL[4]		ILLINOIS GENERAL USE WATER QUALITY STANDARDS[5]
Matrix	Soil	Sediment	Surface Water	Ingestion	Inhalation	Ingestion	Inhalation	Human Health = nc Cancer = ca		Human Health Criteria
	(mg/kg)	(mg/kg)	(ug/L)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)		(ug/L)
Fenamiphos								1.53	nc	
Fluometuron								79.43	nc	
Fluoranthene				3,100		82,000		229.36	nc	120
Fluorene				3,100		82,000		274.71	nc	4500
Fluoride				4,700		12,000		366.63	nc	
Fluoridone								4888.25	nc	
Flurprimidol								1222.06	nc	
Flutolanil								3666.28	nc	
Fluvalinate								611.03	nc	
Folpet								138.97	ca	
Fomesafen								2.56	ca	
Fonofos								122.21	nc	
Formaldehyde								9165.65	nc	
Formic Acid								12220.62	nc	
Fosetyl-al								18330.93	nc	
Freon 113								2090.62	nc	
Furan								2.54	nc	
Furazolidone								0.13	ca	
Furfural								183.31	nc	
Furium								0.01	ca	
Furmecyclox								16.21	ca	
gamma -HCH (Lindane)				0.5		96		0.44	ca	
Glufosinate-ammonium								24.44	nc	
Glycidaldehyde								24.44	nc	
Glyphosate								6110.31	nc	
Haloxyfop-methyl								3.06	nc	
Harmony								794.34	nc	
HCH (beta)								0.32	ca	
HCH-technical								0.32	ca	
Heptachlor				0.1	0.1	28	16	0.11	ca	0.000068
Heptachlor epoxide				0.07	5	2.7	13	0.05	ca	

TABLE 1-4
SCREENING VALUES

LAND USE CONTROL IMPLEMENTATION PLAN
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

	BACKGROUND CONTAMINENT LEVELS[1]			IEPA SOIL REMEDIATION OBJECTIVES FOR RESIDENTIAL PROPERTIES[2]		IEPA SOIL REMEDIATION OBJECTIVES FOR CONSTRUCTION WORKER[3]		PRGs FOR RESIDENTIAL SOIL[4]		ILLINOIS GENERAL USE WATER QUALITY STANDARDS[5]
Matrix	Soil	Sediment	Surface Water	Ingestion	Inhalation	Ingestion	Inhalation	Human Health = nc Cancer = ca		Human Health Criteria
	(mg/kg)	(mg/kg)	(ug/L)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)		(ug/L)
Hexabromobenzene								122.21	nc	
Hexachlorobenzene				0.4	1	78	2.6	0.30	ca	
Hexachlorobutadiene								1.83	nc	
Hexachlorocyclopentadiene				550	10	14,000	1.1	3.65	nc	
Hexachloroethane				78		2,000		6.11	nc	
Hexachlorophene								1.83	nc	
Hexahydro-1,3,5-trinitro-1,3,5-triazine								4.42	ca	
Hexazinone								201.64	nc	
HMX								3055.15	nc	
Hydrazine, dimethyl								0.16	ca	
Hydrazine, hydrazine sulfate								0.16	ca	
Hydrazine, monomethyl								0.16	ca	
Hydrogen cyanide								1.08	nc	
Imazalil								79.43	nc	
Imazaquin								1527.58	nc	
Indeno[1,2,3-cd]pyrene				0.9		170		0.62	ca	0.1
Iprodione								244.41	nc	
Iron	19306	20750	100					2346.32	nc	
Isobutanol								1251.39	nc	
Isophorone				15,600	4,600	410,000	4,600	511.98	ca	
Isopropalin								91.65	nc	
Isopropyl methyl phosphonic acid								611.03	nc	
Isoxaben								305.52	nc	
Kepone								0.06	ca	
Lactofen								12.22	nc	
Lead	23.4	24	2	400		400		400	nc	20000
Lead (tetraethyl)								0.00061	nc	
Linuron								12.22	nc	
Lithium								156.43	nc	
Londax								1222.09	nc	
Magnesium	1552	1909	2534							

TABLE 1-4
SCREENING VALUES

LAND USE CONTROL IMPLEMENTATION PLAN
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

	BACKGROUND CONTAMINENT LEVELS[1]			IEPA SOIL REMEDIATION OBJECTIVES FOR RESIDENTIAL PROPERTIES[2]		IEPA SOIL REMEDIATION OBJECTIVES FOR CONSTRUCTION WORKER[3]		PRGs FOR RESIDENTIAL SOIL[4]		ILLINOIS GENERAL USE WATER QUALITY STANDARDS[5]
Matrix	Soil	Sediment	Surface Water	Ingestion	Inhalation	Ingestion	Inhalation	Human Health = nc Cancer = ca		Human Health Criteria
	(mg/kg)	(mg/kg)	(ug/L)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)		(ug/L)
Malathion								122.21	nc	
Maleic anhydride								611.03	nc	
Maleic hydrazide								166.79	nc	
Malononitrile								0.12	nc	
m-Aminophenol								427.72	nc	
Mancozeb								183.31	nc	
Maneb								8.11	ca	
Manganese	3640	1043	582	3,700	69,000	9,600	8,700	176.24	nc	
Mephosfolan								0.55	nc	
Mepiquat chloride								183.31	nc	
Mercury	0.1	0.2	0.2	23	10	61	52,000			
Merphos								0.18	nc	
Merphos oxide								0.18	nc	
Metalaxyl								366.63	nc	
Methacrylonitrile								0.21	nc	
Methamidophos								0.31	nc	
Methanol								3055.15	nc	
Methidathion								6.11	nc	
Methomyl								4.43	nc	
Methoxychlor				390		1,000		30.55	nc	
Methyl acetate								2208.67	nc	
Methyl acrylate								6.97	nc	
Methyl bromide (Bromomethane)				110	10	1,000	3.9	0.39	nc	
Methyl ethyl ketone								732.54	nc	
Methyl isobutyl ketone								78.65	nc	
Methyl Mercaptan								3.48	nc	
Methyl methacrylate								218.74	nc	
Methyl parathion								1.53	nc	
Methyl phosphonic acid								122.21	nc	
Methyl styrene (alpha)								680.00	sat	
Methyl styrene (mixture)								13.06	nc	

TABLE 1-4
SCREENING VALUES

LAND USE CONTROL IMPLEMENTATION PLAN
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

	BACKGROUND CONTAMINENT LEVELS[1]			IEPA SOIL REMEDIATION OBJECTIVES FOR RESIDENTIAL PROPERTIES[2]		IEPA SOIL REMEDIATION OBJECTIVES FOR CONSTRUCTION WORKER[3]		PRGs FOR RESIDENTIAL SOIL[4]		ILLINOIS GENERAL USE WATER QUALITY STANDARDS[5]
Matrix	Soil	Sediment	Surface Water	Ingestion	Inhalation	Ingestion	Inhalation	Human Health = nc Cancer = ca		Human Health Criteria
	(mg/kg)	(mg/kg)	(ug/L)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)		(ug/L)
Methyl tertbutyl ether (MTBE)								61.54	ca	
Methylcyclohexane								259.11	nc	
Methylene bromide								6.69	nc	
Methylene chloride								9.11	ca	
Methylene chloride (Dichloromethane)				85	13	12,000	34	916.55	nc	
Metribuzin								152.76	nc	
Mirex								0.27	ca	
m-Nitrotoluene								366.75	nc	
Molinate								12.22	nc	
Molybdenum								39.11	nc	
Monochloramine								611.03	nc	
m-Phenylenediamine								366.62	nc	
m-Xylene				160,000	420	410,000	420			
N,N-Dimethylformamide								6108.38	nc	
N,N-Diphenyl-1,4 benzenediamine (DPPD)								18.33	nc	
Naled								12.22	nc	
Naphthalene				1,600	170	25,000		5.59	nc	
Napropamide								6110.31	nc	
n-Butylbenzene								58.00	nc	
n-Hexane								12.08	nc	
Nickel	18.9	16.9	10	1,600	13,000	4,100	440,000	1564.28	nc	
Nitrate as N				130,000						
Nitrobenzene				39	92	18		19.64	nc	
Nitrofurantoin								4277.22	nc	
Nitrofurazone								0.32	ca	
Nitroglycerin								34.74	ca	
Nitroguanidine								6110.31	nc	
N-N-Dimethylaniline								12.22	nc	
N-Nitroso di-n-propylamine								0.07	ca	
N-Nitrosodiethanolamine								0.17	ca	
N-Nitrosodiethylamine								0.0032	ca	

TABLE 1-4
SCREENING VALUES

LAND USE CONTROL IMPLEMENTATION PLAN
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

	BACKGROUND CONTAMINENT LEVELS[1]			IEPA SOIL REMEDIATION OBJECTIVES FOR RESIDENTIAL PROPERTIES[2]		IEPA SOIL REMEDIATION OBJECTIVES FOR CONSTRUCTION WORKER[3]		PRGs FOR RESIDENTIAL SOIL[4]		ILLINOIS GENERAL USE WATER QUALITY STANDARDS[5]
Matrix	Soil	Sediment	Surface Water	Ingestion	Inhalation	Ingestion	Inhalation	Human Health = nc Cancer = ca		Human Health Criteria
	(mg/kg)	(mg/kg)	(ug/L)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)		(ug/L)
N-Nitrosodimethylamine								0.01	ca	
N-Nitrosodi-n-butylamine				0.09		1,000	9.4	0.02	ca	
N-Nitrosodiphenylamine				130		4,100	1.8	99.26	ca	
N-Nitroso-N-methylethylamine								0.02	ca	
N-Nitrosopyrrolidine								0.23	ca	
Norflurazon								2444.12	nc	
n-Propylbenzene								57.86	nc	
NuStar								42.77	nc	
o-Chloronitrobenzene								0.14	nc	
o-Chlorotoluene								15.84	nc	
Octabromodiphenyl ether								183.31	nc	
Octamethylpyrophosphoramide								122.21	nc	
o-Nitrotoluene								366.75	nc	
Oryzalin								3055.15	nc	
Oxadiazon								305.52	nc	
Oxamyl								1527.58	nc	
Oxyfluorfen								183.31	nc	
o-Xylene				160,000	410	410,000	410			
pH										
p,a,a,a-Tetrachlorotoluene								0.02	ca	
Paclobutrazol								794.34	nc	
Paraquat								274.96	nc	
Parathion								366.62	nc	
p-Chlorobenzoic acid								1222.06	nc	
p-Chloronitrobenzene								1.02	nc	
Pebulate								3055.15	nc	
Pendimethalin								2444.12	nc	
Pentabromo-6-chloro cyclohexane								21.15	ca	
Pentabromodiphenyl ether								122.21	nc	
Pentachlorobenzene								48.88	nc	
Pentachloronitrobenzene								1.87	ca	

TABLE 1-4
SCREENING VALUES

LAND USE CONTROL IMPLEMENTATION PLAN
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

	BACKGROUND CONTAMINENT LEVELS[1]			IEPA SOIL REMEDIATION OBJECTIVES FOR RESIDENTIAL PROPERTIES[2]		IEPA SOIL REMEDIATION OBJECTIVES FOR CONSTRUCTION WORKER[3]		PRGs FOR RESIDENTIAL SOIL[4]		ILLINOIS GENERAL USE WATER QUALITY STANDARDS[5]
Matrix	Soil	Sediment	Surface Water	Ingestion	Inhalation	Ingestion	Inhalation	Human Health = nc Cancer = ca		Human Health Criteria
	(mg/kg)	(mg/kg)	(ug/L)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)		(ug/L)
Pentachlorophenol				3		520		2.98	ca	
Perchlorate								0.78	nc	
Permethrin								3055.15	nc	
Phenmedipham								15275.77	nc	
Phenol				47,000		120,000		36661.86	nc	
Phenothiazine								122.21	nc	
Phenylmercuric acetate								4.89	nc	
Phorate								12.22	nc	
Phosmet								1222.06	nc	
Phosphine								18.33	nc	
Phosphorus (white)								1.56	nc	
Phthalic anhydride								12199.68	nc	
p-Hydroquinone								244.41	nc	
Picloram				5,500		14,000		4277.22	nc	
Pirimiphos-methyl								611.03	nc	
p-Nitrotoluene								366.75	nc	
Polybrominated biphenyls								0.04	nc	
Polychlorinated biphenyls (PCBs)				1		1		0.22	ca	0.000015
Polychlorinated terphenyls								0.11	ca	
Potassium	625	1421	1613							
p-Phenylenediamine								11609.59	nc	
p-Phthalic acid								61103.10	nc	
Prochloraz								3.24	ca	
Profluralin								36.66	nc	
Prometon								91.65	nc	
Prometryn								24.44	nc	
Pronamide								458.27	nc	
Propachlor								79.43	nc	
Propanil								30.55	nc	
Propargite								122.21	nc	
Propargyl alcohol								12.22	nc	

TABLE 1-4
SCREENING VALUES

LAND USE CONTROL IMPLEMENTATION PLAN
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

	BACKGROUND CONTAMINENT LEVELS[1]			IEPA SOIL REMEDIATION OBJECTIVES FOR RESIDENTIAL PROPERTIES[2]		IEPA SOIL REMEDIATION OBJECTIVES FOR CONSTRUCTION WORKER[3]		PRGs FOR RESIDENTIAL SOIL[4]		ILLINOIS GENERAL USE WATER QUALITY STANDARDS[5]
Matrix	Soil	Sediment	Surface Water	Ingestion	Inhalation	Ingestion	Inhalation	Human Health = nc Cancer = ca		Human Health Criteria
	(mg/kg)	(mg/kg)	(ug/L)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)		(ug/L)
Propazine								122.21	nc	
Propham								122.21	nc	
Propiconazole								79.43	nc	
Propylene glycol								3003.41	nc	
Propylene glycol, monoethyl ether								4277.22	nc	
Propylene glycol, monomethyl ether								4277.19	nc	
Propylene oxide								1.93	ca	
p-Toluidine								2.56	ca	
Pursuit								1527.58	nc	
p-Xylene				160,000	460	410,000	460			
Pydrin								152.76	nc	
Pyrene				2,300		61,000		231.60	nc	3500
Pyridine								61.10	nc	
Quinalphos								30.55	nc	
Quinoline								0.16	ca	
RDX (Cyclonite)								4.42	ca	
Resmethrin								1833.09	nc	
Ronnel								3055.15	nc	
Rotenone								244.41	nc	
Savey								1527.58	nc	
sec-Butylbenzene								45.00	nc	
Selenious Acid								305.52	nc	
Selenium	2.3	0.64	2.7	390		1,000		391.07	nc	
Selenourea								305.52	nc	
Sethoxydim								5499.28	nc	
Silver	0.6	3	10	390		1,000		391.07	nc	
Simazine				390		1,000		4.05	ca	
Sodium	170	1450	3169							
Sodium diethyldithiocarbamate								1.80	ca	
Sodium fluoroacetate								1.22	nc	
Sodium metavanadate								61.10	nc	

TABLE 1-4
SCREENING VALUES

LAND USE CONTROL IMPLEMENTATION PLAN
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

	BACKGROUND CONTAMINENT LEVELS[1]			IEPA SOIL REMEDIATION OBJECTIVES FOR RESIDENTIAL PROPERTIES[2]		IEPA SOIL REMEDIATION OBJECTIVES FOR CONSTRUCTION WORKER[3]		PRGs FOR RESIDENTIAL SOIL[4]		ILLINOIS GENERAL USE WATER QUALITY STANDARDS[5]
Matrix	Soil	Sediment	Surface Water	Ingestion	Inhalation	Ingestion	Inhalation	Human Health = nc Cancer = ca		Human Health Criteria
	(mg/kg)	(mg/kg)	(ug/L)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)		(ug/L)
Strontium, stable								46924.17	nc	
Strychnine								18.33	nc	
Styrene				16,000	1,500	41,000	430	438.21	nc	
Systhane								1527.58	nc	
Tebuthiuron								4277.22	nc	
Temephos								1222.06	nc	
Terbacil								794.34	nc	
Terbufos								1.53	nc	
Terbutryn								61.10	nc	
tert-Butylbenzene								53.00	nc	
Tetrachloroethylene (PCE)				12	11	2,400	28	1.51	ca	2.8
Tetrachlorovinphos								20.27	ca	
Tetraethyldithiopyrophosphate								3.06	nc	
Tetrahydrofuran								9.36	ca	
Tetryl								61.10	nc	
Thallium	0.4	0.3	10	6.3		160		0.52	nc	
Thiobencarb								61.10	nc	
Thiocyanate								305.52	nc	
Thiofanox								1.83	nc	
Thiophanate-methyl								488.82	nc	
Thiram								30.55	nc	
Tin								4692.42	nc	
Titanium										
Toluene				16,000	650	410,000	42	65.60	nc	62000
Toluene-2,4-diamine								0.15	ca	
Toluene-2,5-diamine								3666.19	nc	
Toluene-2,6-diamine								1222.06	nc	
Toxaphene				0.6	89	110	240	0.44	ca	
Tralomethrin								45.83	nc	
Triallate								79.43	nc	
Triasulfuron								61.10	nc	

TABLE 1-4
SCREENING VALUES

LAND USE CONTROL IMPLEMENTATION PLAN
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

	BACKGROUND CONTAMINENT LEVELS[1]			IEPA SOIL REMEDIATION OBJECTIVES FOR RESIDENTIAL PROPERTIES[2]		IEPA SOIL REMEDIATION OBJECTIVES FOR CONSTRUCTION WORKER[3]		PRGs FOR RESIDENTIAL SOIL[4]		ILLINOIS GENERAL USE WATER QUALITY STANDARDS[5]
Matrix	Soil	Sediment	Surface Water	Ingestion	Inhalation	Ingestion	Inhalation	Human Health = nc Cancer = ca		Human Health Criteria
	(mg/kg)	(mg/kg)	(ug/L)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)		(ug/L)
Tributyltin oxide (TBTO)								1.83	nc	
Trichloroethylene (TCE)				58	5	1,200	12	0.05	ca	25
Trichlorofluoromethane								38.58	nc	
Tridiphane								18.33	nc	
Triethylamine								2.34	nc	
Trifluralin								45.83	nc	
Trimellitic Anhydride (TMAN)								0.86	nc	
Trimethyl phosphate								13.15	ca	
Triphenylphosphine oxide								30.55	nc	
Tris(2-chloroethyl) phosphate								151.99	ca	
Uranium								1.56	nc	
Vanadium	47.2	28	50	550		1,400		54.75	nc	
Vernam								6.11	nc	
Vinclozolin								152.76	nc	
Vinyl acetate				78,000	1,000	200,000	10	42.57	nc	
Vinyl bromide (bromoethene)								0.19	ca	
Vinyl chloride				0.46	0.28	170	1.1	0.08	ca	120
Warfarin								1.83	nc	
Xylenes (total)				160,000	320	410,000	320	27.50	nc	62000
Zinc	51.4	57.1	20	23,000		61,000		2346.32	nc	
Zinc phosphide								2.35	nc	
Zineb								305.52	nc	

Legend
mg/kg = milligrams per kilogram
ug/L = micrograms per Liter

Footnotes
[1] USFWS, 2001. Draft-Final Preliminary Assessment/Site Inspection Report, Additional and Uncharacterized Sites Operable Unit, Crab Orchard National Wildlife Refuge NPL Site, Marion, IllinoisVolume 1, Table 2-14, September 2001. *Background numbers represent the 95% upper tolerance level for each matrix.*

TABLE 1-4
SCREENING VALUES

LAND USE CONTROL IMPLEMENTATION PLAN
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

	BACKGROUND CONTAMINENT LEVELS[1]			IEPA SOIL REMEDIATION OBJECTIVES FOR RESIDENTIAL PROPERTIES[2]		IEPA SOIL REMEDIATION OBJECTIVES FOR CONSTRUCTION WORKER[3]		PRGs FOR RESIDENTIAL SOIL[4]	ILLINOIS GENERAL USE WATER QUALITY STANDARDS[5]
Matrix	Soil	Sediment	Surface Water	Ingestion	Inhalation	Ingestion	Inhalation	Human Health = nc Cancer = ca	Human Health Criteria
	(mg/kg)	(mg/kg)	(ug/L)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(ug/L)

[2] Illinois Environmental Protection Agency, Illinois Pollution Control Board, Title 35, Subtitle G, Chapter I, Subchapter f, Part 742, Tiered Approach to Corrective Action Objectives, Appendix B, Table A at *http://www.ipcb.state.il.us/TITLE_35/main.htm*.

[3] Illinois Environmental Protection Agency, Illinois Pollution Control Board, Title 35, Subtitle G, Chapter I, Subchapter f, Part 742, Tiered Approach to Corrective Action Objectives, Appendix B, Table B at *http://www.ipcb.state.il.us/TITLE_35/main.htm*.

[4] United States Environmental Protection Agency, Region 9 at http://www.epa.gov/region09/waste/prg/index.htm.

[5] This table is a compilation of Illinois General Use Water Quality Standards for Site 36 of the MISCA OU (Table 2-2 of the FSP) and Sites 32/33 of the PCB OU (Table 7-1 of the Ecological Risk Assessment).

Table 1-5
Crab Orchard National Wildlife Refuge
Personal Protective Equipment Guidelines for Intrusive and Non-Intrusive Activities

Site Number	Site Name	Other Site Designations	Approximate Size (Acres)	Site-Specific Land Use Controls in Effect/PPE Required (Yes/No)	Justification for Land Use Controls (contaminants exceeding risk-based screening criteria)	Minimum OSHA PPE Level for activities involving digging	Minimum PPE for short-term site visitors	Additional Measures to Minimize Exposure	Specific Locations within each Site	Contaminants
Metals Area Operable Unit (MAOU)										
15	Plating Pond			No						
22	Old Refuge Shop Channel			No						
29	Fire Station Landfill			No						
PCB Areas Operable Unit (PCB OU)										
17	Job Corps Landfill			No						
28	Water Tower Landfill			No						
32 and 33	Area 9 Landfill and Building Complex			Yes	Groundwater - TCE and other VOCs Soil - VOCs, SVOCs, PCBs, inorganics	C for workers in an excavation, D1 for workers outside excavation if airborne dust is visible, D2 for workers outside excavation if airborne dust is not visible	D1 if airborne dust is visible, D3 if airborne dust is not visible	Dust control measures should be implemented during excavation or other activities where soil is disturbed		
Explosives/Munitions Manufacturing Operable Unit (EMMA OU)										
COC-1	COC-1 near Hampton Cemetery		0.75	No						
COC-2	COC-2 near Hampton Cemetery		2	No						
COC-3	COC-3 near Hampton Cemetery		Unknown	No						
COC-4	COC-4 near Hampton Cemetery		3.5	No						
COC-5	COC-5 near Hampton Cemetery		1.4	No						
COC-6	COC-6 near Hampton Cemetery		6	No						
COC-7	COC-7 near Hampton Cemetery		2	No						
COC-8	COC-8 near Hampton Cemetery		Unknown	No						
COC-9	COC-9 near Hampton Cemetery		4	No						
COC-10	COC-10 near Hampton Cemetery		Unknown	No						
COC-11	COC-11 near Hampton Cemetery		Unknown	No	COC-11 is now part of AUS-0062 (Site 62), so Site-wide land use controls appy since site AUS-0062 has no site-specific land use controls.					
COC-12	COC-12 near Hampton Cemetery		Unknown	No						
COC-13	COC-13 near Hampton Cemetery		Unknown	No	COC-13 is now part of AUS-0064 (Site 64), so Site-wide land use controls apply since site AUS-0064 has no site-specific land use controls.					
COC-14	COC-14 near Hampton Cemetery		Unknown	No	COC-14 is now part of AUS-0066 (Site 66), so Site-wide land use controls apply since site AUS-0066 has no site-specific land use controls.					
COC-15	COC-15 near Hampton Cemetery			No						
COP-1	Crab Orchard Pond No. 1			No						
COP-1	Crab Orchard Pond No. 2			No						
COP-3	Crab Orchard Pond No. 3			No						
COP-4	Crab Orchard Pond No. 4			No						
BUNKER 1-3	Bunker 1-3			No						
Miscellaneous Areas Operable Unit (MISCA OU)										
7	D Area Southeast Drainage Channel			No						
7A	D Area North Lawn			No						
8	D Area Southwest Drainage Channel			No						
9	P Area Northwest Drainage Channel			No						
10	Waterworks North Drainage Channel			No						
11	P Area Southeast Drainage			No						
11A	P Area North			No						
12	Area 8 Impoundment			No						

Table 1-5
Crab Orchard National Wildlife Refuge
Personal Protective Equipment Guidelines for Intrusive and Non-Intrusive Activities

Site Number	Site Name	Other Site Designations	Approximate Size (Acres)	Site-Specific Land Use Controls in Effect/PPE Required (Yes/No)	Justification for Land Use Controls (contaminants exceeding risk-based screening criteria)	Minimum OSHA PPE Level for activities involving digging	Minimum PPE for short-term site visitors	Additional Measures to Minimize Exposure	Specific Locations within each Site	Contaminants
13	Area 8 Change House			No	Site Number 13 is now part of AUS-0A8S (Load Line III), so Site-wide land use controls apply since site AUS-0A8S has no site-specific land use controls.					
14	Area 8 Solvent Storage Drainage Ditch		3.5	Yes	Groundwater - VOCs Soil - VOCs, lead	C for workers in an excavation, D1 for workers outside excavation if airborne dust is visible, D2 for workers outside excavation if airborne dust is not visible	D1 if airborne dust is visible, D3 if airborne dust is not visible	Dust control measures should be implemented during excavation or other activities where soil is disturbed		Soil and GW have toluene, ethylbenzene, xylenes, and methylene chloride. Remediation is planned for GW and soil. Soil also has Cr and Pb. Couldn't find any analytical data in ELUCIP or PA/SI. I suggest Level C anywhere there is known or likely to be VOCs exceeding screening criteria in soil and/or groundwater, within 500' for GW samples and within 250' for soil samples.No analytical data could be found in the PA/SI or LUCIP.
16	Area 7 Industrial Site			No						
18	Area 13 Loading Platform			No	Site Number 18 is now part of AUS-0A13 (Finished Ammomium Igloos), so Site-wide land use controls apply since site AUS-0A13 has no site-specific land use controls.					
20	D Area South Drainage Channel			No						
21	Southeast Corner Field			No						
22A	Former Post Treating Facility			No						
24	Pepsi Plant West Drainage Ditch			No						
25	Crab Orchard Creek at Marion Landfill			No						
26	Crab Orchard Creek Below Marion Sewage			No						
27	Crab Orchard Creek Below I-51 Dredge Area			No						
30	Munitions Control Site			No						
31	Refuge Control Site			No						
34	Crab Orchard Lake			Yes	PPE not required; however, fish consumption restrictions are in effect					
35	Area 9 East Waterway			No						
36	Refuge Wastewater Treatment Plant			Yes	Soil - PCBs, cadmium,	D1 for workers in an excavation, D1 for workers outside excavation if airborne dust is visible, D2 for workers outside excavation if airborne dust is not visible	D1 if airborne dust is visible, D3 if airborne dust is not visible	Dust control measures should be implemented during excavation or other activities where soil is disturbed		Remediation planned since ROD in 2002. No analytical data could be found in the PA/SI or LUCIP. If there are large portions of this site without PCB or cadmium contamination, then change excavation workers to D2 unless airborne dust is visible.
Water Towers Operable Unit (WTOU)										
Water Tower No. 1	Water Tower No. 1			No						
Water Tower No. 2	Water Tower No. 2			No						
Water Tower No. 3	Water Tower No. 3			No						
Water Tower No. 4	Water Tower No. 4			No						
Cedar Point Water Tower	Cedar Point Water Tower			No						
Visitor Center	Visitor Center			No						
Additional and Uncharacterized Sites Operable Unit (AUS OU)										
AUS-0A2B	Booster Loading Line	Area 2B	125	Yes	Groundwater - TCE and other VOCs Soil - TCE	C for workers in an excavation			Within 500' of groundwater sample W02	Groundwater sample W02, TCE = 47 ug/L
AUS-0A2D	Detonator Loading Line	Area 2D	150	Yes	Groundwater - TCE and other VOCs	C for workers in an excavation			Within 1,000' of groundwater sample W01, and within 500' of groundwater sample W03	Sample W01, TCE = 54,000 ug/L, cis-1,2-DCE = 9,700 ug/L Sample W03, TCE = 4,200 ug/L, cis-1,2-DCE = 400 ug/L, PCE = 2,800 ug/L, VC = 11 ug/L

Table 1-5
Crab Orchard National Wildlife Refuge
Personal Protective Equipment Guidelines for Intrusive and Non-Intrusive Activities

Site Number	Site Name	Other Site Designations	Approximate Size (Acres)	Site-Specific Land Use Controls in Effect/PPE Required (Yes/No)	Justification for Land Use Controls (contaminants exceeding risk-based screening criteria)	Minimum OSHA PPE Level for activities involving digging	Minimum PPE for short-term site visitors	Additional Measures to Minimize Exposure	Specific Locations within each Site	Contaminants
AUS-0A2F	Fuse Loading Line	Area 2F	125	Yes	Groundwater - TCE and other VOCs	C for workers in an excavation, D1 for workers outside excavation if airborne dust is visible, D2 for workers outside excavation if airborne dust is not visible			Within 1,000' of groundwater sample W02	Sample W02, TCE = 2,400 ug/L, cis-1,2-DCE = 210 ug/L
AUS-0A2P	Artillery Primer Loading Line	Area 2P	150	Yes	Groundwater - TCE and other VOCs	C for workers in an excavation			Within 1,000' of groundwater sample W03	Sample W03, TCE = 120,000 ug/L, PCE = 230 ug/L
AUS-0A2R	Railroad Spur	Area 2R	30	No						
AUS-0A03	IOP Finished Ammunition Group 1 Area	Area 3	150	No						
AUS-0A4E	East Shop Area	Area 4 East	60	No						
AUS-0A4W	West Shop Area	Area 4 West	80	Yes	Soil - Inorganics	D1 for workers in an excavation, D1 for workers outside excavation if airborne dust is visible, D2 for workers outside excavation if airborne dust is not visible	D1 if airborne dust is visible, D3 if airborne dust is not visible	Dust control measures should be implemented during excavation or other activities where soil is disturbed	Within 250' of soil sample 003	Sample 003, Cadmium = 4,520 mg/kg, arsenic = 60.1 mg/kg
AUS-0A06	Ammomium Nitrate High Explosives & Smokeless Powder Storage Area	Area 6	550	No						
AUS-0A07	Inert Storage	Area 7	100	Yes	Soil - Pesticides	D1 for workers inside or outside excavation if airborne dust is visible, D2 for workers outside excavation if airborne dust is not visible, D1* for workers in buildings IN-1-3, IN-1-4, IN-1-5 and IN-1-6 if airborne dust is visible	D1 if airborne dust is visible, D1* in buildings IN-1-3, IN-1-4, IN-1-5, and IN-1-6, D3 if airborne dust is not visible	Dust control measures should be implemented during excavation or other activities where soil is disturbed	Within 250' of soil samples 001, 002, 004, 033, 036, 038, 039, 047, and 061	Sample 001, Aldrin = 520,000 ug/kg, Dieldrin = 55,000 ug/kg, Sample 002, Aldrin = 240,000 ug/kg, Dieldrin = 240,000 ug/kg, Sample 004, Aldrin = 350,000 ug/kg, Dieldrin = 290,000 ug/kg, Sample 033, Aldrin = 160,000 ug/kg, Dieldrin = 22,000 ug/kg, Sample 036, Dieldrin = 13,000 ug/kg, Sample 038, Aldrin = 54,000 ug/kg, Sample 039, Dieldrin = 49,000 ug/kg, Sample 047, Aldrin = 88,000 ug/kg, Dieldrin = 140,000 ug/kg, Sample 061, Dieldrin = 13,000 ug/kg
AUS-0A8S	Load Line III	Area 8	150	No						
AUS-0A09	Load Line I	Area 9	100	Yes	Groundwater - TCE	C for workers in an excavation			Within 500' of groundwater sample W01	
					Soils - PCBs	D1 for workers in an excavation, D1 for workers outside excavation if airborne dust is visible, D2 for workers outside excavation if airborne dust is not visible	D1 if airborne dust is visible, D3 if airborne dust is not visible	Dust control measures should be implemented during excavation or other activities where soil is disturbed	Refer to Figures 10-1 and 10-2	Refer to Figures 10-1 and 10-2

Table 1-5
Crab Orchard National Wildlife Refuge
Personal Protective Equipment Guidelines for Intrusive and Non-Intrusive Activities

Site Number	Site Name	Other Site Designations	Approximate Size (Acres)	Site-Specific Land Use Controls in Effect/PPE Required (Yes/No)	Justification for Land Use Controls (contaminants exceeding risk-based screening criteria)	Minimum OSHA PPE Level for activities involving digging	Minimum PPE for short-term site visitors	Additional Measures to Minimize Exposure	Specific Locations within each Site	Contaminants
AUS-0A10	Fuse and Booster Storage Magazines	Area 10	40	Yes	Soil - TCE	C for workers in an excavation, D1 for workers outside excavation if airborne dust is visible, D2 for workers outside excavation if airborne dust is not visible		Dust control measures should be implemented during excavation or other activities where soil is disturbed	Within 250' of soil sample 002	
AUS-A11A	Acid & Ammomium Nitrate Area (part of Load Line II)	Area 11A	50	No						
AUS-A11H	High Explosives Area (part of Load Line II)	Area 11H	70	Yes	Soil and Sediment - Explosives (not at levels of concern for explosive effects), VOCs	C for workers in an excavation, D1 for workers outside excavation if airborne dust is visible, D2 for workers outside excavation if airborne dust is not visible	D1 if airborne dust is visible, D3 if airborne dust is not visible	Dust control measures should be implemented during excavation or other activities where soil is disturbed	Within 250' of soil samples 022 and 028	Sample 022, 2,4-DNT = 210,000 ug/kg, Sample 028, TCE = 92 ug/k. Although this TCE concentration is below risk-based screening criteria for industrial soil, the absence of groundwater data in the immediate vicinity of this soil sample 028 justifies the use of land use controls until the nature and extent of contamiantion is fully delineated.
AUS-A11N	Nitroglycerin Area	Area 11N	30	No						
AUS-A11P	Pilot Propellant Plant/CAP Production Area	Area 11P	30	No						
AUS-A11S	Support Area (part of Load Line II)	Area 11S	50	Yes	Groundwater - TCE and other VOCs, trinitrotoluene (not at levels of concern for explosive effects)	C for workers in an excavation		Dust control measures should be implemented during excavation or other activities where soil is disturbed	Within 1,000' of groundwater samples W01, W02, and W04	Sample W01, TCE = 6 ug/L, Sample W02, TCE = 280,000 ug/L, cis-1,2-DCE = 10,000 ug/L, Sample W04, TCE = 520, cis-1,2-DCE = 78
					Soil - TCE and other VOCs	C for workers in an excavation, D1 for workers outside excavation if airborne dust is visible, D2 for workers outside excavation if airborne dust is not visible	D1 if airborne dust is visible, D3 if airborne dust is not visible	Dust control measures should be implemented during excavation or other activities where soil is disturbed	Within 250' of soil sample 002	Sample W02 (soil sample), TCE = 21,000 ug/kg, cis-1,2-DCE = 1,100 ug/L
AUS-0A12	Former Ammomium Nitrate Plant	Area 12	100	Yes	Groundwater - VOCs	C for workers in an excavation			Within 500' of groundwater sample 008	Sample 008, TCE = 6 ug/L, PCE = 54, cis-1,2-DCE = 130 ug/L
AUS-0A13	Finished Ammomium Igloos	Area 13	500	No						
AUS-0062	COC (Mounds and Pits)	Area 62	2	No						
AUS-0063	COC (Fenced Area West of COC-1)	Area 63		No						
AUS-0064	COC (Mounds and Brick Pit)	Area 64		No						
AUS-0065	COC (Foundations Northeast of COC-1)	Area 65	0.5	No						
AUS-0066	COC (Berm with Red Brick Rubble)	Area 66	0.5-1	No						
AUS-0067	COC (Fence with "Contaminated Area" Sign - Northwest of COC-6)	Area 67	0.25	Yes	Water from Cistern - Dinitrotoluene (not at levels of concern for explosive effects)	D2 modified for protection against splashing (e.g., waterproof coveralls) if water from cistern is to be sampled or handled in any way.			Cistern	Sample 002, 2,6-DNT = 6.5 ug/L

Table 1-5
Crab Orchard National Wildlife Refuge
Personal Protective Equipment Guidelines for Intrusive and Non-Intrusive Activities

Site Number	Site Name	Other Site Designations	Approximate Size (Acres)	Site-Specific Land Use Controls in Effect/PPE Required (Yes/No)	Justification for Land Use Controls (contaminants exceeding risk-based screening criteria)	Minimum OSHA PPE Level for activities involving digging	Minimum PPE for short-term site visitors	Additional Measures to Minimize Exposure	Specific Locations within each Site	Contaminants
AUS-0069	COC (Dump Near South Shore of Crab Orchard Lake)			No						
AUS-0109	COC (Possible Former Explosives Detonation Area)			No						
AUS-0001	Fire and Police Headquarters		1.5	No						
AUS-0002	Wastewater Treatment Plant		1.5	No						
AUS-0018	Railroad Classification Yard		7	No						
AUS-0019	Former Railroad Spur (North of Area 4E)			No						
AUS-0021	Area 7 Fire Station	Incorporated into AUS-0A07		No						
AUS-0022	Small Arms Training Facility			No						
AUS-0043	Areas 11 & 12 Fire Station	Area 43	0.5	No						
AUS-0060	Fulminate Storage Igloos	Area 60	6	No						
AUS-0061	Detonation & Disposal Area	Area 61	0.5	No						
AUS-106A	Drum Disposal Area East of Area 11		0.1	Yes	Soil - TCE	C for workers in an excavation, D1 for workers outside excavation if airborne dust is visible, D2 for workers outside excavation if airborne dust is not visible	D1 if airborne dust is visible, D3 if airborne dust is not visible	Dust control measures should be implemented during excavation or other activities where soil is disturbed	Within 500' of soil samples 001, 002, 003, 004, 005, 007	Sample 001, TCE = 94 ug/kg, Sample 002, TCE = 13,000 ug/kg, Sample 003, TCE = 140 ug/kg, Sample 004, TCE = 2,500 ug/kg, Sample 005, TCE = 110 ug/kg, Sample 007, TCE = 260 ug/kg
AUS-0107	Possible Former Disposal Area Located Just Northwest of Area 8			No						
AUS-0108	Possible Disposal Area East of COC-10			No						

Notes:

Level C — Full or half-face, air purifying respirator (NIOSH approved)

Hooded or non-hooded (based on task-specific potential for splashing and/or dust generation) chemical-resistant clothing (overalls with long-sleeved jacket; coveralls; or one or two-piece splash suit; disposable chemical-resistant overalls)
Coveralls (optional, as applicable)
Gloves, outer, chemical-resistant
Gloves, inner, chemical-resistant
Boots, chemical-resistant, protective steel toe and shank
Hard hat (under suit, optional, as applicable)
Face shield (optional, as applicable)

Level D1 — Dust mask, snug-fitting
Coveralls (optional, as applicable)

Hooded chemical-resistant clothing (overalls with long-sleeved jacket; coveralls; or one or two-piece splash suit; disposable chemical-resistant overalls) if potentially exposed to groundwater at bottom of trench or excavation
Gloves, outer, chemical-resistant
Gloves, inner, chemical-resistant
Boots, chemical-resistant, protective steel toe and shank
Hard hat (optional, as applicable)
Face shield (optional, as applicable)

Level D1* — Same as Level D1 with the addition of chemical-protective boot covers

Level D2 — Same as Level D1 but without the dust mask

Level D3 - Strictly limited to short-time site worker and/or visitor conducting non-invasive activities
Dust mask, snug-fitting if airborne dust is visible
Long pants (i.e., no shorts)
Short or long-sleeve shirts
Work gloves (optional, as applicable)
Boots, chemical-resistant, protective steel toe and shank

TCE = Trichloroethylene
PCE = Tetrachloroethylene
cis-1,2-DCE = cis-1,2-Dichloroethylene
VC = Vinyl Chloride
2,4-DNT = 2,4-Dinitrotoluene
2,6-DNT = 2,6-Dinitrotoluene

CONWR Overview
Figure 1-1

Crab Orchard National Wildlife Refuge (CONWR)

February 2007

Crab Orchard Lake
Little Grassy Lake
Devil's Kitchen Lake
ILLINOIS 13
ILLINOIS 148
57

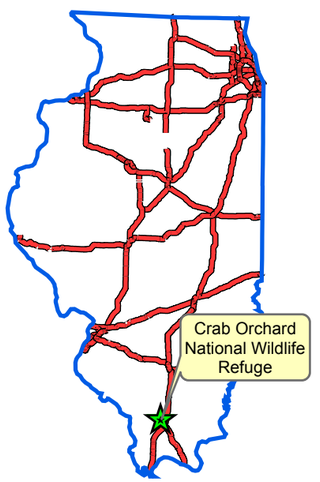
Crab Orchard National Wildlife Refuge
Lakes
Streams

Roads
Interstate
Principle Arterial
Minor Arterial
Rural Local
Urban Local

U.S. FISH & WILDLIFE SERVICE

N

0 0.5 1 2 Miles



PCB OU Overview
Figure 1-2

PCB Areas
Operable Unit (OU)

February 2007

- PCB OU Site Locations
- IOP Industrial Areas
- Former Illinois Ordinance Plant
- Crab Orchard National Wildlife Refuge
- Lakes
- Streams

Roads

- Interstate
- Principle Arterial
- Minor Arterial
- Rural Local
- Urban Local

N

0 0.5 1 2 Miles

Crab Orchard Lake

Area 1
Area 2D
Area 2F
Area 2B
Area 2P
Area 14
Area 3
Area 4W
Area 4E
Area 5
Area 6
Area 7
Area 8
Area 9
Area 10
Area 11
Area 12
Area 13

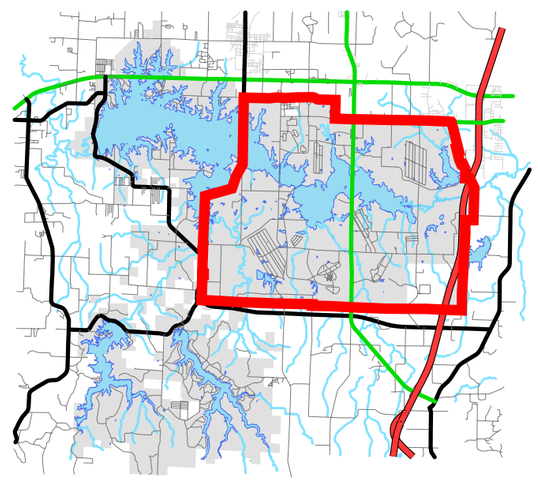
Site 17
Site 32
Site 33
Site 28

ILLINOIS 13
ILLINOIS 148
57

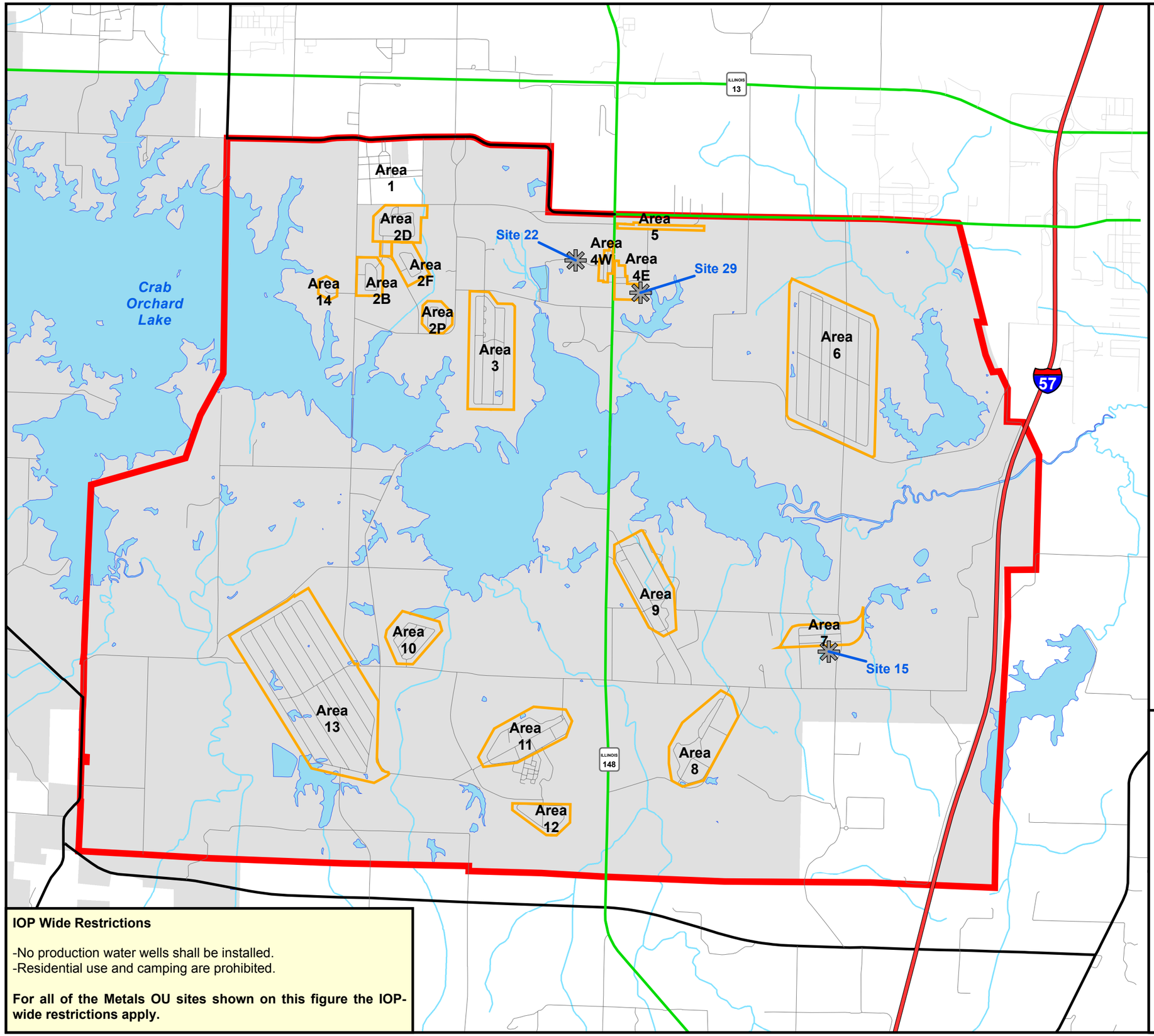
IOP Wide Restrictions

-No production water wells shall be installed.
-Residential use and camping are prohibited.

For all of the PCB OU sites shown on this figure the IOP-wide restrictions apply. Sites 32 and 33 have additional restrictions - refer to Figures 10-1 and 10-2.



Metals OU Overview
Figure 1-3



IOP Wide Restrictions

-No production water wells shall be installed.
-Residential use and camping are prohibited.

For all of the Metals OU sites shown on this figure the IOP-wide restrictions apply.

Metals Area Operable Unit (OU)

February 2007

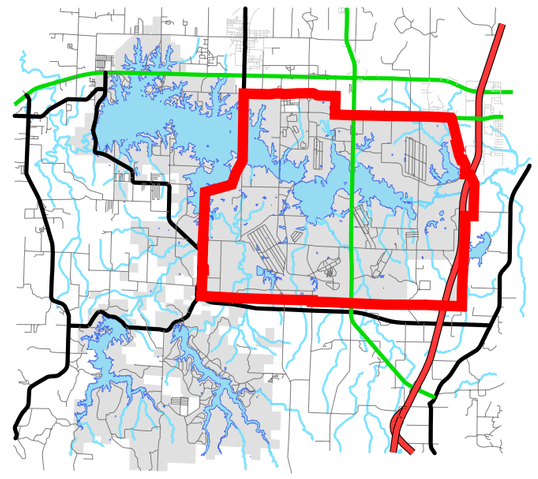
- Metals Area OU Site Locations
- IOP Industrial Areas
- Crab Orchard National Wildlife Refuge
- Former Illinois Ordinance Plant
- Lakes
- Streams

Roads

- Interstate
- Principle Arterial
- Minor Arterial
- Rural Local
- Urban Local

N

0 0.5 1 2 Miles



MISCA OU Overview
Figure 1-4

Miscellaneous Areas (MISCA) Operable Unit (OU)

February 2007

- MISCA OU Site Locations
- IOP Industrial Areas
- Former Illinois Ordinance Plant
- Crab Orchard Wildlife Refuge
- Lakes
- Streams

Roads

- Interstate
- Principle Arterial
- Minor Arterial
- Rural Local
- Urban Local

N

0 0.5 1 2 Miles

Crab Orchard Lake

Area 14
Area 2B
Area 2D
Area 2F
Area 2P
Area 3
Area 4W
Area 4E
Area 5
Area 6
Area 7
Area 8
Area 9
Area 10
Area 11
Area 12
Area 13

7A
8
7
20
36
22A
9
10
11A
11
31
34
27
35
16
21
14
12
13
18
30

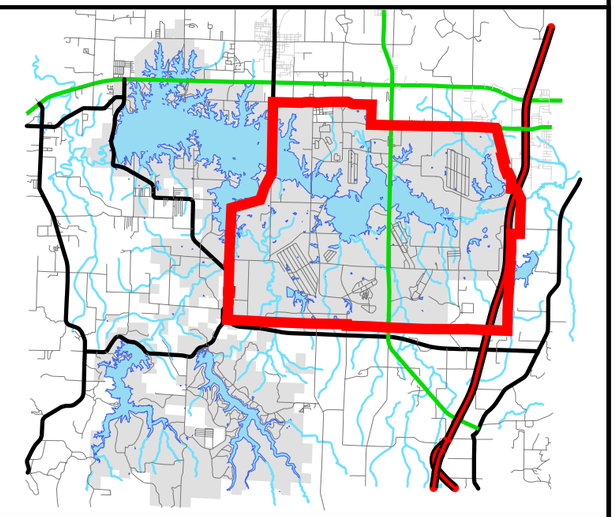
ILLINOIS 13
ILLINOIS 148
57

IOP Wide Restrictions

-No production water wells shall be installed.
-Residential use and camping are prohibited.

For all of the MISCA OU sites shown on this figure the IOP-wide restrictions apply.

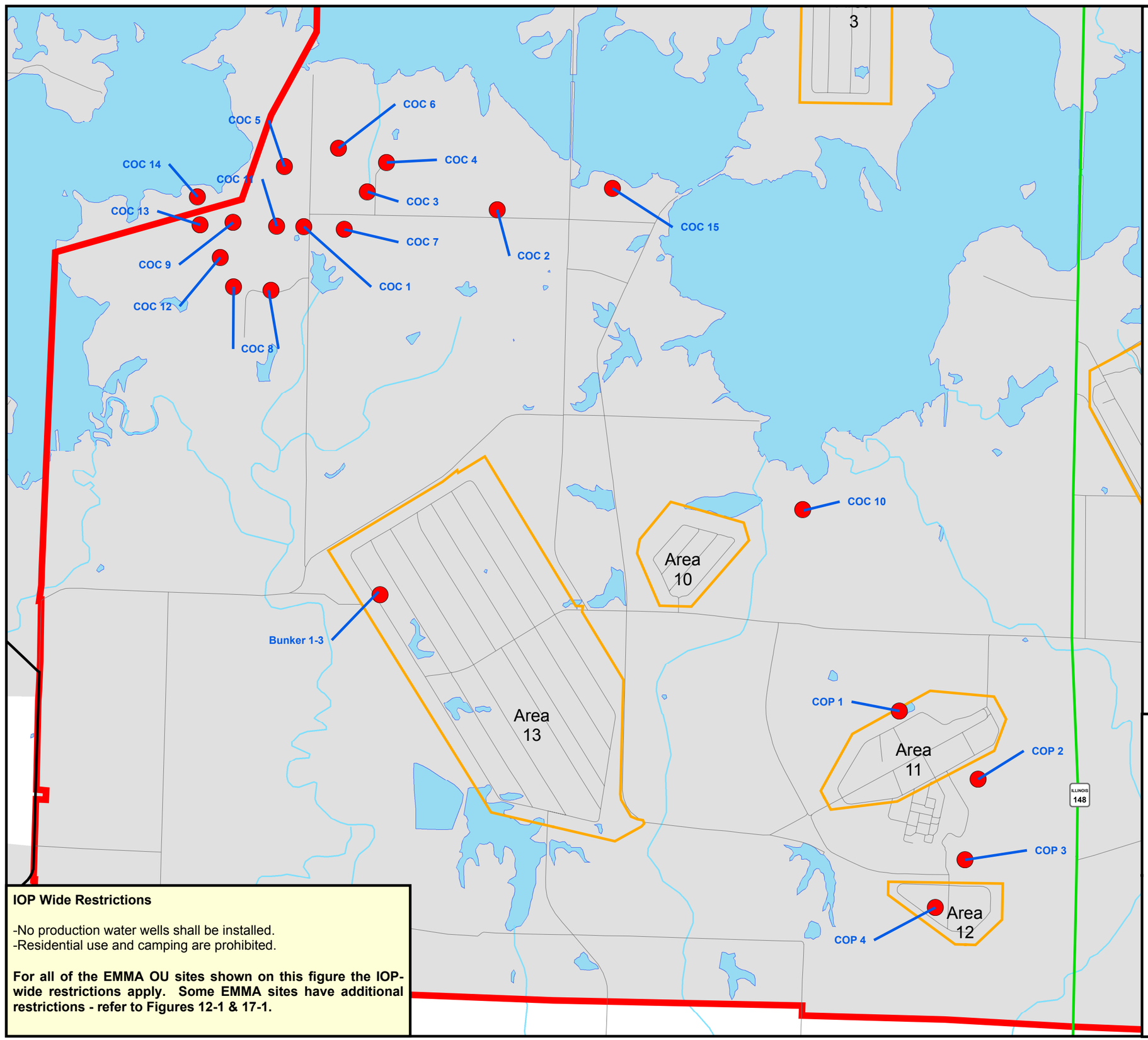
Site 10 has additional restrictions - refer to Figure 3-4
Site 14 has additional restrictions - refer to Figure 9-1
Site 16 has additional restrictions - refer to Figure 8-1



EMMA OU Overview
Figure 1-5

Explosives/Munitions Manufacturing Areas (EMMA) Operable Unit (OU)

February 2007



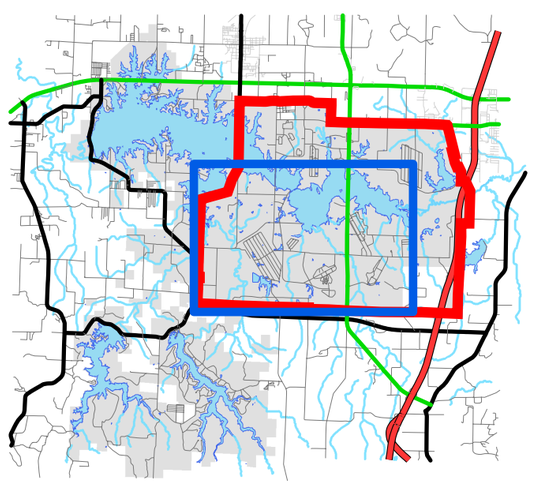
- EMMA OU Site Locations
- IOP Industrial Areas
- Former Illinois Ordinance Plant
- Crab Orchard National Wildlife Refuge
- Lakes
- Streams

Roads

- Interstate
- Principle Arterial
- Minor Arterial
- Rural Local
- Urban Local

N

0 0.25 0.5 1 Miles



IOP Wide Restrictions

-No production water wells shall be installed.
-Residential use and camping are prohibited.

For all of the EMMA OU sites shown on this figure the IOP-wide restrictions apply. Some EMMA sites have additional restrictions - refer to Figures 12-1 & 17-1.

Water Towers OU Overview
Figure 1-6

Water Towers Operable Unit (OU)

February 2007

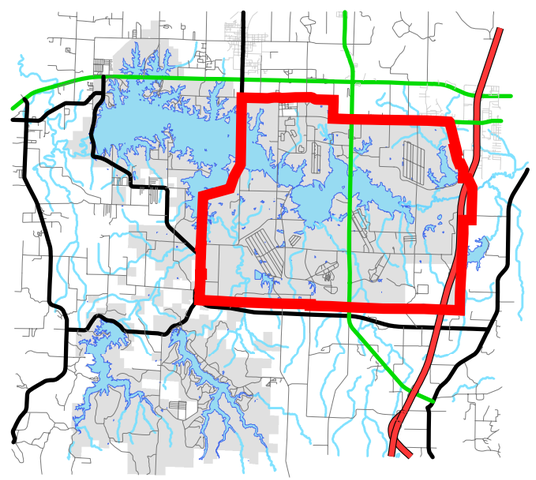
- Water Tower OU Sites Locations
- IOP Industrial Areas
- Former Illinois Ordinance Plant
- Crab Orchard National Wildlife Refuge
- Lakes
- Streams

Roads

- Interstate
- Principle Arterial
- Minor Arterial
- Rural Local
- Urban Local

N

0 0.5 1 2 Miles



IOP Wide Restrictions

-No production water wells shall be installed.
-Residential use and camping are prohibited.

For all of the Water Tower OU sites shown on this figure the IOP-wide restrictions apply.

AUS OU Overview
Figure 1-7

Additional and Uncharacterized Sites (AUS) Operable Unit (OU)

February 2007

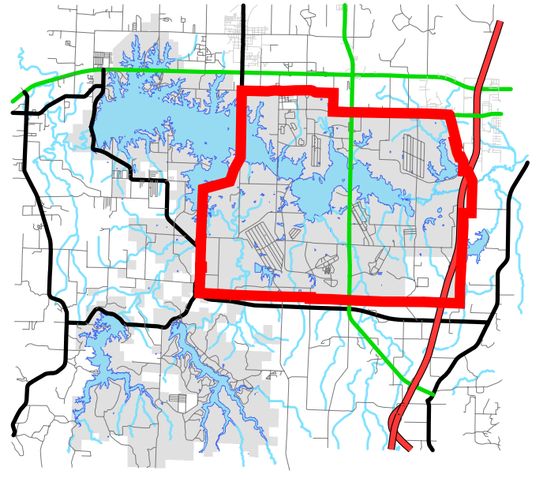
- AUS OU Site Locations
- Former Illinois Ordinance Plant
- Crab Orchard National Wildlife Refuge
- Lakes
- Streams

Roads

- Interstate
- Principle Arterial
- Minor Arterial
- Rural Local
- Urban Local

N

0 0.5 1 2 Miles



IOP Wide Restrictions

-No production water wells shall be installed.
-Residential use and camping are prohibited.

For all of the AUS OU sites shown on this figure the IOP-wide restrictions apply. Additional restrictions apply to all AUS sites and PPE recomendations apply to many of the AUS sites. Refer to site-specific figures.

2.1 LUCIP— PRODUCTION WELL RESTRICTION

2.1.1 Site Location

This restriction applies to the entire closed area of the Refuge, which is the area of the former Illinois Ordnance Plant (IOP). The site boundary is shown in **Figure 2-1**.

2.1.2 LUC Objective

The objective of this LUC is to prevent ingestion of potentially contaminated groundwater and induced migration of contaminant plumes.

2.1.3 LUC(s) Implemented to Achieve Objective(s)

FWS is implementing a ban on all production wells within the boundaries of the former IOP.

Some Sites within the former IOP have groundwater contaminant levels in the upper aquifer that are in excess of federal regulatory maximum concentration limits (MCLs), State of Illinois standards for Class I (potable) Groundwater, and risk-based tap water concentrations established by U.S. EPA Region 9. At other sites the groundwater has not been characterized, but soil concentrations of chemicals indicate that the groundwater may have concentrations exceeding the same standards indicated above. The extent of groundwater contamination at these sites has not been fully characterized, and some sites will have exceedances of standards even after remedies are implemented.

There are currently no production wells on the Refuge; the potable water for the Refuge is supplied by the City of Herrin, which has a reservoir for its source. There are some potable wells near the Refuge boundaries, located within the bedrock materials.

All production wells, not just potable wells, are prohibited, as the installation and pumping of production wells in or near contaminant plumes could lead to inadvertent creation of vertical and/or horizontal preferential migration pathways.

Because of the uncertainty regarding the nature and extent of groundwater contamination, installing production wells will not be allowed.

2.1.4 Actions Needed to Implement and Maintain the LUC

All construction activities must be approved by the Refuge. Refuge staff will be well aware of the well restriction. The stand alone portion of the ELUC will be given to all lease and special use permit holders, and Refuge staff and volunteers. Hunters and other IOP users will receive a briefing detailing the restrictions.

In accordance with Section VI of the ELUC, this LUC will be implemented 30 days after the acceptance of the ELUC Plan, and annual certification will be maintained by the FWS Refuge Manager.

2.1.5 Action Needed to Remove the LUC

This restriction can be removed for a specific location only by an investigation of the groundwater that confirms that the groundwater concentrations are within MCLs, Illinois Class I standards, and the Region 9 risk-based concentrations over an area sufficiently large such that pumping would not influence any other nearby plumes. At any site with known exceedances, the ban can be lifted only after the site groundwater is remediated to achieve these levels, and confirmation that the levels have been achieved is completed. The ban is site-wide except for those specific areas that have been determined to have clean groundwater. The site-wide ban could be considered for removal when all known sites have been cleaned up to Class I standards and all potential sites have been investigated and confirmed clean.

2.1.6 Applicable Decision Document

No specific decision document applies, since this LUCIP applies to the entire former IOP area, and decision documents address specific sites or OUs.

2.2 LUCIP— RESIDENTIAL/CAMPING RESTRICTION

2.2.1 Site Location

This restriction applies to the entire closed area of the Refuge, which is the area of the former Illinois Ordnance Plant. The site boundary is shown in **Figure 2-1**.

2.2.2 LUC Objective

The objective of this LUC is to prevent potential unacceptable risks to residential users and campers.

2.2.3 LUC(s) Implemented to Achieve Objective(s)

FWS is implementing a ban on residential use and camping within the boundaries of the former Illinois Ordnance Plant (IOP) at the Refuge. This restriction, and the provisions below, would also apply to any IOP land considered for a land transfer.

2.2.4 Actions Needed to Implement and Maintain the LUC

In accordance with Section VI of the ELUC, this LUC will be implemented 30 days after the acceptance of the ELUC, and annual certification will be maintained by the FWS Refuge Manager.

2.2.5 Action Needed to Remove the LUC

This restriction can be removed for a specific location only by an investigation of the location proposed for residential use or camping, as described below.

If the site proposed for residential use is within any of the operable units (OUs) established for the Crab Orchard NPL site, analytical sampling of all potentially affected media (for example, soil, soil vapor, sediment, surface water as applicable) would be required. The sampling density and depths need to be sufficient to allow evaluation of residential exposure scenarios within individual half-acre parcels. A risk assessment for the proposed use scenarios would be needed. If the risk assessment shows unacceptable risk, remediation would be required before a ban could be considered for lifting. The ban could be lifted only after all risks are shown to be at acceptable levels for the proposed use scenario.

At any sites considered for residential use that are outside of designated OUs, the investigation would require evaluation of all available aerial photographs and other information related to potential contamination of the site. If the photographs show any evidence of post-1940 construction, dumping, or other ground disturbance, the site will be treated as if it were in an OU, and sampling and a risk assessment as described above would be needed. If available records and photographs show no indication of past use that could lead to contamination, nor evidence of contamination from migration from an OU, this information shall be documented. The ban could be considered for removal on the basis that potential for contamination was not found.

2.2.6 Applicable Decision Document

No specific decision document applies, since this LUCIP applies to the entire former IOP area, and decision documents address specific sites or OUs.

IOP Overview
Figure 2-1

Former Illinois Ordnance Plant (IOP) and IOP Industrial Areas

February 2007

Area 1
Area 2D
Area 2F
Area 2B
Area 14
Area 2P
Area 3
Area 4W
Area 4E
Area 5
Area 6
Area 7
Area 8
Area 9
Area 10
Area 11
Area 12
Area 13

Crab Orchard Lake

ILLINOIS 13
ILLINOIS 148
57

IOP Industrial Areas
Former Illinois Ordinance Plant
Crab Orchard National Wildlife Refuge
Lakes
Streams

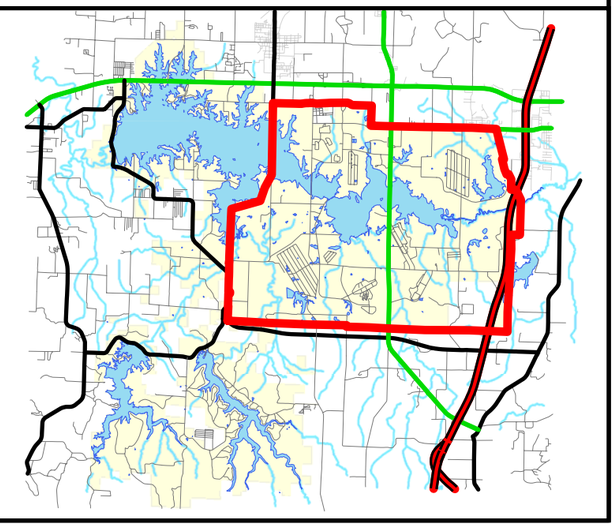
Roads

Interstate
Principle Arterial
Minor Arterial
Rural Local
Urban Local

U.S. FISH & WILDLIFE SERVICE

N

0 0.5 1 2 Miles



Area 2 is located on the east side of Wolf Creek Road, north of Crab Orchard Lake **(Figure 3-1)**. During the Illinois Ordnance Plant (IOP) era (1942-1945), this area was used for loading boosters, detonators, fuses, and primers for the ordnance produced at the IOP. Boosters, detonators, fuses and primers are parts of the explosive train in a device such as a bomb or mine. These IOP uses are the basis for the sub-area designations still in use today (Areas 2B, 2D, 2F, and 2P).

Area 2 is currently fenced, and access is controlled by the tenant. Areas 2B, 2F, and 2D are connected by roadways and are serviced by a single main security entrance on Post Oak Road, at the north end of Area 2. Access to Area 2P is through a security entrance on Stringtown Road, at the south end of Area 2.

3.1 AREA 2B

Site Description

Area 2B, the former IOP Booster Load Line, is on the west side of Area 2 **(Figures 1-7 and 3-1)**. The IOP Booster Load Line consisted of 17 buildings. All the building numbers were prefixed with "B-2." Later industrial tenants added and removed buildings. This fenced site covers about 125 acres.

Operational History and Waste Characteristics

Boosters produced at the IOP used tetryl (2,4,6-tetranitro-N-methyl aniline) for the explosive charge and they may also have contained some mercury fulminate. Tetryl was delivered from off site; processing on the booster load line included screening, blending, pressing, and loading.

Post-World War II industrial tenants used Area 2B for ordnance and pyrotechnic manufacturing. Universal Match Corporation (UMC) began operating in Area 2B sometime after 1952. UMC used Area 2B for tetryl-pelleting operations, manufacturing gas generators and delayed fuses, and for loading large explosive devices. UMC also used this area for manufacturing and testing pyrotechnic devices including explosive switches, igniters, detonators, flares, and atomic bomb burst simulators. UMC left the Refuge in 1963.

After UMC left, several former UMC employees formed Central Technologies, Inc. (CTI), which manufactured and tested pyrotechnic devices in Areas 2B for a short period. Little is known of their operation

Olin/Primex/GDO&TS began leasing in Area 2B in 1963 and have been the only documented lessee in Area 2B since 1970. GDO&TS is the current tenant. Olin/Primex/GDO&TS has used Area 2B for manufacturing ammonium nitrate propellants, ammonium oxalate inhibitors, insulator mixes, and magnesium-teflon flares; for machining; testing gas generators; storing hazardous waste; and for quality assurance laboratory analysis. One building contained a trichlorethane vapor degreaser.

Statements by former employees of both UMC and Olin indicate that dumping of organic chemicals (solvents) onto the grounds around process buildings was common. It is likely that this type of activity was also prevalent during the IOP period. Solvents reportedly used and/or dumped by industrial tenants include methylene chloride, methyl ethyl ketone, acetone, trichloroethylene (TCE), and hexane. Documented Olin wastes include the following, among others: beryllium dust; salts of barium, cadmium, chromium, lead, mercury, selenium, and silver; trichloroethane; di-n-octyl phthalate; dimethyl phthalate; toluene di-isocyanate, spent halogenated solvents; and 2-nitrodiphenylamine.

During regular cleaning activities in some process buildings not containing sumps, water was used to hose down the building interiors. The wash water was then allowed to drain out the door onto the surrounding grounds and ditches.

Olin was known to have used the following chemicals at the Refuge, among others: boron, barium nitrate, chromic acid, mercury, copper sulfate, zinc oxide, chloroform, and several phthalates.

Both UMC and CTI reportedly maintained burn pads in Area 2B. Early industrial tenants at the Refuge used burning as a principal means of waste disposal.

3.1.1 LUCIP for AUS-0A2B – IOP Booster Load Line (AUS OU)

3.1.1.1 Site Description and Investigation Results

AUS-0A2B (**Figure 3-1**) is currently part of a remedial investigation conducted by General Dynamics Ordnance and Technical Systems. It was identified in the AUS OU PA/SI as requiring an RI because of exceedances of screening values.

Site Investigation

The SI included sampling of soil, groundwater, surface water and drums.

Notable Contamination Found

TCE was detected in the groundwater at a maximum concentration of 47 micrograms per liter (ug/L). The federal maximum contaminant level (MCL), one of the SI screening criterion, is 5 ug/L for TCE. Cis-1,2-dichloroethene a degradation product of TCE, was detected above the respective SI screening criteria for groundwater. TCE concentrations exceeded screening criteria in the soil.

Detections of 18 semivolatile organic compounds (SVOCs) in soils exceeded SI screening criteria. These included dibenzofuran and 12 polyaromatic hydrocarbons (PAHs), which are products of incomplete combustion; they are all common industrial contaminants. Other SVOCs detected above SI screening criteria included three phthalates, which are common plasticizers; methylnaphthalene, a component of diesel fuel; and carbazole. Carbazole has been found to be common at other propellant manufacturing sites. It is a possible breakdown product of the nitrodiphenylamines used as stabilizers in propellant.

Most inorganic constituents exceeded SI soil screening criteria, including, among others, barium, beryllium, boron, cadmium, copper, cyanide, lead, mercury, selenium, silver, and zinc. Maximum detections included antimony at 56 mg/kg *(background = 0.8 mg/kg)*, lead at 2,000 mg/kg *(background = 23 mg/kg)*, and copper at 1,560 mg/kg *(background = 11 mg/kg)*. Lead detections in surface water exceeded State of Illinois Water Quality Criteria. Several inorganic detections in drum samples exceeded SI screening criteria.

3.1.1.2 LUCIP Objective

The IOP-wide LUCIPs are applicable (Section 2). In addition, because the site is not characterized, another LUCIP objective is to reduce potential for exposure until specific objectives can be identified based on site characterization data. In particular, because of the presence in groundwater and known use of chlorinated solvents at this site, particularly TCE, a specific objective is to prevent harmful exposure to chlorinated solvent vapors.

When the results from the current RI are available, this LUCIP will be reviewed and appropriate modifications made.

3.1.1.3 LUC(s) Implemented to Achieve Objective

In addition to the IOP-wide LUCs, access to this area is restricted to personnel with a specific need to be at the site. No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers. Additionally, soil from this site should not be used for borrow material.

Because standard hand-held organic vapor monitors are not sensitive enough to detect low concentrations that may be harmful, and site-specific soil concentration data are not available, digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts. In the areas around the industrial facilities likely to have used chlorinated solvents, CERCLA staff should be consulted at the time any earthmoving activities are planned or scheduled, other than soil collection by OSHA-trained personnel, as noted above. These areas are shown in **Figure 3-1**. Agricultural use is prohibited at this site.

These LUCs will be modified as appropriate as data are obtained in the RI. In particular, any soil locations with TCE concentrations in excess of 10 mg/kg will be designated as off-limits for excavation except by OSHA-trained and certified work crews. This information will also be updated as EPA finalizes its guidance for TCE exposure.

PPE guidelines are provided for a portion of this site. Refer to Section 1.4.1, Table 1-5, and **Figure 3-1**.

3.1.1.4 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. Other restrictions will depend upon the results of the RI/FS currently in progress.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

3.1.1.5 Applicable Decision Document

There is not yet a decision document for this site.

3.2 AREA 2D

Site Description

Area 2D, the IOP Detonator Load Line, is located on the north side of Area 2 (**Figures 1,7 and 3-2**). The original building complex consisted of 41 buildings. All the building numbers were prefixed with "D-1." Industrial tenants have removed some buildings and added many more. Building numbers now extend into the 90s. This fenced site covers about 150 acres.

Operational History and Waste Characteristics

Detonators produced at the IOP used lead azide, tetryl, and probably mercury fulminate as the explosive charge. Other materials used in production were antimony sulfide and potassium chlorate. Explosives were not manufactured at the IOP; they were shipped in and processed on the load lines.

Since World War II, ordnance and pyrotechnic manufacturers have used Area 2D for production. UMC leased Area 2D from 1953 to 1963. UMC reportedly began with research and development of primary and secondary explosives, pyrotechnic devices, and propellants in Area 2D. Originally UMC's production work at the Refuge consisted mainly of pyrotechnic devices, initiators (fuse trains), large explosive devices, smoke markers, and photoflash shells. UMC's pyrotechnic devices included explosive switches; igniters, detonators, flares and atomic bomb burst simulators. UMC reportedly used lead styphnate and lead azide in their operations.

Olin/Primex/GDO&TS have operated in Area 2D from 1964 to the present. Olin began the bulk of their solid propellant operations (SPO) in Area 2D in 1964. This included gas generators, jet starters (starter cartridges), tank pressurizers, missile guidance control products, and aircraft emergency evacuation slide inflation devices. Solid propellants are manufactured by mixing the propellant components together in a mixer either dry or with a solvent. Powdered lead stearate was reportedly used in the manufacture of gas generators in Area 2D, as was TCE.

Other Olin/Primex/GDO&TS Area 2D products include the Light Antitank Weapon (LAW) rocket, 20mm fuses, boosters, and ammunition ignition mixes. Olin/Primex also used several building in Area 2D for storage of explosive/hazardous waste and used some buildings as explosive scrap pick-up points.

Refer to the discussion under AUS-0A2B above for a description of the dumping of organic chemicals, industrial tenant cleaning activities, chemicals used, waste products, and waste burning.

Both UMC and Olin reportedly maintained burn pads in Area 2D.

3.2.1 LUCIP for AUS-0A2D – IOP Detonator Load Line (AUS OU)

3.2.1.1 Site Description and Investigation Results

AUS-0A2D (**Figure 3-2**) is currently part of a remedial investigation conducted by General Dynamics Ordnance and Technical Systems for the AUS OU. It was identified in the AUS OU PA/SI as requiring an RI because of exceedances of screening values.

Site Investigation

The SI included soil, groundwater, and surface water samples.

Notable Contamination Found

TCE was detected in the groundwater at a maximum concentration of 54,000 ug/L *(MCL = 5 ug/L).* Detections of cis-1,2-dichloroethene and vinyl chloride, degradation products of TCE, also exceeded SI screening criteria for groundwater, as did several other chlorinated volatile organic compounds (VOCs). RDX (Royal Demolition Explosive), was detected in soils at concentrations exceeding SI screening criteria. Detections of several VOCs in soil exceeded SI screening criteria.

Most of the SVOCs that exceeded SI soil screening at AUS-0A2B also exceeded the screening criteria at AUS-0A2D, including the PAHs, the phthalates, methylnaphthalene, dibenzofuran, and carbazole. At AUS-0A2D, concentrations of carbazole and most PAHs were well above screening criteria.

Detections of most inorganics in soils exceeded SI screening criteria, including the same chemicals listed under AUS-0A2B, except that cyanide and selenium did not exceed the criteria at AUS-0A2D. Maximum detections include arsenic at 120 mg/kg *(background = 13 mg/kg),* chromium at 97 mg/*kg (background = 25),* copper at 937 *(background = 11 kg),* silver at 40 mg/kg *(background = 0.6 mg/kg),* and zinc at 1,060 mg/kg *(background = 51 mg/kg).*

3.2.1.2 LUCIP Objective

The IOP-wide LUCIPs are applicable (Section 2). In addition, because the site is not characterized, another LUCIP objective is to reduce potential for exposure until specific objectives can be identified based on site characterization data. In particular, because of the presence in groundwater and known use of chlorinated solvents at this site, particularly TCE, a specific objective is to prevent harmful exposure to chlorinated solvent vapors.

When the results from the current RI are available, this LUCIP will be reviewed and appropriate modifications made.

3.2.1.3 LUC(s) Implemented to Achieve Objective

In addition to the IOP-wide LUCs, access to this area is restricted to personnel with a specific need to be at the site. No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers. Additionally, soil from this site should not be used for borrow material.

Because standard hand-held organic vapor monitors are not sensitive enough to detect low concentrations that may be harmful, and site-specific soil concentration data are not available, digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts. In the areas around the industrial facilities likely to have used chlorinated solvents, CERCLA staff should be consulted at the time any earthmoving activities are planned or scheduled, other than soil collection by OSHA-trained personnel, as noted above. These areas are shown in **Figure 3-2**. Agricultural use is prohibited at this site.

These LUCs will be modified as appropriate as data are obtained in the RI. In particular, any soil locations with TCE concentrations in excess of 10 mg/kg will be designated as off-limits for excavation except by OSHA-trained and certified work crews. This information will also be updated as EPA finalizes its guidance for TCE exposure.

PPE guidelines are provided for a portion of this site. Refer to Section 1.4.1, Table 1-5, and **Figure 3-2**.

3.2.1.4 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. Other restrictions will depend upon the results of the RI/FS currently in progress.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

3.2.1.5 Applicable Decision Document

There is not yet a decision document for this site.

3.2.2 LUCIP for Site 7 – D Area Southeast Drainage Channel (MISCA OU)

3.2.2.1 Site Description

Site 7 of the MISCA OU includes a segment of a drainage channel (intermittent stream) located southeast of the D Area (also known as Area 2D) as shown on **Figure 1-4**. Area 2D was the former IOP Detonator Loading Line. Since the 1950s, this area has been leased by industrial tenants for explosives and munitions manufacturing.

The stream flows south and southwest eventually discharging into Crab Orchard Lake. Other than the intermittent stream as discussed above, there are no other distinguishing surface or subsurface features associated with this site. The suspected sources of contamination at this site are discharges into the drainage channel from industrial activities in this area.

Previous investigations at Site 7 include the 1988 RI and the 1993 Phase I RI.

3.2.2.2 Investigations

1988 RI (O'Brien & Gere)

During the 1988 RI, one sediment sample (0-1 foot deep) and one surface water sample were analyzed. Both samples were analyzed for VOCs, PCBs, pesticides, explosives, and other indicator parameters.

Table 3-1 summarizes only the detected analytical results from both samples.[24] None of the detections exceeded levels of concern established for the 1988 RI. However, as shown in **Table 3-1**, a comparison of the 1988 data with the screening criteria used for this LUCIP shows two potential chemicals of concern for the sediment sample only. Both aluminum and antimony exceeded the following screening criteria in the sediment sample:

- Background Sediment 95% Upper Tolerance Limit (UTL), and
- USEPA Region 9 Residential Soil Preliminary Remediation Goal

1993 Phase I RI (Woodward Clyde)

Sampling performed at Site 7 under the 1993 Phase I was conducted in order to further evaluate the potential risk to human health, wildlife, and the environment. One composite/discrete sediment sample pair was collected. The composite sample (1.7 to 1.8 feet deep) was analyzed for SVOCs,

[24] Note that a number of analytes are not included because these data were later rejected: DPRA Document No. 00018887, a letter from USEPA to USFWS regarding Crab Orchard Lake RI/FS, dated February 18, 1987. A list of the rejected data can be found in the letter. This is true for all references to analytical data from samples in this section collected during the 1988 O'Brien & Gere RI.

PCBs, pesticides, explosives, metals, and cyanide, while the discrete sample (1.9 feet deep) was analyzed for VOCs.

Table 3-1 summarizes only the detected analytical results from the two samples.[25] None of the detections exceeded levels of concern established for the 1993 Phase I RI which determined that no further investigation was necessary. A comparison of the 1993 data with the screening criteria established for this LUCIP shows no potential chemicals of concern (**Table 3-1**).

3.2.2.3 LUCIP Objective

The LUCIP objective is the same as for the entire IOP (see Section 2 – IOP-Wide LUCIPS). Based on the available data, no other restrictions are needed at this time. Additional investigation may be done in this area as part of the AUS OU RI. The need for any additional restrictions will be evaluated as part of that RI.

3.2.2.4 LUC(s) Implemented to Achieve Objective

No additional LUCs beyond the IOP-wide LUCs are needed except that soil from this site should not be used for borrow material.

3.2.2.5 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. However, if additional data show risks not yet identified, additional restrictions may apply.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

3.2.2.6 Applicable Decision Document

The applicable decision document is the Record of Decision, Site 36 of the Miscellaneous Areas Operable Unit, Crab Orchard National Wildlife Refuge NPL Site, Marion, Illinois (USFWS, 2002). While the ROD identifies this site as a "No Action" site, the IOP-wide LUCs are still needed because of the exceedances of screening criteria and lack of groundwater data.

[25] Split samples were taken of both the composite/discreet sample pair. Information other than the location of those samples is not available. The 1993 analytical results for Site 7 shown in Table 6-2 are from the original composite/discrete sample pair.

3.2.3 LUCIP for Site 7A – D Area North Lawn (MISCA OU)

3.2.3.1 Site Description

This site is also located in Area 2D and is part of the MISCA OU. Site 7A, shown on **Figure 1-4**, is located in a 3-acre lawn northwest of Building D-1-35 within the fence line defining Area 2D. There is a drainage channel located south of the lawn extending beneath a fence to the west, flowing some 2,500 feet to Crab Orchard Lake. It was reported that barrels of chemicals were dumped on a knoll in this lawn area. However, during site visits, there was no evidence of a knoll but there were a few depressions in the lawn area. There were no other surface or subsurface features observed in this area.

Previous investigations at Site 7A include the 1988 RI and the 1993 Phase I RI.

3.2.3.2 Investigations

1988 RI (O'Brien & Gere)

During the 1988 RI, several soil samples were analyzed and magnetometer and electromagnetic surveys were performed. Neither survey detected anomalies suggestive of buried metallic objects. Seventeen composite soil samples were collected from three transects established in the three-acre lawn area from the surface (0-6 inches) to depths of 1-2 feet and 2-3 feet.[26] Sixteen of the samples were analyzed for metals, and all 17 samples were analyzed for VOCs, PCBs, pesticides, explosives, and other indicator parameters. One sample was also analyzed for SVOCs.

Table 3-2 summarizes only the detected analytical results from the composite soil samples. None of the detections exceeded levels of concern established for the 1988 RI. However, as shown in **Table 3-2**, a comparison of the 1988 data with the screening criteria used for this LUCIP shows two potential chemicals of concern: aluminum and iron.

Aluminum exceeded the following screening criteria in one surface soil sample:

- Background Soil 95% Upper Tolerance Limit (UTL), and
- USEPA Region 9 Residential Soil Preliminary Remediation Goal

Iron exceeded the following screening criteria in five soil samples (one surface, one 1-2' sample, and two 2-3' samples):

- Background Soil 95% Upper Tolerance Limit (UTL), and
- USEPA Region 9 Residential Soil Preliminary Remediation Goal

[26] The entire lawn area was not included in this site – only the sample locations are a part of this site. These sample locations were not surveyed, but they can be approximated from the figure.

1993 Phase I RI (Woodward Clyde)

Four composite/discrete surface soil sample pairs were collected. The four composite samples (1.4 to 1.7 feet deep) were analyzed for SVOCs, PCBs, pesticides, explosives, metals, and cyanide, while the four discrete samples (1.8 to 1.9 feet deep) were analyzed for VOCs.

Table 3-2 summarizes only the detected analytical results from the eight soil samples. None of the detections exceeded levels of concern established for the 1993 Phase I RI which determined that no further investigation was necessary. A comparison of the 1993 data with the screening criteria established for this LUCIP shows no potential chemicals of concern (**Table 3-2**).

3.2.3.3 LUCIP Objective

Based on the available data, no objectives other than the IOP-wide objectives (Section 2) other are needed at this time. Additional investigation may be done in this area as part of the AUS OU RI. The need for any additional restrictions will be evaluated as part of that RI.

3.2.3.4 LUC(s) Implemented to Achieve Objective

No additional LUCs beyond the IOP-wide LUCs are needed except that soil from this site should not be used for borrow material.

3.2.3.5 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. However, if additional data show risks not yet identified, additional restrictions may apply.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

3.2.3.6 Applicable Decision Document

The applicable decision document is the Record of Decision, Site 36 of the Miscellaneous Areas Operable Unit, Crab Orchard National Wildlife Refuge NPL Site, Marion, Illinois (USFWS, 2002). While the ROD identifies this site as a "No Action" site, the IOP-wide LUCs are still needed because of the exceedances of screening criteria and lack of groundwater data.

3.2.4 LUCIP for Site 8 – D Area Southwest Drainage Channel (MISCA OU)

3.2.4.1 Site Description

Site 8 is located in a perennial stream (south of Area 2D) that receives surface runoff from the active industrial facility in Area 2D (**Figure 1-4**). The stream flows to the southwest for approximately 4,000 feet discharging into Crab Orchard Lake. There are no other distinguishing surface or subsurface features associated with this site. The suspected source of contamination at this site is industrial discharges into streams and drainage ditches from industrial activities in Area 2.

Previous investigations at Site 8 include the 1988 RI and the 1993 Phase I RI.

3.2.4.2 Investigations

1988 RI (O'Brien & Gere)

During the 1988 RI, one sediment sample (0-1 foot deep) and one surface water sample were analyzed for VOCs, PCBs, pesticides, and explosives. **Table 3-3** summarizes only the detected analytical results from these samples. None of the detections exceeded levels of concern established for the 1988 RI, nor did they exceed any screening criteria used for this LUCIP (**Table 3-3**).

1993 Phase I RI (Woodward Clyde)

One composite surface soil sample (1.6-1.7 feet) and two discreet soil samples (1.6 and 1.7 feet) were collected from Site 8. The composite sample was analyzed for SVOCs, PCBs, pesticides, explosives, metals, and cyanide, while the discrete samples (1.9 feet deep) were analyzed for VOCs.

Table 3-3 summarizes only the detected analytical results from the three samples. None of the detections exceeded levels of concern established for the 1993 Phase I RI which determined that no further investigation was necessary. A comparison of the 1993 data with the screening criteria established for this LUCIP shows no potential chemicals of concern (**Table 3-3**).

3.2.4.3 LUCIP Objective

Based on the available data, no objectives other than the IOP-wide objectives are needed at this time. Additional investigation may be done in this area as part of the AUS OU RI. The need for any additional restrictions will be evaluated as part of that RI.

3.2.4.4 LUC(s) Implemented to Achieve Objective

No additional LUCs beyond the IOP-wide LUCs are needed except that soil from this site should not be used for borrow material.

3.2.4.5 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. However, if additional data show risks not yet identified, additional restrictions may apply.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

3.2.4.6 Applicable Decision Document

The applicable decision document is the Record of Decision, Site 36 of the Miscellaneous Areas Operable Unit, Crab Orchard National Wildlife Refuge NPL Site, Marion, Illinois (USFWS, 2002). While the ROD identifies this site as a "No Action" site, the IOP-wide LUCs are still needed because of the lack of groundwater data.

3.3 AREA 2F

Site Description

Area 2F, the IOP Fuse Load Line, is located east of Area 2B and south of Area 2D (**Figures 1-7 and 3-3**). The original Area 2F building complex consisted of 14 buildings, all prefixed with "F-2." Industrial tenants have removed some buildings and added others. This fenced site covers about 125 acres.

Operational History and Waste Characteristics

The IOP Fuse Loading Line was used for manufacturing delays and fuses which included the preparation and loading of black powder, lead azide, antimony sulfide, potassium chlorate, and tetryl.

UMC leased Area 2F from 1959 to 1961. There is little information about UMC's activities in Area 2F.

Olin/Primex/GDO&TS have operated in Area 2F from 1970 to the present. Olin/Primex/GDO&TS manufactured artillery projectiles in Area 2F. Olin also had a metal fabrication operation in Area 2F that used cutting oils and degreasers, including TCE and/or methylene chloride. This area has also been used as a storage facility for components and finished products, as well as for fuels and oxidizers such as magnesium, boron, perchlorates, nitrates, and peroxides. The area has also reportedly been used for manufacturing propellant systems and gas generators.

Refer to the discussion under AUS-0A2B above for a description of the dumping of organic chemicals, industrial tenant cleaning activities, chemicals used, waste products, and waste burning.

A large area that has been used as a dumping ground was observed during the site reconnaissance, at the north end of Area 2F. The materials dumped in the area include soil, trees, construction debris and three boilers.

3.3.1 LUCIP for AUS-0A2F – IOP Fuse Load Line (AUS OU)

3.3.1.1 Site Description and Investigation Results

AUS-0A2F (**Figure 3-3**) is currently part of a remedial investigation conducted by General Dynamics Ordnance and Technical Systems. It was identified in the AUS OU PA/SI as requiring an RI because of exceedances of screening values.

Site Investigation

The SI included soil, groundwater, and surface water samples.

Notable Contamination Found

TCE was detected in the groundwater at a maximum concentration of 2,400 ug/L (MCL = 5 ug/L). Detections of cis-1,2-dichloroethene, tetrachloroethylene, nitrate-nitrite, and phosphorous also exceeded SI screening criteria for groundwater. Detections of TCE and cis-1,2-dichloroethene in soil exceeded SI screening criteria.

Among the SVOCs, nine PAHs exceeded soil screening criteria.

Maximum detections of most inorganic constituents in soils exceeded SI screening criteria, including antimony, boron, cadmium, copper, mercury, silver, and zinc.

3.3.1.2 LUCIP Objective

The IOP-wide LUCIPs are applicable (Section 2). In addition, because the site is not characterized, another LUCIP objective is to reduce potential for exposure until specific objectives can be identified based on site characterization data. In particular, because of the presence in groundwater and known use of chlorinated solvents at this site, particularly TCE, a specific objective is to prevent harmful exposure to chlorinated solvent vapors.

When the results from the current RI are available, this LUCIP will be reviewed and appropriate modifications made.

3.3.1.3 LUC(s) Implemented to Achieve Objective

In addition to the IOP-wide LUCs, access to this area is restricted to personnel with a specific need to be at the site. No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers. Additionally, soil from this site should not be used for borrow material.

Because standard hand-held organic vapor monitors are not sensitive enough to detect low concentrations that may be harmful, and site-specific soil concentration data are not available,

digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts. In the areas around the industrial facilities likely to have used chlorinated solvents, CERCLA staff should be consulted at the time any earthmoving activities are planned or scheduled, other than soil collection by OSHA-trained personnel, as noted above. These areas are shown in **Figure 3-3**. Agricultural use is prohibited at this site.

These LUCs will be modified as appropriate as data are obtained in the RI. In particular, any soil locations with TCE concentrations in excess of 10 mg/kg will be designated as off-limits for excavation except by OSHA-trained and certified work crews. This information will also be updated as EPA finalizes its guidance for TCE exposure.

PPE guidelines are provided for a portion of this site. Refer to Section 1.4.1, Table 1-5, and **Figure 3-3**.

3.3.1.4 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. Other restrictions will depend upon the results of the RI/FS currently in progress.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

3.3.1.5 Applicable Decision Document

There is not yet a decision document for this site.

3.3.2 LUCIP for Site 20 – F Area South Drainage Channel (MISCA OU)[27]

3.3.2.1 Site Description

Site 20 is located in a drainage ditch to of Building F-2-2 in the F Area (also known as Area 2F) as shown on **Figure 1-4**. This drainageway segment receives runoff from a nearby abandoned industrial building where chemicals were reportedly dumped (1988 RI). Area 2F was the former IOP Fuse Loading Line and has been used by industrial tenants primarily for munitions manufacturing since the 1950s.

The drainage ditch flows to the northeast and discharges into an un-named stream that flows southwest discharging into Crab Orchard Lake. There was a sheen on the water in this drainage ditch during 1988 RI sampling activities.

Previous investigations at Site 20 include the 1988 RI, the 1993 Phase I RI, and the 1996 Phase II RI. The limits of Site 20 are defined by the sample locations and the sample depths described below.

3.3.2.2 Investigations

1988 RI (O'Brien & Gere)

During the 1988 RI, one composite sediment sample (0-1ft deep) was analyzed for VOCs, SVOCs, Pesticides, metals, and other indicator parameters.

Table 3-4 summarizes only the detected analytical results from the sediment sample. None of the detections exceeded levels of concern established for the 1988 RI. However, as shown in **Table 3-4**, a comparison of the 1988 data with the screening criteria used for this LUCIP shows one potential chemical of concern:

- N-Nitrosodimethylamine exceeded the USEPA Region 9 Residential Soil Preliminary Remediation Goal

1993 Phase I RI (Woodward Clyde)

One composite/discrete surface soil sample pair was collected. The composite sample (1.0 to 2.0 feet deep) was analyzed for SVOCs, PCBs, pesticides, explosives, metals, and cyanide, while the discrete samples (1.5 feet deep) was analyzed for VOCs.

[27] The 1988 O'Brien & Gere mistakenly refers to this site as the "D Area South Drainage Channel." Site 20 is located within Area 2F and will be noted as the "F Area Drainage Channel" in all tables and text of this document.

Table 3-4 summarizes only the detected analytical results from the soil sample. None of the detections exceeded levels of concern established for the 1993 Phase I RI which determined that no further investigation was necessary. A comparison of the 1993 data with the screening criteria established for this LUCIP shows one potential chemical of concern (**Table 3-4**).

Thallium exceeded the following screening criteria in the soil sample:

- Background Soil 95% Upper Tolerance Limit (UTL), and
- USEPA Region 9 Residential Soil Preliminary Remediation Goal

3.3.2.3 LUCIP Objective

Based on the available data, no objectives other than the IOP-wide objectives are needed at this time. Additional investigation may be done in this area as part of the AUS OU RI. The need for any additional restrictions will be evaluated as part of that RI.

3.3.2.4 LUC(s) Implemented to Achieve Objective

No additional LUCs beyond the IOP-wide LUCs are needed except that soil from this site should not be used as borrow material.

3.3.2.5 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. However, if additional data show risks not yet identified, additional restrictions may apply.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

3.3.2.6 Applicable Decision Document

The applicable decision document is the Record of Decision, Site 36 of the Miscellaneous Areas Operable Unit, Crab Orchard National Wildlife Refuge NPL Site, Marion, Illinois (USFWS, 2002). While the ROD identifies this site as a "No Action" site, the IOP-wide LUCs are still needed because of the exceedances of screening criteria and lack of groundwater data.

3.4 AREA 2P

Site Description

Area 2P, the IOP Primer Load Line, is on the south side of Area 2, and originally consisted of 14 buildings, all designated with "P-1." (**Figures 1-7 and 3-4**). Since the end of World War II, some buildings have been removed and others added by industrial tenants. This fenced site covers about 150 acres.

Operational History and Waste Characteristics

Primers that were loaded at the IOP Primer Loading Line were constructed of inert materials such as brass, onion skin paper, percussion cup and beeswax. They also contained ignitable components such as percussion compounds and black powder, which is made up of potassium nitrate, sulfur, and charcoal.

The only known industrial tenant in Area 2P is Olin/Primex/GDO&TS, which has leased the area from 1957 to the present. Olin's use of Area 2P began with research and development (R&D) of solid propellants, and some production of solid propellants. A small part of Olin's work in the P area was developing ball powder propellant that included materials such as nitroglycerin, di-octyl phthalate, and other plasticizers. Initially, a larger part of Olin's work in Area 2P involved gas generators that included the use of ammonium nitrate with a plastic/rubber base.

Olin's solid propellant R&D activities involved the small scale mixing of solid propellants and their subsequent testing. During the 1970s, Olin began R&D for their ammunition product lines in Area 2P.

Chemicals used in Area 2P include degreasers and solvents used in solid propellant production. Olin used some of the buildings in this area for storage of solvents, plasticizers, propellants, ammunition, incendiary mixes, and for PCB transformers. Olin also used some of the buildings for ballistic testing, black powder screening and pelleting, gas generator testing, and for machine shop activities such as welding, lathing, and degreasing.

Olin also generated the following explosive scrap which was stored at pick up points in Area 2P: J-66 type ammonium perchlorate, ammonium nitrate rubber, perchlorate propellant with iron oxide, composite double base propellant containing aluminum and ammonium perchlorate, and ethyl acetate with scrap propellant. Primex used some of the buildings as 90-day hazardous waste accumulation areas.

3.4.1 LUCIP for AUS-0A2P – IOP Primer Load Line (AUS OU)

3.4.1.1 Site Description and Investigation Results

AUS-0A2P (**Figure 3-4**) is currently part of a remedial investigation conducted by General Dynamics Ordnance and Technical Systems. It was identified in the AUS OU PA/SI as requiring an RI because of exceedances of screening values.

Site Investigation

The SI included soil, groundwater, and surface water samples.

Notable Contamination Found

TCE was detected in the groundwater at a maximum concentration of 110,000 ug/L *(MCL = 5 ug/L).* Other VOCs in groundwater detected above SI screening criteria include trichloroethane, dichloroethane, dichloroethene, chloroform (an industrial solvent), tetrachloroethylene (PCE, used for vapor degreasing of metals), vinyl chloride, nitrate-nitrite and phosphorous. Detections of PCE and TCE in soil exceeded SI screening criteria.

The SVOCs that exceeded soil screening criteria were the same as those in AUS-0A2B, except that two additional PAHs exceeded SI screening criteria, and only two of the three phthalates exceeded the criteria.

Detections of most inorganic constituents in soils exceeded SI screening criteria, including antimony, boron, cadmium, chromium, copper, mercury, selenium, silver, and zinc.

3.4.1.2 LUCIP Objective

The IOP-wide LUCIPs are applicable (Section 2). In addition, because the site is not characterized, another LUCIP objective is to reduce potential for exposure until specific objectives can be identified based on site characterization data. In particular, because of the presence in groundwater and known use of chlorinated solvents at this site, particularly TCE, a specific objective is to prevent harmful exposure to chlorinated solvent vapors.

When the results from the current RI are available, this LUCIP will be reviewed and appropriate modifications made.

3.4.1.3 LUC(s) Implemented to Achieve Objective

In addition to the IOP-wide LUCs, access to this area is restricted to personnel with a specific need to be at the site. No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers. Additionally, soil from this site should not be used for borrow material.

Because standard hand-held organic vapor monitors are not sensitive enough to detect low concentrations that may be harmful, and site-specific soil concentration data are not available, digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts. In the areas around the industrial facilities likely to have used chlorinated solvents, CERCLA staff should be consulted at the time any earthmoving activities are planned or scheduled, other than soil collection by OSHA-trained personnel, as noted above. These areas are shown in **Figure 3-4**. Agricultural use is prohibited at this site.

These LUCs will be modified as appropriate as data are obtained in the RI. In particular, any soil locations with TCE concentrations in excess of 10 mg/kg will be designated as off-limits for excavation except by OSHA-trained and certified work crews. This information will also be updated as EPA finalizes its guidance for TCE exposure.

PPE guidelines are provided for a portion of this site. Refer to Section 1.4.1, Table 1-5, and **Figure 3-4**.

3.4.1.4 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. Other restrictions will depend upon the results of the RI/FS currently in progress.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

3.4.1.5 Applicable Decision Document

There is not yet a decision document for this site.

3.4.2 LUCIP for Site 9 – P Area Northwest Drainage Channel (MISCA OU)

3.4.2.1 Site Description

Site 9 is located in a perennial stream northwest of the P Area (also known as Area 2P) as shown on **Figure 1-4**. Area 2P was the former IOP Primer Loading Line to be used later used by industrial tenants for explosives and munitions manufacturing. This stream, which flows southwest eventually discharging into Crab Orchard Lake, receives runoff from industrial activities in both Areas 2D and 2P. There are no other distinguishing surface or subsurface features associated with this site. The suspected source of contamination at this site is industrial discharges into streams and drainage ditches from industrial activities in Area 2.

Previous investigations at Site 9 include the 1988 RI and the 1993 Phase I RI.

3.4.2.2 Investigations

1988 RI (O'Brien & Gere)

During the 1988 RI, one composite sediment sample (0-1 foot deep) and one composite surface water sample were analyzed. Both samples were analyzed for VOCs, PCBs, pesticides, explosives, and other indicator parameters.

Table 3-5 summarizes only the detected analytical results from these samples. None of the detections exceeded levels of concern established for the 1988 RI. However, as shown in **Table 3-5**, a comparison of the 1988 data with the screening criteria used for this LUCIP shows three potential chemicals of concern: iron, manganese, and Aroclor 1254.

Both iron and manganese exceeded the following screening criteria in the sediment sample:

- Background Sediment 95% Upper Tolerance Limit (UTL), and
- USEPA Region 9 Residential Soil Preliminary Remediation Goal

Aroclor-1254 exceeded the following screening criterion in the sediment sample:

- USEPA Region 9 Residential Soil Preliminary Remediation Goal

1993 Phase I RI (Woodward Clyde)

One composite/discrete sediment sample pair was collected. The composite sample (2.0 to 2.1 feet deep) was analyzed for SVOCs, PCBs, pesticides, explosives, metals, and cyanide, while the discrete sample (2.0 to 2.1 feet deep) was analyzed for VOCs.

Table 3-5 summarizes only the detected analytical results from these samples.[28] None of the detections exceeded levels of concern established for the 1993 Phase I RI which determined that no further investigation was necessary. However, as shown in **Table 3-5**, a comparison of the 1993 data with the screening criteria used for this LUCIP shows one potential chemical of concern. Iron exceeded the following screening criteria in the sediment sample:

- Background Sediment 95% Upper Tolerance Limit (UTL), and
- USEPA Region 9 Residential Soil Preliminary Remediation Goal

3.4.2.3 LUCIP Objective

Based on the available data, no objectives other than the IOP-wide objectives (Section 2) are needed at this time. Additional investigation may be done in this area as part of the AUS OU RI. The need for any additional restrictions will be evaluated as part of that RI.

3.4.2.4 LUC(s) Implemented to Achieve Objective

No additional LUCs beyond the IOP-wide LUCs are needed except that soil from this site should not be used for borrow material.

3.4.2.5 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. However, if additional data show risks not yet identified, additional restrictions may apply.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

3.4.2.6 Applicable Decision Document

The applicable decision document is the Record of Decision, Site 36 of the Miscellaneous Areas Operable Unit, Crab Orchard National Wildlife Refuge NPL Site, Marion, Illinois (USFWS, 2002). While the ROD identifies this site as a "No Action" site, the IOP-wide LUCs are still needed because of the exceedances of screening criteria and lack of groundwater data.

[28] Split samples were taken of both the composite/discreet sample pair. Information other than the location of those samples is not available. The 1993 analytical results for Site 9 shown in Table 6-5 are from the original composite/discrete sample pair.

3.4.3 LUCIP for Site 10 – Waterworks North Drainage Channel (MISCA OU)

3.4.3.1 Site Description

Site 10 is comprised of two drainage ways that converge just prior to discharging into Crab Orchard Lake (**Figures 1-4 and 3-4**). The first segment is located in the southwest-flowing perennial stream northwest of Area 2P, downstream from Site 9; and the second segment is located in a southeast-flowing drainage way just west of the Sites 9/10 perennial stream. The second (southeast-flowing) drainage way discharges into the southwest flowing stream which discharges into Crab Orchard Lake. There are no other distinguishing surface or subsurface features associated with this site. The suspected sourced of contamination at this site are discharges into streams and drainage ditches from industrial activities in Area 2.

Previous investigations at Site 10 include the 1988 RI, the 1993 Phase I RI, and the 1996 Phase II RI.

3.4.3.2 Investigations

1988 RI (O'Brien & Gere)

Two composite surface water samples, two composite sediment samples (0 to 1 foot deep), and five grab sediment samples (0 to 1 foot deep) were collected from this site during both phases of the 1988 RI. One surface water sample and one sediment sample were analyzed for VOCs, pesticides, metals, and other indicator parameters. The second composite sediment sample was analyzed for VOCs, SVOCs, and pesticides. Analytical results for the other surface water sample and all five of the grab sediment samples are considered not usable due to exceedances of holding times and other QA/QC problems. Therefore, those samples are not discussed further in this LUCIP. **Table 3-6** summarizes only the detected analytical results from the viable sample results. None of the detections exceeded levels of concern established for the 1988 RI. Further, a comparison of the 1988 data with the screening criteria established for this LUCIP shows no potential chemicals of concern (**Table 3-6**).

1993 Phase I RI (Woodward Clyde)

Two composite/discrete sediment sample pairs were collected. The two composite samples (1.5 to 2.3 feet deep) were analyzed for SVOCs, PCBs, pesticides, explosives, metals, and cyanide, while the two discrete samples (1.6 to 1.7 feet deep) were analyzed for VOCs.

Table 3-6 summarizes only the detected analytical results from the sediment sample pairs. Some PAHs exceeded levels of concern established for the 1993 Phase I RI resulting in further sampling (Phase II – see 6.5.2.3). A comparison of the 1993 data with the screening criteria established for this LUCIP shows no potential chemicals of concern (**Table 3-6**).

1996 Phase II RI (Woodward Clyde)

Due to the elevated concentrations of some analytes evaluated during the 1993 Phase I investigation, an additional seven discreet sediment samples (ranging from 1 to 1.7 feet deep), plus two soil (0.2 to 2 feet deep) and two surface water samples were collected at Site 10. One of the soil sample was analyzed for metals while both soil samples were analyzed for SVOCs. All seven of the sediment samples were analyzed for SVOCs. One of the sediment samples was also analyzed for VOCs, pesticides, metals and cyanide. Both of surface water samples were analyzed for VOCs, SVOCs, pesticides, metals, and cyanide.

The results of these analyses along with the results of sediment collected for solid phase toxicity testing for the *hyallela azteca* and fat head minnow were used to verify and further delineate the extent of contamination and to perform a baseline risk assessment. Note, sediment collected for the solid phase toxicity testing is not discussed nor used for comparison in this LUCIP.

Table 3-6 summarizes only the detected analytical results from the Phase II samples. Some elevated VOCs were noted in surface water samples, however, the results were below the screening criteria. Further, a baseline ecological risk assessment concluded that Site 10 posed little risk to ecological receptors. The RI concluded that no further action was necessary for Site 10. However, the RI also reported that the Refuge restricts human use of Site 10 and anticipates future restrictions on human use at the site. The report further stated "a human health risk assessment was not conducted at Site 10 since a completed exposure pathway for human risk does not exist at this site."[29]

A comparison of the 1996 data with the screening criteria established for this LUCIP shows several potential chemicals of concern.

Aluminum, arsenic, and iron exceeded the following screening criteria in one sediment sample:

- Background Sediment 95% Upper Tolerance Limit (UTL), and
- USEPA Region 9 Residential Soil Preliminary Remediation Goal

Iron exceeded the following screening criteria in one surface soil sample:

- Background Soil 95% Upper Tolerance Limit (UTL), and
- USEPA Region 9 Residential Soil Preliminary Remediation Goal

Benzo(a)pyrene exceeded the following screening criterion in two sediment samples:

- USEPA Region 9 Residential Soil Preliminary Remediation Goal

Benzo(a)pyrene exceeded the following screening criterion in one sediment sample:

[29] USFWS, April 2002. Record of Decision, Site 36 of the Miscellaneous Areas Operable Unit, Crab Orchard National Wildlife Refuge NPL Site, Marion, Illinois, Pages 14-15 of the Decision Summary.

- IEPA TACO Tier 1 Soil Remediation Objective for Residential Properties (ingestion exposure route)

Benzo(b)fluoranthene and N-Nitroso-di-n-propylamine exceeded the following screening criterion in one sediment sample each:

- USEPA Region 9 Residential Soil Preliminary Remediation Goal

3.4.3.3 LUCIP Objective

The Site 36 Record of Decision, which included Site 10 (see reference below in Section 3.4.3.6) includes land use controls as the remedy for Site 10. The objective of the LUCIP for Site 10 is to implement those controls in accordance with the ROD. Based on the available data, no objectives other than the IOP-wide are needed at this time (**Figure 3-4**). Additional investigation may be done in this area as part of the AUS OU RI. The need for any additional restrictions will be evaluated as part of that RI. The applicable ROD text is as follows (note that Sites 36 and 16 are also included in the discussion):

> Institutional controls will be implemented at Site 36 to ensure that potable water supply wells are not installed at the site in the region of exceedances of MCLs/State of Illinois Class I groundwater standards until groundwater is restored for contaminants of concern. Institutional controls will also be implemented at Sites 10 and 16 to appropriately restrict human access. If future risk assessments show that the sites are appropriate for unrestricted use or reduced limitations on human activity, the institutional controls will be removed or modified as appropriate. These institutional controls will be implemented, maintained, and enforced by DOI/FWS. An Institutional Control Implementation Plan (ICIP) will be prepared as part of the Remedial Design Document. The following items will be included in the ICIP:
>
> • Identification of specific land use restrictions applicable to Sites 10, 16 and 36, the specific geographic extent of the restrictions, and the basis for the restrictions.
>
> • Implementation of enforcement procedures, including control methods, use of existing GIS contaminant database for the site, and visual inspection frequency and methodology.
>
> • Procedure for routine inspection reports.
>
> The exposure assumptions used in the human health risk assessments were consistent with the current human uses of the site. Regarding future land use, any change in land use inconsistent with any land use contained in those

specific exposure assumptions in the risk assessments will require an evaluation of whether the anticipated land use change will pose unacceptable risks to human health and the environment or negatively impact the effectiveness of the selected Site remedy. This is enforceable under the National Wildlife Refuge Administration Act (16USC668dd), Section (d)(3)(A)(I), which requires that the Secretary of the Interior (Secretary)"…shall not initiate or permit a new use of a refuge or expand, renew, or extend an existing use of a refuge, unless the Secretary has determined that the use is a compatible use and that the use is not inconsistent with public safety." The Secretary's determination must be in writing and is subject to public review and comment. Potential land use changes are currently being evaluated through the CCP process that is required by 16USC668dd.

3.4.3.4 LUC(s) Implemented to Achieve Objective

No additional LUCs beyond the IOP-wide LUCs are needed except that soil from this site should not be used for borrow material.

3.4.3.5 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. However, if additional data show risks not yet identified, additional restrictions may apply.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

3.4.3.6 Applicable Decision Document

The applicable decision document is the Record of Decision, Site 36 of the Miscellaneous Areas Operable Unit, Crab Orchard National Wildlife Refuge NPL Site, Marion, Illinois (USFWS, 2002).

3.4.4 LUCIP for Site 11 – P Area Southeast Drainage (MISCA OU)

3.4.4.1 Site Description

Site 11, the P Area Southeast Drainage, is a segment of a perennial stream channel southwest of Area 2P (**Figure 1-4**). This stream segment receives runoff from parts of the active industrial facility at Area 2, and flows southwest then south (approximately 3,000 feet) discharging to Crab Orchard Lake. There are no other distinguishing surface or subsurface features associated with this site. The suspected source of contamination at this site is industrial discharges into streams and drainage ditches from industrial activities in Area 2.

Previous investigations at Site 11 include the 1988 RI and the 1993 Phase I RI.

3.4.4.2 Investigations

1988 RI (O'Brien & Gere)

During the 1988 RI, two sediment samples (0-1 foot deep) and one surface water sample were analyzed. The surface water sample and one of the sediment samples were analyzed for VOCs, PCBs, pesticides, explosives, metals, and other indicator parameters.

Table 3-7 summarizes only the detected analytical results from these samples. None of the detections exceeded levels of concern established for the 1988 RI. Further, a comparison of the 1988 data with the screening criteria established for this LUCIP shows no potential chemicals of concern (**Table 3-7**).

1993 Phase I RI (Woodward Clyde)

One composite/discrete soil pair was collected. The composite sample (1.7 to 1.9 feet deep) was analyzed for SVOCs, PCBs, pesticides, explosives, metals, and cyanide, while the discrete sample (1.3 feet deep) was analyzed for VOCs.

Table 3-7 summarizes only the detected analytical results from the soil sample pair. None of the detections exceeded levels of concern established for the 1993 Phase I RI which determined that no further investigation was necessary. However, as shown in **Table 3-7**, a comparison of the 1993 data with the screening criteria used for this LUCIP shows two potential chemicals of concern.
Arsenic and iron exceeded the following screening criteria in the composite soil sample:

- Background Soil 95% Upper Tolerance Limit (UTL), and
- USEPA Region 9 Residential Soil Preliminary Remediation Goal

3.4.4.3 LUCIP Objective

Based on the available data, no objectives other than the IOP-wide objectives (Section 2) are needed at this time. Additional investigation may be done in this area as part of the AUS OU RI. The need for any additional restrictions will be evaluated as part of that RI.

3.4.4.4 LUC(s) Implemented to Achieve Objective

No additional LUCs beyond the IOP-wide LUCs are needed except that soil from this site should not be used for borrow material.

3.4.4.5 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. However, if additional data show risks not yet identified, additional restrictions may apply.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

3.4.4.6 Applicable Decision Document

The applicable decision document is the Record of Decision, Site 36 of the Miscellaneous Areas Operable Unit, Crab Orchard National Wildlife Refuge NPL Site, Marion, Illinois (USFWS, 2002). While the ROD identifies this site as a "No Action" site, the IOP-wide LUCs are still needed because of the exceedances of screening criteria and lack of groundwater data.

3.4.5 LUCIP for Site 11A – P Area North (MISCA OU)

3.4.5.1 Site Description

Site 11A is located in the northern portion of area 2P near several existing buildings that were reportedly used for storage of materials for explosives production (**Figure 1-4)**. Chemicals were reportedly dumped on the ground in this area which consists of drainage ditches around and near two buildings and an L-shaped walkway. Runoff from this area of the site flows to the drainage ditches that carry the water northwest of Area 2P into a southwest-flowing drainage way discharging into Crab Orchard Lake. Samples were collected from drainage ditches.

Previous investigations at Site 11A include the 1988 RI and the 1993 Phase I RI

3.4.5.2 Investigations

1988 RI (O'Brien & Gere)

During the 1988 RI, five sediment samples (0-1 foot deep) and four soil samples (0-1 foot deep) were analyzed. VOCs, PCBs, and metals were analyzed in all the sediment samples. SVOCs were analyzed in only one sediment sample. Explosives and pesticides were analyzed in four of the sediment samples. All four soil samples were analyzed for VOCs, pesticides, total PCBs, and metals.

Table 3-8 summarizes only the detected analytical results from these samples. None of the detections exceeded levels of concern established for the 1988 RI. However, as shown in **Table 3-8**, a comparison of the 1988 data with the screening criteria used for this LUCIP shows five potential chemicals of concern for sediment and one potential chemical of concern for soil.

Sediment

Aluminum and iron exceeded the following screening criteria in three sediment samples:

- Background Sediment 95% Upper Tolerance Limit (UTL), and
- USEPA Region 9 Residential Soil Preliminary Remediation Goal

Antimony and manganese exceeded the following screening criteria in one sediment sample:

- Background Sediment 95% Upper Tolerance Limit (UTL), and
- USEPA Region 9 Residential Soil Preliminary Remediation Goal

Aroclor-1254 exceeded the following screening criterion in one sediment sample:

- USEPA Region 9 Residential Soil Preliminary Remediation Goal

Soil

Iron exceeded the following screening criteria in two soil samples:
- Background Soil 95% Upper Tolerance Limit (UTL), and
- USEPA Region 9 Residential Soil Preliminary Remediation Goal

1993 Phase I RI (Woodward Clyde)

Four composite/discrete surface soil sample pairs were collected. The four composite samples (1.5 to 1.9 feet deep) were analyzed for SVOCs, PCBs, pesticides, explosives, metals, and cyanide, while the four discrete samples (1.7 to 1.8 feet deep) were analyzed for VOCs.

Table 3-8 summarizes only the detected analytical results from the four sample pairs. None of the detections exceeded levels of concern established for the 1993 Phase I RI which determined that no further investigation was necessary. However, as shown in **Table 3-8**, a comparison of the 1993 data with the screening criteria used for this LUCIP shows two potential chemicals of concern.

Iron and thallium exceeded the following screening criteria in three soil samples:
- Background Soil 95% Upper Tolerance Limit (UTL), and
- USEPA Region 9 Residential Soil Preliminary Remediation Goal

3.4.5.3 LUCIP Objective

Based on the available data, no restrictions other than the IOP-wide restrictions are needed at this time. Additional investigation may be done in this area as part of the AUS OU RI. The need for any additional restrictions will be evaluated as part of that RI.

3.4.5.4 LUC(s) Implemented to Achieve Objective

No additional LUCs beyond the IOP-wide LUCs are needed except that soil from this site should not be used for borrow material.

3.4.5.5 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. However, if additional data show risks not yet identified, additional restrictions may apply.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

3.4.5.6 Applicable Decision Document

The applicable decision document is the Record of Decision, Site 36 of the Miscellaneous Areas Operable Unit, Crab Orchard National Wildlife Refuge NPL Site, Marion, Illinois (USFWS, 2002). While the ROD identifies this site as a "No Action" site, the IOP-wide LUCs are still needed because of the exceedances of screening criteria and lack of groundwater data.

3.5 AREA 2R

Site Description

Area 2R is a railroad spur that was constructed as part of the IOP and has been used by later industrial tenants (**Figures 1-7 and 3-5**).

The site currently consists of two storage areas, a railroad spur and a loading dock. There were originally two rail spurs and one main line.

Operational History and Waste Characteristics

The USFWS operated the railroads on the Refuge from 1947 to 1976. It is assumed that any of the tenants in Area 2 may have used the rail lines and loading docks in Area 2R.

Open storage of materials, a excavation with probable liquid, and a probable horizontal tank were observed on the 1943 aerial photograph. A possible disposal area was noted on the 1980 aerial photograph.

3.5.1 LUCIP for AUS-0A2R – Railroad Spur (AUS OU)

3.5.1.1 Site Description and Investigation Results

AUS-0A2R (**Figure 3-5**) is currently part of a remedial investigation conducted by General Dynamics Ordnance and Technical Systems. It was identified in the AUS OU PA/SI as requiring an RI because of exceedances of screening values.

Site Investigation

The SI included soil and trench water samples; no groundwater monitoring wells were installed.

Notable Contamination Found

Detections of methylnaphthalene and 13 PAHs, common contaminants at rail yards, exceeded SI soil screening criteria. Several inorganic constituents in soil exceeded SI screening criteria, including antimony, barium, boron, cadmium, copper, lead, mercury, and zinc.

3.5.1.2 LUCIP Objective

The IOP-wide LUCIP objectives apply. As with all sites under investigation in the AUS OU RI, exposure should be minimized as much as practicable. RI results may indicate the need for additional restrictions.

When the results from the current RI are available, this LUCIP will be reviewed and appropriate modifications made.

3.5.1.3 LUC(s) Implemented to Achieve Objective

In addition to the IOP-wide LUCs, access to this area is restricted to personnel with a specific need to be at the site. No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers. Additionally, soil from this site should not be used for borrow material.

Because standard hand-held organic vapor monitors are not sensitive enough to detect low concentrations that may be harmful, and site-specific soil concentration data are not available, digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts. In the areas around the industrial facilities likely to have used chlorinated solvents, CERCLA staff should be consulted at the time any earthmoving activities are planned or scheduled, other than soil collection by OSHA-trained personnel, as noted above. These areas are shown in **Figure 3-5**. Agricultural use is prohibited at this site. These LUCs will be modified as appropriate as data are obtained in the RI.

3.5.1.4 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. Other restrictions will depend upon the results of the RI/FS currently in progress.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

3.5.1.5 Applicable Decision Document

There is not yet a decision document for this site.

TABLE 3-1
ANALYTICAL DATA SCREENING FOR
SITE 7 - D AREA SOUTHEAST DRAINAGE CHANNEL
MISCA OU

LAND USE CONTROL IMPLEMENTATION PLAN
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Source	WCC (1993 Phase I)		O'B&G		O'B&G	
Sample ID	COSE0701/2		7-2-3-1		7-1-2-1	
Matrix (soil & sediment values shown in mg/kg; surface water values in ug/L)	Sediment	*R. Code*	Sediment	*R. Code*	Surface Water	*R. Code*
Depth (feet)	1.7-1.8/1.9		0-1		NA	
CONSTITUENT						
Aluminum	9100	H	14400	B H	500	C
Antimony	ND		7.3	B H	ND	
Arsenic	4.4	H	--		--	
Barium	120		114		72	C
Beryllium	0.92		--		--	
Boron			39		30	
Calcium	16000	B	6980	B	19800	C
Chromium	11.5		17		ND	
Cobalt	15	B	8		ND	
Copper	12.2		--		--	
Iron	16000	H	16500	H	3200	C
Lead	11.4		--		--	
Magnesium	9500	B	16700	B	7240	C
Manganese	1040	H	405	H	1500	C
Nickel	11.8		--		--	
Potassium	347					
Silver	0.6		--		--	
Sodium	370		150		4900	C
Thallium	0.33	B				
Vanadium	26		37	B	ND	
Zinc	31		--		--	

Shading indicates constituent exceeded background and at least one screening criterion for inorganics; for all other constituents, shading indicates an exceedance of at least one screening criterion.

Legend
mg/kg = milligrams per kilogram, ug/L = micrograms per Liter
-- = Analyzed but not shown (see Note included in Source (1), below)
NA = Not Applicable or Not Analyzed
ND = Not detected
For data qualifiers, refer to source reports.

Sources:
(1) O'Brien & Gere, 1988. Remedial Investigation Report, Crab Orchard National Wildlife Refuge , August. Note, results for some chemicals reported by O'Brien & Gere (1988 RI) were determined to be not useable; all usable results are considered estimated. For a list of chemicals considered not useable, refer to DPRA Document No. 00018887, a letter dated 02/18/87 from USEPA to USFWS.
(2) Woodward-Clyde, 1996. Remedial Investigation Report, Remedial Investigation Miscellaneous Areas Operable Unit, Crab Orchard National Wildlife Refuge, February.

Reference Codes:
A - Background Soil 95% UTL
B - Background Sediment 95% UTL
C - Background Surface Water 95% UTL
D - IEPA TACO Tier 1 Soil Remediation Objectives for Residential Properties – Ingestion Exposure Route
E - IEPA TACO Tier 1 Soil Remediation Objectives for Residential Properties – Inhalation Exposure Route
F - IEPA TACO Tier 1 Soil Remediation Objectives for Construction Worker Ingestion Exposure Route
G - IEPA TACO Tier 1 Soil Remediation Objectives for Construction Worker Inhalation Exposure Route
H - USEPA Region 9 Residential Soil Preliminary Remediation Goals
I – Illinois General Use Water Quality Standards – Created for the AUS OU, CONWR

TABLE 3-2, ANALYTICAL DATA SCREENING FOR
SITE 7A - D AREA NORTH LAWN, MISCA OU

LAND USE CONTROL IMPLEMENTATION PLAN
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Source	O'B&G		O'B&G		O'B&G		O'B&G		O'B&G		O'B&G		O'B&G		O'B&G		O'B&G		O'B&G		O'B&G	
Sample ID	7A-1-1-1		7A-2-1-1		7A-3-1-1		7A-4-1-1		7A-5-1-1		7A-6-1-1		7A-7-1-1		7A-8-1-1		7A-9-1-1		7A-9-1-6		7A-10-1-1	
Matrix (soil & sediment values shown in mg/kg; surface water values in ug/L)	Soil	*R. Code*	Soil	*R. Code*	Soil	*R. Code*	Soil	*R. Code*	Soil	*R. Code*	Soil	*R. Code*	Soil	*R. Code*	Soil	*R. Code*	Soil	*R. Code*	Soil	*R. Code*	Soil	*R. Code*
Depth (feet)	Surface		0.5-1		1-2		2-3		Surface		0.5-1		1-2		2-3		Surface		Surface		0.5-1	
CONSTITUENT																						
2-Methylnaphthalene																			0.003			
Aluminum	58600	A H	15600	H	27800	H	18500	H	15700	H	14700	H	12800	H	24200	H	8100	H			9290	H
Anthracene																			0.004			
Arsenic	--		--		--		--		--		--		--		--		--		--		--	
Barium	43.6		85.4		98		257	A	120		120		130		130		67.9				129	
Boron			2.9		4.7		4.9		8.3	A	6	A	4.5		6.5	A					2.7	
Butyl benzyl phthalate																			0.022			
Calcium	1510		2160		1000		780		9890	A	12200	A	33300	A	1200		5930	A			2070	
Chromium	6		17		27	A	21		17		17		14		23		10				10	
Cobalt	2		3		5		9		5		5		5		6		3				5	
Copper	--		--		--		--		--		--		--		--		--		--		--	
Di-n-butyl phthalate																			0.013			
Endosulfan																						
Fluoranthene																			0.033			
Iron	59400	A H	14600	H	25300	A H	25300	A H	19000	H	17000	H	14100	H	26100	A H	10100	H			9460	H
Lead	--		--		--		--		--		--		--		--		--		--		--	
Magnesium	1110		2390	A	3110	A	2620	A	5800	A	5720	A	6540	A	2700	A	1930	A			1350	
Manganese	3330	H	455	H	264	H	754	H	775	H	688	H	1090	H	558	H	693	H			1420	H
Mercury	--		--		--		--		--		--		--		--		--		--		--	
Methylene chloride (Dichloromethane)	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Molybdenum											1		4									
Nickel	--		--		--		--		--		--		--		--		--		--		--	
Phenanthrene																			0.021			
Potassium																						
Pyrene																			0.039			
Sodium	40		120		170		220	A	130		140		190	A	290	A	70		263	A	170	
Thallium																						
Titanium	92.2		265		288		319		213		210		237		246		102				99.8	
Vanadium	14		35		54	A	45		39		36		31		48	A	26				31	
Zinc	--		--		--		--		--		--		--		--		--		--		--	

Legend
mg/kg = milligrams per kilogram
ug/L = micrograms per Liter
-- = Analyzed but not shown (see Note included in Source (1), below)
NA = Not Applicable or Not Analyzed
ND = Not detected
For data qualifiers, refer to source reports.

Reference Codes:
A - Background Soil 95% UTL
B - Background Sediment 95% UTL
C - Background Surface Water 95% UTL
D - IEPA TACO Tier 1 Soil Remediation Objectives for Residential Properties – Ingestion Exposure Route
E - IEPA TACO Tier 1 Soil Remediation Objectives for Residential Properties – Inhalation Exposure Route
F - IEPA TACO Tier 1 Soil Remediation Objectives for Construction Worker Ingestion Exposure Route
G - IEPA TACO Tier 1 Soil Remediation Objectives for Construction Worker Inhalation Exposure Route
H - USEPA Region 9 Residential Soil Preliminary Remediation Goals
I – Illinois General Use Water Quality Standards – Created for the AUS OU, CONWR

Shading indicates constituent exceeded background and at least one screening criterion for inorganics; for all other constituents, shading indicates an exceedance of at least one screening criterion.

Sources:
(1) O'Brien & Gere, 1988. Remedial Investigation Report, Crab Orchard National Wildlife Refuge , August. Note, Results for some chemicals reported by O'Brien & Gere (1988 RI) were determined to be not useable; all usable results are considered estimated. For a list of chemicals considered not useable, refer to DPRA Document No. 00018887, a letter dated 02/18/87 from USEPA to USFWS.
(2) Woodward-Clyde, 1996. Remedial Investigation Report, Remedial Investigation Miscellaneous Areas Operable Unit, Crab Orchard National Wildlife Refuge , February.

TABLE 3-2, ANALYTICAL DATA SCREENING FOR
SITE 7A - D AREA NORTH LAWN, MISCA OU

LAND USE CONTROL IMPLEMENTATION PLAN
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Source	O'B&G		O'B&G		O'B&G		O'B&G		O'B&G		O'B&G		WCC (1993 Ph I)		WCC (1993 Ph I)		WCC (1993 Ph I)		WCC (1993 Ph I)	
Sample ID	7A-11-1-1		7A-12-1-1		7A-13-1-1		7A-14-1-1		7A-15-1-1		7A-16-1-1		COSO7A01/2		COSO7A03/4		COSO7A05/6		COSO7A07/8	
Matrix (soil & sediment values shown in mg/kg; surface water values in ug/L)	Soil	*R. Code*	Soil	*R. Code*	Soil	*R. Code*	Soil	*R. Code*	Soil	*R. Code*	Soil	*R. Code*	Soil	*R. Code*	Soil	*R. Code*	Soil	*R. Code*	Soil	*R. Code*
Depth (feet)	1-2		2-3		Surface		0.5-1		1-2		2-3		1.4/1.9		1.5-1.6/1.8		1.6-1.7/1.8		1.5/1.9	
CONSTITUENT																				
2-Methylnaphthalene													ND		ND		ND		ND	
Aluminum	13000	H	16000	H	12300	H	12200	H	16800	H	17600	H	6000		6100		7100		9200	H
Anthracene																				
Arsenic	--		--		--		--		--		--		3.2	H	2.9	H	4.9	H	3.4	H
Barium	109		113		129		85		68.8		460	A	51		130		62		60	
Boron	4.3		5		16	A			3.9		9.3	A								
Butyl benzyl phthalate																				
Calcium			2410		1830		2160		740		680		1180		13000	A	1090		1400	
Chromium	14		17		15		10		18		22		8.1		7.5		8.2		11.6	
Cobalt	5		4		7		4		4		9		3.4							
Copper	--		--		--		--		--		--		5.2		5.7		6.1		9.2	
Di-n-butyl phthalate																				
Endosulfan																				
Fluoranthene																				
Iron	10600	H	19100	H	15700	H	12000	H	16500	H	35600	A H	7800	H	8700	H	8000	H	11800	H
Lead	--		--		--		--		--		--		7.6		7.2		11.4		7.9	
Magnesium	3200	A	2360	A	1630	A	1850	A	2150	A	2900	A	1010		1400		1000		1500	
Manganese	767	H	534	H	1350	H	698	H	166		534	H	410	H	1200	H	310	H	280	H
Mercury	--		--		--		--		--		--		0.04		0.02		0.04			
Methylene chloride (Dichloromethane)	ND		ND		ND		ND		ND		ND		ND		ND		0.014		0.014	
Molybdenum											1									
Nickel	--		--		--		--		--		--		3.6		5.8		3.8		6.6	
Phenanthrene																				
Potassium													310		190		240		350	
Pyrene																				
Sodium	230	A	270	A	110		86		130		280	A	60		120		150		120	
Thallium													0.36							
Titanium	162		235		185		82.2		233		255									
Vanadium	29		41		38		29		38		42		16		18		15		21	
Zinc	--		--		--		--		--		--		21		20		21		28	

Legend
mg/kg = milligrams per kilogram
ug/L = micrograms per Liter
-- = Analyzed but not shown (see Note included in Source (1), below)
NA = Not Applicable or Not Analyzed
ND = Not detected
For data qualifiers, refer to source reports.

Reference Codes:
A - Background Soil 95% UTL
B - Background Sediment 95% UTL
C - Background Surface Water 95% UTL

D - IEPA TACO Tier 1 Soil Remediation Objectives for Residential Properties – Ingestion Exposure Route
E - IEPA TACO Tier 1 Soil Remediation Objectives for Residential Properties – Inhalation Exposure Route
F - IEPA TACO Tier 1 Soil Remediation Objectives for Construction Worker Ingestion Exposure Route
G - IEPA TACO Tier 1 Soil Remediation Objectives for Construction Worker Inhalation Exposure Route
H - USEPA Region 9 Residential Soil Preliminary Remediation Goals
I – Illinois General Use Water Quality Standards – Created for the AUS OU, CONWR

Shading indicates constituent exceeded background and at least one screening criterion for inorganics; for all other constituents, shading indicates an exceedance of at least one screening criterion.

Sources:
(1) O'Brien & Gere, 1988. Remedial Investigation Report, Crab Orchard National Wildlife Refuge , August. Note, Results for some chemicals reported by O'Brien & Gere (1988 RI) were determined to be not useable; all usable results are considered estimated. For a list of chemicals considered not useable, refer to DPRA Document No. 00018887, a letter dated 02/18/87 from USEPA to USFWS.
(2) Woodward-Clyde, 1996. Remedial Investigation Report, Remedial Investigation Miscellaneous Areas Operable Unit, Crab Orchard National Wildlife Refuge , February.

TABLE 3-3
ANALYTICAL DATA SCREENING FOR
SITE 8 - D AREA SOUTHWEST DRAINAGE CHANNEL
MISCA OU

LAND USE CONTROL IMPLEMENTATION PLAN
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Source	WCC (1993 Ph I)		WCC (1993 Ph I)		WCC (1993 Ph I)		O'B&G		O'B&G	
Sample ID	COSO0801		COSO0802		COSO0803		8-2-3-1		8-1-2-1	
Matrix (soil & sediment values shown in mg/kg; surface water values in ug/L)	Soil	*R. Code*	Soil	*R. Code*	Soil	*R. Code*	Sediment	*R. Code*	Surface Water	*R. Code*
Depth (feet)	1.6-1.7		1.7		1.6		0-1		NA	
CONSTITUENT										
4,4'-DDT	ND						0.022		ND	
Acetone			0.07		0.2		ND		ND	
Aluminum	8400	H					9160	H	ND	
Arsenic	2.5	H					--		--	
Barium	150						110		90	C
Beryllium	0.86	A					--		--	
Boron							46		60	
Calcium	2800	A					38200	B	76600	C
Chromium	12						10		ND	
Cobalt	8.5						8		ND	
Copper	10.6						--		--	
Iron	10500	H					15600	H	300	C
Lead	12						--		--	
Magnesium	1800	A					16700	B	16500	C
Manganese	250	H					428	H	160	
Methyl ethyl ketone			ND		0.06					
Methylene chloride (Dichloromethane)			ND		0.008		ND		ND	
Molybdenum									ND	
Nickel	11.5						--		--	
Potassium	310									
Silver	0.74	A					--		--	
Sodium	310	A					100		22000	C
Thallium	0.4									
Titanium							125		ND	
Vanadium	22						20		ND	
Zinc	32						--		--	

Shading indicates constituent exceeded background and at least one screening criterion for inorganics; for all other constituents, shading indicates an exceedance of at least one screening criterion.

Legend
mg/kg = milligrams per kilogram
ug/L = micrograms per Liter
-- = Analyzed but not shown (see Note included in Source (1), below)
NA = Not Applicable or Not Analyzed

For data qualifiers, refer to source reports.

Sources:
(1) O'Brien & Gere, 1988. Remedial Investigation Report, Crab Orchard National Wildlife Refuge , August. Note, Results for some chemicals reported by O'Brien & Gere (1988 RI) were determined to be not useable; all usable results are considered estimated. For a list of chemicals considered not useable, refer to DPRA Document No. 00018887, a letter dated 02/18/87 from USEPA to USFWS.
(2) Woodward-Clyde, 1996. Remedial Investigation Report, Remedial Investigation Miscellaneous Areas Operable Unit, Crab Orchard National Wildlife Refuge , February.

Reference Codes:
A - Background Soil 95% UTL
B - Background Sediment 95% UTL
C - Background Surface Water 95% UTL
D - IEPA TACO Tier 1 Soil Remediation Objectives for Residential Properties – Ingestion Exposure Route
E - IEPA TACO Tier 1 Soil Remediation Objectives for Residential Properties – Inhalation Exposure Route
F - IEPA TACO Tier 1 Soil Remediation Objectives for Construction Worker Ingestion Exposure Route
G - IEPA TACO Tier 1 Soil Remediation Objectives for Construction Worker Inhalation Exposure Route
H - USEPA Region 9 Residential Soil Preliminary Remediation Goals
I – Illinois General Use Water Quality Standards – Created for the AUS OU, CONWR

TABLE 3-4
ANALYTICAL DATA SCREENING FOR
SITE 20 - F AREA DRAINAGE CHANNEL
MISCA OU

LAND USE CONTROL IMPLEMENTATION PLAN
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Source	WCC		O'B&G	
Sample ID	COSO2001		20-2-3-6	
Matrix (soil & sediment values shown in mg/kg; surface water values in ug/L)	Soil	*R. Code*	Sediment	*R. Code*
Depth (feet)	1.0-2.0/1.5		0-1	
CONSTITUENT				
2-Methylnaphthalene	ND		0.321	
Acetone	0.37			
Aluminum	10600	H		
Arsenic	7.3	H	--	
Barium	150			
Beryllium	0.6		--	
Bis(2-ethylhexyl)phthalate	ND		2.32	
Cadmium	0.74	A	--	
Calcium	1900			
Chromium	17			
Cobalt	8.6			
Copper	11.3		--	
Dibenzofuran	ND		0.144	
Fluoranthene	ND		0.057	
Iron	17000	H		
Lead	50	A	--	
Magnesium	2200	A		
Manganese	310	H		
Naphthalene	ND		0.069	
Nickel	19	A	--	
N-Nitrosodimethylamine	ND		0.336	H
Phenanthrene	ND		0.247	
Potassium	550			
Silver	1.5	A	--	
Sodium	200	A	200	
Thallium	0.52	A H		
Vanadium	23			
Zinc	40		--	

Note: The O'Brien & Gere RI mistakenly refers to this site as the "D Area South Drainage Channel." Site 20 is located within Area 2F and will be noted as the "F Area Drainage Channel" in all tables and text of this document.

Shading indicates constituent exceeded background and at least one screening criterion for inorganics; for all other constituents, shading indicates an exceedance of at least one screening criterion.

Legend
mg/kg = milligrams per kilogram, ug/L = micrograms per Liter
-- = Analyzed but not shown (see Note included in Source (1), below)
NA = Not Applicable or Not Analyzed
ND = Not detected
For data qualifiers, refer to source reports.

Sources:
(1) O'Brien & Gere, 1988. Remedial Investigation Report, Crab Orchard National Wildlife Refuge, August. Note, results for some chemicals reported by O'Brien & Gere (1988 RI) were determined to be not useable; all usable results are considered estimated. For a list of chemicals considered not useable, refer to DPRA Document No. 00018887, a letter dated 02/18/87 from USEPA to USFWS.

(2) Woodward-Clyde, 1996. Remedial Investigation Report, Remedial Investigation Miscellaneous Areas Operable Unit, Crab Orchard National Wildlife Refuge February.

Reference Codes:
A - Background Soil 95% UTL
B - Background Sediment 95% UTL
C - Background Surface Water 95% UTL
D - IEPA TACO Tier 1 Soil Remediation Objectives for Residential Properties – Ingestion Exposure Route
E - IEPA TACO Tier 1 Soil Remediation Objectives for Residential Properties – Inhalation Exposure Route
F - IEPA TACO Tier 1 Soil Remediation Objectives for Construction Worker Ingestion Exposure Route
G - IEPA TACO Tier 1 Soil Remediation Objectives for Construction Worker Inhalation Exposure Route
H - USEPA Region 9 Residential Soil Preliminary Remediation Goals
I – Illinois General Use Water Quality Standards – Created for the AUS OU, CONWR

TABLE 3-5
ANALYTICAL DATA SCREENING FOR
SITE 9 - P AREA NORTHWEST DRAINAGE CHANNEL
MISCA OU

LAND USE CONTROL IMPLEMENTATION PLAN
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Source	WCC (1993 Phase I)		O'B&G		O'B&G	
Sample ID	COSE0901/2		9-2-3-1		9-1-2-1	
Matrix (soil & sediment values shown in mg/kg; surface water values in ug/L)	Sediment	*R. Code*	Sediment	*R. Code*	Surface Water	*R. Code*
Depth (feet)	2.0-2.1/2.0-2.1		0-1		NA	
CONSTITUENT						
Aluminum	7800	H	7620	H	ND	
Aroclor 1254	ND		0.249	H	ND	
Arsenic	4.9	H	--		--	
Barium	150		116		51	C
Beryllium	0.89		--		--	
Boron			53		50	
Calcium	2000	B	1800	B	42900	C
Chromium	15		10		ND	
Cobalt	16	B	10	B	ND	
Copper	14		--		--	
Iron	22000	B H	28600	B H	ND	
Lead	15		--		--	
Magnesium	1800		1230		10500	C
Manganese	900	H	1460	B H	ND	
Nickel	16		--		--	
Potassium	470					
Silver	1.7		--		--	
Sodium	180		60		17400	C
Thallium	0.51	B				
Titanium			109		ND	
Vanadium	23		40	B	ND	
Zinc	44		--		--	

Shading indicates constituent exceeded background and at least one screening criterion for inorganics; for all other constituents, shading indicates an exceedance of at least one screening criterion.

Legend
mg/kg = milligrams per kilogram, ug/L = micrograms per Liter
-- = Analyzed but not shown (see Note included in Source (1), below)
NA = Not Applicable or Not Analyzed
ND = Not detected
For data qualifiers, refer to source reports.

Sources:
(1) O'Brien & Gere, 1988. Remedial Investigation Report, Crab Orchard National Wildlife Refuge , August. Note, results for some chemicals reported by O'Brien & Gere (1988 RI) were determined to be not useable; all usable results are considered estimated. For a list of chemicals considred not useable refer to DPRA Document No. 00018887, a letter dated 02/18/87 from USEPA to (USFWS).
(2) Woodward-Clyde, 1996. Remedial Investigation Report, Remedial Investigation Miscellaneous Areas Operable Unit, Crab Orchard National Wildlife Refuge , February.

Reference Codes:
A - Background Soil 95% UTL
B - Background Sediment 95% UTL
C - Background Surface Water 95% UTL
D - IEPA TACO Tier 1 Soil Remediation Objectives for Residential Properties – Ingestion Exposure Route
E - IEPA TACO Tier 1 Soil Remediation Objectives for Residential Properties – Inhalation Exposure Route
F - IEPA TACO Tier 1 Soil Remediation Objectives for Construction Worker Ingestion Exposure Route
G - IEPA TACO Tier 1 Soil Remediation Objectives for Construction Worker Inhalation Exposure Route
H - USEPA Region 9 Residential Soil Preliminary Remediation Goals
I – Illinois General Use Water Quality Standards – Created for the AUS OU, CONWR

TABLE 3-6
ANALYTICAL DATA SCREENING FOR
SITE 10 - WATERWORKS NORTH DRAINAGE CHANNEL
MISCA OU

LAND USE CONTROL IMPLEMENTATION PLAN
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Source	O'B&G		O'B&G		O'B&G		WCC (1993 Phase I)		WCC (1993 Phase I)		WCC (1996 Phase II)		WCC (1996 Phase II)		WCC (1996 Phase II)	
Sample ID	10-1-2-1		10-2-3-4		10-2-3-7		COSE1001/2		COSE1003/4		COSO21001		COSO21002		COSE21001	
Matrix (soil & sediment values shown in mg/kg surface water values in ug/L)	Surface Water	*R. Code*	Sediment	*R. Code*	Sediment	*R. Code*	Sediment	*R. Code*	Sediment	*R. Code*	Soil	*R. Code*	Soil	*R. Code*	Sediment	*R. Code*
Depth (feet)	NA		0-1		0-1		1.5-1.8/1.6		1.8-2.3/1.7		0.2-1		0.2-1		1-3	
CONSTITUENT																
1,2-Dichloroethene	ND		ND		ND		ND		ND						ND	
2,4-Dimethylpheno					0.06		ND		ND		ND		ND			
2-Methylnaphthalene					0.004		ND		ND		ND		ND		ND	
Acenaphthylene							ND		ND		ND		ND		ND	
Acetone							0.083		ND						0.1	
Aluminum	ND		8130	H			5100		7100		13000	H			17600	B H
Anthracene					ND		ND		ND		ND		ND		0.11	
Arsenic	--		--		--		4.6	H	2.9	H	8.2	H			13.3	B H
Barium	44	C	68.8				68		84		142				147	
Benz[a]anthracene					0.025		0.25		ND		ND		ND		0.43	
Benzo[a]pyrene	--		--		--		ND		ND		ND		ND		0.25	D H
Benzo[b]fluoranthene					ND		0.34		ND		ND		ND		0.64	H
Benzo[g,h,i]perylene					ND		ND		ND		ND		ND		0.063	
Benzo[k]fluoranthene					ND		ND		ND		ND		ND		0.25	
Beryllium	--		--		--		ND		ND		0.6				0.74	
Bis(2-ethylhexyl)phthalate					0.54		0.39				0.066		ND		ND	
Boron	50		23												ND	
Butyl benzyl phthalate					0.003		ND		ND		ND		ND		ND	
Calcium	30500	C	1900	B			1500	B	1150		2450				3940	B
Chloroform	ND		ND		ND		ND		ND						ND	
Chromium	ND		10				9.7		12		14.9				23.2	B
Chrysene					ND		ND		ND		ND		ND		0.55	
Cobalt	ND						8.4		10	B	21.2				8.9	
Copper	--		--		--		8.9		8.8		12.3	A			20.2	B
Dibenz[ah]anthracene					ND		ND		ND		ND		ND		0.048	
Fluoranthene					ND		0.69		ND		ND		ND		0.91	
Indeno[1,2,3-cd]pyrene					ND		ND		ND		ND		ND		0.18	
Iron	600	C	9430	H			12800	H	16000	H	20700	A H			28800	B H
Lead	--		--		--		12.8		9.5		14.1				16.4	
Magnesium	9850	C	1160				800		950		2260	A			3080	B
Manganese	270		168				560	H	850	H	1620	H			430	H
Mercury	--		--		--		ND		ND		ND				0.2	
Methyl ethyl ketone	--		--		--		0.00002		ND						0.009	
Methylene chloride	ND		ND		ND		ND		ND						ND	
Nickel	--		--		--		7.7		5.6		14.8				13.8	
N-Nitroso di-n-propylamine					ND		ND		ND		ND		ND		ND	
Phenanthrene					ND		0.45		ND		ND		ND		0.43	
Potassium							390		350		510				825	
Pyrene					0.038		0.51		ND		ND		ND		0.54	
Selenium	--		--		--						2				ND	
Silver	--		--		--		1.24		1.2		1.2	A			ND	
Sodium	16700	C	254				65		89		123				116	
Thallium							0.3		0.29		ND				ND	
Titanium	ND		111													
Trichloroethylene (TCE)	ND		ND		ND										ND	
Vanadium	ND		20				22		23		22.8				32	B
Zinc	--		--		--		34		27		84.5	A			95.5	B

Shading indicates constituent exceeded background and at least one screening criterion for inorganics; for all other constituents, shading indicates exceedance of at least one screening criterion.

Legend
mg/kg = milligrams per kilogram, ug/L = micrograms per Liter
-- = Analyzed but not shown (see Note included in Source (1), below)
ND = Not detected, NA = Not Applicable
For data qualifiers, refer to source reports.
Blank results indicate no analyses for that compound in that sample.
Sources:
(1) O'Brien & Gere, 1988. Remedial Investigation Report, Crab Orchard National Wildlife Refuge, August. Note, Results for some chemicals reported by O'Brien & Gere (1988 RI) were determined to be not useable; all usable results are considered estimated.
(2) Woodward-Clyde, 1996. Remedial Investigation Report, Remedial Investigation Miscellaneous Areas Operable Unit, Crab Orchard National Wildlife Refuge, February.

Reference Codes:
A - Background Soil 95% UTL
B - Background Sediment 95% UTL
C - Background Surface Water 95% UTL
D - IEPA TACO Tier 1 Soil Remediation Objectives for Residential Properties – Ingestion Exposure Route
E - IEPA TACO Tier 1 Soil Remediation Objectives for Residential Properties – Inhalation Exposure Route
F - IEPA TACO Tier 1 Soil Remediation Objectives for Construction Worker Ingestion Exposure Route
G - IEPA TACO Tier 1 Soil Remediation Objectives for Construction Worker Inhalation Exposure Route
H - USEPA Region 9 Residential Soil Preliminary Remediation Goals
I – Illinois General Use Water Quality Standards – Created for the AUS OU, CONWR

TABLE 3-6
ANALYTICAL DATA SCREENING FOR
SITE 10 - WATERWORKS NORTH DRAINAGE CHANNEL
MISCA OU

LAND USE CONTROL IMPLEMENTATION PLAN
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Source	WCC (1996 Phase II)		WCC (1996 Phase II)		WCC (1996 Phase II)		WCC (1996 Phase II)		WCC (1996 Phase II)		WCC (1996 Phase II)		WCC (1996 Phase II)		WCC (1996 Phase II)	
Sample ID	COSE21002		COSE21003		COSE21004		COSE21005		COSE21006		COSE21007		COSE21008		COSW21001	
Matrix (soil & sediment values shown in mg/kg, surface water values in ug/L)	Sediment	*R. Code*	Sediment	*R. Code*	Sediment	*R. Code*	Sediment	*R. Code*	Sediment	*R. Code*	Sediment	*R. Code*	Sediment	*R. Code*	Surface Water	*R. Code*
Depth (feet)	1-2		1.3-1.7		1.1-1.3		1.2-1.5		1-1.3		1.2-1.5				NA	
CONSTITUENT																
1,2-Dichloroethene													ND		ND	
2,4-Dimethylpheno					ND						ND		ND		ND	
2-Methylnaphthalene	ND		ND		ND		ND		ND		ND		ND		ND	
Acenaphthylene	ND		ND		ND		ND		ND		ND		ND		ND	
Acetone													ND		ND	
Aluminum													8410	H	1350	C
Anthracene	ND		ND		ND		ND		ND		ND		ND		ND	
Arsenic													8.8	H	7	
Barium													59.8		37.9	C
Benz[a]anthracene	ND		ND		ND		ND		ND		ND		0.1		ND	
Benzo[a]pyrene	ND		ND		ND		ND		ND		ND		0.067	H	ND	
Benzo[b]fluoranthene	ND		ND		ND		ND		ND		ND		0.15		ND	
Benzo[g,h,i]perylene	ND		ND		ND		ND		ND		ND		ND		ND	
Benzo[k]fluoranthene	ND		ND		ND		ND		ND		ND		0.071		ND	
Beryllium													0.24		ND	
Bis(2-ethylhexyl)phthalat	ND		ND		ND		ND		ND		ND		0.045		ND	
Boron																
Butyl benzyl phthalate	ND		ND		ND		ND		ND		ND		ND		ND	
Calcium													93300	B	21800	C
Chloroform													ND		ND	
Chromium													10.1		ND	
Chrysene	ND		ND		ND		ND		ND		ND		0.12		ND	
Cobalt													5.6		ND	
Copper													10.7		ND	
Dibenz[ah]anthracene	ND		ND		ND		ND		ND		ND		ND		ND	
Fluoranthene	ND		ND		ND		ND		ND		ND		0.24		ND	
Indeno[1,2,3-cd]pyrene	ND		ND		ND		ND		ND		ND		0.055		ND	
Iron													13600	H	1480	C
Lead													11.4		ND	
Magnesium													9180	B	5260	C
Manganese													495	H	276	
Mercury													0.12		ND	
Methyl ethyl ketone													0.004		ND	
Methylene chloride													ND		ND	
Nickel													7		ND	
N-Nitroso di-n-propylamine	ND		ND		ND		ND		ND		ND		0.35	H	ND	
Phenanthrene	ND		ND		ND		ND		ND		ND		0.1		ND	
Potassium													451		3280	C
Pyrene	ND		ND		ND		ND		ND		ND		0.14		ND	
Selenium													1.3	B	ND	
Silver													ND		ND	
Sodium													81.3		7850	C
Thallium													ND		ND	
Titanium																
Trichloroethylene (TCE)													ND		5	
Vanadium													21.3		3.4	
Zinc													187	B	ND	

Shading indicates constituent exceeded background and at least one screening criterion for inorganics; for all other constituents, shading indicates exceedance of at least one screening criterion.

Legend
mg/kg = milligrams per kilogram, ug/L = micrograms per Liter
-- = Analyzed but not shown (see Note included in Source (1), below)
ND = Not detected, NA = Not Applicable
For data qualifiers, refer to source reports.
Blank results indicate no analyses for that compound in that sample.
Sources:
(1) O'Brien & Gere, 1988. Remedial Investigation Report, Crab Orchard National Wildlife Refuge, August. Note, Results for some chemicals reported by O'Brien & Gere (1988 RI) were determined to be not useable; all usable results are considered estimated.
(2) Woodward-Clyde, 1996. Remedial Investigation Report, Remedial Investigation Miscellaneous Areas Operable Unit, Crab Orchard National Wildlife Refuge, February.

Reference Codes:
A - Background Soil 95% UTL
B - Background Sediment 95% UTL
C - Background Surface Water 95% UTL
D - IEPA TACO Tier 1 Soil Remediation Objectives for Residential Properties – Ingestion Exposure Route
E - IEPA TACO Tier 1 Soil Remediation Objectives for Residential Properties – Inhalation Exposure Route
F - IEPA TACO Tier 1 Soil Remediation Objectives for Construction Worker Ingestion Exposure Route
G - IEPA TACO Tier 1 Soil Remediation Objectives for Construction Worker Inhalation Exposure Route
H - USEPA Region 9 Residential Soil Preliminary Remediation Goals
I – Illinois General Use Water Quality Standards – Created for the AUS OU, CONWR

TABLE 3-6
ANALYTICAL DATA SCREENING FOR
SITE 10 - WATERWORKS NORTH DRAINAGE CHANNEL
MISCA OU

LAND USE CONTROL IMPLEMENTATION PLAN
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Source	WCC (1996 Phase II)		WCC (1996 Phase II)	
Sample ID	COSW21002		COSW21003	
Matrix (soil & sediment values shown in mg/kg, surface water values in ug/L)	Surface Water	*R. Code*	Surface Water	*R. Code*
Depth (feet)	NA		NA	
CONSTITUENT				
1,2-Dichloroethene	23		ND	
2,4-Dimethylphenol	ND		ND	
2-Methylnaphthalene	ND		ND	
Acenaphthylene	ND		ND	
Acetone	ND		ND	
Aluminum	1570	C	1480	C
Anthracene	ND		ND	
Arsenic	6.3		5.1	
Barium	52.3	C	38.2	C
Benz[a]anthracene	ND		ND	
Benzo[a]pyrene	ND		ND	
Benzo[b]fluoranthene	ND		ND	
Benzo[g,h,i)perylene	ND		ND	
Benzo[k]fluoranthene	ND		ND	
Beryllium	ND		ND	
Bis(2-ethylhexyl)phthalate	ND		ND	
Boron				
Butyl benzyl phthalate	ND		ND	
Calcium	36500	C	21800	C
Chloroform	4		ND	
Chromium	ND		ND	
Chrysene	ND		ND	
Cobalt	ND		ND	
Copper	ND		ND	
Dibenz[ah]anthracene	ND		ND	
Fluoranthene	ND		ND	
Indeno[1,2,3-cd]pyrene	ND		ND	
Iron	1650	C	1530	C
Lead	ND		ND	
Magnesium	9750	C	5280	C
Manganese	160		287	
Mercury	ND		ND	
Methyl ethyl ketone	ND		ND	
Methylene chloride	ND		ND	
Nickel	ND		ND	
N-Nitroso di-n-propylamine	ND		ND	
Phenanthrene	ND		ND	
Potassium	4840	C	3390	C
Pyrene	ND		ND	
Selenium	ND		ND	
Silver	ND		ND	
Sodium	36100	C	8760	C
Thallium	ND		ND	
Titanium				
Trichloroethylene (TCE)	46	I	5	
Vanadium	3.5		2.3	
Zinc	ND		ND	

Shading indicates constituent exceeded background and at least one screening criterion for inorganics; for all other constituents, shading indicates exceedance of at least one screening criterion.

Legend
mg/kg = milligrams per kilogram, ug/L = micrograms per Liter
-- = Analyzed but not shown (see Note included in Source (1), below)
ND = Not detected
For data qualifiers, refer to source reports.

Sources:
(1) O'Brien & Gere, 1988. Remedial Investigation Report, Crab Orchard National Wildlife Refuge, August. Note, Results for some chemicals reported by O'Brien & Gere (1988 RI) were determined to be not useable; all usable results are considered estimated.
(2) Woodward-Clyde, 1996. Remedial Investigation Report, Remedial Investigation Miscellaneous Areas Operable Unit, Crab Orchard National Wildlife Refuge, February.

Reference Codes:
A - Background Soil 95% UTL
B - Background Sediment 95% UTL
C - Background Surface Water 95% UTL
D - IEPA TACO Tier 1 Soil Remediation Objectives for Residential Properties – Ingestion Exposure Route
E - IEPA TACO Tier 1 Soil Remediation Objectives for Residential Properties – Inhalation Exposure Route
F - IEPA TACO Tier 1 Soil Remediation Objectives for Construction Worker Ingestion Exposure Route
G - IEPA TACO Tier 1 Soil Remediation Objectives for Construction Worker Inhalation Exposure Route
H - USEPA Region 9 Residential Soil Preliminary Remediation Goals
I – Illinois General Use Water Quality Standards – Created for the AUS OU, CONWR

TABLE 3-7
ANALYTICAL DATA SCREENING FOR
SITE 11 - P AREA SOUTHEAST DRAINAGE CHANNEL
MISCA OU

LAND USE CONTROL IMPLEMENTATION PLAN
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Source	O'B&G		O'B&G		O'B&G		WCC (1993 Ph I)		WCC (1993 Ph I)	
Sample ID	11-1-2-1		11-2-3-1		11-2-3-6		COSO1101		COSO1102	
Matrix (soil & sediment values shown in mg/kg; surface water values in ug/L)	Surface Water	*R. Code*	Sediment	*R. Code*	Sediment	*R. Code*	Soil	*R. Code*	Soil	*R. Code*
Depth (feet)	NA		0-1		0-1		1.7-1.9		1.3	
CONSTITUENT										
1,1-Dichloroethylene	ND		ND		0.014				ND	
2-Methylnaphthalene					0.004		ND			
Acetone									0.28	
Aluminum	ND		11200	H			12400	H		
Arsenic	--		--				15	A H		
Barium	44	C	91.1				130			
Benzyl alcohol					0.008					
Beryllium	--		--		--		1	A		
Boron	50		45							
Bromodichloromethane	3		ND		ND				ND	
Cadmium	--		--		--		0.73	A		
Calcium	44100	C	3220	B			2200			
Carbon disulfide					0.003				ND	
Chlorobenzene	ND		ND		0.002				ND	
Chloroform	31		ND		0.006				ND	
Chromium	ND		20	B			20			
Cobalt	ND		10	B			9.9			
Copper	--		--		--		16	A		
HMX	8		ND				ND			
Iron	ND		20400	H			26000	A H		
Lead	--		--		--		12.3			
Magnesium	10600	C	1550				1800	A		
Manganese	95		986	H			420	H		
Nickel	--		--		--		11.8			
Potassium							659	A		
Silver	--		--		--		1.6	A		
Sodium	18300	C	100		240		710	A		
Thallium							0.33			
Titanium	ND		104							
Toluene	ND		ND		0.002				ND	
Vanadium	ND		37	B			43			
Zinc	--		--		--		71	A		

Shading indicates constituent exceeded background and at least one screening criterion for inorganics; for all other constituents, shading indicates an exceedance of at least one screening criterion.

Legend

mg/kg = milligrams per kilogram, ug/L = micrograms per Liter
-- = Analyzed but not shown (see Note included in Source (1), below)
ND = Not detected
For data qualifiers, refer to source reports.

Blank results indicate no analyses for that compound in that sample.
NA = Not Applicable

Sources:

(1) O'Brien & Gere, 1988. Remedial Investigation Report, Crab Orchard National Wildlife Refuge , August. Note, Results for some chemicals reported by O'Brien & Gere (1988 RI) were determined to be not useable; all usable results are considered estimated. For a list of chemicals considered not useable, refer to DPRA Document No. 00018887, a letter dated 02/18/87 from USEPA to USFWS.

(2) Woodward-Clyde, 1996. Remedial Investigation Report, Remedial Investigation Miscellaneous Areas Operable Unit, Crab Orchard National Wildlife Refuge , February.

Reference Codes:

A - Background Soil 95% UTL
B - Background Sediment 95% UTL
C - Background Surface Water 95% UTL
D - IEPA TACO Tier 1 Soil Remediation Objectives for Residential Properties – Ingestion Exposure Route
E - IEPA TACO Tier 1 Soil Remediation Objectives for Residential Properties – Inhalation Exposure Route
F - IEPA TACO Tier 1 Soil Remediation Objectives for Construction Worker Ingestion Exposure Route
G - IEPA TACO Tier 1 Soil Remediation Objectives for Construction Worker Inhalation Exposure Route
H - USEPA Region 9 Residential Soil Preliminary Remediation Goals
I – Illinois General Use Water Quality Standards – Created for the AUS OU, CONWR

TABLE 3-8, ANALYTICAL DATA SCREENING FOR
SITE 11A - P AREA NORTH, MISCA OU

LAND USE CONTROL IMPLEMENTATION PLAN
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Source	O'B&G		O'B&G		O'B&G		O'B&G		O'B&G		O'B&G		O'B&G		O'B&G		O'B&G		WCC (1993 Ph I)		WCC (1993 Ph I)		WCC (1993 Ph I)		WCC (1993 Ph I)	
Sample ID	11A-1-3-1		11A-2-3-1		11A-3-3-1		11A-3-3-6		11A-4-3-1		11A-5-1-1		11A-6-1-1		11A-7-1-1		11A-8-1-1		COSO11A01/5		COSO11A02/6		COSO11A03/7		COSO11A04/8	
Matrix (soil & sediment values shown in mg/kg; surface water values in ug/L)	Sediment	*R. Code*	Sediment	*R. Code*	Sediment	*R. Code*	Sediment	*R. Code*	Sediment	*R. Code*	Soil	*R. Code*	Soil	*R. Code*	Soil	*R. Code*	Soil	*R. Code*	Soil	*R. Code*	Soil	*R. Code*	Soil	*R. Code*	Soil	*R. Code*
Depth (feet)	0-1		0-1		0-1		0-1		0-1		0-1		0-1		0-1		0-1		1.5-1.6/1.7		1.7-1.9/1.7		1.7-1.8/1.7		1.7-1.8/1.8	
CONSTITUENT																										
1,1,2-Trichloroethane	ND		ND		ND		0.019		ND		ND		ND		ND		ND		ND		ND		ND		ND	
2,4,6-Trinitrotoluene	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		0.38		ND	
2-Methylnaphthalene							0.003												ND		ND		ND		ND	
2-Methylphenol (o-Cresol)							0.004												ND		ND		ND		ND	
Acetone							0.43												ND		ND		ND		0.052	
Aluminum	21800	B H	23200	B H	16800	B H			15700		9780	H	15100	H	9640	H	11600	H	12100	H	10800	H	16000	H	9400	H
Antimony	ND		ND		11	B H			ND		ND		ND		ND		ND		ND		ND		ND		ND	
Aroclor 1254	ND		ND		0.892	H	ND		0.279		ND		ND		ND		ND		ND		ND		ND		ND	
Arsenic	--		--		--		--		--		--		--		--		--		7.2	H	6	H	5.9	H	7.4	H
Barium	127		123		135				102		66.5		109		72.9		96.5		88		190		108		180	
Boron	8.4		8.4		7.4				3		14	A	4.4		16	A	14	A								
Bromoform	ND		ND		ND		0.007		ND		ND		ND		ND		ND				ND					
Butyl benzyl phthalate							0.049																			
Calcium	1200		2930	B	2860	B			1610		44200	A	2140		50500	A			26000	A	2000		1600		2300	
Chloroform	ND		ND		ND		0.004		ND		ND		ND		ND		ND				ND					
Chromium	25	B	26	B	20	B			18		10		19		10		17		15		16		20		14.2	
Cobalt	7		6		9				10		10		10		3		6		8.6		12.4		7.1		9.5	
Copper	--		--		--		--		--		--		--		--		--		15	A	19	A	18	A	12.6	A
Di-n-butyl phthalate							0.024																			
Heptachlor epoxide	ND		ND				ND		ND		ND		ND		ND		ND		0.0044		ND		ND		ND	
Iron	26400	B H	27100	B H	22200	B H			21800		12600	H	22500	A H	11700	H	36200	A H	20000	A H	20000	A H	22000	A H	15000	H
Lead	--		--		--		--		--		--		--		--		--		16		10.2		12		12.7	
Magnesium	3610	B	3910	B	2930	B			2410		26900	A	2740	A	29900	A	15100	A	17000	A	2600	A	2600	A	1800	A
Manganese	314	H	428	H	1180	B H			852		567	H	733	H	639	H	939	H	690	H	580	H	320	H	610	H
Mercury	--		--		--		--		--		--		--		--		--		0.02		ND		0.02		0.04	
Methyl ethyl ketone	--		--		--		--		--		--		--		--		--		ND		ND		0.004		0.014	
Methylene chloride	ND		ND		ND		0.027		ND		ND		ND		ND		ND		0.007		ND		ND		0.017	
Nickel	--		--		--		--		--		--		--		--		--		11		15		11.2		8.8	
Phenol							0.028												ND		ND		ND		ND	
Potassium																			740	A	600		720	A	610	
Silver	--		--		--		--		--		--		--		--		--		1.8	A	1.08	A	1.09	A	0.86	A
Sodium	110		89		80		324		60		100		70		110		87		67		140		72		64	
Thallium																			0.55	A H	0.54	A H	0.56	A H	0.36	
Titanium	430		370		388				249		192		251		136		261									
Vanadium	54	B	53	B	46	B			42		23		38		22		29		27		22		24		26	
Zinc	--		--		--		--		--		--		--		--		--		45		59	A	51		115	A

Legend
mg/kg = milligrams per kilogram, ug/L = micrograms per Liter
-- = Analyzed but not shown (see Note included in Source (1), below)
ND = Not detected
For data qualifiers, refer to source reports.
Blank results indicate no analyses for that constituent in that sample.
NA = Not Applicable

Reference Codes:
A - Background Soil 95% UTL
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D - IEPA TACO Tier 1 Soil Remediation Objectives for Residential Properties – Ingestion Exposure Route
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F - IEPA TACO Tier 1 Soil Remediation Objectives for Construction Worker Ingestion Exposure Route
G - IEPA TACO Tier 1 Soil Remediation Objectives for Construction Worker Inhalation Exposure Route
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I – Illinois General Use Water Quality Standards – Created for the AUS OU, CONWR

Shading indicates constituent exceeded background and at least one screening criterion for inorganics; for all other constituents, shading indicates an exceedance of at least one screening criterion.

Sources:

(1) O'Brien & Gere, 1988. Remedial Investigation Report, Crab Orchard National Wildlife Refuge , August. Note, Results for some chemicals reported by O'Brien & Gere (1988 RI) were determined to be not useable; all usable results are considered estimated. For a list of chemicals considered not useable, refer to DPRA Document No. 00018887, a letter from USEPA to USFWS.
(2) Woodward-Clyde, 1996. Remedial Investigation Report, Remedial Investigation Miscellaneous Areas Operable Unit, Crab Orchard National Wildlife Refuge , February.

AUS-0A2B Figure 3-1

IOP Wide Restrictions

-No production water wells shall be installed.
-Residential use and camping are prohibited.

AUS-0A2B Restrictions

-Access to this area is restricted to personnel with a specific need to be at the site.
-No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers.
-Agricultural uses are prohibited at this site.
-Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts.
-Soil from this site should not be used for borrow material.
-CERCLA staff should be consulted at the time any earthmoving activities are planned or scheduled.

AUS-0A2B Personal Protective Equipment (PPE) Recommendations

Level C*
-Full or half-face, air purifying respirator (NIOSH approved).
-Hooded or non-hooded (based on task-specific potential for splashing and/or dust generation) Chemical-resistant clothing (overalls with long-sleeved jacket; coveralls; or one or two-piece splash suit; disposable chemical-resistant overalls).
-Coveralls (optional, as applicable).
-Gloves, outer, chemical-resistant.
-Gloves, inner, chemical-resistant.
-Boots, chemical-resistant, protective steel toe and shank.
-Hard hat (under suit, optional, as applicable).
-Face shield (optional, as applicable).

Level D1*
-Dust mask, snug-fitting.
-Hooded chemical-resistant clothing (overalls with long-sleeved jacket; coveralls; or one or two-piece splash suit; disposable chemical-resistant overalls) if potentially exposed to groundwater at bottom of trench or excavation.
-Coveralls (optional, as applicable).
-Gloves, outer, chemical-resistant.
-Gloves, inner, chemical-resistant.
-Boots, chemical-resistant, protective steel toe and shank.
-Hard hat (optional, as applicable).
-Face shield (optional, as applicable).

Level D2*
-Same as Level D1 without the dust mask.

*Applies only if there are excavation activities in the area.

Area 2D
B-2-16
B-2-23
B-2-27
Area 2F
*Level C PPE recommended for workers in an excavation.
*Level D1 PPE recommended for workers outside excavated area if airborne dust is visible.
*Level D2 PPE recommended for workers outside excavated area if airborne dust is not visible.
*Level C PPE Recommended for Workers in an Excavation
AUS 0A2B
B-2-1
B-2-2
Area 2B
B-2-10
Wolf Creek Road

AUS-0A2B
February 2007
PPE Recommendations
AUS RIFS Boundaries
Area 2B Buildings
Roads and Parking
0 50 100 200 Feet
N

IOP Wide Restrictions

-No production water wells shall be installed.
-Residential use and camping are prohibited.

AUS-0A2D Restrictions

-Access to this area is restricted to personnel with a specific need to be at the site.
-No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers.
-Agricultural uses are prohibited at this site.
-Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts.
-Soil from this site should not be used for borrow material.
-CERCLA staff should be consulted at the time any earthmoving activities are planned or scheduled.

AUS-0A2D Personal Protective Equipment (PPE) Recommendations

Level C*
-Full or half-face, air purifying respirator (NIOSH approved).
-Hooded or non-hooded (based on task-specific potential for splashing and/or dust generation) Chemical-resistant clothing (overalls with long-sleeved jacket; coveralls; or one or two-piece splash suit; disposable chemical-resistant overalls).
-Coveralls (optional, as applicable).
-Gloves, outer, chemical-resistant.
-Gloves, inner, chemical-resistant.
-Boots, chemical-resistant, protective steel toe and shank.
-Hard hat (under suit, optional, as applicable).
-Face shield (optional, as applicable).

Level D1*
-Dust mask, snug-fitting.
-Hooded chemical-resistant clothing (overalls with long-sleeved jacket; coveralls; or one or two-piece splash suit; disposable chemical-resistant overalls) if potentially exposed to groundwater at bottom of trench or excavation.
-Coveralls (optional, as applicable).
-Gloves, outer, chemical-resistant.
-Gloves, inner, chemical-resistant.
-Boots, chemical-resistant, protective steel toe and shank.
-Hard hat (optional, as applicable).
-Face shield (optional, as applicable).

Level D2*
-Same as Level D1 without the dust mask.

*Applies only if there are excavation activities in the area.

Post Oak Road
Wolf Creek Road

AUS 0A2D

D-1-35
D-1-36
D-1-13
D-1-6
D-1-7
D-1-8
D-1-90
D-1-4
D-1-11
D-1-25
D-1-27P

*Level C PPE recommended for Workers in an Excavation

Area 2B
Area 2D
Area 2F

*Level C PPE recommended for workers in an excavation.

*Level D1 PPE recommended for workers outside excavated area if airborne dust is visible.

*Level D2 PPE recommended for workers outside excavated area if airborne dust is not visible.

AUS-0A2D
February 2007
PPE Recommendations
AUS RIFS Boundaries
Area 2D Buildings
Streams
Roads and Parking
0 100 200 Feet
N

AUS-0A2F
Figure 3-3

AREA 2B

*Level C PPE Recommended for Workers in an Excavation.

AUS 0A2F

F-2-2
F-2-10
F-2-45
F-2-11
F-2-9
F-2-12
F-2-1

Area 2F

*Level C PPE recommended for workers in an excavation.

*Level D1 PPE recommended for workers outside excavated area if airborne dust is visible.

*Level D2 PPE recommended for workers outside excavated area if airborne dust is not visible.

IOP Wide Restrictions

-No production water wells shall be installed.
-Residential use and camping are prohibited.

AUS-0A2F Restrictions

-Access to this area is restricted to personnel with a specific need to be at the site.
-No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers.
-Agricultural uses are prohibited at this site.
-Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts.
-Soil from this site should not be used for borrow material.
-CERCLA staff should be consulted at the time any earthmoving activities are planned or scheduled.

AUS-0A2F Personal Protective Equipment (PPE) Recommendations

Level C*
-Full or half-face, air purifying respirator (NIOSH approved).
-Hooded or non-hooded (based on task-specific potential for splashing and/or dust generation) Chemical-resistant clothing (overalls with long-sleeved jacket; coveralls; or one or two-piece splash suit; disposable chemical-resistant overalls).
-Coveralls (optional, as applicable).
-Gloves, outer, chemical-resistant.
-Gloves, inner, chemical-resistant.
-Boots, chemical-resistant, protective steel toe and shank.
-Hard hat (under suit, optional, as applicable).
-Face shield (optional, as applicable).

Level D1*
-Dust mask, snug-fitting.
-Hooded chemical-resistant clothing (overalls with long-sleeved jacket; coveralls; or one or two-piece splash suit; disposable chemical-resistant overalls) if potentially exposed to groundwater at bottom of trench or excavation.
-Coveralls (optional, as applicable).
-Gloves, outer, chemical-resistant.
-Gloves, inner, chemical-resistant.
-Boots, chemical-resistant, protective steel toe and shank.
-Hard hat (optional, as applicable).
-Face shield (optional, as applicable).

Level D2*
-Same as Level D1 without the dust mask.

AUS-0A2F
February 2007
PPE Recommendations
AUS RIFS Boundaries
Area 2F Buildings
Streams
Roads and Parking
0 100 200 Feet
N

AUS-0A2P and MISCA OU Site 10 Figure 3-4

IOP Wide Restrictions

-No production water wells shall be installed.
-Residential use and camping are prohibited.

AUS-0A2P Restrictions

-Access to this area is restricted to personnel with a specific need to be at the site.
-No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers.
-Agricultural uses are prohibited at this site.
-Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts.
-Soil from this site should not be used for borrow material.
-CERCLA staff should be consulted at the time any earthmoving activities are planned or scheduled.

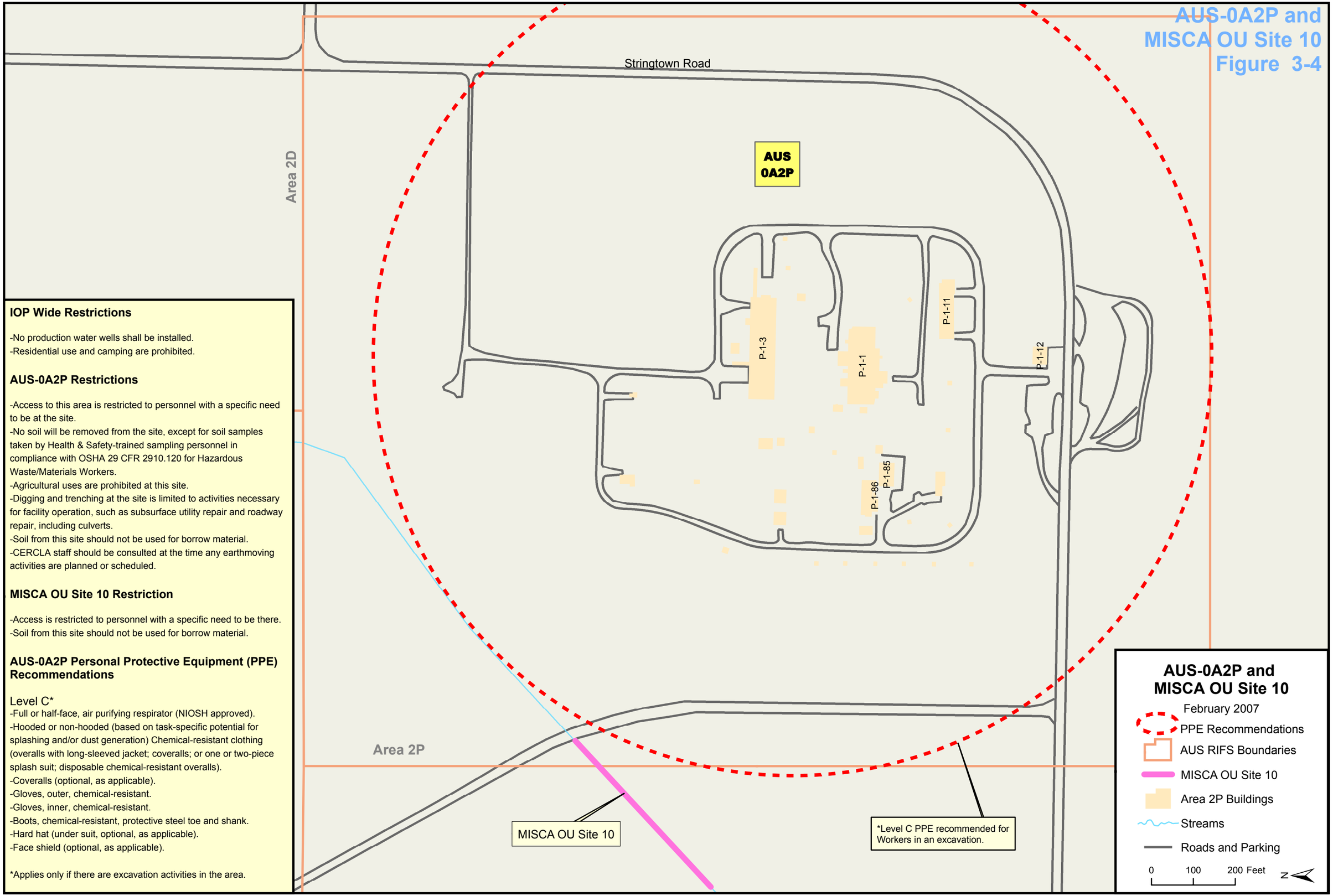
MISCA OU Site 10 Restriction

-Access is restricted to personnel with a specific need to be there.
-Soil from this site should not be used for borrow material.

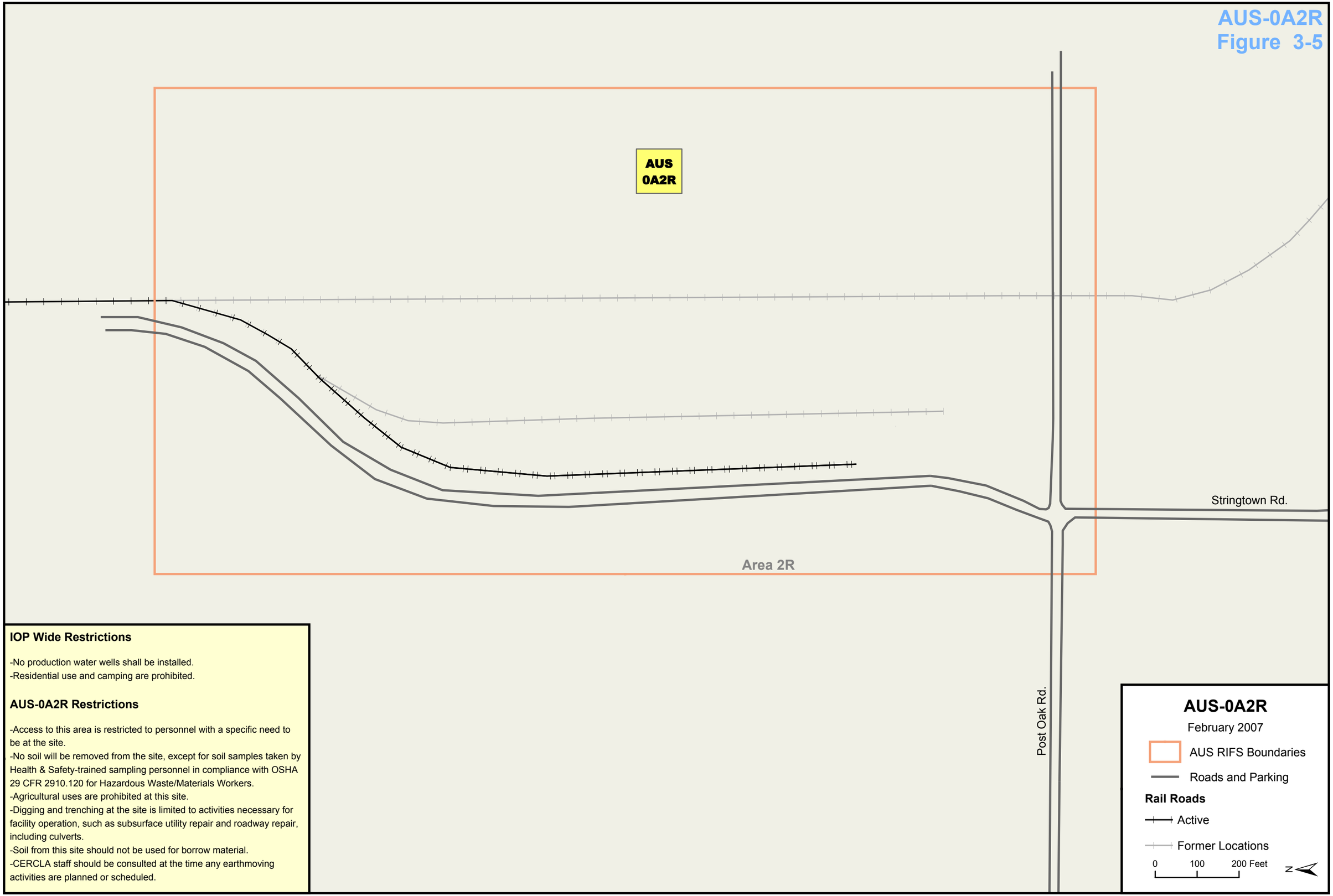
AUS-0A2P Personal Protective Equipment (PPE) Recommendations

Level C*
-Full or half-face, air purifying respirator (NIOSH approved).
-Hooded or non-hooded (based on task-specific potential for splashing and/or dust generation) Chemical-resistant clothing (overalls with long-sleeved jacket; coveralls; or one or two-piece splash suit; disposable chemical-resistant overalls).
-Coveralls (optional, as applicable).
-Gloves, outer, chemical-resistant.
-Gloves, inner, chemical-resistant.
-Boots, chemical-resistant, protective steel toe and shank.
-Hard hat (under suit, optional, as applicable).
-Face shield (optional, as applicable).

*Applies only if there are excavation activities in the area.



AUS-0A2R
Figure 3-5



IOP Wide Restrictions

-No production water wells shall be installed.
-Residential use and camping are prohibited.

AUS-0A2R Restrictions

-Access to this area is restricted to personnel with a specific need to be at the site.
-No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers.
-Agricultural uses are prohibited at this site.
-Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts.
-Soil from this site should not be used for borrow material.
-CERCLA staff should be consulted at the time any earthmoving activities are planned or scheduled.

AUS-0A2R

February 2007

AUS RIFS Boundaries

Roads and Parking

Rail Roads

Active

Former Locations

0 100 200 Feet

N

4.1 AREA 3

Area 3 is the former IOP Finished Ammunition Group I Area – a warehouse area used for storage of finished ammunition **(Figures 1-7 and 4-1).** Since World War II, it has been used by tenants for storage. No chemical data and little historic use data are available for the site. It is currently being investigated as part of the AUS OU RI conducted by General Dynamics Ordnance and Tactical Systems.

4.1.1 LUCIP for AUS-0A03 – IOP Finished Ammunition Group I Area (AUS OU)

4.1.1.1 LUCIP Objective

The IOP-wide LUCIP objectives apply. As with all sites under investigation in the AUS OU RI, exposure should be minimized as much as practicable. RI results may indicate the need for additional restrictions.

When the results from the current RI are available, this LUCIP will be reviewed and appropriate modifications made.

4.1.1.2 LUC(s) Implemented to Achieve Objective

In addition to the IOP-wide LUCs, no soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers (**Figure 4-1**). Additionally, soil from this site should not be used for borrow material.

Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts. Agricultural use is prohibited at this site. These LUCs will be modified as appropriate as data are obtained in the RI.

4.1.1.3 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. Other restrictions will depend upon the results of the RI/FS currently in progress.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

4.1.1.4 Applicable Decision Document

There is not yet a decision document for this site.

AUS-0A03
Figure 4-1

Pigeon Creek Rd.

FAM 4-6 FAM 4-5 FAM 4-4 FAM 4-3 FAM 4-2 FAM 4-1

FAM 3-7 FAM 3-6 FAM 3-5 FAM 3-4 FAM 3-3 FAM 3-2 FAM 3-1

FAM 2-7 FAM 2-6 FAM 2-5 FAM 2-4 FAM 2-3 AUS 0A03 FAM 2-2 FAM 2-1

FAM 1-7 FAM 1-6 FAM 1-5 FAM 1-4 FAM 1-3 FAM 1-2 FAM 1-1

Area 3

Area 2P

Stringtown Rd.

Crab Orchard Lake

IOP Wide Restrictions

-No production water wells shall be installed.
-Residential use and camping are prohibited.

AUS-0A03 Restrictions

-No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers.
-Agricultural uses are prohibited at this site.
-Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts.
-Soil from this site should not be used for borrow material.
-CERCLA staff should be consulted at the time any earthmoving activities are planned or scheduled.

AUS-0A03

February 2007

AUS RIFS Boundaries

Finished Ammunition (FAM)

Area Structures

Building

Concrete Pad

Roads

Former RR Locations

Lakes

0 200 400 Feet

N

5.1 AREA 4

Area 4, the IOP Shop Area, is north of Crab Orchard Lake on both sides of Highway 148 (**Figures 1-7 and 5-1**). This was an IOP support area, with machine shop, electrical and communication facility, diesel repair shop, automotive repair shop, laboratory, and similar facilities. The buildings have since been used by various tenants.

5.1.1 LUCIP for AUS-0A4E – East Shop Area (AUS OU)

AUS-0A4E (Area 4 East) is currently part of a remedial investigation conducted by General Dynamics Ordnance and Technical Systems. It was identified in the AUS OU PA/SI as requiring an RI because of exceedances of screening values. See **Figure 5-1** for location.

5.1.1.1 Site Description and Investigation Results

Site Description

Area 4 East was originally built as an automotive shop to support IOP operations. Only two of the six original buildings remain. Since World War II, the area has been used by various tenants for purposes such as manufacturing and storage.

Operational History and Waste Characteristics

During World War II, this area was used for maintenance of the IOP truck pool and heavy equipment. All automotive shop buildings begin with the designation "S-4"; they include a wash and grease house, a gas station, a garage, and buildings for the storage of oil and auto parts. Another building, S-3-4, was used to pump fuel to the West Shop Area.

Tenant uses of the buildings varied from manufacturing wrought iron items (Southern Metal Arts Company), latex rolls (Midwest Brush), and crates and cartons (Dura Crates, Inc.). Area 4 East was also used for refurbishing mining equipment (Electric & Machine Company) and likely for vehicle maintenance (Southern Illinois University). Schilli Transportation used a building Area 4 East as a service garage. Other tenants included Diagraph Corporation, GTE, Mark Twain Marine Industries, McBride Trucking, Shamrock Boat Manufacturing, Trojan Powder/Ensign Bickford Industries, and Primex Technologies.

There was debris, mostly automotive related, scattered throughout the wooded parts of the site, including an area of empty, abandoned drums along a drainageway.

Site Investigation

The SI included soil, groundwater, and surface water samples.

Notable Contamination Found

Exceedances of screening criteria at this site were mostly relatively small. Detections of ethylbenzene and xylenes in the soil near the former IOP gas station exceeded SI screening criteria. Among the SVOCs, methylnaphthalene, dibenzofuran, two phthalates and 12 PAHs in soils exceeded SI screening criteria. SI soil screening criteria was exceeded for most inorganics, although, except for copper which was detected at 816 mg/kg *(background = 11 mg/kg)* the exceedances were small.

5.1.1.2 LUCIP Objective

The IOP-wide LUCIP objectives apply. As with all sites under investigation in the AUS OU RI, exposure should be minimized as much as practicable. RI results may indicate the need for additional restrictions.

When the results from the current RI are available, this LUCIP will be reviewed and appropriate modifications made.

5.1.1.3 LUC(s) Implemented to Achieve Objective

In addition to the IOP-wide LUCs, access should be limited to personnel who need to use the site. No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers. Additionally, soil from this site should not be used for borrow material. Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts. Refer to **Figure 5-1**. Agricultural use is prohibited at this site.

This LUCIP will be re-evaluated as RI data are obtained.

5.1.1.4 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. Other restrictions will depend upon the results of the RI/FS currently in progress.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

5.1.1.5 Applicable Decision Document

There is not yet a decision document for this site.

5.1.2 LUCIP for AUS-0A4W – West Shop Area (AUS OU)

AUS-0A4W (Area 4 West) is currently part of a remedial investigation conducted by General Dynamics Ordnance and Technical Systems. It was identified in the AUS OU PA/SI as requiring an RI because of exceedances of screening values. See **Figure 5-1** for location.

5.1.2.1 Site Description and Investigation Results

Site Description

Area 4 West, located west of Highway 148, originally housed buildings that supported IOP infrastructure and operation. All of the buildings started with the prefixes "S-1," "S-2" or "S-3, " and are arranged in three north-south oriented rows. Some buildings are no longer on site.

Operational History and Waste Characteristics

IOP buildings included a laundry, a locomotive repair building, a tool and gage shop, a laboratory, a machine shop, a piping and plumbing shop, a boiler house, and a light equipment repair building.

After the end of World War II, several of the buildings were leased by businesses including furniture, transformer, and coder cartridge manufacturers; printers; lumber suppliers; and publishers. There were also two plating operations, Supreme Plating Company and Herrin Plating. Under the directive of the Illinois Environmental Protection Agency, Supreme Plating cleaned and emptied an underground tank that contained liquid waste from its operation. Part of this area was also remediated under the Metals Areas Operable Unit (MAOU).

GDO&TS is the major current tenant in Area 4 West.

Site Investigation

The SI included several soil samples of varying depths; no groundwater monitoring wells were installed.

Notable Contamination Found

SVOCs that exceeded SI soil screening criteria included methylnaphthalene, dibenzofuran, carbazole, two phthalates, and nine PAHs; exceedances were generally small.

Most inorganic constituents were detected at levels exceeding SI screening criteria, including arsenic at 60 mg/kg, cadmium at 4,520 mg/kg, chromium at 298 mg/kg, and zinc at 780 mg/kg.

Later investigations found relatively high levels of cadmium in dust samples taken from Building S-2-5, which was being used for storage. FWS's contractor recommended that workers in the building monitor the dust and use respiratory protection.[30]

5.1.2.2 LUCIP Objective

The IOP-wide LUCIP objectives apply. A specific objective for this site is to limit exposure to the remaining contamination from plating activities that occurred in Building S-2-4 (demolished, with building debris buried on site) and Building S-2-5 (existing and recently used by tenants for storage). As with all sites under investigation in the RI, access should be limited to personnel who need to use the site, to prevent potential exposure. Additionally, any proposed activities at or near these two buildings must be coordinated closely with Refuge CERCLA staff. RI results may indicate the need for additional restrictions.

When the results from the current RI are available, this LUCIP will be reviewed and appropriate modifications made.

5.1.2.3 LUC(s) Implemented to Achieve Objective

In addition to the IOP-wide LUCs, access should be limited to personnel who need to use the site. No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers. Additionally, soil from this site should not be used for borrow material and agricultural use is prohibited. Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts.

Access to Building S-2-5 is restricted to personnel who are OSHA-trained and certified, as noted above. Workers in building S-2-5 should wear respiratory protection, in conjunction with dust monitoring, to insure that OSHA levels are not exceeded. All OHSA-trained personnel should have received instructions in selection of appropriate respirators and cartridges.

Any proposed activities at or near Buildings S-2-4 and S-2-5 must be coordinated closely with Refuge CERCLA staff. Lawn mowing is prohibited in the area around Buildings S-2-4 and S-2-5 (**Figure 5-1**). Warning signs have been placed in the area.

PPE guidelines are provided for a portion of this site. Refer to Section 1.4.1, Table 1-5, and **Figure 5-1**.

This LUCIP will be re-evaluated as RI data are obtained.

[30] Letter from URS Corporation to U.S. Fish and Wildlife Service, regarding Worker Respiratory Protection in Building S-2-5, September 26, 2002.

5.1.2.4 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. Remediation of the cadmium contamination at and in the vicinity of former Buildings S-2-4 and existing Building S-2-5 will be needed before the LUC can be removed. Other restrictions will depend upon the results of the RI/FS currently in progress.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

5.1.2.5 Applicable Decision Document

There is not yet a decision document for this site.

5.1.3 LUCIP for Site 22A – Former Post Treating Facility (MISCA OU)

5.1.3.1 Site Description

Site 22A is a potential former post-treating facility with dioxin and pentachlorophenol contaminated soil. In 1996, the Department of the Interior/Fish and Wildlife Service (DOI/FWS) conducted a removal action at Site 22A. Site 22A is located adjacent to the former Refuge shop and maintenance yard in Area 4 West (**Figure 1-4**).

The following table is from the ROD which includes Site 22A.[31] The tabulated concentrations are those remaining after the remedy was complete.

Summary of Maximum Detections of Contaminants of Concern in Soil at Site 22A			
Contaminant	**Maximum Original Concentration, mg/kg**	**Maximum Concentration after Removal Action, mg/kg**	**USEPA Region 9 PRG for Residential Soil, mg/kg**
Pentachlorophenol	26	4.6 (8.5 to 9.5 ft depth)	3.0
Dioxins and furans (TCDD TEQs)	3,800E-6	81E-6	3.9E-6
DDT	0.038	0.023	1.7
DDE	0.042	0.027	1.7
DDD	0.012	0.004	2.4
PCBs	0.140	0.140	0.22
Mercury	0.26	<0.12	23
Selenium	2.3	<2	390
Zinc	119	81	23,000

The ROD states:

> Only TCDD TEQs and one pentachlorophenol detection exceeded the Region 9 residential PRGs. However, the maximum TCDD TEQ was below USEPA's current cleanup goal for TCDD TEQ of one part per billion. For pentachlorophenol, the reasonable maximum exposure (RME) for this site is below the Region 9 PRG. Of 29 samples originally analyzed for pentachlorophenol at Site 22A, 18 represent soil that was excavated and disposed as part of the removal action. Of the 11 samples from soil that was outside the excavated area, 9 were non-detect for pentachlorophenol, one had a detection of 0.054 mg/kg, and one had a detection of 4.6 mg/kg, from the depth interval 8.5 to 9.5 feet below the ground surface. This area was backfilled with clean soil to the ground surface.

[31] USFWS, April 2002. Record of Decision, Site 36 of the Miscellaneous Areas Operable Unit, Crab Orchard National Wildlife Refuge NPL Site, Marion, Illinois, Page 61 of the Decision Summary.

Based on the human health risk assessment, comparison to Region 9 Residential PRGs, and the current USEPA cleanup goals for dioxin, Site 22A was determined to require no further action for protection of human health.

5.1.3.2 LUCIP Objective

Based on the available data, no objectives other than the IOP-wide objectives (Section 2) are needed.

5.1.3.3 LUC(s) Implemented to Achieve Objective

No additional LUC beyond the IOP-wide LUCs are needed except that soil from this site should not be used as borrow material.

5.1.3.4 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

5.1.3.5 Applicable Decision Document

The applicable decision document is the Record of Decision, Site 36 of the Miscellaneous Areas Operable Unit, Crab Orchard National Wildlife Refuge NPL Site, Marion, Illinois (USFWS, 2002).

5.1.4 LUCIP for Site 22 – Old Refuge Shop Channel (MAOU)

5.1.4.1 Site Description and Investigation Results

Site 22 was a drainageway leading away from Area 4 West that was contaminated with cadmium, lead, chromium and cyanide (**Figure 1-3**). It was required to be remediated to 10 mg/kg for cadmium, but the ROD (1990) did not specify numeric values for cleanup for the other constituents. Remediation was completed in 1996. For confirmation sampling, the level of 450 mg/kg for lead and 35 mg/kg for chromium were used. Cyanide was rarely detected in confirmation samples, and when it was the concentration was near the detection limit.[32] Groundwater concentrations in excess of federal maximum concentration limits were detected, but the groundwater was not included in the remedy.

5.1.4.2 LUCIP Objective

No objectives besides the IOP-wide objectives (Section 2) are needed.

5.1.4.3 LUC(s) Implemented to Achieve Objective

No LUCs other than the IOP-wide LUCs are needed, except that soil from this site should not used for borrow material.

5.1.4.4 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

5.1.4.5 Applicable Decision Document

The applicable decision document is the MAOU ROD. [33]

[32] U.S. Fish and Wildlife Service, November 1997. Closeout Report for the Metals Areas Operable Unit, Crab Orchard National Wildlife Refuge Superfund Site, Marino, Illinois (Williamson County).
[33] USEPA, Region V, *Declaration for the Record of Decision, Crab Orchard National Wildlife Refuge, Metals Areas Operable Unit*, March 30, 1990.

5.1.5 LUCIP for Site 29 - Fire Station Landfill (MAOU)

5.1.5.1 Site Description and Investigation Results

Site 29 was a landfill near Area 4 East, with lead as the primary contaminant (**Figure 1-3**). During the remediation, which was completed in 1996, all landfilled materials were removed, down to natural soil. The cleanup objective of 450 mg/kg for lead was achieved.[34] Groundwater concentrations in excess of federal maximum concentration limits were detected, but the groundwater was not included in the remedy.

5.1.5.2 LUCIP Objective

No objectives besides the IOP-wide objectives (Section 2) are needed.

5.1.5.3 LUC(s) Implemented to Achieve Objective

No LUCs other than the IOP-wide LUCs are needed, except that soil from this site should not used for borrow material.

5.1.5.4 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

5.1.5.5 Applicable Decision Document

The applicable decision document is the MAOU ROD. [35]

[34] U.S. Fish and Wildlife Service, November 1997. Closeout Report for the Metals Areas Operable Unit, Crab Orchard National Wildlife Refuge Superfund Site, Marino, Illinois (Williamson County).
[35] USEPA, Region V, *Declaration for the Record of Decision, Crab Orchard National Wildlife Refuge, Metals Areas Operable Unit*, March 30, 1990.

AUS-0A4E and AUS-0A4W
Figure 5-1

IOP Wide Restrictions

-No production water wells shall be installed.
-Residential use and camping are prohibited.

AUS-0A4E and AUS-0A4E Restrictions

-No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous waste/Materials Workers.
-Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts.
-Agricultural uses are prohibited at this site.
-Access to this area is restricted to personnel with a specific need to be at the site.

S-2-4 Restrictions

-Lawn mowing in this area is prohibited.
-Note warning signs that have been placed in the area.

S-2-5 Restrictions

-Access to Building S-2-5 is strictly limited to personnel who are OSHA-trained and certified.
-Workers in this building are required to wear respiratory protection, in conjunction with dust monitoring, to insure that OSHA levels are not exceeded. All OHSA-trained personnel should have received instructions in selection of appropriate respirators and cartridges.
-Lawn mowing in this area is prohibited.
-Note warning signs that have been placed in the area.

AUS-0A04 Personal Protective Equipment (PPE) Recommendations

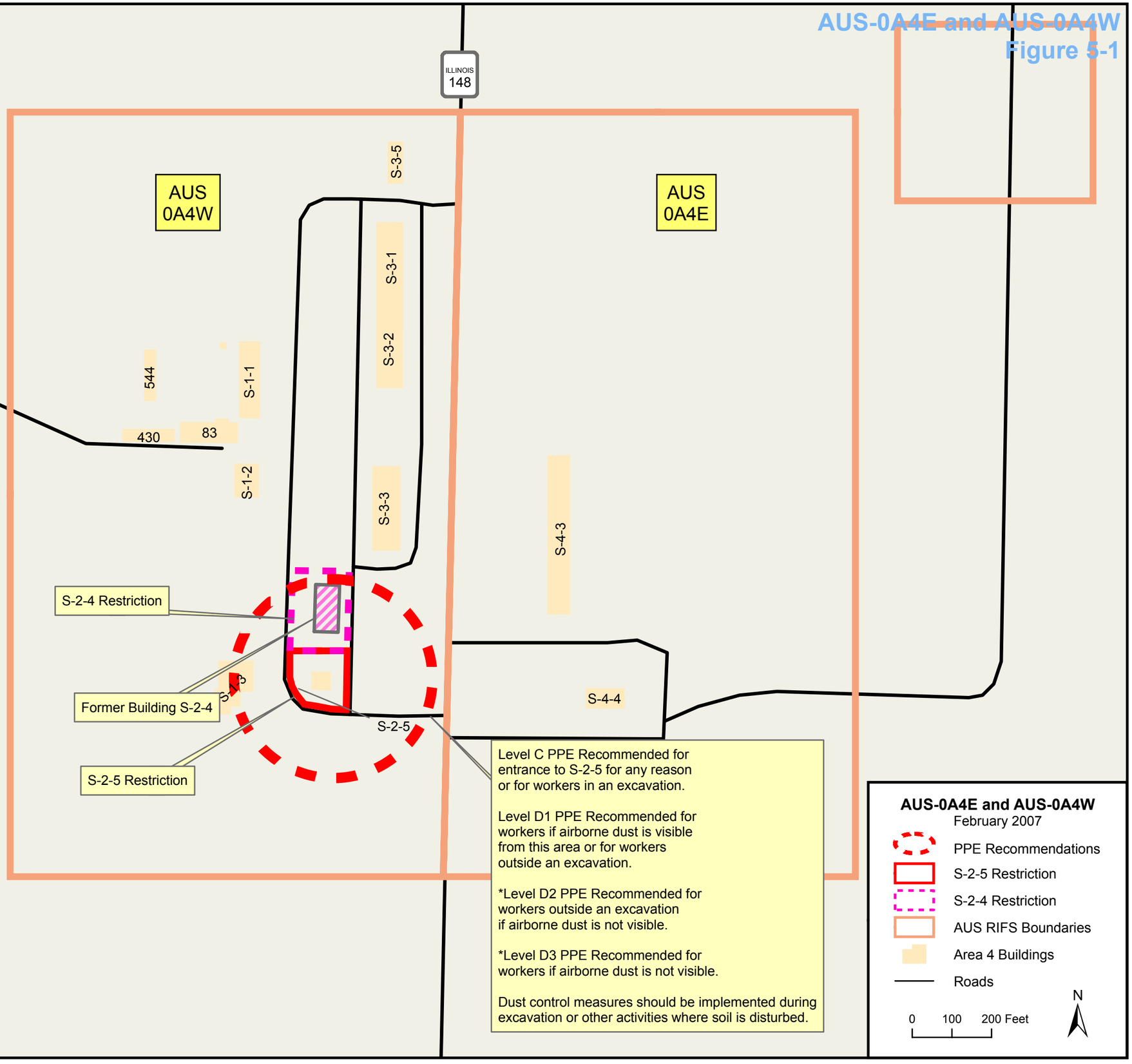
Level C
-Full or half-face, air purifying respirator (NIOSH approved).
-Hooded or non-hooded (based on task-specific potential for splashing and/or dust generation) Chemical-resistant clothing (overalls with long-sleeved jacket; coveralls; or one or two-piece splash suit; disposable chemical-resistant overalls).
-Coveralls (optional, as applicable).
-Gloves, outer, chemical-resistant.
-Gloves, inner, chemical-resistant.
-Boots, chemical-resistant, protective steel toe and shank.
-Hard hat (under suit, optional, as applicable).
-Face shield (optional, as applicable).

Level D1
-Dust mask, snug-fitting.
-Hooded chemical-resistant clothing (overalls with long-sleeved jacket; coveralls; or one or two-piece splash suit; disposable chemical-resistant overalls) if potentially exposed to groundwater at bottom of trench or excavation.
-Coveralls (optional, as applicable).
-Gloves, outer, chemical-resistant.
-Gloves, inner, chemical-resistant.
-Boots, chemical-resistant, protective steel toe and shank.
-Hard hat (optional, as applicable).
-Face shield (optional, as applicable).

Level D2*
-Same as Level D1 without the dust mask.

Level D3*
-Dust mask, snug-fitting if airborne dust is visible.
-Long pants (i.e., no shorts).
-Short or long-sleeve shirts.
-Work gloves (optional, as applicable).
-Boots, chemical-resistant, protective steel toe and shank.

*Applies only if there are excavation activities in the area.



6.1 AREA 5

Area 5, the former IOP Railroad Classification Yard, is located at the southeast corner of the intersection of Old Highway 13 and Route 148 (**Figures 1-7 and 6-1**). The building has been used over the years by tenants, primarily for office space.

6.1.1 LUCIP for AUS-0018 – Railroad Classification Yard (AUS OU)

AUS-0018 is currently part of a remedial investigation conducted by General Dynamics Ordnance and Technical Systems. It was identified in the AUS OU PA/SI as requiring an RI because of exceedances of screening values.

6.1.1.1 Site Description and Investigation Results

Site Description

AUS-0018, the former IOP Railroad Classification Yard, is located at the southeast corner of the intersection of Old Highway 13 and Route 148 (**Figure 6-1**). Based on IOP drawings, there were numerous sets of railroad tracks and four buildings, all prefixed with "Y-1."

At the time of the site reconnaissance in the spring of 1999, all the tracks had been removed and only building remaining on site was the IOP Station Ordill & Yard Office. This building has since been removed.

Operational History and Waste Characteristics

This train-sorting facility was originally constructed and operated by SWDC/War Department as a part of the IOP and it had a 200-car capacity.

Larger tenants in this area included Olin and Trojan/U.S. Powder/Commercial Solvents Corporation.

Site Investigation

The SI included several soil samples of varying depths; no groundwater monitoring wells were installed.

Notable Contamination Found

Inorganics in soil that exceeded SI screening criteria are arsenic, barium, chromium, lead, and nickel.

6.1.1.2 LUCIP Objective

The IOP-wide LUCIP objectives apply. As with all sites under investigation in the AUS OU RI, exposure should be minimized as much as practicable. No soil will be removed from the site, except for soil samples taken by OSHA-trained sampling personnel for the purpose of analysis. RI results may indicate the need for additional restrictions.

When the results from the current RI are available, this LUCIP will be reviewed and appropriate modifications made.

6.1.1.3 LUC(s) Implemented to Achieve Objective

In addition to the IOP-wide LUCs, access to this area is restricted to personnel with a specific need to be at the site (**Figure 6-1**). No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers. Additionally, soil from this site should not be used for borrow material and agricultural use is prohibited at this site.

Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts. These LUCs will be modified as appropriate as data are obtained in the RI.

6.1.1.4 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. Other restrictions will depend upon the results of the RI/FS currently in progress.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

6.1.1.5 Applicable Decision Document

There is not yet a decision document for this site.

AUS-0018
Figure 6-1

ILLINOIS 148

Old Hwy 13

Johns Ln.

Mullins Ln.

Stanley Ln.

Sitter Ln.

Noble Ln.

AUS 0018

ESDA Rd.

Area 5

Area 4W

Area 4E

IOP Wide Restrictions

-No production water wells shall be installed.
-Residential use and camping are prohibited.

Area 5 Restrictions

- Access to this area is restricted to personnel with a specific need to be at the site.
-No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers.
-Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts.
-Agricultural uses are prohibited at this site.
-Soil from this site should not be used for borrow material.

AUS-0018
February 2007

AUS RIFS Boundaries
Roads

Rail Roads

Active
Former Locations
Crab Orchard NWR

0 250 500 Feet

N

7.1 AREA 6

Area 6 is the former IOP Ammonium Nitrate High Explosive and Smokeless Powder Storage Area. This approximately 550-acre site is located south of Old Highway 13, in the eastern part of the Refuge (**Figures 1-7 and 7-1**). Area 6 consists of 79 explosive storage igloos in 7 rows. All of the igloos numbers are prefixed with "HE" (high explosives).

7.1.1 LUCIP for AUS-0A06 – IOP Ammonium Nitrate High Explosive & Smokeless Powder Storage Area

AUS-0A06 is currently part of a remedial investigation conducted by General Dynamics Ordnance and Technical Systems. It was identified in the AUS OU PA/SI as requiring an RI because of exceedances of screening values.

7.1.1.1 Site Description and Investigation Results

Site Description

Area 6 is the former IOP Ammonium Nitrate High Explosive and Smokeless Powder Storage Area. This approximately 550-acre site is located south of Old Highway 13, in the eastern part of the Refuge (**Figure 7-1**).

Area 6 consists of 79 explosive storage igloos in 7 rows. All of the igloos numbers are prefixed with "HE" (high explosives).

Operational History and Waste Characteristics

During the IOP era from 1942 through 1945, all of the igloos in this area were used for storage of high explosives. Tenants have since used the igloos mostly for storage of propellants and explosives. Some tenants have also stored pesticides, gunpowder, fireworks, and fertilizers.

One of the current tenants, Dooley Brothers, Inc., indicated they buried explosive materials next to Igloos HE-7-11 and HE-7-12 on two occasions.

GDO&TS and Ensign Bickford are the two major current tenants in Area 6.

Site Investigation

The SI included several soil samples of varying depths; no groundwater monitoring wells were installed.

Notable Contamination Found

Detections of the explosive compound nitrobenzene exceeded SI soil screening criteria. It was not detected at levels at which explosion is a hazard; the issue is toxicity.

Detections of many SVOCs in soil exceeded screening criteria. N-nitroso-di-n-propylamine and n-nitrosodiphenylamine were detected at concentrations well above screening criteria. Diphenylamines are commonly used as stabilizers and antioxidants for propellants. 2-nitrodiphenylamine is a documented Olin waste product. Carbazole, a possible degradation production of diphenylamines, was also detected above SI soil screening criteria.

Four phthalates exceeded SI soil screening criteria, including di-n-octyl phthalate, a documented Olin waste product.

Fourteen PAHs exceeded screening criteria, many by a wide margin.

Pentachlorophenol, a wood preservative that has also been used as a herbicide and pesticide, was detected above SI soil screening criteria. Hexachlorobenzene, which is used in some military explosives and is a contaminant in some pesticides, was detected above SI soil screening criteria. Another pesticide ingredient, 2,4,6-trichlorophenol, was detected above SI soil screening criteria.

7.1.1.2 LUCIP Objective

In addition to the IOP-wide LUCs, access to this area is restricted to personnel with a specific need to be at the site (**Figure 7-1**). No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers. Additionally, soil from this site should not be used for borrow material. Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts. These LUCs will be modified as appropriate as data are obtained in the RI.

7.1.1.3 LUC(s) Implemented to Achieve Objective

In addition to the IOP-wide LUCs, access should be limited to personnel who need to use the site. Earthmoving should be limited to activities necessary for facility operation.

These LUCIPs will be re-evaluated as RI data are obtained.

7.1.1.4 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. Other restrictions will depend upon the results of the RI/FS currently in progress.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

7.1.1.5 Applicable Decision Document

There is not yet a decision document for this site.

AUS-0A06
Figure 7-1

HE 7-12 HE 7-11 HE 7-10 HE 7-9 HE 7-8 HE 7-7 HE 7-6 HE 7-5 HE 7-4 HE 7-3 HE 7-2 HE 7-1

HE 6-12 HE 6-11 HE 6-10 HE 6-9 HE 6-8 HE 6-7 HE 6-6 HE 6-5 HE 6-4 HE 6-3 HE 6-2 HE 6-1

Old Chamnestown Road

HE 5-12 HE 5-11 HE 5-10 HE 5-9 HE 5-8 HE 5-7 HE 5-6 HE 5-5 HE 5-4 HE 5-3 HE 5-2 HE 5-1

AUS 0A06

HE 4-12 HE 4-11 HE 4-10 HE 4-9 HE 4-8 HE 4-7 HE 4-6 HE 4-5 HE 4-4 HE 4-3 HE 4-2 HE 4-1

HE 3-12 HE 3-11 HE 3-10 HE 3-9 HE 3-8 HE 3-7 HE 3-6 HE 3-5 HE 3-4 HE 3-3 HE 3-2 HE 3-1

HE 2-12 HE 2-11 HE 2-10 HE 2-9 HE 2-8 HE 2-7 HE 2-6 HE 2-5 HE 2-4 HE 2-3 HE 2-2 HE 2-1

HE 1-12 HE 1-11 HE 1-10 HE 1-9 HE 1-8 HE 1-7 HE 1-6 HE 1-5 HE 1-4 HE 1-3 HE 1-2 HE 1-1

Area 6

IOP Wide Restrictions

-No production water wells shall be installed.
-Residential use and camping are prohibited.

AUS-0A06 Restrictions

- Access to this area is restricted to personnel with a specific need to be at the site.
-No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers.
-Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts.

AUS-0A06
February 2007

- AUS RIFS Boundaries
- High Explosives (HE) Igloos
  - Current
  - Former Locations
- Roads
- Former RR Locations
- Lakes
- Streams

0 250 500 Feet

N

8.1 AREA 7

Area 7, the IOP Inert Storage Area, is located just south of the east end of Crab Orchard Lake (**Figures 1-7 and 8-1**). It was used for warehousing metal parts and other inert materials used in ordnance production.

The original building complex consisted of 6 rows of buildings (6 to 7 buildings per row) each of which were 51 feet (ft) wide by 200 ft long. All building numbers were prefixed with "IN" (for Inert Storage). The site covers about 100 acres.

8.1.1 LUCIP for AUS-0A07 – Inert Storage (AUS OU)

AUS-0A07 is currently part of a remedial investigation conducted by General Dynamics Ordnance and Technical Systems. It was identified in the AUS OU PA/SI as requiring an RI because of exceedances of screening values. The site also incorporates the former Site AUS-0021, the Area 7 Fire Station.

8.1.1.1 Site Description and Investigation Results

Operational History and Waste Characteristics

During the IOP era, all but two of the buildings in Area 7 were used as warehouses for inert storage (**Figure 8-1**).

A succession of tenants have since leased the buildings, mostly for storage, but a few were used for manufacturing and maintenance work. Based on the information to date, the most significant areas of concern appear to the related to the Great Lakes Terminal and Transport Company's pesticide storage, Olin's short-lived metal fabrication operation, and the related operations of Helical Bit/R.A. Wilkie Machine and Plating Co.

Site Investigation

The SI included only shallow soil samples; no groundwater monitoring wells were installed.

Notable Contamination Found

TCE, a common metal degreaser, was found in the soil above the SI screening criteria at many sampling locations throughout the site. Methylene chloride was also detected above SI soil screening criteria.

Many pesticides concentrations exceeded SI screening criteria for soil in the vicinity of the former pesticide storage areas. Pesticides, with maximum soil concentrations detected include aldrin, 520 mg/kg (SI screening criterion = 0.15 mg/kg), and dieldrin, 290 mg/kg (SI screening criterion = 0.15 mg/kg). DDE, DDT, DDD, chlordane, heptachlor, and others were detected above SI screening criteria. SVOCs, PCBs, and several metals were detected above SI soil screening criteria.

Later investigations found pesticide-contaminated dust in Buildings IN-1-3, IN-1-4, IN-1-5, and IN-1-6, which had previously been used for pesticide storage.

8.1.1.2 LUCIP Objective

In addition to the IOP-wide LUCs, access to this area is restricted to personnel with a specific need to be at the site (e.g., employees of tenants, sampling crews). No soil will be removed from the site, except for soil samples taken by OSHA-trained sampling personnel for the purpose of analysis. The site will not be used for agricultural purposes.

A specific objective for this site is to limit exposure to the pesticide contamination associated with Buildings IN-1-3, IN-1-4, IN-1-5, and IN-1-6. As with all sites under investigation in the RI, access should be limited to personnel who need to use the site, to prevent potential exposure. RI results may indicate the need for additional restrictions.

When the results from the current RI are available, this LUCIP will be reviewed and appropriate modifications made.

8.1.1.3 LUC(s) Implemented to Achieve Objective

In addition to the IOP-wide LUCs, access to this area is restricted to personnel with a specific need to be at the site (**Figure 8-1**). No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers. Additionally, soil from this site should not be used for borrow material.

Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts. Agricultural use is prohibited at this site. These LUCs will be modified as appropriate as data are obtained in the RI.

As shown in **Figure 8-1**, access to immediate surroundings and inside of Buildings IN-1-3 through -6 is restricted to personnel with a specific need to be at or in these locations. Exposure should be minimized as much as practicable. Additionally, moving is prohibited around these buildings.

PPE guidelines are provided for a portion of this site. Refer to Section 1.4.1, Table 1-5, and **Figure 8-1**.

These LUCIPs will be re-evaluated as RI data are obtained.

8.1.1.4 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. Remediation of pesticide contamination will be necessary to remove the LUCs related to pesticides. Other restrictions will depend upon the results of the RI/FS currently in progress.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

8.1.1.5 Applicable Decision Document

There is not yet a decision document for this site.

8.1.2 LUCIP for Site 16 – Area 7 Industrial Site (MISCA OU)

8.1.2.1 Site Description

This site is located in Area 7, the former IOP Inert Storage Area (**Figures 1-4 and 8-1**). The buildings in the area have been leased to a variety of industrial tenants since the end of World War II. The 1988 O'Brien & Gere RI reported that in the mid-1980s, black residues were noted near five of the large buildings in this area. Samples were located in the stream and around several buildings. Note, this site includes only those sample locations

There are several warehouse-type buildings remaining in Area 7. There is an intermittent stream that runs from south to north through the center of this site, which coincides with the center of Area 7. This stream transports all drainage from Area 7 northward discharging into Crab Orchard Lake. While some oil-stained soils were noted during RI activities, they are no longer evident on site. The suspected sources of contamination at this site were a waste oil recovery and recycling facility, and a facility that refurbished mining equipment.

Previous investigations at Site 16 include the 1988 RI, the 1993 Phase I RI and the 1996 Phase II RI.

8.1.2.2 Investigations

1988 RI (O'Brien & Gere)

During the 1988 RI, three composite surface water samples, four composite sediment samples, and 11 composite soil samples were. Two of the surface water samples and three of the sediment samples were analyzed for VOCs, total PCBs, pesticides, explosives, and metals. The remaining surface water sample was analyzed for metals; and the remaining sediment sample was analyzed for VOCs, SVOCs, pesticides, PCBs, and sodium. Most of the soil samples were analyzed for the full list of analytes as well, with a few exceptions.

Table 8-1 summarizes only the detected analytical results from these samples. The 1988 RI determined that none of the detections posed a risk to humans or wildlife and nor further evaluation was recommended for Site 16. However, the RI also reported that the Refuge restricts human use of Site 16 and anticipates future restrictions on human use at the site. The report further stated "a human health risk assessment was not conducted at Site 16 since a completed exposure pathway for human risk does not exist at this site."[36]

However, as shown in **Table 8-1**, a comparison of the 1988 data with the screening criteria used for this LUCIP shows several potential chemicals of concern in sediment and soil.

[36] USFWS, April 2002. Record of Decision, Site 36 of the Miscellaneous Areas Operable Unit, Crab Orchard National Wildlife Refuge NPL Site, Marion, Illinois, Page 17 of the Decision Summary.

Soil

Antimony and iron exceeded the following screening criteria in some soil samples:
- Background Soil 95% Upper Tolerance Limit (UTL), and
- USEPA Region 9 Residential Soil Preliminary Remediation Goal

Aroclor 1254 exceeded the following screening criteria in three soil samples:
- USEPA Region 9 Residential Soil Preliminary Remediation Goal

Sediment

Aluminum, antimony, iron, and manganese exceeded the following screening criteria in some sediment samples:
- Background Sediment 95% Upper Tolerance Limit (UTL), and
- USEPA Region 9 Residential Soil Preliminary Remediation Goal

N-Nitrosodi-n-propylamine exceeded the following screening criteria in one sediment sample:
- USEPA Region 9 Residential Soil Preliminary Remediation Goal

1993 Phase I RI (Woodward Clyde)

Two composite/discrete surface soil sample pairs were collected. The composite samples (0.5 to 0.8 feet deep) were analyzed for SVOCs, PCBs, pesticides, explosives, metals, and cyanide, while the discrete samples (1.8 to 1.9 feet deep) were analyzed for VOCs.

Table 8-1 summarizes only the detected analytical results from the two sample pairs. None of the detections exceeded levels of concern established for the 1993 Phase I RI which determined that no further investigation was necessary. However, as shown in **Table 8-1**, a comparison of the 1993 data with the screening criteria used for this LUCIP shows one potential chemical of concern in sediment:

Arsenic exceeded the following screening criteria in one soil sample:
- Background Sediment 95% Upper Tolerance Limit (UTL), and
- USEPA Region 9 Residential Soil Preliminary Remediation Goal

8.1.2.3 LUCIP Objective

The Site 36 Record of Decision, which included Site 16 (see reference below in Section 8.1.2.6) includes land use controls as the remedy for Site 10. The objective of the LUCIP for Site 16 is to implement those controls in accordance with the ROD. Based on the available data, no objectives other than the IOP-wide are needed at this time (**Figure 8-1**). Additional investigation may be done in this area as part of the AUS OU RI. The need for any additional restrictions will

be evaluated as part of that RI. The applicable ROD text is as follows (note that Sites 36 and 10 are also included in the discussion):

> Institutional controls will be implemented at Site 36 to ensure that potable water supply wells are not installed at the site in the region of exceedances of MCLs/State of Illinois Class I groundwater standards until groundwater is restored for contaminants of concern. Institutional controls will also be implemented at Sites 10 and 16 to appropriately restrict human access. If future risk assessments show that the sites are appropriate for unrestricted use or reduced limitations on human activity, the institutional controls will be removed or modified as appropriate. These institutional controls will be implemented, maintained, and enforced by DOI/FWS. An Institutional Control Implementation Plan (ICIP) will be prepared as part of the Remedial Design Document. The following items will be included in the ICIP:
>
> • Identification of specific land use restrictions applicable to Sites 10, 16 and 36, the specific geographic extent of the restrictions, and the basis for the restrictions.
>
> • Implementation of enforcement procedures, including control methods, use of existing GIS contaminant database for the site, and visual inspection frequency and methodology.
>
> • Procedure for routine inspection reports.
>
> The exposure assumptions used in the human health risk assessments were consistent with the current human uses of the site. Regarding future land use, any change in land use inconsistent with any land use contained in those specific exposure assumptions in the risk assessments will require an evaluation of whether the anticipated land use change will pose unacceptable risks to human health and the environment or negatively impact the effectiveness of the selected Site remedy. This is enforceable under the National Wildlife Refuge Administration Act (16USC668dd), Section (d)(3)(A)(I), which requires that the Secretary of the Interior (Secretary)"…shall not initiate or permit a new use of a refuge or expand, renew, or extend an existing use of a refuge, unless the Secretary has determined that the use is a compatible use and that the use is not inconsistent with public safety." The Secretary's determination must be in writing and is subject to public review and comment. Potential land use changes are currently being evaluated through the CCP process that is required by 16USC668dd.

8.1.2.4 LUC(s) Implemented to Achieve Objective

No additional LUCs beyond the IOP-wide LUCs are needed except that soil from this site should not be used as borrow material.

8.1.2.5 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. However, if additional data show risks not yet identified, additional restrictions may apply.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

8.1.2.6 Applicable Decision Document

The applicable decision document is the Record of Decision, Site 36 of the Miscellaneous Areas Operable Unit, Crab Orchard National Wildlife Refuge NPL Site, Marion, Illinois (USFWS, 2002).

TABLE 8-1, ANALYTICAL DATA SCREENING FOR
SITE 16 - AREA 7 INDUSTRIAL SITE, MISCA OU

LAND USE CONTROL IMPLEMENTATION PLAN
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Source	O'B&G		O'B&G		O'B&G		O'B&G		O'B&G		O'B&G		O'B&G		O'B&G		O'B&G		O'B&G		O'B&G		O'B&G	
Sample ID	16-1-2-1		16-3-2-1		16-18-2-8		16-2-3-1		16-4-3-1		16-4-3-6		16-8-3-1		16-9-1-4		16-10-1-1		16-10-1-7		16-11-1-1		16-12-1-1	
Depth (feet)	NA		NA		NA		0-1		0-1		0-1		0-1		0-1		0-1		0-1		0-1		0-1	
Matrix (soil & sediment values shown in mg/kg; surface water values in ug/L)	Surface Water	*R. Code*	Surface Water	*R. Code*	Surface Water	*R. Code*	Sediment	*R. Code*	Sediment	*R. Code*	Sediment	*R. Code*	Sediment	*R. Code*	Soil	*R. Code*	Soil	*R. Code*	Soil	*R. Code*	Soil	*R. Code*	Soil	*R. Code*
CONSTITUENT																								
2-Methylnaphthalene											0.005								ND					
Acetone									ND								ND							
Aluminum	ND		ND				12900	B H	8170	H			11200	H	2990		17900	H			16000	H	1850	
Anthracene					0.256														ND					
Antimony	ND		ND				ND		ND				20	B H	ND		ND				ND		22	A H
Aroclor 1254									ND						0.263	H	ND							
Arsenic	--		--		--		--		--		--		--		--		--		--		--		--	
Barium	69	C	74	C			104		75.3				180		61.1		180				122		75.3	
Benz[a]anthracene											0.191								ND					
Bis(2-ethylhexyl)phthalate											0.044								ND					
Boron	70		60				43		38				49		14	A	11	A			7.6	A	19	A
Calcium	74700	C	93700	C			7320	B	22100	B			9890	B	225000	A	3170	A			3220	A	133000	A
Chromium	ND		ND				20	B	10				38	B	16		25				21		19	
Chrysene											0.453								ND					
Cobalt	ND		ND				9		8				20	B	4		9				10		ND	
Copper	--		--		--		--		--		--		--		--		--		--		--		--	
Dibenzofuran											0.006								ND					
Di-n-butyl phthalate											0.007								ND					
Ethylbenzene	ND		ND				ND		ND		ND				ND		ND		ND		ND		ND	
Fluoranthene											0.389								ND					
Iron	300	C	ND				20300	H	16900	H			26000	B H	6760	H	22300	A H			19500	A H	14100	H
Lead	--		--		--		--		--		--		--		--		--		--		--		--	
Magnesium	25600	C	36700	C	23700	C	2840	B	7280	B			2710	B	12800	A	3850	A			3500	A	7940	A
Manganese	340		70				929	H	650	H			2010	B H	202	H	410	H			508	H	235	H
Methyl ethyl ketone (2-Butanone)	--		--		--		--		--		--		--		--		--		--		--		--	
Naphthalene																			ND					
Nickel	--		--		--		--		--		--		--		--		--		--		--		--	
N-Nitroso di-n-propylamine											0.115	H							ND					
Phenanthrene											0.019								ND					
Potassium																								
Pyrene											0.336								ND					
Silver	--		--		--		--		--		--		--		--		--		--		--		--	
Sodium	28300	C	40300	C	40300	C	100		100		190		90		300	A	230	A	170		170		230	A
Thallium																								
Titanium	ND		ND		ND		148		148				141		18		407				302		1107	
Vanadium	ND		ND		ND		36	B	28				44	B	ND		46				42		10	
Xylenes (total)	ND		ND		ND		ND		ND		ND		ND		ND		ND				ND		ND	
Zinc	--		--		--		--		--		--		--		--		--		--		--		--	

Legend

mg/kg = milligrams per kilogram, ug/L = micrograms per Liter

-- = Analyzed but not shown (see Note included in Source (1), below)

ND = Not detected

For data qualifiers, refer to source reports.

Shading indicates constituent exceeded background and at least one screening criterion for inorganics; for all other constituents, shading indicates an exceedance of at least one screening criterion.

Note: if result is blank, the constituent was not analyzed in that sample.

Reference Codes:

A - Background Soil 95% UTL

B - Background Sediment 95% UTL

C - Background Surface Water 95% UTL

D - IEPA TACO Tier 1 Soil Remed. Object. for Residential Properties – Ingestion Exposure Route

E - IEPA TACO Tier 1 Soil Remed. Object. for Residential Properties – Inhalation Exposure Route

F - IEPA TACO Tier 1 Soil Remed. Object. for Construction Worker Ingestion Exposure Route

G - IEPA TACO Tier 1 Soil Remed. Object. for Construction Worker Inhalation Exposure Route

H - USEPA Region 9 Residential Soil Preliminary Remediation Goals

I – Illinois General Use Water Quality Standards – Created for the AUS OU, CONWR

NA = Not Applicable

Sources:

(1) O'Brien & Gere, 1988. Remedial Investigation Report, Crab Orchard National Wildlife Refuge , August. Note, Results for some chemicals reported by O'Brien & Gere (1988 RI) were determined to be not useable; all usable results are considered estimated. For a list of chemicals considered not useable, refer to DPRA Document No. 00018887, a letter dated 02/18/87 from USEPA to USFWS.

(2) Woodward-Clyde, 1996. Remedial Investigation Report, Remedial Investigation Miscellaneous Areas Operable Unit, Crab Orchard National Wildlife Refuge , February.

TABLE 8-1, ANALYTICAL DATA SCREENING FOR
SITE 16 - AREA 7 INDUSTRIAL SITE, MISCA OU

LAND USE CONTROL IMPLEMENTATION PLAN
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Source	O'B&G		O'B&G		O'B&G		O'B&G		O'B&G		O'B&G		WCC		WCC		WCC		WCC		WCC		WCC	
Sample ID	16-13-1-1		16-14-1-1		16-15-1-4		16-15-1-6		16-16-1-1		16-17-1-1		COCO1601/2		COCO1603/4		COSE21601		COSE21602		COSE21603		COSE21604	
Depth (feet)	0-1		0-1		0-1		0-1		0-1		0-1													
Matrix (soil & sediment values shown in mg/kg; surface water values in ug/L)	Soil	*R. Code*	Soil	*R. Code*	Soil	*R. Code*	Soil	*R. Code*	Soil	*R. Code*	Soil	*R. Code*	Soil	*R. Code*	Soil	*R. Code*	Sediment	*R. Code*	Sediment	*R. Code*	Sediment	*R. Code*	Sediment	*R. Code*
CONSTITUENT																								
2-Methylnaphthalene							0.139						ND		ND		ND		ND		ND		ND	
Acetone													0.22		0.022		ND		ND		ND		ND	
Aluminum	16100	H	3280		5320				13800	H	15600	H	8400	H	10900	H								
Anthracene							ND																	
Antimony	5.1	A H	ND		ND				ND		ND													
Aroclor 1254			2.552	H			0.28	H									ND		ND		ND		ND	
Arsenic	--		--		--		--		--		--		3.4	H	5.1	H	12.2	B H	5.3	H	5.1	H	5.9	H
Barium	135		52.7		119				146		113		109		105									
Benz[a]anthracene							ND						ND		ND		ND		ND		ND		ND	
Bis(2-ethylhexyl)phthalate							ND						ND		ND		ND		ND		ND		ND	
Boron	5.1		17	A	67	A			3.4		7.6	A												
Calcium	2660	A	197000	A	105000	A			883		7640	A	53000	A	5400	A								
Chromium	22		18		83	A			42	A	21		14		19		15.6		12.4		15.8		12.8	
Chrysene							0.041						ND		ND		ND		ND		ND		ND	
Cobalt	10		4		5				6		7		7.2		15									
Copper	--		--		--		--		--		--		14	A	35	A	7.9		7.4		15.8		11.8	
Dibenzofuran							0.05						ND		ND		ND		ND		ND		ND	
Di-n-butyl phthalate							0.041						ND		ND		ND		ND		ND		ND	
Ethylbenzene	ND		ND		ND				ND		ND		ND		ND		ND		1.2		ND		ND	
Fluoranthene							ND						ND		ND		ND		ND		ND		ND	
Iron	18900	H	8580	H	30700	A H			16600	H	19200	H	14000	H	19000	H								
Lead	--		--		--		--		--		--		9.6		24	A	17		7.4		9.7		11.8	
Magnesium	3040	A	21100	A	10700	A			2370	A	5660	A	14000	A	19000	A								
Manganese	476	H	236	H	460	H			411	H	394	H	440	H	780	H								
Methyl ethyl ketone (2-Butanone)	--		--		--		--		--		--		ND		ND		ND		0.57		ND		ND	
Naphthalene							0.051						ND		ND		ND		ND		ND		ND	
Nickel	--		--		--		--		--		--		11		15		10.5		7.8		9.7		9.9	
N-Nitroso di-n-propylamine							ND						ND		ND		ND		ND		ND		ND	
Phenanthrene							0.107						ND		ND		ND		ND		ND		ND	
Potassium													400		570									
Pyrene							0.034						ND		ND		ND		ND		ND		ND	
Silver	--		--		--		--		--		--		ND		1.8	A	ND		ND		ND		ND	
Sodium	160		270	A	240	A	140		130		110		89		80									
Thallium													0.36		0.44	A	ND		ND		ND		ND	
Titanium	167		32		77.7				205		247													
Vanadium	43		ND		10				36		39		19		28									
Xylenes (total)	ND		ND		ND				ND		ND		ND		ND		13		7.9		ND		ND	
Zinc	--		--		--		--		--		--		40		88	A	22		26.2		39.7		35.4	

Legend

mg/kg = milligrams per kilogram, ug/L = micrograms per Liter

-- = Analyzed but not shown (see Note included in Source (1), below)

ND = Not detected

For data qualifiers, refer to source reports.

Shading indicates constituent exceeded background and at least one screening criterion for inorganics; for all other constituents, shading indicates an exceedance of at least one screening criterion.

Note: if result is blank, the constituent was not analyzed in that sample.

D - IEPA TACO Tier 1 Soil Remed. Object. for Residential Properties – Ingestion Exposure Route

E - IEPA TACO Tier 1 Soil Remed. Object. for Residential Properties – Inhalation Exposure Route

F - IEPA TACO Tier 1 Soil Remed. Object. for Construction Worker Ingestion Exposure Route

G - IEPA TACO Tier 1 Soil Remed. Object. for Construction Worker Inhalation Exposure Route

H - USEPA Region 9 Residential Soil Preliminary Remediation Goals

I – Illinois General Use Water Quality Standards – Created for the AUS OU, CONWR

NA = Not Applicable

(1) O'Brien & Gere, 1988. Remedial Investigation Report, Crab Orchard National Wildlife Refuge , August. Note, Results for some chemicals reported by O'Brien & Gere (1988 RI) were determined to be not useable; all usable results are considered estimated. For a list of chemicals considered not useable, refer to DPRA Document No. 00018887, a letter dated 02/18/87 from USEPA to USFWS.

(2) Woodward-Clyde, 1996. Remedial Investigation Report, Remedial Investigation Miscellaneous Areas Operable Unit, Crab Orchard National Wildlife Refuge , February.

AUS-0A07 and MISCA OU Site 16 Figure 8-1

IOP Wide Restrictions

-No production water wells shall be installed.
-Residential use and camping are prohibited.

AUS-0A07 and Site 16 Restrictions

-Access to this area is restricted to personnel with a specific need to be at the site.
-No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers.
-Agricultural uses are prohibited at this site.
-Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts.
-Soil from this site should not be used for borrow material.
-CERCLA staff should be consulted at the time any earthmoving activities are planned or scheduled.

Buildings IN-1-3, IN-1-4, IN-1-5, and IN-1-6 and the area surrounding these buildings.

- Minimize exposure as much as practicable.
- Mowing is prohibited around these buildings.

Note, warning signs have been placed around the affected areas.

AUS-0A07 Personal Protective Equipment (PPE) Recommendations

Level D1**
-Dust mask, snug-fitting.
-Hooded chemical-resistant clothing (overalls with long-sleeved jacket; coveralls; or one or two-piece splash suit; disposable chemical-resistant overalls) if potentially exposed to groundwater at bottom of trench or excavation.
-Coveralls (optional, as applicable).
-Gloves, outer, chemical-resistant.
-Gloves, inner, chemical-resistant.
-Boots, chemical-resistant, protective steel toe and shank.
-Hard hat (optional, as applicable).
-Face shield (optional, as applicable).

Level D2*
-Same as Level D1 without the dust mask.

*Applies only if there are excavation activities in the area.

Buildings IN-1-3, IN-1-4, IN-1-5, and surrounding area restrictions.

Level D1 PPE Recommended for workers or short time site visitors in buildings IN-1-3, IN-1-4, IN-1-5, or IN-1-6.

IN-1-6 IN-1-5 IN-1-4 IN-1-3 IN-1-2 IN-1-1
IN-2-6 IN-2-5 IN-2-3 IN-2-2 IN-2-1
IN-3-6 IN-3-4 IN-3-3 IN-3-2
IN-4-6 IN-4-5 IN-4-3 IN-4-2 IN-4-1
IN-5-6 IN-5-4 IN-5-1
IN-6-5 IN-6-2 IN-6-1

AUS 0A07

Area 7

Level D1 PPE Recommended for workers and short term site visitors if airborne dust is visible or for workers in an excavation.

*Level D2 PPE Recommended for workers outside an excavation if airborne dust is not visible.

Dust control measures should be implemented during excavation or other activities where soil is disturbed.

AUS-0A07 and MISCA OU Site 16
February 2007

- PPE Recommendations
- Pesticide Access Restriction
- AUS RIFS Boundaries
- Area 7 Buildings
- MISCA OU Site 16
- Roads
- Former RR Locations
- Streams

0 100 200 Feet

N

9.1 AREA 8

Site AUS-0A8S is south of Crab Orchard Lake and includes the southern part of the former IOP Group III Load Line (**Figures 1-7 and 9-1**). The load line originally included 29 buildings, which were prefixed with "III-1." The site includes about 150 acres.

The only remaining buildings from the Group III Load Line are those from the northern portion of the former load line. None of the buildings in the site designated as AUS-0A8S are still on site.

9.1.1 LUCIP for AUS-0A8S – Load Line III (AUS OU)

AUS-0A08 is currently part of a remedial investigation conducted by General Dynamics Ordnance and Technical Systems. It was identified in the AUS OU PA/SI as requiring an RI because of exceedances of screening values.

9.1.1.1 Site Description and Investigation Results

Operational History and Waste Characteristics

Load Line III was an IOP melt-pour operation for 500-pound bombs (**Figure 9-1**). TNT, which was sometimes blended with ammonium nitrate, was brought from off-site, melted, and poured into the bomb casings.

Products manufactured by post-World War II tenants included fiberglass canoes, propellants, pyrotechnics, and ground explosive powder. After a 1981 fire, the entire site was razed and buried. No industrial activity has taken place at Area 8 South since that time.

Olin occupied several of the former IOP buildings in Area 8 South from 1959 through the early 1960s for storage of ammonium nitrate fertilizer. Lease information indicates that Olin occupied the entire southern portion of Area 8 from 1960 through 1962.

Petrof Trading Company (Petrof) occupied two Area 8 buildings in the late 1960s. Petrof's operation in Area 8 involved grinding explosive powder. After Petrof left the site, black powder that was left behind was buried by the USFWS and the burial area was fenced off and marked.

CTI leased the south end of Area 8 from June 1969 to November 1970. CTI produced pyrotechnic devices for the military and their major product was the Mark II ground burst simulator. They also produced cannon net traps and parts for rocket separators.

American Fiber-Glass, Incorporated (AFL), leased this area from 1973 to 1981, when fire destroyed the facility. AFL manufactured fiberglass products, primarily canoes. A former employee reported that AFL used organic solvents, such as toluene, for cleanup operations.

Site Investigation

The SI included drum content, soil, sediment, groundwater, and surface water samples.

Notable Contamination Found

Most of the contamination was limited to the far southern end of the site. Both 2,4-and 2,6-dinitrotoluene were detected in the soil above SI screening criteria. 2,4-dinitrotoluene was

detected at 1,400 ug/kg, compared to a screening criterion of 0.8 ug/kg. Dinitrotoluene is used as a gelatinizing and waterproofing agent in explosives, and as an additive in propellant and smokeless powder. 2,4-dinitrotoluene is also used in the production of toluene di-isocyanate.

Maximum concentrations of several metals in sediments exceeded SI screening criteria, including copper at 3,300 mg/kg, arsenic at 63 mg/kg, lead at 665 mg/kg, and zinc at 1,800 mg/kg.

The Illinois surface water quality standard for copper was exceeded.

9.1.1.2 LUCIP Objective

The IOP-wide LUCIP objectives apply. As with all sites under investigation in the AUS OU RI, exposure should be minimized as much as practicable. RI results may indicate the need for additional restrictions (**Figure 9-1**).

When the results from the current RI are available, this LUCIP will be reviewed and appropriate modifications made.

9.1.1.3 LUC(s) Implemented to Achieve Objective

In addition to the IOP-wide LUCs, access to this area is restricted to personnel with a specific need to be at the site (**Figure 9-1**). No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers. Additionally, soil from this site should not be used for borrow material

Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts. Agricultural use is prohibited at this site. These LUCs will be modified as appropriate as data are obtained in the RI.

PPE guidelines are provided for a portion of this site. Refer to Section 1.4.1, Table 1-5, and **Figure 9-1**.

9.1.1.4 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. Other restrictions will depend upon the results of the RI/FS currently in progress.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

9.1.1.5 Applicable Decision Document

There is not yet a decision document for this site.

9.1.2 LUCIP for Site 12 – Area 8 Impoundment (MISCA OU)

9.1.2.1 Site Description

Site 12 is located to the east of former Area 8 Building III-1-24 in the location of a circular impoundment approximately 100 feet in diameter (**Figure 1-4**). In the past, there was an aboveground storage tank located within the circular berm. The tank was reportedly used for storage of fuel oil for the IOP boiler house previously located nearby. The tank was reportedly removed during the early 1960s. The 6-foot walls of the bermed area were previously breached. The suspected source of contamination at this site is the former fuel oil tank - several black oily pools and black sediment and tars located in and around the impoundment were visible in the mid-1980s. By 1992 these features were not visible. The area is now overgrown with trees and vegetation.

Previous investigations at Site 12 included the 1988 RI and the 1993 Phase I RI

9.1.2.2 Investigations

1988 RI (O'Brien & Gere)

During the 1988 RI, two composite sediment samples (0-1 foot deep) and one composite soil sampled (0-1 foot deep) were analyzed. The soil sample and one of the sediment samples were analyzed for VOCs, pesticides, total PCBs, and metals. The remaining sediment sample was analyzed for VOCs, SVOCS, pesticides, PCBs, and sodium.

Table 9-1 summarizes only the detected analytical results from these samples. None of the detections exceeded levels of concern established for the 1988 RI. However, as shown in **Table 9-1**, a comparison of the 1988 data with the screening criteria used for this LUCIP shows one potential chemical of concern for soil and one for sediment.

Soil

Aldrin exceeded the following screening criteria in the soil sample:

- IEPA TACO Tier 1 Soil Remediation Objective for Residential Properties (ingestion exposure route)
- USEPA Region 9 Residential Soil Preliminary Remediation Goal

Sediment

Aluminum exceeded the following screening criteria in one sediment sample:

- Background Sediment 95% Upper Tolerance Limit (UTL), and
- USEPA Region 9 Residential Soil Preliminary Remediation Goal

1993 Phase I RI (Woodward Clyde)

Two composite/discrete surface soil sample pairs were collected. The composite samples (1.8 to 2.2 feet deep) were analyzed for SVOCs, PCBs, pesticides, explosives, metals, and cyanide, while the discrete samples (1.8 feet deep) were analyzed for VOCs.

Table 9-1 summarizes only the detected analytical results from the two sample pairs. None of the detections exceeded levels of concern established for the 1993 Phase I RI which determined that no further investigation was necessary. However, as shown in **Table 9-1**, a comparison of the 1993 data with the screening criteria used for this LUCIP shows one potential chemical of concern.

Thallium exceeded the following screening criteria in three soil samples:

- Background Soil 95% Upper Tolerance Limit (UTL), and
- USEPA Region 9 Residential Soil Preliminary Remediation Goal

9.1.2.3 LUCIP Objective

Based on the available data, no restrictions other than the IOP-wide LUCs are needed at this time. Additional investigation may be done in this area as part of the AUS OU RI. The need for any additional restrictions will be evaluated as part of that RI.

9.1.2.4 LUC(s) Implemented to Achieve Objective

No additional LUCs beyond the IOP-wide LUCs are needed except that soil from this site should not be used for borrow material.

9.1.2.5 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. However, if additional data show risks not yet identified, additional restrictions may apply.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

9.1.2.6 Applicable Decision Document

The applicable decision document is the Record of Decision, Site 36 of the Miscellaneous Areas Operable Unit, Crab Orchard National Wildlife Refuge NPL Site, Marion, Illinois (USFWS, 2002). While the ROD identifies this site as a "No Action" site, the IOP-wide LUCs are still needed because of the exceedances of screening criteria and lack of groundwater data.

9.1.3 LUCIP FOR Site 14 – Area 8 Solvent Storage Drainage Ditch (MISCA OU)

9.1.3.1 Site Description and Location

Site 14 is an approximately 3.5-acre area at a current tenant's active manufacturing and warehouse facility (**Figures 1-4 and 9-1**). Soil and groundwater are contaminated primarily with toluene, ethylbenzene, xylenes, and methylene chloride. The groundwater contamination exceeds MCLs and State of Illinois Class I groundwater standards for these constituents. Remediation will be done to prevent further degradation of the groundwater and to restore the groundwater to its State designated beneficial use (State of Illinois Class I groundwater standards or MCLs). In addition, soil at this site is also contaminated with chromium (representing a potential risk to the American Robin) and with lead (representing a potential human health risk). Site 14 is located in the northern part of Area 8. It is a relatively flat, poorly drained area. It is located at an existing manufacturing facility in the industrial part of the Refuge. The buildings shown in the attached figure are part of the operating facility. The site consists primarily of the grassy area partially surrounded by three buildings (the former Repour Building, Building 3 [including Annex 3], and Annex 3A), and the soil beneath the former Repour Building. Elevations at Site 14 range from a high of 440 feet just south of Annex 3, to a low of 433 feet, in the drainage channel north of the former Repour Building. See attached figure for site location details.

9.1.3.2 LUCIP Objective

The IOP-wide objectives apply. An additional objective is to ensure awareness of pre-remediation contamination by all persons potentially affected.

9.1.3.3 LUC(s) Implemented to Achieve Objective

In addition to the IOP-wide LUCs, installation of warning signs around the Site 14 perimeter is required (**Figure 9-1**) and access to this area is restricted to personnel with a specific need to be at the site. No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers.

Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts. Soil from this site should not be used for borrow material. These LUCs will be modified as appropriate as data are obtained in the RI.

9.1.3.4 Action Needed to Remove the LUC

This LUCIP will be revised after the remediation is complete, based on whatever residual contamination is left at the site. Requirements applicable to removal of the IOP-wide LUC would also apply.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

9.1.3.5 Applicable Decision Document

The applicable decision document is the Record of Decision, Site 14 of the Miscellaneous Areas Operable Unit, Crab Orchard National Wildlife Refuge NPL Site, Marion, Illinois (USFWS, 2001).

TABLE 9-1
ANALYTICAL DATA SCREENING FOR
SITE 12 - AREA 8 IMPOUNDMENT
MISCA OU

LAND USE CONTROL IMPLEMENTATION PLAN
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Source	O'B&G		O'B&G		O'B&G		WCC (1993 Ph I)		WCC (1993 Ph I)	
Sample ID	12-3-1-4		12-2-3-1		12-2-3-7		COSO1201/3		COSO1202/4	
Matrix (soil & sediment values shown in mg/kg; surface water values in ug/L)	Soil	*R. Code*	Sediment	*R. Code*	Sediment	*R. Code*	Soil	*R. Code*	Soil	*R. Code*
Depth (feet)	0-1		0-1		0-1		1.8-2.2/1.8		1.9-2.2/1.8	
CONSTITUENT										
Acenaphthene	NA		NA		0.035		ND		ND	
Acetone	NA		NA		NA		1.7		0.059	
Aldrin	0.082	D H	ND		ND		ND		ND	
Aluminum	14300	H	13000	B H	NA		8400	H	9100	H
Anthracene	NA		NA		0.104		ND		ND	
Arsenic	--		--		--		8.2	H	7.4	H
Barium	157		151		NA		140		120	
Beryllium	--		--		--		0.67		0.6	
Boron	2.5		37		NA		NA		NA	
Calcium	1830		3300	B	NA		2400		1160	
Chromium	17		10		NA		13		12	
Cobalt	6		ND		NA		7.8		7.6	
Copper	--		--		--		12	A	8	
Fluoranthene	NA		NA		0.035		ND		ND	
Fluorene	NA		NA		0.108		ND		ND	
Iron	15300	H	16200	H	NA		18000	H	NA	
Lead	--		--		--		16		9.9	
Magnesium	2010	A	2110	B	NA		2000	A	1240	
Manganese	561	H	559	H	NA		1070	H	890	H
Mercury	--		--		--		0.02		ND	
Methyl ethyl ketone	--		--		--		0.007		ND	
Methylene chloride (Dichloromethane)	ND		ND		NA		0.009		0.006	
m-Xylene	0.012		ND		NA		ND		ND	
Nickel	--		--		--		10.5		10.4	
Phenanthrene	NA		NA		0.655		ND		ND	
Potassium	NA		NA				440		360	
Pyrene	NA		NA		0.301		ND		ND	
Silver	--		--		--		1.3	A	1.15	A
Sodium	120		50		210		98		60	
Thallium	NA		NA		NA		0.48	A	0.6	A H
Titanium	200		90.8		NA		NA		NA	
Toluene	ND		ND		NA		ND		0.011	
Vanadium	36		33	B	NA		29		25	
Zinc	--		--		--		32		31	

Note: The O'Brien & Gere RI mistakenly refers to Area 8 as Area 14. MISCA OU Sites 12, 13, and 14 are all located within Area 8. Therefore, all three of these sites will be noted as Area 8 sites, not Area 14. Tables and text for this Institutional Control Plan will be referenced accordingly.

Shading indicates constituent exceeded background and at least one screening criterion for inorganics; for all other constituents, shading indicates an exceedance of at least one screening criterion.

Legend

mg/kg = milligrams per kilogram, ug/L = micrograms per Liter
ND = Not detected
NA = Not Applicable or Not Analyzed
-- = Analyzed but not shown (see Note included in Source (1), below)
For data qualifiers, refer to source reports.

Sources:

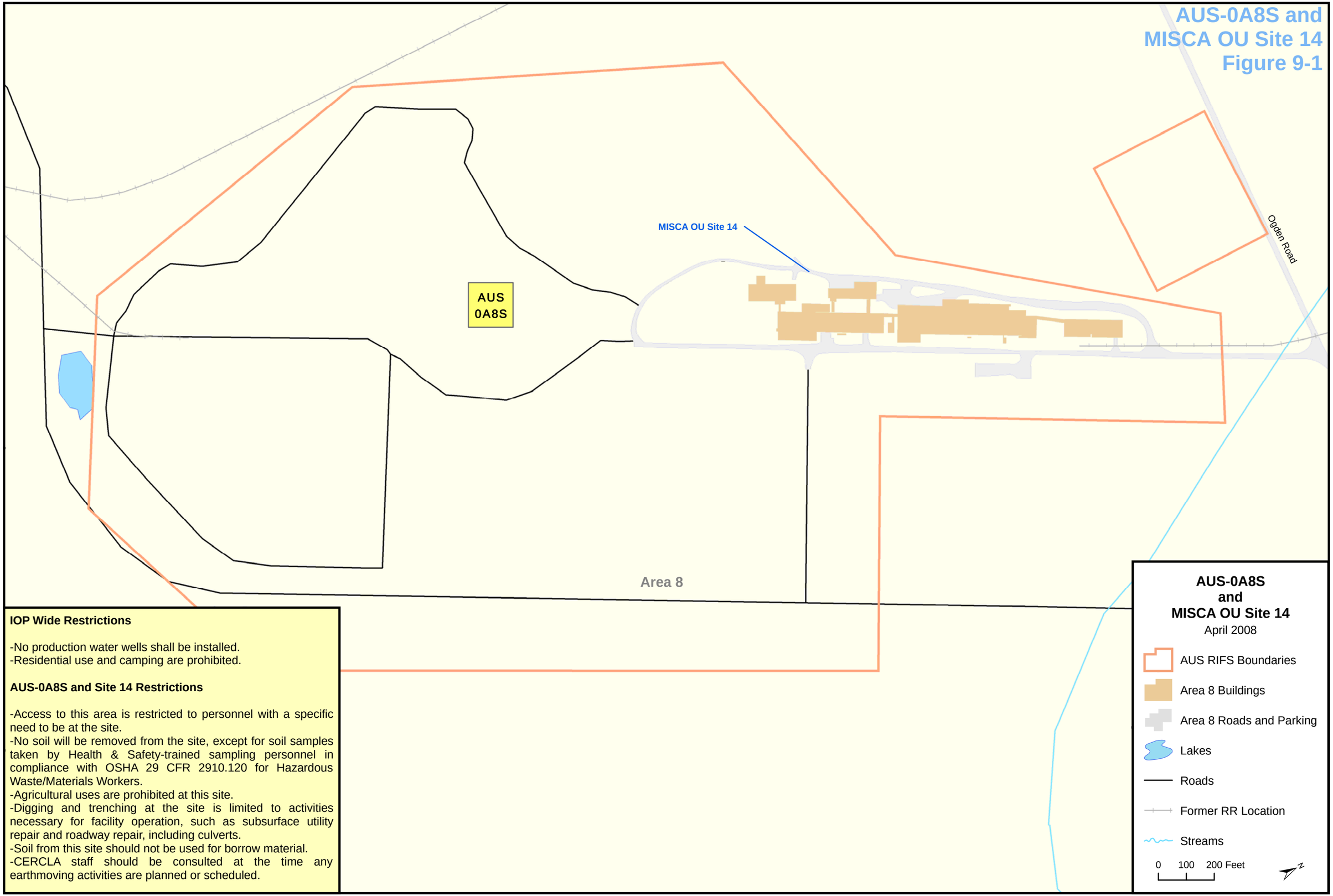
(1) O'Brien & Gere, 1988. Remedial Investigation Report, Crab Orchard National Wildlife Refuge , August. Note, Results for some chemicals reported by O'Brien & Gere (1988 RI) were determined to be not useable; all usable results are considered estimated. For a list of chemicals considered not useable, refer to DPRA Document No. 00018887, a letter dated 02/18/87 from USEPA to USFWS.

(2) Woodward-Clyde, 1996. Remedial Investigation Report, Remedial Investigation Miscellaneous Areas Operable Unit, Crab Orchard National Wildlife Refuge , February.

Reference Codes:

A - Background Soil 95% UTL
B - Background Sediment 95% UTL
C - Background Surface Water 95% UTL
D - IEPA TACO Tier 1 Soil Remediation Objectives for Residential Properties – Ingestion Exposure Route
E - IEPA TACO Tier 1 Soil Remediation Objectives for Residential Properties – Inhalation Exposure Route
F - IEPA TACO Tier 1 Soil Remediation Objectives for Construction Worker Ingestion Exposure Route
G - IEPA TACO Tier 1 Soil Remediation Objectives for Construction Worker Inhalation Exposure Route
H - USEPA Region 9 Residential Soil Preliminary Remediation Goals
I – Illinois General Use Water Quality Standards – Created for the AUS OU, CONWR

AUS-0A8S and MISCA OU Site 14 Figure 9-1



IOP Wide Restrictions

-No production water wells shall be installed.
-Residential use and camping are prohibited.

AUS-0A8S and Site 14 Restrictions

-Access to this area is restricted to personnel with a specific need to be at the site.
-No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers.
-Agricultural uses are prohibited at this site.
-Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts.
-Soil from this site should not be used for borrow material.
-CERCLA staff should be consulted at the time any earthmoving activities are planned or scheduled.

AUS-0A8S and MISCA OU Site 14
April 2008

- AUS RIFS Boundaries
- Area 8 Buildings
- Area 8 Roads and Parking
- Lakes
- Roads
- Former RR Location
- Streams

0 100 200 Feet

N

10.1 AREA 9

Area 9 was the IOP Group Load Line I and is located south of Crab Orchard Lake and east of Highway 148 (**Figures 1-7, 10-1, and 10-2**). Load Line I originally consisted of the 38 buildings. All the building numbers are prefixed with "I-1." Later industrial tenants have added many buildings and building numbers now extend into the 100s.

10.1.1 LUCIP for AUS-0A09 – Load Line I (AUS OU)

In 1996 and 1997, a large area in and near Area 9 was remediated as a part of the PCB OU (See Sites 32/33 of the PCB OU). Site AUS-0A09 includes that part of Area 9 located outside the excavation boundaries for the original PCB OU remediation, and outside the area currently planned for remediation for chlorinated VOC groundwater contamination under the PCB OU (**Figures 10-1 and 10-2**). Site AUS-0A09 includes about 100 acres.

AUS-0A09 is currently part of a remedial investigation conducted by General Dynamics Ordnance and Technical Systems. It was identified in the AUS OU PA/SI as requiring an RI because of exceedances of screening values.

10.1.1.1 Site Description and Investigation Results

Operational History and Waste Characteristics

During World War II, TNT was screened, melted, and loaded on this artillery and bomb loading line.

There were two major tenants and several minor ones in Area 9. Sangamo Electric Company (Sangamo), now Schlumberger Industries, Inc., was the first major tenant, and contamination from its operations is the focus of the PCB OU remediation. Olin and its successors were the other major tenant.

From 1946 to 1962, Sangamo leased the site and manufactured various kinds of capacitors as well as transducers and delay line equalizers. Sangamo used lead to coat small parts, such as electrical connections. Sangamo also used degreasers and other chemicals in their manufacturing processes, such as acids, acetone, ethylene glycol, epoxy resins, silver, ammonia, trichloroethylene, perchloroethylene (PCE), liquid Aroclor 1254 and 1242.

Olin/Primex/GDO&TS have leased buildings in Area 9 from 1967 to the present, for several different activities, including pyrotechnic operations, which included manufacturing magnesium flares and illumination flares; as well as medium caliber ammunition production.

See the discussion under the AUS-0A2B summary for known chemicals used and waste products generated by Olin and its successors.

Site Investigation

The SI included soil and groundwater samples.

Notable Contamination Found

Many PAHs, three phthalates, and several metals were detected in soil at concentrations above SI screening criteria. 2,4-dinitrotoluene was detected at 2,100 ug/kg in soil.

10.1.1.2 LUCIP Objective

The IOP-wide LUCIP objectives apply. As with all sites under investigation in the AUS OU RI, exposure should be minimized as much as practicable. RI results may indicate the need for additional restrictions (**Figures 10-1 and 10-2**).

When the results from the current RI are available, this LUCIP will be reviewed and appropriate modifications made.

10.1.1.3 LUC(s) Implemented to Achieve Objective

In addition to the IOP-wide LUCs, access to this area is restricted to personnel with a specific need to be at the site (**Figures 10-1 and 10-2**). No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers. Additionally, soil from this site should not be used for borrow material.

Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts; CERCLA staff should be consulted at the time any earthmoving activities are planned or scheduled. Agricultural use is prohibited at this site. These LUCs will be modified as appropriate as data are obtained in the RI.

PPE guidelines are provided for a portion of this site. Refer to Section 1.4.1, Table 1-5, and **Figures 10-1 and 10-2**.

10.1.1.4 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. Other restrictions will depend upon the results of the RI/FS currently in progress.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

10.1.1.5 Applicable Decision Document

There is not yet a decision document for this site.

10.1.2 LUCIP for Site 35 – Area 9 East Waterway (MISCA OU)

10.1.2.1 Site Description

Site 35 is a depression lacking vegetation in an agricultural field east of Area 9 (**Figure 1-4**). While the site is not known to have a history of industrial use, the lack of vegetation in the depression suggested possible contamination.

Previous investigations at Site 35 include the 1988 RI.

10.1.2.2 Investigations

1988 RI (O'Brien & Gere)

During the 1988 RI, one composite sediment sample (0-1ft deep) was collected and analyzed for VOCs, SVOCs, pesticides, PCBs, explosives, metals, some indicator parameters.

Table 10-1 summarizes only the detected analytical results from the sediment sample. None of the detections exceeded levels of concern established for the 1988 RI, nor did they exceed any screening criteria used for this LUCIP (**Table 10-1**).

10.1.2.3 LUCIP Objective

Based on the available data, no objectives other than the IOP-wide objectives (Section 2) are needed at this time ().

10.1.2.4 LUC(s) Implemented to Achieve Objective

No additional LUCs beyond the IOP-wide LUCs are needed except that soil from this site should not be used as borrow material.

10.1.2.5 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. However, if additional data show risks not yet identified, additional restrictions may apply.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

10.1.2.6 Applicable Decision Document

The applicable decision document is the Record of Decision, Site 36 of the Miscellaneous Areas Operable Unit, Crab Orchard National Wildlife Refuge NPL Site, Marion, Illinois (USFWS,

2002). While the ROD identifies this site as a "No Action" site, the IOP-wide LUCs are still needed because of the lack of groundwater data.

10.1.3 LUCIP for Sites 32/33 – Area 9 Landfill/Area 9 Building Complex (PCB OU)

10.1.3.1 Site Description and Investigation Results

Remediation for these sites for PCBs and metals was intended to be completed in 1996, and a draft Closeout Report was submitted. PCB contamination was a result of Sangamo's operations (See discussion under AUS-0A09) (**Figures 1-2, 10-1, and 10-2)**.

The remediation criteria, in accordance with the ROD, was as follows:

- Lead to 450 ppm dry soil (dry weight basis)
- Cadmium to 10 ppm dry soil
- PCBs to 1 ppm dry soil in surface soils (defined as the top foot [12 inches] of soils)
- PCBs to 25 ppm dry soil in subsurface soils (defined as soils below the 1-foot depth)
- PCBs to 0.5 ppm dry sediments.

PCBs in soil at most locations were removed to a greater depth than required. A repository was constructed at Site 32 to contain ash from incinerated PCB waste, and also to contain soils with PCB contamination less than 25 ppm. The contaminated material in the repository is covered with 2 feet of clean material (one foot of ash and one foot of soil). Sampling done by FWS of soils and sediments since 1996 has found PCB concentrations at the site in excess of cleanup levels, up to 5,000 ppm. Based on a review of past investigation and remediation data, FWS has concluded that PCBs above cleanup levels may be present at locations throughout the site. FWS is investigating.

During remediation, chlorinated volatile organic (CVOC) contamination was found in soils and groundwater at Site 32 and 33 in Area 9. Further investigation was conducted. In August 2003, a feasibility study for remediation of the CVOC contamination was submitted.

10.1.3.2 LUCIP Objective

The IOP-wide LUCIP objectives apply. Any digging or earthmoving on the Repository is prohibited, except for purposes of repair. An additional objective is to limit exposure to the CVOC contamination near some buildings, and remaining PCB contamination.

10.1.3.3 LUC(s) Implemented to Achieve Objective

In addition to the IOP-wide LUCs, access should be limited to personnel who need to use the site. The site is in an area with restricted access, which will remain in effect at least until all remediation is complete. In addition, because of the TCE contamination in soil and groundwater, earthmoving and excavation should be limited to activities necessary for facility operation. Any excavation in areas where TCE concentrations exceed 10 mg/kg should be done by OSHA-trained and certified (OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers) work crews. The crews should have respirators available and should be trained in their proper use. These areas of TCE contamination in excess of 10 mg/kg are shown in **Figures 10-1 and 10-2**.

Digging should be prohibited except for investigatory purposes. Soil from this site should not be used for borrow material.

Due to TCE and other VOCs found in groundwater and to VOCs, SVOCs, PCBs, and inorganics found in soil, PPE guidelines are provided for this site. Refer to Section 1.4.1, Table 1-5, and **Figures 10-1 and 10-2**.

The PCB OU ROD requires a final risk assessment for this site, after completion of remediation.

10.1.3.4 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. The LUCs for CVOC contamination will remain in effect at least until the CVOC remediation is complete.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

10.1.3.5 Applicable Decision Document

The applicable decision document is the PCB OU ROD, signed in 1990. [37]

[37] U.S. Environmental Protection Agency, 1990b. *Declaration for the Record of Decision, Crab Orchard National Wildlife Refuge, PCB Areas Operable Unit,* August 1, 1990.

TABLE 10-1
ANALYTICAL DATA SCREENING FOR
SITE 35 - AREA 9 EAST WATERWAY
MISCA OU

LAND USE CONTROL IMPLEMENTATION PLAN
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Source	O'B&G	
Sample ID	35-1-3-1	
Matrix (soil & sediment values shown in mg/kg; surface water values in ug/L)	Sediment	*R. Code*
Depth (feet)	0-1	
CONSTITUENT		
Aluminum	7850	H
Aroclor 1254	0.016	
Barium	71.9	
Boron	29	
Calcium	4540	B
Chromium	10	
Iron	13200	H
Magnesium	1730	
Manganese	684	H
Sodium	650	
Titanium	142	
Vanadium	28	

Shading indicates constituent exceeded background and at least one screening criterion for inorganics; for all other constituents, shading indicates an exceedance of at least one screening criterion.

Legend
mg/kg = milligrams per kilogram, ug/L = micrograms per Liter
ND = Not detected
For data qualifiers, refer to source reports.

Sources:
(1) O'Brien & Gere, 1988. Remedial Investigation Report, Crab Orchard National Wildlife Refuge , August. Note, results for some chemicals reported by O'Brien & Gere (1988 RI) were determined to be not useable; all usable results are considered estimated. For a list of chemicals considered not useable, refer to DPRA Document No. 00018887, a letter dated 02/18/87 from USEPA to USFWS.
(2) Woodward-Clyde, 1996. Remedial Investigation Report, Remedial Investigation Miscellaneous Areas Operable Unit, Crab Orchard National Wildlife Refuge, February.

Reference Codes:
A - Background Soil 95% UTL
B - Background Sediment 95% UTL
C - Background Surface Water 95% UTL
D - IEPA TACO Tier 1 Soil Remediation Objectives for Residential Properties – Ingestion Exposure Route
E - IEPA TACO Tier 1 Soil Remediation Objectives for Residential Properties – Inhalation Exposure Route
F - IEPA TACO Tier 1 Soil Remediation Objectives for Construction Worker Ingestion Exposure Route
G - IEPA TACO Tier 1 Soil Remediation Objectives for Construction Worker Inhalation Exposure Route
H - USEPA Region 9 Residential Soil Preliminary Remediation Goals
I – Illinois General Use Water Quality Standards – Created for the AUS OU, CONWR

AUS-0A09 (North) and PCB OU Sites 32&33 Figure 10-1

IOP Wide Restrictions

-No production water wells shall be installed.
-Residential use and camping are prohibited.

AUS-0A09 (North) including PCB OU Sites 32 & 33 Restrictions

-Access to this area is restricted to personnel with a specific need to be at the site.
-No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials workers.
-Agricultural uses are prohibited at this site.
-Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts.
-Soil from this site should not be used for borrow material.
-CERCLA staff should be consulted at the time any earthmoving activities are planned or scheduled.
-Personnel mowing should wear a long sleeve shirt and pants, a dust mask, a head covering such as a baseball cap, and protective eyewear, as well as any other protective gear they would normally wear.

PCB OU Personal Protective Equipment (PPE) Recommendations

Level C
-Full or half-face, air purifying respirator (NIOSH approved).
-Hooded or non-hooded (based on task-specific potential for splashing and/or dust generation) Chemical-resistant clothing (overalls with long-sleeved jacket; coveralls; or one or two-piece splash suit; disposable chemical-resistant overalls).
-Coveralls (optional, as applicable).
-Gloves, outer, chemical-resistant.
-Gloves, inner, chemical-resistant.
-Boots, chemical-resistant, protective steel toe and shank.
-Hard hat (under suit, optional, as applicable).
-Face shield (optional, as applicable).

Level D1*
-Dust mask, snug-fitting.
-Hooded chemical-resistant clothing (overalls with long-sleeved jacket; coveralls; or one or two-piece splash suit; disposable chemical-resistant overalls) if potentially exposed to groundwater at bottom of trench or excavation.
-Coveralls (optional, as applicable).
-Gloves, outer, chemical-resistant.
-Gloves, inner, chemical-resistant.
-Boots, chemical-resistant, protective steel toe and shank.
-Hard hat (optional, as applicable).
-Face shield (optional, as applicable).

Level D2*
-Same as Level D1 without the dust mask.

Level D3*
-Dust mask, snug-fitting if airborne dust is visible.
-Long pants (i.e., no shorts).
-Short or long-sleeve shirts.
-Work gloves (optional, as applicable).
-Boots, chemical-resistant, protective steel toe and shank.

*Applies only if there are excavation activities in the area.

*Level C PPE Recommended for workers in an excavation.

I-1-23

I-1-20

I-1-12

I-1-88

AUS-0A09 (North)

Area 9

*Level D1 PPE Recommended for workers in excavation.

*Level D1 PPE Recommended for workers outside excavation if airborne dust is visible.

*Level D2 PPE Recommended for workers outside excavation if airborne dust is not visible.

*Level D3 PPE Recommended if airborne dust is not visible.

Dust control measures should be implemented during excavation or other activities where soil is disturbed.

AUS-0A09 (North) and PCB OU Sites 32 and 33
February 2007

- PPE Recommendations
- AUS RIFS Boundaries
- I Area Buildings
- Hydrants
- Waterlines
- Manholes
- Sewer Lines
- PCB Repository
- PCB Structures
- Roads
- Lakes
- Streams

0 250 500 Feet

AUS-0A09 (South) and PCB OU sites 32&33 Figure 10-2

IOP Wide Restrictions

-No production water wells shall be installed.
-Residential use and camping are prohibited.

AUS-0A09 (South) including PCB OU Sites 32 & 33 Restrictions

-Access to this area is restricted to personnel with a specific need to be at the site.
-No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials workers.
-Agricultural uses are prohibited at this site.
-Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts.
-Soil from this site should not be used for borrow material.
-CERCLA staff should be consulted at the time any earthmoving activities are planned or scheduled.
-Personnel mowing should wear a long sleeve shirt and pants, a dust mask, a head covering such as a baseball cap, and protective eyewear, as well as any other protective gear they would normally wear.

PCB OU Personal Protective Equipment (PPE) Recommendations

Level C1*
-Full or half-face, air purifying respirator (NIOSH approved).
-Hooded or non-hooded (based on task-specific potential for splashing and/or dust generation) Chemical-resistant clothing (overalls with long-sleeved jacket; coveralls; or one or two-piece splash suit; disposable chemical-resistant overalls).
-Coveralls (optional, as applicable).
-Gloves, outer, chemical-resistant.
-Gloves, inner, chemical-resistant.
-Boots, chemical-resistant, protective steel toe and shank.
-Hard hat (under suit, optional, as applicable).
-Face shield (optional, as applicable).

Level D1*
-Dust mask, snug-fitting.
-Hooded chemical-resistant clothing (overalls with long-sleeved jacket; coveralls; or one or two-piece splash suit; disposable chemical-resistant overalls) if potentially exposed to groundwater at bottom of trench or excavation.
-Coveralls (optional, as applicable).
-Gloves, outer, chemical-resistant.
-Gloves, inner, chemical-resistant.
-Boots, chemical-resistant, protective steel toe and shank.
-Hard hat (optional, as applicable).
-Face shield (optional, as applicable).

Level D2*
-Same as Level D1 without the dust mask.

Level D3*
-Dust mask, snug-fitting if airborne dust is visible.
-Long pants (i.e., no shorts).
-Short or long-sleeve shirts.
-Work gloves (optional, as applicable).
-Boots, chemical-resistant, protective steel toe and shank.

*Applies only if there are excavation activities in the area.

*Level D1 PPE Recommended for workers in excavation.

*Level D1 PPE Recommended for workers outside excavation if airborne dust is visible.

*Level D2 PPE Recommended for workers outside excavation if airborne dust is not visible.

*Level D3 PPE Recommended if airborne dust is not visible.

Dust control measures should be implemented during excavation or other activities where soil is disturbed.

AUS-0A09 (South)

I-1-88

I-1-3

I-1-2

I-1-1

Area 9

*Level C PPE Recommended for workers in an excavation.

AUS-0A09 (South) and PCB OU Sites 32 and 33
February 2007

- PPE Recommendations
- AUS RIFS Boundaries
- I Area Buildings
- Hydrants
- Waterlines
- Manholes
- Sewer Lines
- Roads
- Streams

0 150 300 Feet

11.1 AREA 10

Area 10, the former IOP Fuse and Booster Storage Magazine (FBM) area, is located south of Crab Orchard Lake, on the north side of Ogden Road (**Figures 1-7 and 11-1**). Area 10 was a group of 16 storage magazines for components of ordnance produced on the load lines. The site covers about 40 acres.

The FBM area was in the shape of a trapezoid, and the storage magazines were arranged in four rows. All of the magazine numbers started with the prefix "FBM." By 1965, all of the magazines had been removed.

11.1.1 LUCIP for AUS-0A10 – Fuse and Booster Storage Magazines (AUS OU)

AUS-0A10 is currently part of a remedial investigation conducted by General Dynamics Ordnance and Technical Systems. It was identified in the AUS OU PA/SI as requiring an RI because of exceedances of screening values.

11.1.1.1 Site Description and Investigation Results

Operational History and Waste Characteristics

During World War II, fuses and boosters stored in Area 10 were transported to the IOP Load Lines, where anti-tank mines, bombs and artillery were being produced (**Figure 11-1**).

In 1949, USFWS used three of the magazines for grain storage. Sangamo Weston, Inc. (Sangamo), the only documented tenant in Area 10, leased two magazines from 1949 to at least 1951.

Although it had no leases in Area 10, Olin constructed and used large pits in this area for the incineration of ignitable wastes from its production operations. John Miller, a former Olin manager and chemist, indicated that Olin moved from one burning ground to another as they outgrew the previous burn area, and that all of Olin's manufacturing operations on the Refuge used a single burn area at the same time. Olin documents indicate that they moved their burning grounds from Area 12 to Area 2D in 1965, from Area 2D to Area 9 in 1967 and from Area 9 to Area 10 in 1968. The Area 10 burn area was in operation until open burning was banned at the Refuge in 1970.

Scrap explosive wastes that Olin burned at Area 10 consisted of propellant, illumination scrap mix, igniter scrap, laboratory waste pyrotechnic materials, and other explosives and explosive contaminated materials. Oil was added to explosive material to cushion and dampen the material to prevent explosions prior to burning. Scrap was collected at workstations or scrap areas and taken to Area 10 where it was dumped into the burn pits and topped with small quantities of ignitable powders.

Olin has estimated that 120,000 pounds (lbs) of waste were burned in this area and that about 1,000 lbs of residue remained, consisting mainly of metal oxides. Olin reported that the soils in the vicinity of this burning ground possibly contained lead contamination, and also that fuel oil, acetone, lupersol (methyl ethyl ketone peroxide)and other chemicals would have been present in these pits.

In 1970, when open burning was banned, the pits were covered. Since that time the site has been used by local law enforcement personnel for small arms practice.

Site Investigation

The SI included soil and surface water samples; no groundwater monitoring wells were installed.

Notable Contamination Found

TCE was detected above SI screening criteria in soil. Maximum detections of several inorganics exceeded SI screening criteria, including barium at 14,100 mg/kg, and boron at 513 mg/kg.

11.1.1.2 LUCIP Objective

The IOP-wide LUCIP objectives apply. As with all sites under investigation in the AUS OU RI, exposure should be minimized as much as practicable. RI results may indicate the need for additional restrictions.

When the results from the current RI are available, this LUCIP will be reviewed and appropriate modifications made.

11.1.1.3 LUC(s) Implemented to Achieve Objective

In addition to the IOP-wide LUCs, access to this area is restricted to personnel with a specific need to be at the site (**Figure 11-1**). No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers. Additionally, soil from this site should not be used for borrow material.

Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts. CERCLA staff should be consulted at the time any earthmoving activities are planned or scheduled. Agricultural use is prohibited at this site. These LUCs will be modified as appropriate as data are obtained in the RI.

PPE guidelines are provided for a portion of this site. Refer to Section 1.4.1, Table 1-5, and **Figure 11-1**.

11.1.1.4 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. Other restrictions will depend upon the results of the RI/FS currently in progress.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

11.1.1.5 Applicable Decision Document

There is not yet a decision document for this site.

AUS-0A10 and AUS-0043
Figure 11-1

IOP Wide Restrictions

-No production water wells shall be installed.
-Residential use and camping are prohibited.

AUS-0A10 and AUS-0043 Restrictions

-Access to this area is restricted to personnel with a specific need to be at the site.
-No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers.
-Agricultural uses are prohibited at this site.
-Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts.
-Soil from this site should not be used for borrow material.
-CERCLA staff should be consulted at the time any earthmoving activities are planned or scheduled.

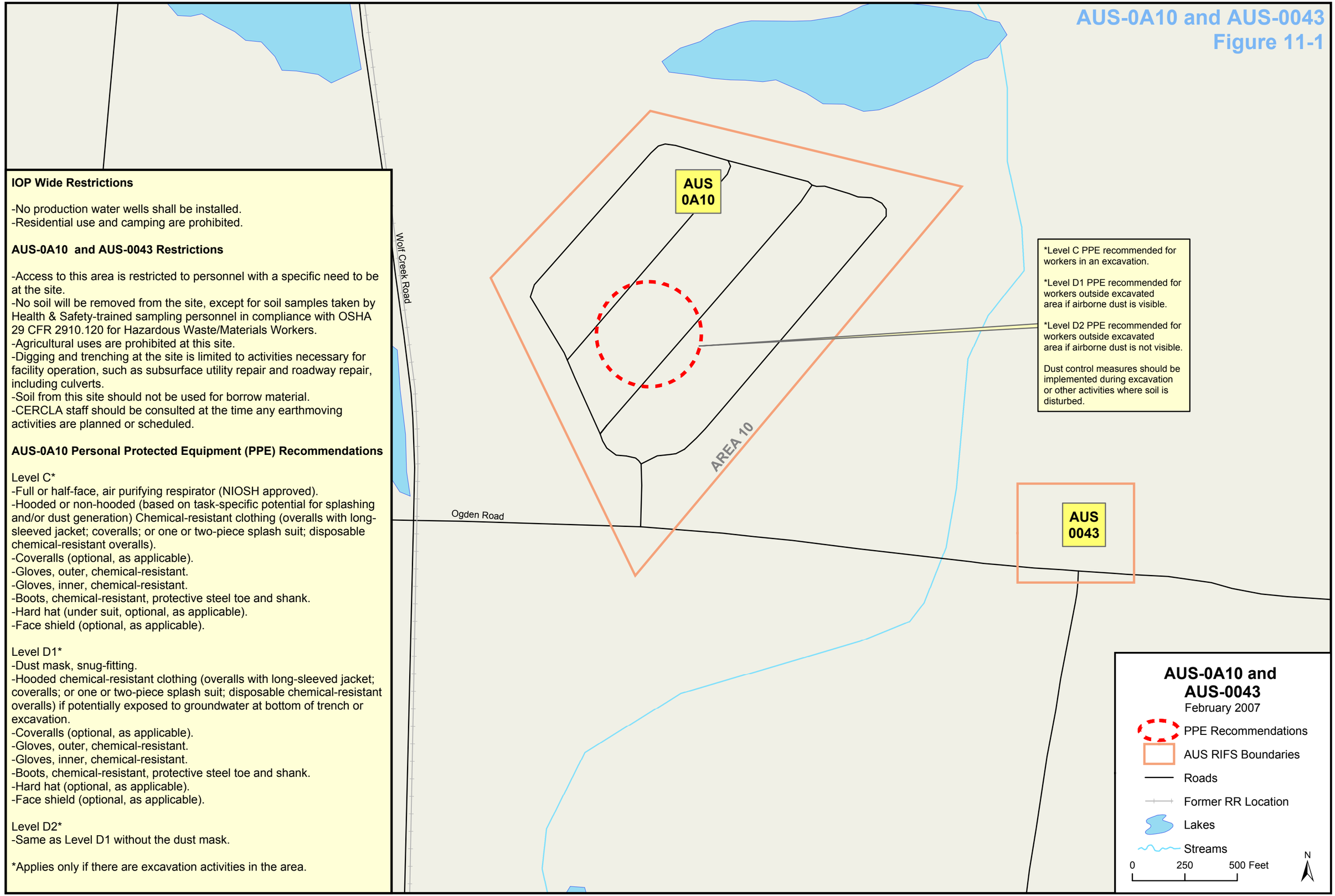
AUS-0A10 Personal Protected Equipment (PPE) Recommendations

Level C*
-Full or half-face, air purifying respirator (NIOSH approved).
-Hooded or non-hooded (based on task-specific potential for splashing and/or dust generation) Chemical-resistant clothing (overalls with long-sleeved jacket; coveralls; or one or two-piece splash suit; disposable chemical-resistant overalls).
-Coveralls (optional, as applicable).
-Gloves, outer, chemical-resistant.
-Gloves, inner, chemical-resistant.
-Boots, chemical-resistant, protective steel toe and shank.
-Hard hat (under suit, optional, as applicable).
-Face shield (optional, as applicable).

Level D1*
-Dust mask, snug-fitting.
-Hooded chemical-resistant clothing (overalls with long-sleeved jacket; coveralls; or one or two-piece splash suit; disposable chemical-resistant overalls) if potentially exposed to groundwater at bottom of trench or excavation.
-Coveralls (optional, as applicable).
-Gloves, outer, chemical-resistant.
-Gloves, inner, chemical-resistant.
-Boots, chemical-resistant, protective steel toe and shank.
-Hard hat (optional, as applicable).
-Face shield (optional, as applicable).

Level D2*
-Same as Level D1 without the dust mask.

*Applies only if there are excavation activities in the area.



12.1 AREAS 11 AND 12

Areas 11 and 12, located south of Crab Orchard Lake, are addressed together because they were part of a single, large post-World War II industrial facility. At the north end of this now contiguous area is the site of the IOP Group II Load Line, which is in Area 11. At the south end is the site of the IOP Ammonium Nitrate Plant, which is in Area 12. The current Areas 11/12 include these two IOP features plus about 100 to 200 acres of Refuge land between them that was developed by post-Word War II industrial tenants.

The enlarged industrial complex, including buffer zones, was over 600 acres in size. Access was limited to tenant employees. Because of its size and the variety of past industrial activities, Area 11 was subdivided into five sites for the purposes of the PA/SI report (**Figures 1-7 and 12-1**). The boundaries of these five sites are based on industrial use by Olin and Commercial Solvents Corporation (CSC), the major tenants, as follows:

- Area 11A—acid and ammonium nitrate manufacturing (Site AUS-A11A).
- Area 11H—high explosives manufacturing (Site AUS-A11H).
- Area 11N—nitroglycerin manufacturing (Site AUS-A11N).
- Area 11P—propellant manufacturing (Olin), explosive cap manufacturing (CSC) (Site AUS-A11P).
- Area 11S—support area for explosives manufacturing (Site AUS-A11S).

Beginning in 1956, Areas 11 and 12 were leased by Olin and used primarily for manufacturing industrial (non-military) explosives. Olin built an acid and ammonium nitrate plant using some of the IOP Load Line II structures. Olin also constructed and operated a nitroglycerin plant, dynamite mix houses, a burn area, and ponds for storage of millions of pounds of explosives. These features were built in previously undeveloped parts of the Refuge between the original Group II Load Line and the Ammonium Nitrate Plant.

Olin sold its industrial explosives business to CSC in 1963 and CSC moved into Areas 11/12 in 1964. CSC and its successors leased this area from 1964 through 1982. Part of the sale to CSC included an RDX manufacturing operation and an explosive cap manufacturing operation, both of which were located at Olin facilities off the Refuge and moved by CSC to Areas 11/12. Olin also operated a pilot propellant plant in Area 11 which was not included in the sale. The propellant operation had been moved to Area 2 prior to the sale.

Trojan Powder Company, a CSC division, operated the Area 11/12 facility. Manufacturing was phased out beginning in 1968, and ended completely sometime before 1976. Trojan did some explosive decontamination in 1971 and 1972, but was still storing explosives at the site in 1977, when its successor, IMC Chemical Group (IMC), petitioned the Illinois Pollution Control Board for a variance from the regulations that prohibited open burning because such burning was necessary for further decontamination of the buildings in Areas 11 and 12. Three variances were

granted during 1977 and 1978, for building decontamination and destruction of unusable explosives. After IMC removed the remaining usable explosives and completed the explosive decontamination, they left the site in 1982. Mallinckrodt, Inc, is the corporate successor to CSC/IMC. The purpose of the CSC/IMC decontamination was to eliminate explosive hazards at the site. The work did not address chemical contamination. The remaining buildings in the area were demolished by the USFWS in the late 1980s and early 1990s.

Area 12 was the former IOP Ammonium Nitrate Plant. It is located south of Area 11, and is accessible by way of Area 11 roadways (**Figures 1-7 and 12-1**). It originally consisted of 12 buildings designated with the prefix "ANP-1. The area has been unoccupied since 1982, and all buildings have been removed.

12.1.1 LUCIP for AUS-A11A – Acid and Ammonium Nitrate Area (AUS OU)

AUS-A11A is currently part of a remedial investigation conducted by General Dynamics Ordnance and Technical Systems. It was identified in the AUS OU PA/SI as requiring an RI because of exceedances of screening values.

12.1.1.1 Site Description and Investigation Results

Area 11A is the acid and ammonium nitrate manufacturing area and is located in the north-central portion of Area 11 between Areas 11P and 11S (**Figure 12-1**). This area was part of the IOP Group II Load Line and was used mostly for TNT and ammonium nitrate storage and screening.

Both Olin and CSC used this area as an acid and ammonium nitrate production facility. In 1957, Olin began production of acid and ammonium nitrate in this area. Nitric and possibly sulfuric acid were produced. Both acids were stored in this area. CSC used the buildings and other facilities as Olin did, with minor changes.

Site Investigation

The SI included soil, sediment, groundwater, and surface water samples.

Notable Contamination Found

Phosphorus and nitrate-nitrite in groundwater exceeded SI screening criteria. N-nitrosodiphenylamine, pentachlorophenol, and 2,4-dinitrotoluene detections in sediments exceeded SI screening criteria. Detections of most inorganics, many PAHs, three phthalates, and carbazole exceeded screening criteria in soil and/or sediments.

12.1.1.2 LUCIP Objective

The IOP-wide LUCIP objectives apply. As with all sites under investigation in the AUS OU RI, exposure should be minimized as much as practicable. RI results may indicate the need for additional restrictions.

When the results from the current RI are available, this LUCIP will be reviewed and appropriate modifications made.

12.1.1.3 LUC(s) Implemented to Achieve Objective

In addition to the IOP-wide LUCs, access to this area is restricted to personnel with a specific need to be at the site (**Figure 12-1**). No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers. Digging and trenching at the site is limited to activities

necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts. CERCLA staff should be consulted at the time digging activities are planned or scheduled. Soil from this site should not be used for borrow material, and agricultural use is prohibited at this site.

Controlled burns will not be conducted in this area, and the current hunting restriction will remain in place.

These LUCs will be modified as appropriate as data are obtained in the RI.

12.1.1.4 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. Other restrictions will depend upon the results of the RI/FS currently in progress.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

12.1.1.5 Applicable Decision Document

There is not yet a decision document for this site.

12.1.2 LUCIP for AUS-A11H – High Explosives Area (AUS OU)

AUS-A11H is currently part of a remedial investigation conducted by General Dynamics Ordnance and Technical Systems. It was identified in the AUS OU PA/SI as requiring an RI because of exceedances of screening values.

12.1.2.1 Site Description and Investigation Results

Site AUS-A11H, the High Explosives Area, is located in the western portion of Area 11 just south of Area 11P (**Figure 12-1**). It was used by industrial tenants for manufacturing high explosives from the 1950s to the 1970s. During World War II, the northern section of Site AUS-A11H was part of the IOP Group II Load Line.

Operational History and Waste Characteristics

Area 11H was used by the SWDC/War Department during IOP operations as a part of the Melt Loading Line and contained two change houses and a melt loading building.

Olin constructed the High Explosives Manufacturing Area, or Dynamite Area, on the property between the IOP Group II Load Line and the IOP Ammonium Nitrate Plant. Note that the term "dynamite" as used here is a generic term for industrial blasting explosives. It appears that Olin produced nitroglycerin dynamite in this area, as well as ammonium nitrate fuel oil explosives (ANFO), and water gel and slurry explosives which are the common explosives used in the mining industry.

The major constituents of nitroglycerin dynamite are nitroglycerin and dope, which is a general term for the porous combustible material that is combined with nitroglycerin to form dynamite. Some other raw materials used in production were ammonium nitrate, nitrocellulose, nitrocotton, ethyl centralite, and dimethyl sebacate (also known as dimethyl ester).

Water gels and slurry explosives consist of ammonium nitrate with or without other oxidizing agents, sensitizers, fuels, and gelatin forming compounds. Materials that are commonly used as additives in these explosives, and that Olin was known to have used in Area 11H, include TNT and smokeless powder. Other common additives that might have been used are pentolite, methylamine nitrate, potassium dichromate and PETN.

CSC and its successors operated the High Explosives Area from 1964 until they phased out production between 1968 and 1971. CSC most often used the same buildings as Olin; however, CSC used Building 22 for their Torpex operation. Torpex is composed of RDX, TNT, aluminum powder and wax.

Site Investigation

The SI included soil, sediment, groundwater, surface water, and trench water samples.

Notable Contamination Found

The following explosive compounds exceeded SI screening criteria in sediment: nitroglycerin, HMX (Her Majesty's Explosive), RDX, TNT, nitrobenzene, 2,4-dinitrotoluene, 2,6-dinitrotoluene, 1,3,5-trinitrobenzene, and 1,3-dinitrobenzene. These compounds were detected at levels of concern for toxicity and/or cancer effects, but not at levels of concern for explosive effects.

TCE, PCE, and cis-1,2-dichloroethene exceeded SI screening criteria in soils.

Nitrate-nitrite and phosphorus detection in groundwater exceeded SI screening criteria.

Detections of most PAHs in soil and/or sediment exceeded screening criteria, plus two phthalates, carbazole, and n-nitrosodiphenylamine. Maximum detections of most inorganics in soil and/or sediment exceeded screening criteria, including soil concentrations of cadmium at 204 mg/kg, and chromium at 585 mg/kg.

12.1.2.2 LUCIP Objective

The IOP-wide LUCIP objectives apply. As with all sites under investigation in the AUS OU RI, exposure should be minimized as much as practicable. RI results may indicate the need for additional restrictions.

When the results from the current RI are available, this LUCIP will be reviewed and appropriate modifications made.

12.1.2.3 LUC(s) Implemented to Achieve Objective

In addition to the IOP-wide LUCs, access to this area is restricted to personnel with a specific need to be at the site (**Figure 12-1**). No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers. Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts. CERCLA staff should be consulted at the time digging activities are planned or scheduled. Soil from this site should not be used for borrow material, and agricultural use is prohibited at this site.

Controlled burns will not be conducted in this area, and the current hunting restriction will remain in place.

PPE guidelines are provided for a portion of this site. Refer to Section 1.4.1, Table 1-5, and **Figure 12-1**.

These LUCs will be modified as appropriate as data are obtained in the RI.

12.1.2.4 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. Other restrictions will depend upon the results of the RI/FS currently in progress.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

12.1.2.5 Applicable Decision Document

There is not yet a decision document for this site.

12.1.3 LUCIP for AUS-A11N – Nitroglycerin Area (AUS OU)

AUS-A11N is currently part of a remedial investigation conducted by General Dynamics Ordnance and Technical Systems. It was identified in the AUS OU PA/SI as requiring an RI because of exceedances of screening values.

12.1.3.1 Site Description and Investigation Results

Area 11N, the Nitroglycerin Area, is located in the eastern portion of Area 11, south of Area 11S and east of Area 11H (**Figure 12-1**). Post-World War II industrial tenants used this area for manufacturing nitroglycerin, from the 1950s to the 1970s. During World War II, a small portion of the northern section of Site AUS-A11N was within the IOP Group II Load Line and was used as a parking area, with no buildings.

Operational History and Waste Characteristics

The part of the former IOP Group II Load Line that is within Area 11N was used for loading shells with melted TNT, which sometimes had added ammonium nitrate.

Olin began manufacturing nitroglycerin in late 1957, at the same time it began acid and ammonium nitrate production in Area 11A. Olin produced nitroglycerin by the Biazzi process, which used concentrated nitric and sulfuric acid, pure glycerin or ethylene glycol, and soda ash. The wastewater from the nitroglycerin manufacturing was probably discharged to the East Holding Pond just north of the Nitroglycerin Area. This wastewater probably contained soluble materials like ammonium nitrate, sodium nitrate, acid, and traces of nitroglycerin.

After they acquired it from Olin, CSC probably continued to operate the nitroglycerin manufacturing facility the same way as Olin had.

There were eight possible burning trenches located in AUS-A11N that were identified in historical aerial photographs. The AUS OU site reconnaissance identified two buried railroad tank cars in Area 11N. Buried railroad tank cars are known to have been used at other industrial facilities for liquid waste or fuel storage.

Site Investigation

The SI included soil and surface water samples; no groundwater monitoring wells were installed.

Notable Contamination Found

Several SVOC and inorganic detections in soil exceeded SI screening criteria. Illinois Surface Water Quality Standards were exceeded for copper, iron, lead, and manganese. Lead was detected in the soil at 568 mg/kg.

12.1.3.2 LUCIP Objective

The IOP-wide LUCIP objectives apply. As with all sites under investigation in the AUS OU RI, exposure should be minimized as much as practicable. RI results may indicate the need for additional restrictions.

When the results from the current RI are available, this LUCIP will be reviewed and appropriate modifications made.

12.1.3.3 LUC(s) Implemented to Achieve Objective

In addition to the IOP-wide LUCs, access to this area is restricted to personnel with a specific need to be at the site (**Figure 12-1**). No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers. Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts. CERCLA staff should be consulted at the time digging activities are planned or scheduled. Soil from this site should not be used for borrow material, and agricultural use is prohibited at this site.

Controlled burns will not be conducted in this area, and the current hunting restriction will remain in place.

These LUCs will be modified as appropriate as data are obtained in the RI.

12.1.3.4 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. Other restrictions will depend upon the results of the RI/FS currently in progress.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

12.1.3.5 Applicable Decision Document

There is not yet a decision document for this site.

12.1.4 LUCIP for AUS-A11P – Pilot Propellant Plant/CAP Production Area (AUS OU)

AUS-A11P is currently part of a remedial investigation conducted by General Dynamics Ordnance and Technical Systems. It was identified in the AUS OU PA/SI as requiring an RI because of exceedances of screening values.

12.1.4.1 Site Description and Investigation Results

Site AUS-A11P, the former Area 11 Pilot Propellant Plant/CAP Production Area, is located in the northwestern portion of Area 11, west of Area 11A and north of Area 11H (**Figure 12-1**). From the 1950s to the 1970s, industrial tenants used this area for propellant/explosives manufacturing. During World War II, this site was part of the IOP Group II Load Line.

Operational History and Waste Characteristics

Several buildings within AUS-A11P were originally a part of the IOP Group II Load Line which SWDC/War Department operated during World War II. Shells, anti-tank mines and 500-pound (lb) bombs were loaded with TNT on this line.

Olin began occupying Area 11 in 1956. They initially used this area as a Pilot Propellant Plant for research and development of propellants, and may have later used this area for the manufacture of jet starter cartridges or jet engine starters. Solid propellant used at this plant was composed of ammonium nitrate, synthetic rubber, carbon black, and ammonium oxalate. The propellants contained ammonium perchlorate, magnesium, aluminum, and a plastic binder.

Some of the chemical constituents of gas generators produced by Olin were perchlorates, ammonium nitrate, hexane and various plasticizers. Olin also tested experimental explosive devices in a building in this area. Olin jet engine starters were made using nitroglycerin and ball powder. Ammonium nitrate, nitrocellulose and a plasticizer – dioctyl phthalate – were also used in the gas generators for the jet engine starters.

After Olin sold a portion of its business to CSC in 1964, CSC leased the former Olin facility and used it for the manufacture of Big Inch Caps, which were listed as "Blasting Caps" "for detonators" in the Olin/CSC agreement. The caps were ½-inch in diameter and 1-inch long. They were used with a cord fuse and contained a combination of lead azide and lead styphnate. According to CSC/IMC records, RDX, lead azide and lead styphnate were the explosive contaminants of concern in the buildings used for Big Inch Cap production.

Site Investigation

The SI included soil, sediment, groundwater, and surface water samples.

Notable Contamination Found

TCE and PCE were detected in groundwater above SI screening criteria, but just below MCLs. Many SVOCs were detected in soils and sediments above SI screening criteria, including n-nitrosodiphenylamine and carbazole. 2,4-dinitrotoluene exceeded screening criteria in soils, as did most inorganics. Copper, iron, and manganese exceeded Illinois Surface Water Quality Standards.

12.1.4.2 LUCIP Objective

The IOP-wide LUCIP objectives apply. As with all sites under investigation in the AUS OU RI, exposure should be minimized as much as practicable. RI results may indicate the need for additional restrictions.

When the results from the current RI are available, this LUCIP will be reviewed and appropriate modifications made. The current hunting restriction would remain in place.

12.1.4.3 LUC(s) Implemented to Achieve Objective

In addition to the IOP-wide LUCs, access to this area is restricted to personnel with a specific need to be at the site (**Figure 12-1**). No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers. Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts. CERCLA staff should be consulted at the time digging activities are planned or scheduled. Soil from this site should not be used for borrow material, and agricultural use is prohibited at this site.

Controlled burns will not be conducted in this area, and the current hunting restriction will remain in place.

These LUCs will be modified as appropriate as data are obtained in the RI.

12.1.4.4 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. Other restrictions will depend upon the results of the RI/FS currently in progress.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

12.1.4.5 Applicable Decision Document

There is not yet a decision document for this site.

12.1.5 LUCIP for AUS-A11S – Support Area

AUS-A11S is currently part of a remedial investigation conducted by General Dynamics Ordnance and Technical Systems. It was identified in the AUS OU PA/SI as requiring an RI because of exceedances of screening values.

12.1.5.1 Site Description and Investigation Results

Site AUS-A11S, the Support Area, is located in the northeastern portion of Area 11, east of Area 11A and north of Area 11N. During World War II, the area was part of the IOP Group II Load Line (**Figure 12-1**). Site AUS-A11S was used by industrial tenants from 1946 to the 1980s as a support area for the high explosives manufacturing.

Operational History and Waste Characteristics

SWDC/War Department operated the IOP Group II Load Line during World War II. The area occupied by Site AUS-A11S was on the front end of the load line, where shells were delivered, cleaned and painted.

Silas Mason Company, a Department of. Army contractor who operated the IOP Ammonium Nitrate Plant (Area 12) from 1946 to 1950, also occupied two buildings in Area 11 as warehouses from 1946 to 1948.

Post-IOP industrial tenants included Hoosier Cardinal Corporation (Hoosier) who leased property in Area 11 from 1948 to 1956. Hoosier manufactured and finished decorative equipment and emblems for stoves, refrigerators and automobiles.

During Olin's tenure from 1956 to 1964, most of the buildings in the Support Area were former IOP buildings. Olin used the buildings in this area for a boiler house, laboratory, a component magazine, a carpenter and machine shop, a garage, a welding shop, and oil storage.

CSC/IMC apparently used most of the buildings in Site AUS-A11S for the same purposes as Olin.

Site Investigation

The SI included soil, sediment, groundwater, and surface water samples.

Notable Contamination Found

TCE was detected in the groundwater at 280,000 ug/L. Other contaminants that exceed SI screening criteria for groundwater are: cis-1,2-dichloroethene, naphthalene, TNT, phosphorus, and sulfate. Several chlorinated VOCs exceeded SI screening criteria in soils.

2,4-dinitrotoluene in soil exceeded screening criteria, as did many PAHs and three phthalates. Maximum detections of most inorganics exceeded SI screening criteria in soils and/or sediments.

12.1.5.2 LUCIP Objective

The IOP-wide LUCIPs are applicable (Section 2). In addition, because the site is not characterized, another LUCIP objective is to reduce potential for exposure until specific objectives can be identified based on site characterization data. In particular, because of the presence in groundwater and known use of chlorinated solvents at this site, particularly TCE, a specific objective is to prevent harmful exposure to chlorinated solvent vapors.

When the results from the current RI are available, this LUCIP will be reviewed and appropriate modifications made.

12.1.5.3 LUC(s) Implemented to Achieve Objective

In addition to the IOP-wide LUCs, access to this area is restricted to personnel with a specific need to be at the site (**Figure 12-1**). No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers.

In the areas around the industrial facilities likely to have used chlorinated solvents or in areas with soil TCE concentrations in excess of 10 mg/kg, excavation shall be done only by the aforementioned OSHA-trained and certified personnel. These approximate areas are shown in **Figure 12-1**. CERCLA staff should be consulted at the time any earthmoving activities are planned or scheduled. Further, digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts. Soil from this site should not be used for borrow material, and agricultural use is prohibited at this site.

Controlled burns will not be conducted in this area, and the current hunting restriction will remain in place.

PPE guidelines are provided for a portion of this site. Refer to Section 1.4.1, Table 1-5, and **Figure 12-1**.

These LUCs will be modified as appropriate as data are obtained in the RI.

12.1.5.4 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. Other restrictions will depend upon the results of the RI/FS currently in progress.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

12.1.5.5 Applicable Decision Document

There is not yet a decision document for this site.

12.1.6 LUCIP for AUS-0A12 – Former Ammonium Nitrate Plant (AUS OU)

AUS-0A12 is currently part of a remedial investigation conducted by General Dynamics Ordnance and Technical Systems. It was identified in the AUS OU PA/SI as requiring an RI because of exceedances of screening values.

12.1.6.1 Site Description and Investigation Results

Area 12 was the former IOP Ammonium Nitrate Plant. It is located south of Area 11, and is accessible by way of Area 11 roadways (**Figure 12-1**). It originally consisted of 12 buildings designated with the prefix "ANP-1.

The area has been unoccupied since 1982, and all buildings have been removed.

Operational History and Waste Characteristics

SWDC/War Department used Area 12 for ammonium nitrate production during World War II. The IOP was a "melt-pour" facility. Explosives that were produced elsewhere were melted and poured into various ordnance shells and bombs. TNT was the preferred explosive, but because of a TNT shortage, many ordnance plants, including the IOP, were designed and built to use amatol, a mixture of TNT and ammonium nitrate. Unlike TNT, ammonium nitrate was produced at the plant. When the TNT shortage ended in 1943, TNT alone was used for the main ordnance explosive, and ammonium nitrate production stopped.

The process of producing ammonium nitrate included passing ammonia gas through the nitric acid creating a solution that was then stirred to complete the evaporation process.

Silas Mason, under contract with the Army, manufactured fertilizer-grade ammonium nitrate sometime between 1946 and 1950. In 1950, fertilizer production ended, and the Department of Army transferred control and jurisdiction of the facility to the United States Department of Interior (USDOI).

Post-IOP industrial tenants included UMC, who tested photo flash signals in this area for approximately six months during 1955. Barium nitrate and potassium perchlorate were waste products from the manufacture of photo flash signals.

Olin leased this area from January 1956 through April 1964 for storage, burning, and explosives manufacturing. Olin originally manufactured ammonium nitrate in Area 12 until the ammonium nitrate facility in Area 11 was completed. It is likely that Olin also used Area 12 to manufacture Olinite 7, which was a form of dynamite made with ammonium nitrate and diesel fuel.

In 1960, Olin constructed and filled eight powder storage ponds in the area between the IOP Group II Load Line and the Ammonium Nitrate Plant. The ponds were excavated, lined with a black

plastic, filled with powder and then filled with water. Olin stored flashless, non-hygroscopic powder (FNH) in these ponds.

Olin reported that open burning began in this area in 1956 and continued until 1964, and they estimated that 4,000,000 lbs of explosives, pyrotechnics and propellants were burned in these burning grounds from 1956 through 1964. They also estimated that approximately 40,000 lbs of primarily metal oxides remained at the burning grounds.

CSC occupied Area 12 from April 1964 through 1982. CSC (and its successors) used this area for storage and for RDX production. Additionally, burning grounds were still present on the western side of the property during CSC's tenure, and presumably used by CSC.

Site Investigation

The SI included drum content, soil, sediment, groundwater, surface water, and trench water samples.

Notable Contamination Found

Arsenic, beryllium, chromium, lead, and RDX exceeded SI screening criteria in groundwater.

Detections of carbon tetrachloride, choroform, dichloroethene, methylene chloride, PCE and TCE in soil exceeded SI screening criteria.

Maximum detections of most inorganics in soils exceeded SI screening criteria, including chromium at 1,370 mg/kg, copper at 846 mg/kg, lead at 3,330 mg/kg, cadmium at 15 mg/kg, and zinc at 1,970 mg/kg.

Illinois Surface Water Quality Standards were exceeded for copper, lead, and manganese.

12.1.6.2 LUCIP Objective

The IOP-wide LUCIP objectives apply. As with all sites under investigation in the AUS OU RI, exposure should be minimized as much as practicable. RI results may indicate the need for additional restrictions.

When the results from the current RI are available, this LUCIP will be reviewed and appropriate modifications made.

12.1.6.3 LUC(s) Implemented to Achieve Objective

In addition to the IOP-wide LUCs, access to this area is restricted to personnel with a specific need to be at the site (**Figure 12-1**). No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for

Hazardous Waste/Materials Workers. Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts. CERCLA staff should be consulted at the time digging activities are planned or scheduled. Soil from this site should not be used for borrow material, and agricultural use is prohibited at this site.

Controlled burns will not be conducted in this area, and the current hunting restriction will remain in place.

PPE guidelines are provided for a portion of this site. Refer to Section 1.4.1, Table 1-5, and **Figure 12-1**.

These LUCs will be modified as appropriate as data are obtained in the RI.

12.1.6.4 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. Other restrictions will depend upon the results of the RI/FS currently in progress.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

12.1.6.5 Applicable Decision Document

There is not yet a decision document for this site.

12.1.7 LUCIP for AUS-106A – Drum Disposal Area East of Area 11 (AUS OU)

AUS-106A is currently part of a remedial investigation conducted by General Dynamics Ordnance and Technical Systems. It was identified in the AUS OU PA/SI as requiring an RI because of exceedances of screening values.

12.1.7.1 Site Description and Investigation Results

AUS-106A is a former drum disposal area. It is located due east of the former Nitroglycerin Area in Area 11 (AUS-A11N) on the north side of an abandoned roadway (**Figure 12-1**). The site covers approximately 3,000 square feet (ft) and consists of a mounded area of partially buried drums with some nearby debris, including an oven hood and two former smoke stacks.

Operational History and Waste Characteristics

The 1951 aerial photograph showed a possible disposal site in this location, just north of what appeared to be a farm lane. There was no evidence of this disposal site in the 1943 aerial photographs. In 1951, portions of the site were vegetated, indicating that they may not have been used for some time. By 1960, this area was completely covered with vegetation and the former farm lane no longer appears on the photo, suggesting that this area had been inactive for some time. This also suggests that an operator/tenant who was at the site prior to 1951 may have been responsible for the drums. These operators/tenants include the SWDC/War Department (operator 1942-1945), Hoosier Cardinal (tenant, 1948 through 1954) or Silas Mason (operator, 1947 through 1950).

During the site reconnaissance, it was estimated that 50 to 100 drums were in this area. The drums were partially buried and located along an intermittent streambed. There was a blue-gray solid substance visible in several of the exposed drums.

Site Investigation

The SI included drum content samples and several soil samples of varying depths; no groundwater monitoring wells were installed.

Notable Contamination Found

Benzene, dichloroethene, toluene, and TCE were detected in the drums. TCE was detected at a maximum concentration of 13,000 ug/kg in the soil, well above SI screening criteria.

Soil results included cadmium at 150 mg/kg, chromium at 222 mg/kg, copper at 3,300 mg/kg, lead at 24,700 mg/kg, selenium at 22 mg/kg, and zinc at 3,160 mg/kg.

12.1.7.2 LUCIP Objective

The IOP-wide LUCIPs are applicable (Section 2). In addition, because the site is not characterized, another LUCIP objective is to reduce potential for exposure until specific objectives can be identified based on site characterization data. In particular, because of the high soil concentrations of TCE, a specific objective is to prevent harmful exposure to chlorinated solvent vapors. Another specific objective is to prevent exposure to the drummed materials.

When the results from the current RI are available, this LUCIP will be reviewed and appropriate modifications made.

12.1.7.3 LUC(s) Implemented to Achieve Objective

In addition to the IOP-wide LUCs, access to this area is prohibited except for OSHA-trained personnel. The restricted area is shown in **Figure 12-1**.

No soil nor drummed materials will be removed from the site, except for samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers. Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts. CERCLA staff should be consulted at the time digging activities are planned or scheduled. Soil from this site should not be used for borrow material, and agricultural use is prohibited at this site.

Controlled burns will not be conducted in this area, and the current hunting restriction will remain in place.

PPE guidelines are provided for a portion of this site. Refer to Section 1.4.1, Table 1-5, and **Figure 12-1**.

These LUCs will be modified as appropriate as data are obtained in the RI.

12.1.7.4 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. Other restrictions will depend upon the results of the RI/FS currently in progress.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

12.1.7.5 Applicable Decision Document

There is not yet a decision document for this site.

12.2 LUCIP FOR COP-4 (EMMA OU)

12.2.1 Site Description

Placeholder for Army Information. **Figures 1-5 and 12-1**.

12.2.2 LUCIP Objective

In addition to the LUCIP objective for the entire IOP (see Section 2), other objectives for the COC ELUC Area are to protect against exposure to contaminated soil and protect against possible contact with UXO.

12.2.3 LUC(s) Implemented to Achieve Objective

In addition to the IOP-wide LUCs, certain restrictions are applicable to the COC ELUC Area (**Figure 12-1**). Additional LUCs will include the prohibition of agricultural uses within the area and the prohibition of digging, trenching, or any other disturbance of the soil with the exception of soil samples to be taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers. Controlled burns will not be conducted within the COC LUC Area. Because live munitions have been found in this area in the past, there is a likelihood of finding them in the future.

12.2.4 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

12.2.5 Applicable Decision Document

The applicable decision document is the Record of Decision (ROD) for Crab Orchard National Wildlife Refuge Explosives/Munitions Manufacturing Area (EMMA) Operable Unit (OU) (U.S. Army Corps of Engineers, 1996) along with the Engineering Evaluation and Cost Analysis Final Report, Former Illinois Ordnance Plant, Marion, Illinois (Parsons Engineering Science, Inc., October 1997).

AUS OU Sites in Areas 11 and 12 & COP-4 Figure 12-1

IOP Wide Restrictions

-No production water wells shall be installed.
-Residential use and camping are prohibited.

COP-4 Restrictions

-Agricultural uses are prohibited within the COC ELUC area.
-Digging and trenching or other disturbance of the soil is prohibited within the COC ELUC area except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers.
-Controlled burns will not be conducted within the COC ELUC area.

AUS OU Sites in Areas 11 and 12 Restrictions

-Access to this area is restricted to personnel with a specific need to be at the site.
-No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers.
-Agricultural uses are prohibited at this site.
-Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts.
-Soil from this site should not be used for borrow material.
-CERCLA staff should be consulted at the time any earthmoving activities are planned or scheduled.
-Hunting is not allowed in this area.
-Controlled burns will not be conducted in this area.

AUS OU Sites in Areas 11 and 12 Personal Protective Equipment (PPE) Recommendations

Level C*
-Full or half-face, air purifying respirator (NIOSH approved).
-Hooded or non-hooded (based on task-specific potential for splashing and/or dust generation) Chemical-resistant clothing (overalls with long-sleeved jacket; coveralls; or one or two-piece splash suit; disposable chemical-resistant overalls).
-Coveralls (optional, as applicable).
-Gloves, outer, chemical-resistant.
-Gloves, inner, chemical-resistant.
-Boots, chemical-resistant, protective steel toe and shank.
-Hard hat (under suit, optional, as applicable).
-Face shield (optional, as applicable).

Level D1*
-Dust mask, snug-fitting.
-Hooded chemical-resistant clothing (overalls with long-sleeved jacket; coveralls; or one or two-piece splash suit; disposable chemical-resistant overalls) if potentially exposed to groundwater at bottom of trench or excavation.
-Coveralls (optional, as applicable).
-Gloves, outer, chemical-resistant.
-Gloves, inner, chemical-resistant.
-Boots, chemical-resistant, protective steel toe and shank.
-Hard hat (optional, as applicable).
-Face shield (optional, as applicable).

Level D2*
-Same as Level D1 without the dust mask.

*Applies only if there are excavation activities in the area.

Dust control measures should be implemented during excavation or other activities where soil is disturbed.

AUS A11S
AUS A11A
AUS A11P
Area 11
*Level C PPE recommended for workers in an excavation.
*Level D1 PPE recommended for workers outside excavated area if airborne dust is visible.
*Level D2 PPE recommended for workers outside excavated area if airborne dust is not visible.
*Level C PPE recommended for workers in an excavation.
AUS A11N
AUS 106A
AUS A11H
ILLINOIS 148
AUS 0A12
COP-4
Area 12

COP-4

PPE Recommendations
COP-4 Boundary
COP-4 Monitoring Wells
Roads
0 25 50 Feet
N

AUS OU Sites in Areas 11 and 12 & EMMA OU COP-4
February 2007
PPE Recommendations
AUS RIFS Boundaries
Roads
Former RR Location
Lakes
0 250 500 Feet
N

13.1 AREA 13

Area 13, IOP Finished Ammunition Igloos (FAI) Area, is west of Areas 10 and 11, and south of Crab Orchard Lake (**Figures 1-7 and 13-1**). The site originally included 88 igloos, and covers about 500 acres.

13.1.1 LUCIP for AUS-0A13 – Finished Ammunition Igloos (AUS OU)

AUS-0A13 is currently part of a remedial investigation conducted by General Dynamics Ordnance and Technical Systems. It was identified in the AUS OU PA/SI as requiring an RI because of exceedances of screening values.

13.1.1.1 Site Description and Investigation Results

Operational History and Waste Characteristics

These finished ammunition storage igloos were constructed and operated by SWDC/War Department as part of the IOP (**Figure 13-1**). The igloos have been used by various post-war tenants to store raw materials and products.

Olin Corporation (formerly Olin Mathieson Chemical Company) began leasing igloos in the southern half of Area 13 in 1956. It continued to lease igloos in Area 13, including some in the northern half, until the end of 1996 when its ordnance manufacturing business was spun off to Primex Technologies, Inc. (Primex). Primex took over the Olin leases, which were assumed by GDO&TS in January 2001.

Reportedly, Olin stored and detonated (tested) nitroglycerin in Area 13. Also, Olin reportedly burned dynamite on the road in Area 13, in front of the igloos, using straw and diesel fuel.

Early lease and corporate information is incomplete, but it appears that CSC took over some of Olin's igloos in the northern portion of Area 13 when it purchased a portion of the Olin business on the Refuge in 1963. CSC later changed its name to International Minerals and Chemical Corporation (IMC). IMC sold a portion of its explosives business to Trojan Corporation in 1982. Trojan was acquired by Ensign Bickford Industries in 1986. For a time, Trojan leased the igloos in the southern portion of Area 13 in its own name; Ensign Bickford later took over the leases.

GDO&TS and Ensign Bickford currently lease all the igloos in Area 13. These igloos, in the southern and northern half of the area, respectively, have been used historically for propellant and explosives storage.

Site Investigation

The SI included several soil samples of varying depths; no groundwater monitoring wells were installed.

Notable Contamination Found

The following explosives were detected in soils above SI screening criteria: 2,4-dinitrotoluene, 2,6-dinitrotoluene, and nitroglycerin. None of these were detected at potentially explosive levels. 2,4-dinitrotoluene was detected at 64,000 ug/kg in the soils.

N-nitrosodiphenylamine and carbazole were also detected above SI screening criteria in the soils, as were many other SVOCs and inorganics.

Chromium was detected at 155 mg/kg in the soil.

13.1.1.2 LUCIP Objective

The IOP-wide LUCIP objectives apply. As with all sites under investigation in the AUS OU RI, exposure should be minimized as much as practicable. RI results may indicate the need for additional restrictions.

When the results from the current RI are available, this LUCIP will be reviewed and appropriate modifications made.

13.1.1.3 LUC(s) Implemented to Achieve Objective

In addition to the IOP-wide LUCs, access to this area is restricted to personnel with a specific need to be at the site (**Figure 13-1**). No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers. Additionally, soil from this site should not be used for borrow material.

Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts. These LUCs will be modified as appropriate as data are obtained in the RI.

13.1.1.4 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. Other restrictions will depend upon the results of the RI/FS currently in progress.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

13.1.1.5 Applicable Decision Document

There is not yet a decision document for this site.

AUS-0A13
Figure 13-1

FAI-7-1 FAI-7-2 FAI-7-3 FAI-7-4 FAI-7-5 FAI-7-6 FAI-7-7 FAI-7-8
FAI-7-9 FAI-7-10 FAI-7-11 FAI-7-12

FAI-6-1 FAI-6-2 FAI-6-3 FAI-6-4 FAI-6-5 FAI-6-6 FAI-6-7
FAI-6-8 FAI-6-9 FAI-6-10 FAI-6-11 FAI-6-12 FAI-6-13 FAI-6-14

FAI-5-1 FAI-5-2 FAI-5-3 FAI-5-4 FAI-5-5 FAI-5-6 FAI-5-7 FAI-5-8
FAI-5-9 FAI-5-10 FAI-5-11 FAI-5-12 FAI-5-13 FAI-5-14 FAI-5-15

FAI-4-1 FAI-4-2 FAI-4-3 FAI-4-4 FAI-4-5 FAI-4-6 FAI-4-7
FAI-4-8 FAI-4-9 FAI-4-10 FAI-4-11 FAI-4-12 FAI-4-13 FAI-4-14 FAI-4-15 FAI-4-16

FAI-3-1 FAI-3-2 FAI-3-3 FAI-3-4 FAI-3-5 FAI-3-6 FAI-3-7 FAI-3-8
FAI-3-9 FAI-3-10 FAI-3-11 FAI-3-12 FAI-3-13 FAI-3-14 FAI-3-15

AUS 0A13

FAI-2-1 FAI-2-2 FAI-2-3 FAI-2-4 FAI-2-5 FAI-2-6 FAI-2-7
FAI-2-8 FAI-2-9 FAI-2-10 FAI-2-11 FAI-2-12 FAI-2-13 FAI-2-14

FAI-1-1 FAI-1-2 FAI-1-3 FAI-1-4 FAI-1-5 FAI-1-6 FAI-1-7 FAI-1-8 FAI-1-9 FAI-1-10 FAI-1-11 FAI-1-12 FAI-1-13 FAI-1-14

Area 13

IOP Wide Restrictions

-No production water wells shall be installed.
-Residential use and camping are prohibited.

AUS 0A13 Restrictions

-Access to this area is restricted to personnel with a specific need to be at the site.
-No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers.
-Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts.
-Soil from this site should not be used for borrow material.
-CERCLA staff should be consulted at the time any earthmoving activities are planned or scheduled.

AUS-0A13
February 2007

AUS RIFS Boundaries
Finished Ammunition Igloos (FAI)
Finished
Demolished
Former RR Location
Lakes
Streams
Roads

0 250 500 Feet

14.1 AREA 14

Site AUS-0060 is the location of the IOP Fulminate Storage Igloos, Area 14. The site is located north of Crab Orchard Lake and west of Area 2 (**Figures 1-7 and 14-1**). It covers about 6 acres. Because of the relatively small size of the site and the fact that the original AUS OU designation as Site 60 included the entire area, the original designation was retained, rather than renaming it as Area 14. IOP used this site for storing lead azide and mercury fulminate, which are explosive components of detonators.

14.1.1 LUCIP for AUS-0060 – Fulminate Storage Igloos (AUS OU)

AUS-0060 is currently part of a remedial investigation conducted by General Dynamics Ordnance and Technical Systems. It was identified in the AUS OU PA/SI as requiring an RI because of exceedances of screening values.

14.1.1.1 Site Description and Investigation Results

Operational History and Waste Characteristics

This site was originally designed, built and used by SWDC/War Department for the storage of lead azide and mercury fulminate for use in detonators (**Figure 14-1**). There were five structures located in this area: two azide storage vaults, two fulminate storage vaults and a guard house.

After World War II, the storage igloos may have been used to store other compounds including trinitrotoluene (TNT), tetryl, and nitrocellulose. Lease documents indicate UMC occupied this area from 1956 to 1964. According to a former UMC employee, one of the materials stored in this area was mercury fulminate, along with other high explosives and propellants. They may have also stored lead azide and/or lead styphnate in these igloos, since UMC conducted testing of these explosives.

Olin also used these igloos for general storage from 1970 through at least 1985. Wildlife Materials, Inc., leased Igloo FS-2-2 from at least 1970 to 1985 for storage of black powder, M6 propellant. and electric squibs.

In 1997, under contract with the Department of the Army, Parsons Engineering (1997) investigated this site to determine if ordnance or explosives (OE) remained in the bunkers. A small amount of propellant powder was removed and destroyed.

Site Investigation

The SI included several soil samples of varying depths; no groundwater monitoring wells were installed.

Notable Contamination Found

Several metal detections in soil exceeded SI screening criteria: arsenic, chromium, lead, mercury, and nickel.

14.1.1.2 LUCIP Objective

The IOP-wide LUCIP objectives apply. As with all sites under investigation in the AUS OU RI, exposure should be minimized as much as practicable. RI results may indicate the need for additional restrictions.

When the results from the current RI are available, this LUCIP will be reviewed and appropriate modifications made.

14.1.1.3 LUC(s) Implemented to Achieve Objective

In addition to the IOP-wide LUCs, access to this area is restricted to personnel with a specific need to be at the site (**Figure 14-1**). No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers. Additionally, soil from this site should not be used for borrow material.

Because standard hand-held organic vapor monitors are not sensitive enough to detect low concentrations that may be harmful, and site-specific soil concentration data are not available, digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts. Agricultural use is prohibited at this site.

These LUCs will be modified as appropriate as data are obtained in the RI.

14.1.1.4 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. Other restrictions will depend upon the results of the RI/FS currently in progress.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

14.1.1.5 Applicable Decision Document

There is not yet a decision document for this site.

AUS OU Sites 0001, 0002, 0060 and 0061 Figure 14-1

Area 2D

Area 2B

Wolf Creek Road

AUS 0001

AUS 0002

AUS 0061

AUS 0060

Area 14

IOP Wide Restrictions

-No production water wells shall be installed.
-Residential use and camping are prohibited.

AUS-0001, 0002, 0060, & 0061 Restrictions

- Access to these areas are restricted to personnel with a specific need to be there.
-No soil will be removed from these sites, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers.
-Digging and trenching at these sites are limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts.
-Agricultural uses are prohibited at these sites.
-Soil from these sites should not be used for borrow material.

AUS-0001, 0002, 0060, & 0061

February 2007

AUS RIFS Boundaries

Roads

Lakes

0 250 500 Feet

N

SECTION FIFTEEN OTHER AREAS NORTH OF CRAB ORCHARD LAKE

15.1 LUCIP FOR AUS-0001 – FIRE AND POLICE HEADQUARTERS (AUS OU)

AUS-0001 is currently part of a remedial investigation conducted by General Dynamics Ordnance and Technical Systems. It was identified in the AUS OU PA/SI as requiring an RI because of exceedances of screening values.

15.1.1 Site Description and Investigation Results

AUS-0001, the former IOP Police and Fire Headquarters or Fire Station No. 1, is located west of Wolf Creek Road and south of Old Highway 13 (**Figure 14-1**). No buildings remain on this site, which covers less than one acre.

Operational History and Waste Characteristics

This facility was originally constructed and operated by SWDC/War Department as a part of the IOP. The main building was razed sometime between 1971 and 1980.
The Crab Orchard Sportsmen's Association used this building as their club headquarters.

Site Investigation

The SI included soil and groundwater samples.

Notable Contamination Found

Maximum detections of SVOCs and inorganics in soils exceeded SI screening criteria, including arsenic at 535 mg/kg and zinc at 1,410 mg/kg.

15.1.2 LUCIP Objective

The IOP-wide LUCIP objectives apply. As with all sites under investigation in the AUS OU RI, exposure should be minimized as much as practicable. RI results may indicate the need for additional restrictions.

When the results from the current RI are available, this LUCIP will be reviewed and appropriate modifications made.

15.1.3 LUC(s) Implemented to Achieve Objective

In addition to the IOP-wide LUCs, access to this area is restricted to personnel with a specific need to be at the site (**Figure 14-1**). No soil will be removed from the site, except for soil samples taken

by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers.

Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts. Further, soil from this site should not be used for borrow material. These LUCs will be modified as appropriate as data are obtained in the RI.

15.1.4 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. Other restrictions will depend upon the results of the RI/FS currently in progress.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

15.1.5 Applicable Decision Document

There is not yet a decision document for this site.

15.2 LUCIP FOR AUS-0002 –WASTEWATER TREATMENT PLANT (AUS OU)

AUS-0002 is currently part of a remedial investigation conducted by General Dynamics Ordnance and Technical Systems. It was identified in the AUS OU PA/SI as requiring an RI because of exceedances of screening values.

15.2.1 Site Description and Investigation Results

AUS-0002, the IOP Administrative Area Wastewater Treatment Plant, is south of Old Highway 13 and west of Wolf Creek Road (**Figure 14-1**). The site is less than a acre in size.

Operational History and Waste Characteristics

This IOP WWTP was originally constructed and operated by SWDC/War Department. It appears from an IOP sewer distribution drawing that this WWTP may have supported not only Area 1 but also parts of Area 2.

The WWTP consisted of a blockhouse with four treatment pits and an assumed underground sewer line to the west emptying into two small lagoons. The blockhouse and the four treatment pits were razed sometime between 1980 and 1993. The lagoons are still on site.

No industrial lessees were identified for this plant. According to the historical aerial photograph interpretations, this plant appears to have been abandoned sometime between 1943 and 1951.

Site Investigation

The SI included soil and surface water samples; no groundwater monitoring wells were installed.

Notable Contamination Found

Maximum detections of many inorganics in soils exceeded SI screening criteria, including chromium at 737 mg/kg and silver at 99 mg/kg.

15.2.2 LUCIP Objective

The IOP-wide LUCIP objectives apply. As with all sites under investigation in the AUS OU RI, exposure should be minimized as much as practicable. RI results may indicate the need for additional restrictions.

When the results from the current RI are available, this LUCIP will be reviewed and appropriate modifications made.

15.2.3 LUC(s) Implemented to Achieve Objective

In addition to the IOP-wide LUCs, access to this area is restricted to personnel with a specific need to be at the site (**Figure 14-1**). No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers.

Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts. Further, soil from this site should not be used for borrow material. These LUCs will be modified as appropriate as data are obtained in the RI.

15.2.4 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. Other restrictions will depend upon the results of the RI/FS currently in progress.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

15.2.5 Applicable Decision Document

There is not yet a decision document for this site.

15.3 LUCIP FOR AUS-0061 – IOP DETONATION AND DISPOSAL AREA (AUS OU)

AUS-0061 is currently part of a remedial investigation conducted by General Dynamics Ordnance and Technical Systems. It was identified in the AUS OU PA/SI as requiring an RI because of exceedances of screening values.

15.3.1 Site Description and Investigation Results

"IOP Detonation and Disposal Area" is not an official IOP designation. The site name was developed during the PA/SI investigation as a description of the site which was apparently used during the IOP era for testing explosives, and for disposal. There are three concrete structures on the explosives testing portion of the site. The disposal portion of the site is adjacent to the PCB OU Site 17, the Job Corps Landfill.

The access road to the site is located on the west side of Wolf Creek Road one mile south of Old Highway 13 (**Figure 14-1)**. The detonation area portion of the site is approximately 0.1 miles west of Wolf Creek Road, on the south side of the access road and the disposal area is located on the north side of this access road.

The disposal portion of the site was not investigated during the PA/SI because it was not discovered until the SI field investigation was already in progress. The disposal area is north of the detonation area. It was included with AUS-0061 because of proximity and because both sites appear to be related to IOP activities.

Operational History and Waste Characteristics

According to Mr. Wayne Adams, a former Refuge manager, the concrete structures in the "Detonation Area" of the site were used to detonate explosives during World War II. The two westernmost structures are probable detonation pits and the easternmost structure is a probable firing pit. These conclusions are based on the layout and configuration of the structures, supported by statements from Mr. Adams.

The IOP Disposal Area portion of this site was observed in the 1943 historical aerial photographs. This area appeared to contain 12 to 14 north-south trending trenches and one east-west trending trench. The trenches were filled with unidentifiable materials and were observed in the 1943 aerial photograph only. By 1951, the trenches were filled.

The 1951 and 1960 aerial photographs showed evidence of surface dumping in the western part of the former trench area. This activity appeared to be unrelated to the IOP Disposal Area observed in

the 1943 photograph. This surface dump was apparently the Job Corps Landfill, which was remediated as part of the PCB OU.

There were no known industrial lessees of this property.

Site Investigation

The SI included several soil samples of varying depths in the Detonation Area only; no groundwater monitoring wells were installed. The SI included only the detonation pits and not the trenches.

Notable Contamination Found

SVOCs and most inorganics exceeded SI soil screening criteria at the detonation pits. In the soil samples, cadmium was detected at 91 mg/kg and mercury at 1.1 mg/kg.

15.3.2 LUCIP Objective

The IOP-wide LUCIP objectives apply. As with all sites under investigation in the AUS OU RI, exposure should be minimized as much as practicable. RI results may indicate the need for additional restrictions. An additional objective is to prevent exposure to unknown materials buried at the disposal part of the site.

When the results from the current RI are available, this LUCIP will be reviewed and appropriate modifications made.

15.3.3 LUC(s) Implemented to Achieve Objective

In addition to the IOP-wide LUCs, access to this area is restricted to personnel with a specific need to be at the site (**Figure 14-1**). No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers.

Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts. Further, soil from this site should not be used for borrow material. These LUCs will be modified as appropriate as data are obtained in the RI.

15.3.4 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. Other restrictions will depend upon the results of the RI/FS currently in progress.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

15.3.5 Applicable Decision Document

There is not yet a decision document for this site.

15.4 LUCIP FOR SITE 27 – CRAB ORCHARD CREEK BELOW I-57 DREDGE AREA (MISCA OU)

15.4.1 Site Description

Site 27 is a segment of Crab Orchard Creek, in an area dredged a number of years ago (**Figure 1-4**). Because it is located downstream of the Marion Sewage Treatment Plant, it was investigated in the 1988 RI to evaluate whether discharges from the Marion Sewage Treatment Plant may be impacting Crab Orchard Lake.

Previous investigations at Site 27 include the 1988 RI.

15.4.2 Investigations

1988 RI (O'Brien & Gere)

During the 1988 RI, one composite surface water sample and one composite sediment sample (0-1ft deep) were collected and analyzed for VOCs, pesticides, total PCBs, explosives, metals, some indicator parameters.

Table 15-1 summarizes only the detected analytical results from the surface water and sediment samples. None of the detections exceeded levels of concern established for the 1988 RI, nor did they exceed any screening criteria used for this LUCIP (**Table 15-1**).

15.4.3 LUCIP Objective

Based on the available data, no objectives other than the IOP-wide objectives are needed.

15.4.4 LUC(s) Implemented to Achieve Objective

No additional LUCs beyond the IOP-wide LUCs are needed except that soil from this site should not be used as borrow material.

15.4.5 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. However, if additional data show risks not yet identified, additional restrictions may apply.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

15.4.6 Applicable Decision Document

The applicable decision document is the Record of Decision, Site 36 of the Miscellaneous Areas Operable Unit, Crab Orchard National Wildlife Refuge NPL Site, Marion, Illinois (USFWS, 2002). While the ROD identifies this site as a "No Action" site, the IOP-wide LUCs are still needed because of the lack of groundwater data.

15.5 LUCIP FOR SITE 36 – REFUGE WASTEWATER TREATMENT PLANT (MISCA OU)

15.5.1 Site Description

Site 36, the former refuge wastewater treatment plant, is located on the north side of Crab Orchard Lake (**Figure 1-4**). Soil, sludge, surface water and sediment at the site was remediated in 2005 in accordance with the Record of Decision (ROD) for Site 36, signed in 2002. While there were a number of contaminants of concern, PCBs and cadmium were most notable, with maximum detected concentrations of 130 mg/kg and 584 mg/kg, respectively. The remediation criteria for these contaminants of concern were 0.6 ppm for PCBs in soil and 4 ppm (in soil) and 5 ppm (in sediment) for cadmium.

15.5.2 LUCIP Objective

The IOP-wide LUCIP objectives apply.

15.5.3 LUC(s) Implemented to Achieve Objective

No additional LUCs beyond the IOP-wide LUCs are needed.

15.5.4 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. However, if additional data show risks not yet identified, additional restrictions may apply.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

15.5.5 Applicable Decision Document

The applicable decision document is the Record of Decision, Site 36 of the Miscellaneous Areas Operable Unit, Crab Orchard National Wildlife Refuge NPL Site, Marion, Illinois (USFWS, 2002).

15.6 LUCIP FOR THE VISITOR CENTER (WTOU)

15.6.1 Site Description

The Visitor Center is located Highway 148 just north of Crab Orchard Lake (**Figure 1-6**).

This site was addressed by a removal action in 1992. The site was cleaned up to the goal of 450 mg/kg identified in the *Action Memorandum for the Water Towers Operable Unit at the Crab Orchard National Wildlife Refuge (Refuge) Superfund site* (WTOU), 1992. At the time of the cleanup, that level was considered protective for residential use. However, USEPA Region 9 has recently published a residential preliminary remediation goal (PRG) of 150 mg/kg for lead.

15.6.2 LUCIP Objective

The LUCIP objective is the same as for the entire IOP (see Section 2 – IOP-Wide LUCIPS). Based on the available data, no other restrictions are needed.

15.6.3 LUC(s) Implemented to Achieve Objective

No additional LUCs beyond the IOP-wide LUCs are needed except that soil from this site should not be used for borrow material.

15.6.4 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

15.6.5 Applicable Decision Document

The applicable decision document is the action memorandum referenced above.

15.7 LUCIP FOR SITE 17 – JOB CORPS LANDFILL (PCB OU)

15.7.1 Site Description and Investigation Results

This former landfill was used by Sangamo Electric and was contaminated with PCBs and heavy metals (**Figure 1-2**).

The remediation criteria, in accordance with the ROD, was as follows:

- Lead to 450 ppm dry soil (dry weight basis)
- Cadmium to 10 ppm dry soil
- PCBs to 1 ppm dry soil in surface soils (defined as the top foot [12 inches] of soils)
- PCBs to 25 ppm dry soil in subsurface soils (defined as soils below the 1-foot depth)
- PCBs to 0.5 ppm dry sediments.

Recent studies by FWS indicate the potential for elevated PCB concentrations remaining at this site. FWS is investigating.

15.7.2 LUCIP Objective

The IOP-wide LUCIP objectives apply. An additional objective is to prevent potential exposure to PCBs remaining at this site.

15.7.3 LUC(s) Implemented to Achieve Objective

In addition to the IOP-wide LUCs, access should be limited to personnel who need to use the site. Digging should be prohibited, except for investigatory purposes and soil from this site should not be used for borrow material.

15.7.4 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUCs apply, Confirmation that the PCB OU clean up objectives have been met will be needed to remove the LUC restricting digging.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

15.7.5 Applicable Decision Document

The applicable decision document is the PCB OU ROD, signed in 1990.[38]

[38] U.S. Environmental Protection Agency, 1990b. *Declaration for the Record of Decision, Crab Orchard National Wildlife Refuge, PCB Areas Operable Unit,* August 1, 1990.

TABLE 15-1
ANALYTICAL DATA SCREENING FOR
SITE 27 - CRAB ORCHARD CREEK BELOW I-57 DREDGE AREA
MISCA OU

LAND USE CONTROL IMPLEMENTATION PLAN
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Source	O'B&G		O'B&G	
Sample ID	27-1-2-1		27-2-3-4	
Matrix (soil & sediment values shown in mg/kg; surface water values in ug/L)	Surface Water	*R. Code*	Soil	*R. Code*
Depth (feet)	NA		0-1	
CONSTITUENT				
Aluminum	ND		10400	H
Barium	40	C	125	
Boron	71		34	A
Calcium	49000	C	2320	
Chromium	ND		10	
Cobalt	ND		9	
Iron	500	C	14900	H
Magnesium	12400	C	1570	A
Manganese	638	C	679	H
Sodium	28400	C	100	
Titanium	ND		134	
Vanadium	ND		20	

Shading indicates constituent exceeded background and at least one screening criterion for inorganics; for all other constituents, shading indicates an exceedance of at least one screening criterion.

Legend
mg/kg = milligrams p
NA = Not Applicable or Not Analyzed
ND = Not detected
For data qualifiers, refer to source reports.

Sources:
(1) O'Brien & Gere, 1988. Remedial Investigation Report, Crab Orchard National Wildlife Refuge, August. Note, results for some chemicals reported by O'Brien & Gere (1988 RI) were determined to be not useable; all usable results are considered estimated. For a list of chemicals considered not useable, refer to DPRA Document No. 00018887, a letter dated 02/18/87 from USEPA to USFWS.
(2) Woodward-Clyde, 1996. Remedial Investigation Report, Remedial Investigation Miscellaneous Areas Operable Unit, Crab Orchard National Wildlife Refuge February.

Reference Codes:
A - Background Soil 95% UTL
B - Background Sediment 95% UTL
C - Background Surface Water 95% UTL
D - IEPA TACO Tier 1 Soil Remediation Objectives for Residential Properties – Ingestion Exposure Route
E - IEPA TACO Tier 1 Soil Remediation Objectives for Residential Properties – Inhalation Exposure Route
F - IEPA TACO Tier 1 Soil Remediation Objectives for Construction Worker Ingestion Exposure Route
G - IEPA TACO Tier 1 Soil Remediation Objectives for Construction Worker Inhalation Exposure Route
H - USEPA Region 9 Residential Soil Preliminary Remediation Goals
I – Illinois General Use Water Quality Standards – Created for the AUS OU, CONWR

16.1 LUCIP FOR AUS-0043 – AREAS 11 & 12 FIRE STATION (AUS OU)

AUS-0043 is currently part of a remedial investigation conducted by General Dynamics Ordnance and Technical Systems. It was identified in the AUS OU PA/SI as requiring an RI because of exceedances of screening values.

16.1.1 Site Description and Investigation Results

AUS-0043, the former IOP Fire Station No. 4, is located south of Crab Orchard Lake and northwest of Areas 11 and 12 (**Figures 1-7 and 11-1**). The site covers less than an acre. The fire station building is no longer on site.

Operational History and Waste Characteristics

This Fire Station was operated by SWDC/War Department as a part of the IOP, and serviced IOP facilities in its area. No industrial lessees were identified for this site.

Site Investigation

The SI included soil and surface water samples; no groundwater monitoring wells were installed.

Notable Contamination Found

2,6-dinitrotoluene in soil exceeded SI screening criteria. SVOCs and inorganics exceeded SI soil screening criteria. Lead was detected at 1,110 mg/kg in soil.

16.1.2 LUCIP Objective

The IOP-wide LUCIP objectives apply. As with all sites under investigation in the AUS OU RI, exposure should be minimized as much as practicable. RI results may indicate the need for additional restrictions.

When the results from the current RI are available, this LUCIP will be reviewed and appropriate modifications made.

16.1.3 LUC(s) Implemented to Achieve Objective

In addition to the IOP-wide LUCs, access to this area is restricted to personnel with a specific need to be at the site (**Figure 11-1**). No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers.

Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts. Further, soil from this site should not be used for borrow material and agricultural use is prohibited. These LUCs will be modified as appropriate as data are obtained in the RI.

16.1.4 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. Other restrictions will depend upon the results of the RI/FS currently in progress.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

16.1.5 Applicable Decision Document

There is not yet a decision document for this site.

16.2 LUCIP FOR SITE 21 – SOUTHEAST CORNER FIELD (MISCA OU)

16.2.1 Site Description

Site 21, the Southeast Corner Field, was identified as a possible former dumping area. The site, shown on (**Figure 1-4**) is a fenced area (with many large trees) that gradually slopes to the southeast towards a swampy ditch. It is located near the southeast corner of the Refuge in a pasture where a pile of concrete debris was observed. Field investigations found no evidence of dumping at this site, other than the concrete rubble. It was later determined that the rubble was probably part of a church that pre-dated the Illinois Ordnance Plant (IOP) (1996 RI).

16.2.2 Investigations

1988 RI (O'Brien & Gere)

During the 1988 RI, several samples were analyzed and magnetometer and electromagnetic surveys were conducted. The RI reported that no metallic objects were buried at the site. Four composite soil samples (0 to 1 foot depth) were collected along north-south transects at this site and were analyzed for VOCs, SVOCs, PCBs, pesticides, metals, explosives, and other indicator parameters.

Table 16-1 summarizes only the detected analytical results from the composite soil samples.[39] None of the detections exceeded levels of concern established for the 1988 RI. Because no concerns were indicated, this site was not investigated in the 1993 Phase I MISCA OU RI. Historic and aerial photo review done as part of the 1996 Phase II RI indicated that the debris might have been from the demolition of a church. No evidence of industrial usage was found and no sampling was done at this site as part of the 1996 RI. However, as shown in **Table 16-1**, a comparison of the 1988 data with the screening criteria used for this document shows three potential chemicals of concern.

Antimony exceeded the following screening values in all four soil samples:

- Background Soil 95% Upper Tolerance Limit
- USEPA Region 9 Residential Soil Preliminary Remediation Goal.

PCBs and SVOCs were analyzed in only one sample. The estimated concentration of Aroclor 1254 exceeded the USEPA Region 9 Residential Soil Preliminary Remediation Goal.

[39] Note that a number of analytes are not included because these data were later rejected: DPRA Document No. 00018887, a letter from USEPA to USFWS regarding Crab Orchard Lake RI/FS, dated February 18, 1987. A list of the rejected data can be found in the letter.

16.2.3 LUCIP Objective

Based on the available data, no objectives other than the IOP-wide objectives are needed.

16.2.4 LUC(s) Implemented to Achieve Objective

No additional LUCs beyond the IOP-wide LUCs are needed except that soil from this site should not be used as borrow material.

16.2.5 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

16.2.6 Applicable Decision Document

The applicable decision document is the Record of Decision, Site 36 of the Miscellaneous Areas Operable Unit, Crab Orchard National Wildlife Refuge NPL Site, Marion, Illinois (USFWS, 2002).

16.3 LUCIP FOR COC-10 (EMMA OU)

16.3.1 Site Description

COC-10 is located east of Area 10 and north of Areas 11 and 12 (**Figure 1-5**). It is a well-vegetated site approximately 120 feet square located on the northern edge of a corn field. A man-made depression characterizes most of the site.

Previous investigations at COC-10 include the 1988 FCS, the 1991 Phase I RI, and the 1994 Phase II RI.

16.3.2 Investigations

1988 Final Confirmation Study (Woodward-Clyde Consultants)

During the 1988 FCS, a magnetometer survey was conducted which indicated no detected anomalies suggestive of buried metallic objects. One sediment, one surface water, and two soil samples were collected and analyzed for VOCs, petroleum hydrocarbons, explosives, and metals.

Table 16-2 summarizes only the detected analytical results from the soil samples. While some metals exceeded the 95% upper confidence limit established for the 1988 FCS, the results were judged to be well within the range reported for soils in the United States. A comparison of the 1988 data results with the screening criteria used for this LUCIP shows one exceedance (**Table 16-2**):

Cadmium exceeded the following screening criteria in the sediment sample:

- Background Sediment 95% Upper Tolerance Limit (UTL), and
- USEPA Region 9 Residential Soil Preliminary Remediation Goal

1991 Phase I RI (Environmental Science and Engineering, Inc.)

Four soil, one surface water, and two sediment samples were collected from COC-10 during the 1991 Phase I RI and analyzed for VOCs, SVOCs, explosives, metals, and total petroleum hydrocarbons.

Table 16-2 summarizes only the detected analytical results from the soil samples. Some of the detected analytes warranted further investigation during Phase II RI activities (following). A comparison of the 1991 data with the screening criteria established for this LUCIP shows several potential chemicals of concern (**Table 16-2**).

Iron exceeded the following screening criteria in two soil samples:

- Background Sediment 95% Upper Tolerance Limit (UTL), and
- USEPA Region 9 Residential Soil Preliminary Remediation Goal

Aluminum and iron exceeded the following screening criteria in sediment:

- Background Sediment 95% Upper Tolerance Limit (UTL), and
- USEPA Region 9 Residential Soil Preliminary Remediation Goal

1994 Phase II RI (Environmental Science and Engineering, Inc.)

Two soil, five sediment, and two surface water samples were collected and analyzed for explosives and metals during the 1994 Phase II RI sampling event. **Table 16-2** summarizes only the detected analytical results from these samples. None of the detections exceeded levels of concern established for the 1994 RI. In fact, the 1994 BRA determined that there was no ecological nor human health risk at COC-10. Further, a comparison of the 1994 data with the screening criteria established for this LUCIP shows no potential chemicals of concern (**Table 16-2**):

16.3.3 LUCIP Objective

The LUCIP objective is the same as for the entire IOP (see Section 2). Based on the available data, no other restrictions are needed at this time.

16.3.4 LUC(s) Implemented to Achieve Objective

No additional LUCs beyond the IOP-wide LUCs are needed except that soil from this site should not be used for borrow material.

16.3.5 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

16.3.6 Applicable Decision Document

The applicable decision document is the Record of Decision (ROD) for Crab Orchard National Wildlife Refuge Explosives/Munitions Manufacturing Area (EMMA) Operable Unit (OU) (U.S. Army Corps of Engineers, 1996).

16.4 LUCIP FOR SITE 28 LANDFILL – WATER TOWER (PCB OU)

16.4.1 Site Description and Investigation Results

This former landfill was used by Sangamo Electric and was contaminated with PCBs and heavy metals (**Figure 1-2**).

The remediation criteria, in accordance with the ROD, was as follows:

- Lead to 450 ppm dry soil (dry weight basis)
- Cadmium to 10 ppm dry soil
- PCBs to 1 ppm dry soil in surface soils (defined as the top foot [12 inches] of soils)
- PCBs to 25 ppm dry soil in subsurface soils (defined as soils below the 1-foot depth)
- PCBs to 0.5 ppm dry sediments.

Recent studies by FWS indicate the potential for elevated PCB concentrations remaining at this site. FWS is investigating.

16.4.2 LUCIP Objective

The IOP-wide LUCIP objectives apply. An additional objective is to prevent potential exposure to PCBs remaining at this site.

16.4.3 LUC(s) Implemented to Achieve Objective

In addition to the IOP-wide LUCs, nobody should enter this site until further investigated. Digging should be prohibited, except for investigatory purposes, and soil from this site should not be used for borrow material.

16.4.4 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUCs apply. Confirmation that the PCB OU cleanup objectives have been met will be needed to remove the LUC restricting digging.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

16.4.5 Applicable Decision Document

The applicable decision document is the PCB OU ROD, signed in 1990.[40]

[40] U.S. Environmental Protection Agency, 1990b. *Declaration for the Record of Decision, Crab Orchard National Wildlife Refuge, PCB Areas Operable Unit,* August 1, 1990.

TABLE 16-1
ANALYTICAL DATA SCREENING FOR
SITE 21 - SOUTHWEST CORNER FIELD
MISCA OU

LAND USE CONTROL IMPLEMENTATION PLAN
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Source	O'B&G		O'B&G		O'B&G		O'B&G	
Sample ID	21-1-1-1/6/29		21-2-1-1		21-3-1-1		21-4-1-1	
Matrix (soil & sediment values shown in mg/kg; surface water values in ug/L)	Soil	*R. Code*	Soil	*R. Code*	Soil	*R. Code*	Soil	*R. Code*
Depth (feet)	0-1		0-1		0-1		0-1	
CONSTITUENT								
2-Methylnaphthalene	0.051							
Aluminum	7980	H	13200	H	14000	H	12000	H
Anthracene	0.105							
Antimony	7.9	A H	8.2	A H	7	A H	8.4	A H
Aroclor 1254	0.133	H						
Barium	95.2		81.2		87.2		98.2	
Boron	16	A	9.7	A	8.8	A	3	
Calcium	45000	A	16700	A	12100	A	1800	
Chromium	9		17		17		14	
Cobalt	6		8		6		7	
Dibenzofuran	0.018							
Iron	12700	H	16800	H	18300	H	16600	H
Magnesium	27200	A	10500	A	3280	A	1740	A
Manganese	995	H	638	H	418	H	611	H
Molybdenum	2		2		2		2	
N-Nitrosodimethylamine	0.011	H						
Phenanthrene	0.105							
Sodium	170		80		80		120	
Titanium	202		292		301		164	
Vanadium	18		32		32		31	

Shading indicates constituent exceeded background and at least one screening criterion for inorganics; for all other constituents, shading indicates an exceedance of at least one screening criterion.

Legend
mg/kg = milligrams per kilogram
ug/L = micrograms per Liter
NA = Not Applicable or Not Analyzed
ND = Not detected
For data qualifiers, refer to source reports.

Sources:
(1) O'Brien & Gere, 1988. Remedial Investigation Report, Crab Orchard National Wildlife Refuge , August. Note, Results for some chemicals reported by O'Brien & Gere (1988 RI) were determined to be not useable; all usable results are considered estimated. For a list of chemicals considered not useable, refer to DPRA Document No. 00018887, a letter dated 02/18/87 from USEPA to USFWS.

Reference Codes:
A - Background Soil 95% UTL
B - Background Sediment 95% UTL
C - Background Surface Water 95% UTL
D - IEPA TACO Tier 1 Soil Remediation Objectives for Residential Properties – Ingestion Exposure Route
E - IEPA TACO Tier 1 Soil Remediation Objectives for Residential Properties – Inhalation Exposure Route
F - IEPA TACO Tier 1 Soil Remediation Objectives for Construction Worker Ingestion Exposure Route
G - IEPA TACO Tier 1 Soil Remediation Objectives for Construction Worker Inhalation Exposure Route
H - USEPA Region 9 Residential Soil Preliminary Remediation Goals
I – Illinois General Use Water Quality Standards – Created for the AUS OU, CONWR

TABLE 16-2, ANALYTICAL DATA SCREENING FOR
COC-10 of the EMMA OU

LAND USE CONTROL IMPLEMENTATION PLAN
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Source	WCC (1988 CS)		WCC (1988 CS)		WCC (1988 CS)		WCC (1988 CS)		ESE (1991 Ph I RI)		ESE (1991 Ph I RI)		ESE (1991 Ph I RI)		ESE (1991 Ph I RI)		ESE (1991 Ph I RI)		ESE (1991 Ph I RI)	
Sample ID	COC-10-1		COC-10-3		SSCOC-10-1		SWCOC-10-1		SSCOC10-1		SSCOC10-2		SSCOC10-3		SSCOC10-4		SWCOC10-1		SDCOC10-1	
Matrix (soil & sediment values shown in mg/kg surface water values in ug/L)	Soil	*R. Code*	Soil	*R. Code*	Sediment	*R. Code*	Surface Water	*R. Code*	Soil	*R. Code*	Soil	*R. Code*	Soil	*R. Code*	Soil	*R. Code*	Surface Water	*R. Code*	Sediment	*R. Code*
Depth (feet)	Composite (2, 7, & 12)		Composite (2, 7, & 12)		Surface		NA		Surface		Surface		Surface		Surface		NA		Surface	
CONSTITUENT																				
2,4,6-Trinitrotoluene	ND		ND		ND		ND		ND		ND		ND		ND		ND		0.66	
Aluminum	6650		8930	H	8590	H	36		10500	H	14100	H	17700	H	13900	H	0.8		14400	B H
Antimony	ND		ND		ND		NA		0.81		0.45		ND		ND		ND		ND	
Arsenic	ND		ND		ND		ND		7.69	H	7.46	H	0.603	H	5.23	H	0.003		0.636	H
Barium	140		114		104		24	C	69.2		119		74.2		65.6		0.08		138	
Beryllium	0.57		1	A	0.33		ND		0.61		0.7		0.47		0.47		ND		0.59	
Cadmium	ND		ND		3.8	B H	ND	C	0.24	A	0.27	A	0.23	A	ND		ND		1.54	
Calcium	995		1310		924		6510		417		546		530		582		5.2		848	
Chromium	12		14		12		ND		17.6		19		20.9		17.8		ND		18.7	B
Cobalt	9.6		5.4		6.6		NA		17.1		13.3		7.72		7.97		ND		9.91	B
Copper	9.2		8.1		18	B	ND		9.85		12.9	A	17.1	A	10.7		0.004		21.8	B
Iron	16900	H	18200	H	13100	H	689	C	19300	H	23000	A H	25600	A H	18900	H	7.73		23200	B H
Lead	9.1		10		19		ND		17.3		20.1		17.8		14.4		0.003		16	
Magnesium	1830	A	1890	A	1510		3840	C	1420		2030	A	2710	A	1980	A	1.92		2470	B
Manganese	944	H	320	H	361	H	58		886	H	1740	H	307	H	519	H	0.69		517	H
Mercury	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Nickel	20	A	20	A	11		ND		9.42		12.7		13.9		10.3		ND		15.3	
Nitrobenzene	ND		ND		ND		ND		ND		0.58		ND		ND		ND		ND	
Potassium	ND		ND		ND		NA		232		557		677	A	424		7.5		579	
Selenium	ND		ND		ND		ND		0.41		0.58		0.2		0.45		ND		0.79	B
Silver	0.55		ND		0.63		14	C	0.57		0.85	A	0.4		0.25		ND		0.45	
Sodium	ND		ND		ND		ND		36.1		64.9		53.2		68.9		1.42		92.3	
Thallium	ND		ND		ND		NA		0.46	A	0.14		0.28		0.29		ND		0.26	
Total Petroleum Hydrocarbons	ND		ND		1500		ND		25		18		ND		ND		ND		ND	
Vanadium	19		30		21		NA		34.6		40.6		39.5		35.3		0.002		36.8	B
Zinc	37		32		70	B	6.7		32.7		49.2		50.5		41		0.05		64.4	B

Shading indicates constituent exceeded background and at least one screening criterion for inorganics; for all other constituents, shading indicates an exceedance of at least one screening criterion.

Legend
mg/kg = milligrams per kilogram, ug/L = micrograms per Liter
NA = Not Applicable or Not Analyzed
ND = Not detected
For data qualifiers, refer to source reports.

Sources:
(1) Woodard-Clyde Consultants, 1988. Final Confirmation Study, Crab Orchard National Wildlife Refuge, Marion, Illinois, Volumes I through V.
(2) ESE, 1994. Draft-Final Remedial Investigation/Baseline Risk Assessment Report, EMMA OU, CONWR, Marion, Illinois, Volumes I through V.

Reference Codes:
A - Background Soil 95% UTL
B - Background Sediment 95% UTL
C - Background Surface Water 95% UTL
D - IEPA TACO Tier 1 Soil Remediation Objectives for Residential Properties – Ingestion Exposure Route
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F - IEPA TACO Tier 1 Soil Remediation Objectives for Construction Worker Ingestion Exposure Route
G - IEPA TACO Tier 1 Soil Remediation Objectives for Construction Worker Inhalation Exposure Route
H - USEPA Region 9 Residential Soil Preliminary Remediation Goals
I – Illinois General Use Water Quality Standards – Created for the AUS OU, CONWR

TABLE 16-2, ANALYTICAL DATA SCREENING FOR
COC-10 of the EMMA OU

LAND USE CONTROL IMPLEMENTATION PLAN
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Source	ESE (1991 Ph I RI)		ESE (1994 Ph II RI)		ESE (1994 Ph II RI)		ESE (1994 Ph II RI)		ESE (1994 Ph II RI)		ESE (1994 Ph II RI)		ESE (1994 Ph II RI)		ESE (1994 Ph II RI)		ESE (1994 Ph II RI)		ESE (1994 Ph II RI)	
Sample ID	SDCOC10-2		BCOC10-1-2		BCOC10-1-4		SDCOC10-1		SDCOC10-1		SDCOC10-1		SDCOC103		SDCOC104		SWCOC102		SWCOC103	
Matrix (soil & sediment values shown in mg/kg; surface water values in ug/L)	Sediment	*R. Code*	Soil	*R. Code*	Soil	*R. Code*	Sediment	*R. Code*	Sediment	*R. Code*	Sediment	*R. Code*	Sediment	*R. Code*	Sediment	*R. Code*	Surface Water	*R. Code*	Surface Water	*R. Code*
Depth (feet)	Surface		0-2		4-6		Surface		Surface		Surface		Surface		Surface		NA		NA	
CONSTITUENT																				
2,4,6-Trinitrotoluene	0.72		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Aluminum	12100	B H	NA		NA		NA		NA		NA		NA		NA		NA		NA	
Antimony	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Arsenic	5.27	H	10.1	H	5.77	H	4.38	H	5.03	H	2.25	H	5.5	H	7.98	H	55.2	C	52.9	C
Barium	198	B	NA		NA		NA		NA		NA		NA		NA		NA		NA	
Beryllium	0.64		0.809	A	0.981	A	0.642		0.886		0.754		0.935		ND		ND		ND	
Cadmium	ND		ND		ND		0.906		ND		ND		ND		ND		ND		ND	
Calcium	1010		NA		NA		NA		NA		NA		NA		NA		NA		NA	
Chromium	19.4	B	16.9		17		18.9	B	16.5		17		12.3		16.5		ND		ND	
Cobalt	10.3	B	NA		NA		NA		NA		NA		NA		NA		NA		NA	
Copper	15.6		18.9	A	15.6	A	19.9	B	16.5		9.16		7.76		13.8		ND		ND	
Iron	20000	H	NA		NA		NA		NA		NA		NA		NA		NA		NA	
Lead	10.8		17.7		11.9		15.1		15.9		13.2		14.9		14.1		ND		ND	
Magnesium	2620	B	NA		NA		NA		NA		NA		NA		NA		NA		NA	
Manganese	325	H	NA		NA		NA		NA		NA		NA		NA		NA		NA	
Mercury	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Nickel	17.5	B	17.2		26.8	A	21.5	B	16.6		11.2		12.7		10.9		ND		ND	
Nitrobenzene	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Potassium	522		NA		NA		NA		NA		NA		NA		NA		NA		NA	
Selenium	0.39		0.529		0.637		0.559		0.341		ND		ND		ND		2.6		ND	
Silver	0.46		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Sodium	93.5		NA		NA		NA		NA		NA		NA		NA		NA		NA	
Thallium	0.26		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Total Petroleum Hydrocarbons	ND		NA		NA		NA		NA		NA		NA		NA		NA		NA	
Vanadium	34.7	B	NA		NA		NA		NA		NA		NA		NA		NA		NA	
Zinc	47.6		59.1	A	49.8		62	B	50.1		27.9		32.2		39.2		ND		64.3	C

Shading indicates constituent exceeded background and at least one screening criterion for inorganics; for all other constituents, shading indicates an exceedance of at least one screening criterion.

Legend
mg/kg = milligrams per kilogram, ug/L = micrograms per Liter
NA = Not Applicable or Not Analyzed
ND = Not detected
For data qualifiers, refer to source reports.

Sources:
(1) Woodard-Clyde Consultants, 1988. Final Confirmation Study, Crab Orchard National Wildlife Refuge, Marion, Illinois, Volumes I through V.
(2) ESE, 1994. Draft-Final Remedial Investigation/Baseline Risk Assessment Report, EMMA OU, CONWR, Marion, Illinois, Volumes I through V.

Reference Codes:
A - Background Soil 95% UTL
B - Background Sediment 95% UTL
C - Background Surface Water 95% UTL
D - IEPA TACO Tier 1 Soil Remediation Objectives for Residential Properties – Ingestion Exposure Route
E - IEPA TACO Tier 1 Soil Remediation Objectives for Residential Properties – Inhalation Exposure Route
F - IEPA TACO Tier 1 Soil Remediation Objectives for Construction Worker Ingestion Exposure Route
G - IEPA TACO Tier 1 Soil Remediation Objectives for Construction Worker Inhalation Exposure Route
H - USEPA Region 9 Residential Soil Preliminary Remediation Goals
I – Illinois General Use Water Quality Standards – Created for the AUS OU, CONWR

SECTION SEVENTEEN SITES NEAR THE HAMPTON CEMETERY

17.1 LUCIP FOR AUS-0062 – MOUNDS AND PITS WEST OF COC-1 (AUS OU)

AUS-0062 is currently part of a remedial investigation conducted by General Dynamics Ordnance and Technical Systems. It was identified in the AUS OU PA/SI as requiring an RI because of exceedances of screening values.

17.1.1 Site Description and Investigation Results

AUS-0062 is located in the Crab Orchard Cemetery (COC) area, south of Crab Orchard Lake (**Figures 1-7 and 17-1**). According to the USFWS, AUS-0062 is a former landfill that was closed by the Refuge in 1974.

Operational History and Waste Characteristics

The aerial photograph interpretation indicated that this site appeared to be a roadside clearing and fill operation in 1971, the year of the first photograph that showed any signs of activity in this area. By 1980, the site appeared to be inactive.

Site Investigation

The SI included soil, sediment, and surface water samples; no groundwater monitoring wells were installed.

Notable Contamination Found

TCE and most inorganics in soil exceeded SI screening criteria.

17.1.2 LUCIP Objective

The IOP-wide LUCIP objectives apply. As with all sites under investigation in the AUS OU RI, exposure should be minimized as much as practicable. RI results may indicate the need for additional restrictions.

When the results from the current RI are available, this LUCIP will be reviewed and appropriate modifications made.

17.1.3 LUC(s) Implemented to Achieve Objective

In addition to the IOP-wide LUCs, access to this area is restricted to personnel with a specific need to be at the site (**Figure 17-1**). No soil will be removed from the site, except for soil samples taken

by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers.

Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts. Further, soil from this site should not be used for borrow material and agricultural use is prohibited. These LUCs will be modified as appropriate as data are obtained in the RI.

17.1.4 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. Other restrictions will depend upon the results of the RI/FS currently in progress.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

17.1.5 Applicable Decision Document

There is not yet a decision document for this site.

17.2 LUCIP FOR AUS-0065 – FOUNDATIONS NORTHEAST OF COC-1 (AUS OU)

AUS-0065 is currently part of a remedial investigation conducted by General Dynamics Ordnance and Technical Systems. It was identified in the AUS OU PA/SI as requiring an RI because of exceedances of screening values.

17.2.1 Site Description and Investigation Results

AUS-0065 is a small site in the COC area with building foundations and suspect debris (**Figures 1-7 and 17-1**).

Operational History and Waste Characteristics

It appears that AUS-0065 is the location of a former farmstead as observed in the 1943 aerial photographs. Concrete foundations, soil mounds, depressions, and a brick structure resembling a well are currently visible on site. There have been no known industrial lessees of this property.

Site Investigation

The SI included several soil samples of varying depths; no groundwater monitoring wells were installed.

Notable Contamination Found

Many SVOCs and several inorganics exceeded SI soil screening criteria.

17.2.2 LUCIP Objective

The IOP-wide LUCIP objectives apply. As with all sites under investigation in the AUS OU RI, exposure should be minimized as much as practicable. RI results may indicate the need for additional restrictions.

When the results from the current RI are available, this LUCIP will be reviewed and appropriate modifications made.

17.2.3 LUC(s) Implemented to Achieve Objective

In addition to the IOP-wide LUCs, access to this area is restricted to personnel with a specific need to be at the site (**Figure 17-1**). No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers.

Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts. Further, soil from this site should not be used for borrow material and agricultural use is prohibited. These LUCs will be modified as appropriate as data are obtained in the RI.

17.2.4 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. Other restrictions will depend upon the results of the RI/FS currently in progress.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

17.2.5 Applicable Decision Document

There is not yet a decision document for this site.

17.3 LUCIP FOR AUS-0066 – BERM WITH RED BRICK RUBBLE (AUS OU)

AUS-0066 is currently part of a remedial investigation conducted by General Dynamics Ordnance and Technical Systems. It was identified in the AUS OU PA/SI as requiring an RI because of exceedances of screening values.

17.3.1 Site Description and Investigation Results

AUS-0066 is a small wooded site in the COC area (**Figures 1-7 and 17-1**).

Operational History and Waste Characteristics

AUS-0066 was originally described as "berm with red brick rubble" with a "Danger Contaminated Area" sign to the west. It was identified by USFWS as COC-14 of the EMMA OU and was one of the COC sites investigated only for unexploded ordnance (UXO).

AUS-0066 appears to have been the location of a former farmstead according to the 1943 aerial photographs. There was no other evidence of activity observed in this area on the historical aerial photographs.

In 1997, the Department of Army conducted an ordnance and explosive waste (OEW) investigation at this site. A total of 20 magnetic anomalies were identified; all twenty were identified as ordnance scrap.

There have been no known industrial lessees of this property.

Site Investigation

The SI included soil, sediment, and surface water samples; no groundwater monitoring wells were installed.

Notable Contamination Found

Many SVOCs and several inorganics exceeded SI soil screening criteria. Maximum concentrations detected included cadmium at 36 mg/kg and zinc at 447 mg/kg.

Illinois Surface Water Quality Standards were exceeded for cadmium, copper, iron, lead, manganese, and zinc.

17.3.2 LUCIP Objective

The IOP-wide LUCIP objectives apply. As with all sites under investigation in the AUS OU RI, exposure should be minimized as much as practicable. RI results may indicate the need for additional restrictions.

When the results from the current RI are available, this LUCIP will be reviewed and appropriate modifications made.

17.3.3 LUC(s) Implemented to Achieve Objective

In addition to the IOP-wide LUCs, access to this area is restricted to personnel with a specific need to be at the site (**Figure 17-1**). No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers.

Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts. Further, soil from this site should not be used for borrow material and agricultural use is prohibited. These LUCs will be modified as appropriate as data are obtained in the RI.

17.3.4 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. Other restrictions will depend upon the results of the RI/FS currently in progress.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

17.3.5 Applicable Decision Document

There is not yet a decision document for this site.

17.4 LUCIP for AUS-0067 – Fence with "Contaminated Area" Sign, Northwest of COC-6 (AUS OU)

AUS-0067 is currently part of a remedial investigation conducted by General Dynamics Ordnance and Technical Systems. It was identified in the AUS OU PA/SI as requiring an RI because of exceedances of screening values.

17.4.1 Site Description and Investigation Results

AUS-0067 is west of Wolf Creek Road and north of the COC Area Road (**Figures 1-7 and 17-1**). It was included in the AUS OU primarily because of suspect fencing and signage.

Operational History and Waste Characteristics

AUS-0067 was originally described as "fence with contaminated area (sign) northwest of COC-6." It appears this site was the location of a former farmstead as observed in the 1943 aerial photographs. Subsequent aerial photographs revealed no other activities in this area. A collapsed foundation, a cistern, some construction debris and some soil mounds were observed during the site visit.

There have been no industrial lessees of this property.

Site Investigation

The SI included soil samples and a water sample from a cistern; no groundwater monitoring wells were installed.

Notable Contamination Found

The dinitrotoluene concentration in a water sample from a cistern exceeded SI screening criteria.

17.4.2 LUCIP Objective

The IOP-wide LUCIP objectives apply. As with all sites under investigation in the AUS OU RI, exposure should be minimized as much as practicable. RI results may indicate the need for additional restrictions.

When the results from the current RI are available, this LUCIP will be reviewed and appropriate modifications made.

17.4.3 LUC(s) Implemented to Achieve Objective

In addition to the IOP-wide LUCs, access to this area is restricted to personnel with a specific need to be at the site (**Figure 1-7**). No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers.

Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts. Further, soil from this site should not be used for borrow material and agricultural use is prohibited. These LUCs will be modified as appropriate as data are obtained in the RI.

PPE guidelines are provided for a portion of this site. Refer to Section 1.4.1, Table 1-5, and **Figure 17-1**.

17.4.4 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. Other restrictions will depend upon the results of the RI/FS currently in progress.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

17.4.5 Applicable Decision Document

There is not yet a decision document for this site.

17.5 LUCIP FOR AUS-0069 – DUMP NEAR SOUTH SHORE OF CRAB ORCHARD LAKE (AUS OU)

AUS-0069 is currently part of a remedial investigation conducted by General Dynamics Ordnance and Technical Systems. It was identified in the AUS OU PA/SI as requiring an RI because of exceedances of screening values.

17.5.1 Site Description and Investigation Results

AUS-0069 is in the COC area, adjacent to Crab Orchard Lake (**Figure 1-7 and 17-1**). AUS-0069 partially coincides with EMMA OU Site COC-15, one of the COC sites for which no chemical analyses were performed as part of the EMMA OU RI. AUS-0069 is also a dump site.

Operational History and Waste Characteristics

AUS-0069 was identified in aerial photographs as a potential dump. The 1943 aerial photographs, taken during the IOP operation, show deposits of probable debris and large numbers of crated materials in this area along with a looping access road. By 1951, there was still some ground scarring and mounded debris present on site, however it appears that activity in this area had been terminated.

During the site visit, the following types of material were observed: construction debris (culverts, corrugated asbestos sheeting, concrete rubble, clay blocks, bricks, steel scrap), rusted drums, piping and soil mounds. Most of the debris is located in a stand of trees along the lakeshore and some of the debris is in Crab Orchard Lake.

There have been no known industrial lessees of this property.

Site Investigation

The SI included soil, sediment and trench water samples; no groundwater monitoring wells were installed.

Notable Contamination Found

PCE was detected in soils above the SI screening criteria. Maximum detections of many SVOCs and inorganics exceeded soil and/or sediment SI screening criteria, including antimony at 173 mg/kg, barium at 4,940 mg/kg, cadmium at 28 mg/kg, chromium at 266 mg/kg, lead at 51,000 mg/kg, and zinc at 16,400 mg/kg.

17.5.2 LUCIP Objective

The IOP-wide LUCIP objectives apply. As with all sites under investigation in the AUS OU RI, exposure should be minimized as much as practicable. RI results may indicate the need for additional restrictions. A specific objective is to prevent exposure to the debris at the site.

When the results from the current RI are available, this LUCIP will be reviewed and appropriate modifications made.

17.5.3 LUC(s) Implemented to Achieve Objective

In addition to the IOP-wide LUCs, access to this area is restricted to personnel with a specific need to be at the site (**Figure 17-1**). No soil will be removed from the site, except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers.

Digging and trenching at the site is limited to activities necessary for facility operation, such as subsurface utility repair and roadway repair, including culverts. Further, soil from this site should not be used for borrow material.

Note, the part of the site with the debris is off-limits except for OSHA-trained and certified personnel involved with CERCLA work.

This LUCIP will be re-evaluated as RI data are obtained.

17.5.4 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. Other restrictions will depend upon the results of the RI/FS currently in progress.

See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

17.5.5 Applicable Decision Document

There is not yet a decision document for this site.

17.6 LUCIP FOR HAMPTON CEMETERY COC ELUC AREA (EMMA OU)

17.6.1 Site Description

The COC ELUC Area borders Crab Orchard Lake and consists of sites COC-1, COC-3, COC-4, COC-5, COC-6, COC-9 and the reforested areas around the sites (**Figure 17-1**). COC-1 is located southwest of the Hampton Cemetery at the southwest intersection of Old Carterville Road and Hampton Cemetery Road. COC-3 is just west of COC-4 and both sites are east of Old Carterville Road and just north of Hampton Cemetery Road. COC-5 is northwest of the intersection of Old Carterville Road and Hampton Cemetery Road. COC-6 is northwest of COC-3 and east of Old Carterville Road. COC-9 lies west of COC-1. The reforested areas are north of Hampton Cemetery Road and surround the other sites. COC-15 is east of these other sites, north of Hampton Cemetery Road and east of Wolf Creek Road, along the south side of Crab Orchard Lake. COC-15 coincides with AUS-0069. All of the sites were suspected of being detonation or disposal areas. Sites COC-4, 5, 6, and 9 appear to be detonation areas from the detonation pits and associated fragmentation zones. Because of the trenches or pits that were dug out and filled with scrap and defective ordnance and then covered with dirt, Sites COC-1, 3, and 15 are considered to be disposal areas.

Previous investigations at the COC ELUC AREA include the 1988 Final Confirmation Study (FCS) by Woodward-Clyde Consultants (WCC),[41] the 1991 Phase I Remedial Investigation (RI) by Environmental Science and Engineering, Inc (ESE),[42,43] and the 1994 Phase II RI by ESE.[44,45] A 1997 Engineering Evaluation and Cost Analysis (EE/CA) report by Parsons Engineering (Parsons)[6] was also performed which included an unexploded ordnance (UXO) investigation only.

[41] Woodward-Clyde Consultants (WCC), April 1988. Final Confirmation Study, Crab Orchard National Wildlife Refuge, Marion, Illinois, Volumes I through V.
[42] Environmental Science and Engineering, Inc. December 1991. Explosives/Munitions Manufacturing Areas Operable Unit, Analytical Data Report, Crab Orchard National Wildlife Refuge, Marion, Illinois, Volumes I and II.
[43] Environmental Science and Engineering, Inc., September 1994. Draft Final Remedial Investigation/ Baseline Risk Assessment Report, Explosives/Munitions Manufacturing Areas Operable Unit, Crab Orchard National Wildlife Refuge, Marion, Illinois, Volumes I through V.
[44] Environmental Science and Engineering, Inc. January 1994. Explosives/Munitions Manufacturing Areas Operable Unit, Phase II Analytical Data Report, Crab Orchard National Wildlife Refuge, Marion, Illinois, Volumes I and II.
[45] Environmental Science and Engineering, Inc., September 1994. Draft Final Remedial Investigation/ Baseline Risk Assessment Report, Explosives/Munitions Manufacturing Areas Operable Unit, Crab Orchard National Wildlife Refuge, Marion, Illinois, Volumes I through V.
[6] Parsons Engineering Science, Inc., October 1997. Engineering Evaluation and Cost Analysis, Final Report Former Illinois Ordnance Plant, Marion, Illinois.

17.6.2 Investigations

In 1991 an RI was conducted at the EMMA OU which included a Baseline Risk Assessment (BRA). A Feasibility Study (FS) was performed on the EMMA OU sites based on the RI and BRA findings. The FS evaluated 7 remedial alternatives and was completed in September 1995. The RI included sampling and analysis to characterize the nature and extent of site contamination and background conditions, and the Baseline Risk Assessment (BRA) of current and potential future risks to human health and the environment posed by the contamination for the exposure pathways associated with future land use. Detailed description of the investigation work performed at CONWR and the BRA are presented in the *Remedial Investigation/Baseline Risk Assessment Report, Explosive/Munitions Manufacturing Area (EMMA) Operable Unit (OU), for Crab Orchard National Wildlife Refuge, September 15 (ESE, 1994).* .

Based on the findings of the 1994 Remedial Investigation Report for the EMMA OU, soil, sediment, surface water, and groundwater had been affected at 13 of the 15 sites (COC-1 through COC-10, COP-1 through COP-4, and Bunker1-3). The sites contained metals and nitroaromatic compounds in various media above background concentrations. The results of the Baseline Risk Assessment (BRA) concluded conditions at Sites COC-1, COC-2, COC-5, COC-7, COC-8, COC-9, COC-10, COP-1, COP-2, COP-3, and Bunker 1-3 do not pose an unacceptable potential risk to human health and the environment. There was a potential unacceptable risk indicated at Site COC-6. However, this potential unacceptable risk at Site COC-6 is based on an exposure scenario that is extremely unlikely. Therefore, no further action was recommended for those sites by the ROD for the EMMA OU prepared by ESE and signed by the USEPA and the DA in February 1997 (**Table 1-2)**.

The BRA indicated that Site COC-3 posed a potential and unacceptable risk to human health due to elevated levels of nitroaromatic compounds and metals in the soils. Additionally, potential ecological risks to white-tailed deer, small mammals, and bobwhite quail were identified. The Record of Decision (ROD) determined the following selected remedy for Sites COC-3:

- Excavation and offsite treatment and disposal of soil with concentrations of nitroaromatic compounds; greater than 100,000 mg/kg and lead greater than 450 mg/kg (approximately 270 cy)
- Further removal and offsite disposal of soil shown by TCLP analysis to match the RCRA definition of a characteristic hazardous waste (2,4-DNT greater than 0.13 mg/L and lead greater than 5 mg/L);
- Backfill excavated areas and construction and long-term maintenance of 24-inch soil covers, land use controls, and groundwater monitoring.

Parsons Engineering Science, Inc. conducted an unexploded ordnance investigation and prepared an Engineering Evaluation and Cost Analysis (EE/CA), (Parsons 1997). The investigation recovered

UXO at COC-1, COC-4, COC-5, COC-6, COC-9, and COC-15. A total of 1,107 anomalies were identified at COC-1 during the 1997 UXO site investigation. Three UXO items, all M-1 mine fuzes, were recovered. A total of 165 pounds of ordnance scrap and 60 pounds of non-ordnance scrap were collected and recycled. A total of 1,108 anomalies were identified at COC-3. A total of 150 pounds of non-ordnance scrap and 3.5 pounds of ordnance scrap were recovered. A total of 1,650 anomalies were identified at COC-4. One UXO item, an M-1 mine booster, was found. Approximately of 270 pounds of ordnance scrap and 12 pounds of non-UXO related scrap were removed from COC-4. A total of 3,429 anomalies were identified at COC-5. Two M-1 fuzes were found and removed. Approximately 181 pounds of ordnance scrap and 77 pounds of non-ordnance scrap were removed. A total of 3,894 anomalies were identified at COC-6 during the 1997 UXO site investigation. Five of the anomalies were UXO, three M1 fuzes, One M1 mine, and one projectile fuze. Approximately 220 pounds of ordnance scrap and 71 pounds of non-ordnance scrap were removed. At COC-9, a total of 1,707 anomalies were identified. Eight UXO items were removed; four M51 series fuzes, two M-1 mines, and two M-1 mine boosters. A total of 139 pounds of ordnance scrap and 33 pounds of non-ordnance scrap were recovered. At COC-15, a total of 2,702 anomalies were identified. Seven M-1 mine fuzes were recovered. Approximately 86 pounds of ordnance scrap and 174 pounds of non-ordnance scrap were recovered at COC-15. No UXO were recovered at the other COC sites and they are sites for no further action (**Table 1-2**). The EE/CA recommended the alternative to reforest approximately 70 acres of pastureland, clearance of UXO at selected areas to a depth of 1 foot, and institutional controls to be implemented by the USFWS.

17.6.3 LUCIP Objective

In addition to the LUCIP objective for the entire IOP (see Section 2), other objectives for the COC ELUC Area are to protect against exposure to contaminated soil and protect against possible contact with UXO.

17.6.4 LUC(s) Implemented to Achieve Objective

In addition to the IOP-wide LUCs, certain restrictions are applicable to the COC ELUC Area (**Figure 17-1**). Additional LUCs will include the prohibition of agricultural uses within the area and the prohibition of digging, trenching, or any other disturbance of the soil with the exception of soil samples to be taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers. Controlled burns will not be conducted within the COC LUC Area. Because live munitions have been found in this area in the past, there is a likelihood of finding them in the future.

17.6.5 Action Needed to Remove the LUC

Actions applicable to removal of the IOP-wide LUC would apply. See also Page 4, Paragraph VII (Agency Coordination) of the ELUCP.

17.6.6 Applicable Decision Document

The applicable decision document is the Record of Decision (ROD) for Crab Orchard National Wildlife Refuge Explosives/Munitions Manufacturing Area (EMMA) Operable Unit (OU) (U.S. Army Corps of Engineers, 1996) along with the Engineering Evaluation and Cost Analysis Final Report, Former Illinois Ordnance Plant, Marion, Illinois (Parsons Engineering Science, Inc., October 1997).

17.7 LUCIP FOR COC-11 (EMMA OU)

COC-11 is small site located southwest of Hampton Cemetery, just south of Hampton Cemetery Road (**Figure 1-5**). Chemical data for COC-11 was never collected as part of the EMMA OU; only a UXO investigation was performed. Note, COC-11 was formed into the AUS OU Site AUS-0062, a discussion of which can be found in Section 18.1.

During the 1997 UXO investigation, a total of 133 anomalies were identified and 21 pounds of scrap were removed from COC-11.[46]

<<Placeholder for Army information>>

[46] Parsons Engineering Science, Inc., October 1997. Engineering Evaluation and Cost Analysis Final Report, Former Illinois Ordnance Plant, Marion, Illinois.

Hampton Cemetery Area
Figure 17-1

*Modified Level D2 PPE Recommended for sampling or handling water from cistern.

Crab Orchard Lake

Wolf Creek Road

AUS 0067

COC-6

Hampton Cemetery

COC 3

COC-5

COC-4

Old Carterville Road

COC 9

COC-1

Hampton Cemetery Road

COC 15

IOP Wide Restrictions

-No production water wells shall be installed.
-Residential use and camping are prohibited.

Caution

Because live munitions have been found in this area in the past, there is a likelihood of finding them in this area in the future.

COC ELUC Restrictions

-Agricultural uses are prohibited within the COC ELUC area.
-Digging and trenching or other disturbance of the soil is prohibited within the COC ELUC area except for soil samples taken by Health & Safety-trained sampling personnel in compliance with OSHA 29 CFR 2910.120 for Hazardous Waste/Materials Workers.
-Controlled burns will not be conducted within the COC ELUC area.

AUS-0067 Personal Protective Equipment (PPE) Recommendations

Level D2*
(Modified for Protection against Splashing)

-Waterproff coveralls if water from cistern is to be sampled or handled in any way.
-Gloves, waterproof.
-Boots, waterproof.
-Hard hat (optional, as applicable).
-Face shield (optional, as applicable).

COC-15

0 100 200 Feet

Wolf Creek Road

Hampton Cemetary Road

Hampton Cemetery Area

February 2007

- EMMA OU ELUC Area
- Reforestation Area
- UXO Removal Sites
- PPE Recommendations
- COC3 Remediation Area
- Settling Basin
- COC-3 Monitoring Wells
- Roads
- AUS RIFS Boundaries
- Lakes
- Streams

0 500 1,000 Feet

SECTION EIGHTEEN REFERENCES

Environmental Science and Engineering, Inc., September 1994. Draft Final Remedial Investigation/ Baseline Risk Assessment Report, Explosives/Munitions Manufacturing Areas Operable Unit, Crab Orchard National Wildlife Refuge, Marion, Illinois, Volumes I through V.

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U.S. Environmental Protection Agency, 2001. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment).

U.S. Environmental Protection Agency, Region V, and the Illinois Environmental Protection Agency, and the United States Department of the Interior, and the United States Department of the Army, 1991. Federal Facilities Agreement Under CERLCA Section 120, in the Matter of the U.S. Department of the Interior's Crab Orchard National Wildlife Refuge. September 1991.

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U.S. Fish and Wildlife Service, June 2003. Final Preliminary Assessment/Site Inspection Report, Additional and Uncharacterized Sites Operable Unit, Crab Orchard National Wildlife Refuge NPL Site, Marion, Illinois, Volume I, Table 2-14.