



**Final Preliminary Assessment/Site Inspection Report**

**Additional and Uncharacterized Sites Operable Unit  
Crab Orchard National Wildlife Refuge NPL Site  
Marion, Illinois (Williamson County)**

**June 2003**

This Final PA/SI Report is identical to the  
"Draft-Final" Report issued in September 2001.

**VOLUME XI**

**Sections 30 through 43**

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**ACRONYM LIST**  
**Crab Orchard AUS OU PA/SI Report**

ACRONYM	DEFINITION
3S <sub>b</sub>	Mean plus three standard deviations
A.N.	Ammonium Nitrate
ARAR	Applicable, Relevant and Appropriate Requirements
AOC	Area of Concern
AST	Aboveground Storage Tank
ASTER	Assessment Tools for the Management of Risk (USEPA database)
AUS OU	Additional Uncharacterized Sites Operable Unit
BGS	Below Ground Surface
BNA	Base-Neutral Acids
BOD	Biological Oxygen Demand
BOR	U.S. Bureau of Reclamation
BRA	Baseline Risk Assessment
BTAG	Biological Technical Assistance Group
BTOC	Below Top of Casing
BWT	Below Water Table
CCME	Canadian Council of Ministers of the Environment
CERCLA	Comprehensive Environmental Response Compensation and Liability Act of 1980 (a.k.a. Superfund)
CIA	Central Intelligence Agency
CIPS	Central Illinois Public Service
CLP	Contract Laboratory Program
CM/SEC	Centimeters per Second
COC	Chain-of-Custody
COC	Chemical of Concern
COC	Crab Orchard Cemetery
COI	Chemical of Interest
COL	Crab Orchard Lake
CONWR	Crab Orchard National Wildlife Refuge
COP	Crab Orchard Pond
COPC	Chemical of Potential Concern
COPEC	Chemical of Potential Ecological Concern
CSC	Commercial Solvents Corporation
CSEQGs	Canadian Sediment Quality Guidelines
CSOQGs	Canadian Soil Quality Guidelines
CTI	Central Technologies Incorporated
CVOC	Chlorinated Volatile Organic Compounds
CWQG	Canadian Water Quality Guidelines
DAF	Dilution Attenuation Factor
DEHP	bis(2-ethylhexyl)phthalate
DERP	Defense Environmental Restoration Program
DGOLs	New Dutchlist Groundwater Optimum Levels
DNT	Dinitrotoluene
DOD	Department of Defense
DOI	U.S. Department of the Interior

**ACRONYM LIST**  
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ACRONYM	DEFINITION
DQCR	Daily Quality Control Reports
DQO	Data Quality Objective
DRO	Diesel Range Organics
DSOLs	New Dutchlist Soil Optimum Levels
DTW	Depth to water
DU	Depleted Uranium
EMMA OU	Explosives and Munitions Manufacturing Area Operable Unit
EPA	U.S. Environmental Protection Agency
EqP	Equilibrium Partitioning
ERL	Effects-Range Low
ERM	Effects-Range Medium
ESV	Ecological Screening Value
FDAP	Field Director of Ammunition Plants
FFA	Federal Facility Agreement
FID	Flame Ionization Detector
FOIA	Freedom of Information Act
FNH	Flashless Non-hydroscopic Powder
FS	Feasibility Study
FSP	Field Sampling Plan
FT	feet or foot
FWS	U.S. Fish and Wildlife Service
GPS	Global Positioning System
GRO	Gasoline Range Organics
GSA	General Services Administration
GW	Ground Water
HBX	High Blast Explosives
HE	High Explosives
HEDP	High Explosive Detonation Product
HEI	High Explosives Igniter
HMX	Her Majesty's Explosive (Cyclotetramethylenetetranitramine)
HQ	Hazard Quotient
HSA	Hollow Stem Auger
HSP	Health and Safety Plan
IAC	Illinois Administrative Code
IDW	Investigation Derived Waste
IEPA	Illinois Environmental Protection Agency
IPCB	Illinois Pollution Control Board
IOP	Illinois Ordnance Plant
K <sub>ow</sub>	Octanol-to-Water Partitioning Coefficient
LAW	Light Antitank Weapon
LOEC	Lowest Observed Effects Concentration
MAOU	Metals Area Operable Unit
MATC	Maximum Acceptable Toxicant Concentration

**ACRONYM LIST**  
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ACRONYM	DEFINITION
MCL	Maximum Contaminant Level
MDL	Method Detection Limit
MG/KG	milligrams per kilogram
MG/L	milligrams per liter
MHSPE	Ministry of Housing, Spatial Planning, and the Environment
MISCA OU	Miscellaneous Areas Operable Unit
MM	millimeter
MOCA	4,4' - Methylenebis (2-chloroaniline)
MSDS	Material Safety Data Sheets
MSL	Mean Sea Level
MW	Monitoring Well
NA	Not analyzed
NA	Not applicable
NAPL	Non-aqueous Phase Liquid
NEC	No Effect Concentration
NCP	National Contingency Plan
ND	Not detected
NG	Nitroglycerin
NG/KG	Nanograms per kilogram
NOAA	National Oceanic and Atmospheric Administration
NaOH	Caustic Soda
NOEC	No-observed-effect concentration
NPL	National Priorities List
OD	Outside Diameter
OE	Ordnance and Explosives
OEW	Ordnance and Explosive Waste
OFDAP	Ordnance Field Director of Ammunition Plants
OU	Operable Unit
PA	Preliminary Assessment
PAH	Polynuclear Aromatic Hydrocarbons
PA/SI	Preliminary Assessment/Site Investigation
PBX	Plastic Bonded Explosives
PCB	Poly-chlorinated Biphenyl
PCB OU	PCB Operable Unit
PCE	Tetrachloroethylene
PEC	Probable Effect Concentration
PEL	Probable Effect Level
PETN	Pentaerythritol Tetranitrate
PID	Photo Ionization Detector
PLC	Preliminary Levels of Concern
PM	Project Manager
PPB	Parts Per Billion
PPE	Personnel Protection Equipment

**ACRONYM LIST**  
**Crab Orchard AUS OU PA/SI Report**

ACRONYM	DEFINITION
PPM	Parts Per Million
PRG	Preliminary Remediation Goals
PRP	Potentially Responsible Party
PVC	Polyvinyl Chloride
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
QCSR	Quality Control Summary Report
R&D	Research & Development
RAGS	Risk Assessment Guidance for Superfund (USEPA document)
RCRA	Resource Conservation and Recovery Act
RDX	Royal Demolition Explosive (Cyclonite)
RI	Remedial Investigation
RI/FS	Remedial Investigation / Feasibility Study
RL	Reporting Limit
ROD	Record of Decision
RR	Railroad
RRTC	Railroad Tank Car
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act (1986)
SI	Site Investigation
SIU	Southern Illinois University
SMCL	Secondary Maximum Contaminant Level
SMDP	Scientific Management Decision Point
SOP	Standard Operating Procedure
SPO	Solid Propellant Operations
SSLs	Soil Screening Levels (USEPA)
SVOC	Semi-volatile Organic Compound
SWDC	Sherwin Williams Defense Corporation
TACO	Tiered Approach to Corrective Action Objectives
TAL	Target Analyte List
TBD	To Be Determined
TCDD	Tetrachlorodibenzo-p-Dioxin
TCE	Trichloroethylene
TCL	Target Compound List
TDS	Total Dissolved Solids
TEC	Threshold Effect Concentration
TEL	Threshold Effect Level
TEQ	Toxicity Equivalent for Dioxins/Furans
TNT	Trinitrotoluene
TOC	Total Organic Carbon
TPH	Total Petroleum Hydrocarbons
TRPH	Total Recoverable Petroleum Hydrocarbons
TRV	Toxicity Reference Value

**ACRONYM LIST**  
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ACRONYM	DEFINITION
TSS	Total Suspended Solids
UET	Upper Effect Threshold
UG/KG	micrograms per kilogram
UG/L	micrograms per liter
UMC	Universal Match Corporation
USACE	U.S. Army Corp of Engineers
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
ECOTOX	Ecological Toxicity Database
USFWS	United States Fish & Wildlife Service
USGS	United States Geological Survey
UST	Underground Storage Tank
UXO	Unexploded Ordnance
VJ Day	Victory over Japan day (August 15, 1945)
VOCs	Volatile Organic Compounds
WAA	War Assets Administration
WSA	West Shop Area
WWII	World War II
WWTP	Wastewater Treatment Plant



AUS-0001 is located on the west side of Wolf Creek Road, approximately 0.4 mile south of Old Highway 13. The location of AUS-0001 and the other sites included in this volume are shown in Figure 30-1.

### **AUS Original Site Designations**

AUS-0001 is one of the original Additional and Uncharacterized Sites Operable Unit (AUS OU) sites designated in 1997-1999 by the United States Fish & Wildlife Service (USFWS).

## **30.1 HISTORIC SEARCH INFORMATION**

### **30.1.1 Site Description**

AUS-0001 is the location of the former Illinois Ordnance Plant (IOP) Police and Fire Headquarters or Fire Station No. 1 (IOP Building A-3-1). The site currently consists of a large parking area, four or five building foundations and some debris (Figure 30-2). According to the War Department Facilities Inventory for the IOP, Building A-3-1 encompassed 5,590 square feet (ft) of floor space.<sup>1</sup> No IOP drawings of the building were found.

### **30.1.2 Operational History and Waste Characteristics**

This Police and Fire Headquarters was originally constructed and operated by Sherwin Williams Defense Corporation (SWDC\War Department), under contract with the War Department, as a part of the IOP. The L-shaped foundation of Building A-3-1 is still on site (Figure 30-2). The building was razed sometime between 1971 and 1980.<sup>2</sup>

It is possible that Building A-3-1 was used until the building was razed;<sup>3</sup> however this is not known for certain. Special Use Permits granted the Crab Orchard Sportsmen's Association permission to use Fire Station No. 1 from 1948<sup>4</sup> through 1959<sup>5</sup> as its club headquarters,<sup>6</sup> and it was responsible for hosting and supervising all retriever and springer dog trials on the Refuge.<sup>7</sup>

<sup>1</sup> U.S. Army Corps of Engineers, 1944, War Department Facilities Inventory of the Illinois Ordnance Plant Carbondale, Illinois, Part I, Section 9, Page 1.

<sup>2</sup> Entech, Inc., 1999, Historical Aerial Photographic Analysis – Inventory of Potential Disposal Sites: Additional and Uncharacterized Sites (AUS) Operable Unit, Crab Orchard National Wildlife Refuge, Marion, Illinois, Volume I (Text) Pages 3-5 and 3-6, and Volume II (Maps) Page A. The Entech reports analyze historic aerial overflight photographs of industrial areas at the Refuge, from 1943 to 1993. The photos were obtained from the National Archives and Records Administration (NARA) and the U.S. Department of Agriculture Agricultural Stabilization and Conservation Service (ASCS).

<sup>3</sup> Entech, Inc., 1999, Historical Aerial Photographic Analysis – Inventory of Potential Disposal Sites: Additional and Uncharacterized Sites (AUS) Operable Unit, Crab Orchard National Wildlife Refuge, Marion, Illinois, Volume I (Text) Page 3-6, and Volume II (Maps) Page A.

<sup>4</sup> DPRA Document No. 00021398. Crab Orchard National Wildlife Refuge, Memorandum to Crab Orchard Sportsmen's Association regarding Special Use Permit No. 48-560, dated August 10, 1948; and DPRA Document No. 00008794. Crab Orchard National Wildlife Refuge Special Use Permit No. 48-560, dated August 10, 1948.

<sup>5</sup> DPRA Document No. 00008838. Crab Orchard National Wildlife Refuge Special Use Permit No. 49-609, dated July 19, 1949.

<sup>6</sup> DPRA Document No. 00008711. Crab Orchard National Wildlife Refuge, Memorandum to the Refuge Manager at Crab Orchard Refuge in Carterville Illinois regarding Crab Orchard Sportsmen's Association, , dated July 26, 1948.

<sup>7</sup> DPRA Document No. 00008835. Crab Orchard National Wildlife Refuge, Memorandum to the Chief of the Branch of Wildlife Refuges regarding Special Use Permit No. 49-609, dated July 25, 1949.

These trials were to be held in the area to the east of Sneed Road (Route 148) and south of Crab Orchard Lake.<sup>8</sup>

The Crab Orchard Sportsmen's Association was authorized to construct kennels, dog pens, and fences as were necessary to adequately accommodate the dogs that were entered in or being trained for the field trials.<sup>9</sup> As observed in historical aerial photographs, what were likely the kennels, were constructed sometime between 1951 and 1960,<sup>10</sup> to the west of Building A-3-1. The foundation for these kennels is still present on site and it is located approximately 150 ft west of the former shed(s), discussed below. The foundation is a linear concrete foundation, approximately 15- to 20-ft wide and approximately 135-ft long. There is a trough in the center of this foundation that appears to flow to the south. This concrete pad has four rows of evenly-spaced pipes that are sticking up from the pad, which likely supported the roof of the structure. There are two piles of building debris (steel fencing, wood, and roofing construction debris) located on the northernmost end of this pad.

Some ground discoloration was noted in the parking area east of Building A-3-1 (Figure 30-2) in the 1965 aerial photograph,<sup>11</sup> along with two possible vehicles. These were the only signs of activity at the site at this time.

A former guard shack was located on Wolf Creek Road, at the north end of the present-day parking area (Figure 30-2).

Just west of the Building A-3-1 foundation is another building foundation (Figure 30-2). This building looked like two sheds in historical aerial photographs. These two sheds were razed sometime between 1943 and 1951 (possibly at the end of the war).<sup>12</sup> Based on the layout of this foundation and the piping, it is possible that one of these sheds was a former boiler house; however, this is only speculation. Dark-toned ground discoloration was noted in the 1943 aerial photograph, between Building A-3-1 and the two sheds.<sup>13</sup>

There is a small sump located on the south side of the shed foundation that could have possibly been a blow-off basin. This sump has piping that likely discharged to a nearby culvert, labeled as "possible outfall" on Figure 30-2, which discharges into a drainageway that flows from north to south through the center of AUS-0001. There is also a 2-inch capped pipe that is sticking up

<sup>8</sup> DPRA Document No. 00008048. Crab Orchard National Wildlife Refuge, Memorandum to the Refuge Manager at Crab Orchard Refuge in Carterville, Illinois regarding Crab Orchard Field Trial Club, dated March 28, 1949, Page 1.

<sup>9</sup> DPRA Document No. 00008838. Crab Orchard National Wildlife Refuge Special Use Permit No. 49-609, dated July 19, 1949, Special Conditions, Paragraph 1.

<sup>10</sup> Entech, Inc., 1999, Historical Aerial Photographic Analysis – Inventory of Potential Disposal Sites: Additional and Uncharacterized Sites (AUS) Operable Unit, Crab Orchard National Wildlife Refuge, Marion, Illinois, Volume I (Text) Page 3-5, and Volume II (Maps) Page A.

<sup>11</sup> Entech, Inc., 1999, Historical Aerial Photographic Analysis – Inventory of Potential Disposal Sites: Additional and Uncharacterized Sites (AUS) Operable Unit, Crab Orchard National Wildlife Refuge, Marion, Illinois, Volume I (Text) Page 3-5, and Volume II (Maps) Page A.

<sup>12</sup> Entech, Inc., 1999, Historical Aerial Photographic Analysis – Inventory of Potential Disposal Sites: Additional and Uncharacterized Sites (AUS) Operable Unit, Crab Orchard National Wildlife Refuge, Marion, Illinois, Volume I (Text) Page 3-5, and Volume II (Maps) Page A.

<sup>13</sup> Entech, Inc., 1999, Historical Aerial Photographic Analysis – Inventory of Potential Disposal Sites: Additional and Uncharacterized Sites (AUS) Operable Unit, Crab Orchard National Wildlife Refuge, Marion, Illinois, Volume I (Text) Page 3-5, and Volume II (Maps) Page A.

just behind this foundation. It is possible that this was a vent pipe for an old fuel oil underground storage tank (UST), however this is speculation.

### **30.1.3 AUS-0001 Previous Sampling Results**

#### **USEPA Sampling, 1998**

In 1998, the United States Environmental Protection Agency (USEPA) collected one sample (AUS 1-1) from this site in a pit area, next to the westernmost portion of former Building A-3-1. Coordinates for this sample location are incorrect; however, during the field reconnaissance, the USEPA flag marking this sample location was noted, and that location is shown on Figures 30-2, 30-3, and 30-4. The results for all detected constituents are listed in Table 30-1B. The following semi-volatile organic compounds (SVOCs) were detected above the USEPA Soil Screening Levels (SSLs): benzo[a]pyrene (0.11 milligrams per kilogram (mg/kg)) and benzo[b]fluoranthene (0.4 mg/kg). Arsenic (130 mg/kg), mercury (0.12 mg/kg), and nickel (33 mg/kg) exceeded USEPA SSLs and background values for the Refuge.<sup>14</sup> Copper (43 mg/kg), lead (210 mg/kg), and zinc (310 mg/kg) exceeded New Dutchlist Soil Optimum Levels (DSOLs) and Refuge background levels.

#### **30.1.4 Observations During Site Visit**

AUS-0001 is primarily wooded, see Figure 30-2. There are no buildings remaining in this area; however there are foundations for at least four former structures present on site. These foundations and other site features observed during the site reconnaissance, are discussed in Section 30.1.2 above.

#### **30.1.5 Recommendations Based on Preliminary Assessment**

AUS-0001 was included in the Site Investigation (SI) since there is the possibility that there was a UST present on site and because historical aerial photographs identified some areas of potential liquid releases near the building. Also, USEPA sample results revealed exceedances of Preliminary Assessment (PA) screening levels at this site.

### **30.2 SITE INVESTIGATION INFORMATION**

URS conducted a Site Investigation at AUS-0001 on April 4, 2000 and May 17, 2000. The rationale for sample locations, media, and analytes is presented in the Field Sampling Plan (FSP)<sup>15</sup> for the AUS OU PA/SI. Since the time the FSP was prepared, additional information has become available, and the historic discussion (Section 30.1) has been updated to include that information. The sampling locations discussed below are based on the information that was available at the time the FSP was developed, and may not address all areas of potential releases.

AUS OU SI sample locations are shown on Figures 30-2, 30-3, and 30-4. Survey coordinates for all sample locations in AUS-0001 are listed in Table 30-1. Table 30-3 lists the sample locations

<sup>14</sup> See Table 1-11 of this report for Refuge background soil values used for the PA.

<sup>15</sup> U.S. Fish & Wildlife Service, Department of the Interior, March 2000, Draft Final Field Sampling Plan Site Inspection, Additional and Uncharacterized Sites Operable Unit, Crab Orchard National Wildlife Refuge Superfund Site, Marion, Illinois (Williamson County), prepared by URS Corporation.

and the matrix sampled at that location. All samples were soil except for one groundwater sample, which was taken from the monitoring well installed.

### **30.2.1 Field Investigation**

Sampling was done in accordance with the FSP, except as noted.

#### **Shed and Possible Associated USTs**

The foundation of the former shed(s) that was identified to the west of former Building A-3-1, was identified during the site reconnaissance as a possible former boiler house. Whatever the purpose of the building, it may have had a UST associated with it, since a capped 2-inch pipe was found sticking out of the ground just to the west of the shed(s) foundation. Monitoring well location 0001-W01 was located west of this pipe, in the most likely area of the possible UST. Sample location 0001-003 was located in an area that would likely have received spillage during fuel loading operations.

Sample 0001-004 was located next to the sump, which may be a former blow-off basin. If the sump overflowed, this location would likely have received its overflow.

A pipe leads out of this sump and possibly into a culvert that drains into a north-south flowing ditch, west of the shed(s) foundation. Sample location 0001-005 was located in this north-south ditch, downstream of the possible outfall of the culvert.

Sample location 0001-002 is located between the shed(s) foundation and former Building A-3-1, near a former USEPA sample location. This USEPA sample location had several exceedances of preliminary screening levels. Sample 0001-002 was also taken because of the dark-toned surficial discoloration that was identified in a 1943 aerial photograph.

#### **Westernmost Foundation (with Trough Running through Center)**

Sample 0001-001 was collected near this foundation, where the trough drains onto the ground surface.

### **30.2.2 Field Results**

#### **30.2.2.1 Site Conditions**

##### **30.2.2.1.1 *Geologic Conditions***

There was one monitoring well installed at this site. The soil boring log and monitoring well construction diagrams are included in Appendices A and B, respectively. The boring log describes a 1.5-ft thick layer of fill material (topsoil, gravel, etc.) at the surface. Beneath the fill is a silty clay soil that is described as loess to a depth of 10 ft, and as till below that depth. The boring log describes a material encountered from a depth of 18 to 18.5 ft as “black ash” (located within the till). The origin of this material is unknown; it may have been natural decayed organic material within the till. Auger refusal on limestone was encountered at a depth of 23 ft.

Hand auger samples describe the top ft of soil at the site as fill material including silty sand and silty clay. The fill material at location 0001-004 had metal pieces (iron pieces) and the fill at location 0001-005 included debris (brick).

#### **30.2.2.1.2 Hydrogeologic Conditions**

Groundwater was encountered in the soil boring during drilling, just above the assumed bedrock surface, at a depth of 22.5 ft bgs (elevation 405.9 ft mean sea level (msl)). Table 30-2 presents the groundwater elevations taken at Well AUS-0001-W01 in May, July, September, and October 2000. Slug tests were performed at the well that was installed at this site during the AUS OU investigation, resulting in a hydraulic conductivity of  $1.29 \times 10^{-3}$  centimeters per second (cm/sec). Based on these hydraulic conductivity results, the groundwater at this site would be considered State of Illinois Class I groundwater (35 IAC 620). Slug test results are presented in Table 30-1A. Slug tests are included in Appendix C.

#### **30.2.2.1.3 Hydrologic Conditions**

The primary flow direction of surface water at AUS-0001 is to the west and south. There is a south-flowing collector ditch on the west side of the site (Figure 30-2).

#### **30.2.2.2 Chemical Results**

The sample analytical results are summarized in the following tables:

- Table 30-4 – soil samples results, and
- Table 30-5 – groundwater samples results.

These tables list all the chemicals detected in AUS-0001 during this investigation, along with the frequency and range of detections. Tabulated results of all analyses are included in the Quality Control Summary Report (QCSR).

Sample results are presented on the following figures:

- Figure 30-2 – organic results for soil samples,
- Figure 30-3 – inorganic results for soil samples, and
- Figure 30-4 – all results for groundwater samples at this site.

### **30.3 SCREENING RISK ASSESSMENT**

Results of the screening are presented in Tables 30-6 through 30-8 as follows:

- Table 30-6--human health risk screening for soils,
- Table 30-7--human health risk screening for groundwater, and
- Table 30-8--ecological risk screening for soils.

Each table lists the maximum detected concentration for each constituent analyzed at AUS-0001. The screening results are presented in the tables in terms of hazard quotients (HQs). The HQ for any chemical detected, for any particular screening criterion is simply the ratio of the maximum detected concentration to the screening concentration. For human health for carcinogens, a screening level “cancer risk” is calculated instead of an HQ.

Chemicals that are shaded in the tables are those that exceeded the screening criteria, and are identified as chemicals of potential concern (COPCs) for human health risk, and chemicals of potential ecological concern (COPECs) for ecological risk. The only COPCs/COPECs not shaded in the tables are those inorganic constituents that exceeded the screening criteria but were detected at levels below Refuge background.

In cases where the chemical was analyzed but not detected, the HQ is the ratio between the maximum reporting limit and the screening concentration. Chemicals not detected are identified with a “U” qualifier in the qualifier column. When these HQ values exceed one, they are not shaded. These constituents are not identified as COPCs/COPECs, but rather as uncertainties.

In Figures 30-2 through 30-4, the shading convention used is the same as for the tables discussed above. The particular screening criteria exceeded are indicated by the code in the analytical results labels. Duplicate results are shown only if the duplicate result for an analyte exceeded the screening criteria and the result from the original sample did not; or, if the analyte was detected in the duplicate and not in the original sample. Since in the screening process results which are qualified as estimated (coded with “J”) are treated the same as unqualified results, data qualifiers are not included in the results shown in the figures. Refer to the QCSR for data qualifiers.

Tables 30-9 (human health risk) and 30-10 (ecological risk) list all the analytes and corresponding media sampled and indicate whether each is a COPC (or COPEC), not a COPC (or COPEC), or an uncertainty. The codes in the tables indicate the rationale for each classification. All COPCs (Table 30-9) and COPECs (Table 30-10) are shaded in the tables.

### **30.3.1 Human Health Risk**

#### **30.3.1.1 Soil**

Human health screening results for soil samples are presented in Table 30-6. For carcinogens, a cancer risk was calculated using the USEPA Region 9 Industrial Soil Preliminary Remediation Goals (PRGs) as screening values. The cancer risk was derived by calculating a ratio of the maximum detected concentrations, or the maximum reporting limits, to their appropriate screening values. These ratios were then multiplied by  $1 \times 10^{-6}$ . In addition, ratios were calculated using the USEPA Region 9 Industrial Soil PRG for Toxins, the USEPA Region 9 Migration to Groundwater Criteria (Dilution Attenuation Factor (DAF)=1), the Illinois Tiered Approach to Corrective Action Objectives (TACO) Industrial/Commercial Soil Ingestion Criteria, the Illinois TACO Construction Worker Soil Ingestion Criteria, and the Illinois TACO Class I Soil Component of Groundwater Criteria.

#### **30.3.1.2 Groundwater**

Human health screening results for groundwater are presented in Table 30-7. The maximum groundwater concentrations from AUS-0001 were screened against Maximum Contaminant Levels (MCLs) and Illinois Class I groundwater standards.

### 30.3.2 Ecological Risk

#### 30.3.2.1 Soil

Ecological screening results for soil samples are presented in Table 30-8. Soil screening concentrations for direct exposures were developed using toxicity reference values (TRVs) derived from several sources, including the following:

- USEPA (2000)<sup>16</sup>
- Environment Canada (1995)<sup>17</sup>
- Talmage *et al.* (1999)<sup>18</sup>
- Efrogmson *et al.* (1997a, 1997b)<sup>19</sup>
- CCME (1999)<sup>20</sup>
- MHSPE (1994)<sup>21</sup>
- Other sources

A detailed discussion of the screening concentration selection is presented in Appendix G.

The screening approach for ingestion pathway exposures was based on the potential for a chemical to bioaccumulate. The potential for a chemical to bioaccumulate was based on the organic chemical-specific octanol-to-water partitioning coefficient ( $K_{ow}$ ), which provides an indication of the lipophilicity of an organic chemical, and its potential for sequestration in biological tissue. The document *Assessment and Control of Bioconcentratable Contaminants in Surface Waters* (USEPA 1991)<sup>22</sup> used a log  $K_{ow}$  of 3.5 as a target threshold value indicative of bioaccumulative chemicals to target organic chemicals of greatest concern. Using this as a guideline, organic chemicals with a log  $K_{ow}$  greater than 3.5 were considered potentially bioaccumulative chemicals. Among inorganics, mercury and selenium were considered as potentially bioaccumulative chemicals. Any potentially bioaccumulative chemical that is detected was retained as a COPEC.

<sup>16</sup> USEPA. 2000. Ecological Soil Screening Level Guidance (Draft). USEPA Office of Emergency and Remedial Response, Washington, DC.

<sup>17</sup> Environment Canada. 1995. Toxicity Testing of NCSRP Priority Substances for Development of Soil Quality Guidelines for Contaminated Sites. Guidelines Division, Evaluation and Interpretation Branch, Environmental Conservation Directorate, Environment Canada. Hull, Quebec.

<sup>18</sup> Talmage, S.S., D.M. Opresko, C.J. Maxwell, C.J.E. Welsh, F. M. Cretella, P.H. Reno, and F. B. Daniel. 1999. Nitroaromatic Munition Compounds: Environmental Effects and Screening Values. *Rev Environ. Contam. Toxicol* 161:1-156.

<sup>19</sup> Efrogmson, R.A., M.E. Will, G.W. Suter II, and A.C. Wooten. 1997a. *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision*. Oak Ridge National Laboratory, Oak Ridge, Tennessee. ES/ER/TM-85/R3.

Efrogmson, R.A., M.E. Will, and G.W. Suter II. 1997b. *Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision*. Oak Ridge National Laboratory, Oak Ridge, Tennessee. ES/ER/TM-126/R2.

<sup>20</sup> Canadian Council of Ministers of the Environment. 1999. Canadian Environmental Quality Guidelines.

<sup>21</sup> Ministry of Housing, Spatial Planning, and the Environment (MHSPE). 1994. *Intervention Values and Target Values – Soil Quality Standards*. Directorate General for Environmental Protection, Department of Soil Protection, The Hague, The Netherlands.

<sup>22</sup> USEPA 1991. *Assessment and Control of Bioconcentratable Contaminants in Surface Waters (Draft)*. US Environmental Protection Agency Office of Research and Development, Washington, D.C.

**30.4 SCIENTIFIC MANAGEMENT DECISION POINT**

A Remedial Investigation (RI) is recommended for Site AUS-0001, based on exceedances of the SI screening criteria.

This report recommends that inorganic constituents that exceeded project screening criteria but were within Refuge background levels not necessarily be retained as COPCs/COPECs for further evaluation. These are the constituents coded with "D" on the COPC list, Table 30-9, and on the COPEC list, Table 30-10. The only COPC in this category is barium in soil. The only COPEC coded with a "D" in Table 30-10 is manganese in soil. These chemicals may later be included in the RI for other reasons, but the detections at the locations noted are not considered to be of concern since they are below Refuge background levels. All other COPCs/COPECs listed on these tables should be investigated in the RI. In addition, all analytes listed as uncertainties on these tables should be considered for further evaluation in the RI Work Plan.

Chemicals that exceeded screening criteria and Refuge background (if applicable) are listed in Table 30-11.

Other areas of the site and media and contaminants in addition to those addressed in this study may warrant investigation in the RI. These issues will be addressed in the work plan for the RI.



**TABLE 30-1  
SURVEY COORDINATES FOR SAMPLE LOCATIONS IN AUS-0001**

<b>Sample Location</b>	<b>Northing</b>	<b>Easting</b>	<b>Ground Surface Elevation</b>	<b>Top of Casing Elevation</b>	<b>Comments</b>
0001-001	388613.0	774170.0	429.30	NA	
0001-002	388680.5	774305.1	426.49	NA	
0001-003	388683.3	774285.0	427.92	NA	
0001-004	388674.4	774297.8	428.04	NA	
0001-005	388664.2	774253.3	425.08	NA	
0001-W01	388686.4	774275.2	428.43	430.95	New Monitoring Well

Sheet 1 of 1

NA = Not Applicable

**TABLE 30-1A  
SLUG TEST RESULTS**

Well ID Number	Hydraulic Conductivity (cm/sec)
0001-W01	1.29E-03

Sheet 1 of 1

cm/sec = centimeters per second

TABLE 30-1B  
1998 USEPA SOIL SAMPLE ANALYTICAL RESULTS SUMMARY

Sample ID	Constituent	Result (mg/kg)
1-1	Benzo[a]pyrene	0.11J
	Benzo[b]fluoranthene	0.4
	Chrysene	0.24J
	Di-n-butylphthalate	0.11J
	Fluoranthene	0.23J
	Aluminum	11,000
	Arsenic	130
	Barium	180
	Beryllium	0.8
	Calcium	3,800
	Chromium	27
	Cobalt	13
	Copper	43
	Iron	67,00
	Lead	210
	Magnesium	2,400
	Manganese	1,000
	Mercury	0.12
	Nickel	33
	Potassium	920
Vanadium	35	
Zinc	310	

Sheet 1 of 1

mg/kg = milligrams per kilogram  
J = Estimated

**TABLE 30-2  
AUS-0001 GROUNDWATER ELEVATIONS**

<b>Monitoring Well 0001-W01</b>		
<b>Ground Surface Elevation (ft MSL)</b>		<b>428.43</b>
<b>TOC Elevation (ft MSL)</b>		<b>430.95</b>
<b>Sampling Dates</b>	<b>DTW (ft BTOC)</b>	<b>Water Elevation (ft MSL)</b>
May-00	9.41	421.54
July-00	10.91	420.04
September-00	14.64	416.31
October-00	15.67	415.28

Sheet 1 of 1

MSL = Mean Sea Level  
TOC = Top of Casing  
BTOC = Below Top of Casing  
DTW = Depth to Water

**TABLE 30-3  
MATRICES SAMPLED AT EACH SAMPLE LOCATION AT AUS-0001**

<b>Soil</b>	<b>Groundwater</b>
AUS-0001-001	AUS-0001-W01
AUS-0001-002	
AUS-0001-003	
AUS-0001-004	
AUS-0001-005*	
AUS-0001-W01	

**Sheet 1 of 1**

\* Note that the sample at this location was originally designated as sediment, but is actually a soil sample.

TABLE 30-4  
SOIL SAMPLE ANALYTICAL RESULTS SUMMARY

Constituents	Number of Detections	Range of Detections
<b>Semivolatile Organic Compounds</b>		
2-Methylnaphthalene	1/7	58 ug/kg
Acenaphthylene	1/7	150 ug/kg
Anthracene	1/7	170 ug/kg
Benzo(a)Anthracene	2/7	84 ug/kg to 620 ug/kg
Benzo(a)Pyrene	2/7	78 ug/kg to 330 ug/kg
Benzo(b)Fluoranthene	2/7	170 ug/kg to 1,700 ug/kg
Benzo(g,h,i)Perylene	2/7	70 ug/kg to 360 ug/kg
Benzo(k)Fluoranthene	1/7	450 ug/kg
Bis(2-Ethylhexyl) Phthalate	2/5	51 ug/kg to 270 ug/kg
Carbazole	1/5	56 ug/kg
Chrysene	2/7	100 ug/kg to 1500 ug/kg
Di-n-Butyl Phthalate	2/5	56 ug/kg to 86 ug/kg
Fluoranthene	3/7	110 ug/kg to 2,600 ug/kg
Indeno(1,2,3-c,d)Pyrene	2/7	77 ug/kg to 480 ug/kg
Phenanthrene	2/7	250 ug/kg to 1,200 ug/kg
Pyrene	2/7	140 ug/kg to 1,600 ug/kg
<b>Metals</b>		
Aluminum	5/5	4,170 mg/kg to 12,200 mg/kg
Antimony	3/5	0.47 mg/kg to 1.1 mg/kg
Arsenic	5/5	7.9 mg/kg to 535 mg/kg
Barium	5/5	89.8 mg/kg to 176 mg/kg
Beryllium	1/5	0.85 mg/kg
Boron	1/5	36.8 mg/kg
Cadmium	5/5	0.11 mg/kg to 2.7 mg/kg
Calcium	5/5	908 mg/kg to 15,900 mg/kg
Chromium, Total	5/5	12.8 mg/kg to 27 mg/kg
Cobalt	5/5	5 mg/kg to 8.3 mg/kg
Copper	5/5	8.8 mg/kg to 94 mg/kg
Iron	5/5	15,600 mg/kg to 24,500 mg/kg
Lead	5/5	22.9 mg/kg to 1,050 mg/kg
Magnesium	5/5	884 mg/kg to 2,170 mg/kg
Manganese	5/5	189 mg/kg to 437 mg/kg
Mercury	3/5	0.05 mg/kg to 0.26 mg/kg
Nickel	5/5	14 mg/kg to 21.2 mg/kg
Potassium	5/5	325 mg/kg to 1,430 mg/kg
Selenium	5/5	0.78 mg/kg to 12.9 ug/kg
Silver	5/5	0.24 mg/kg to 3.4 mg/kg
Sodium	1/5	406 mg/kg
Thallium	1/5	2.4 mg/kg

Sheet 1 of 2

**TABLE 30-4**  
**SOIL SAMPLE ANALYTICAL RESULTS SUMMARY**

<b>Constituents</b>	<b>Number of Detections</b>	<b>Range of Detections</b>
Vanadium	5/5	20.7 mg/kg to 55.7 mg/kg
Zinc	5/5	44.9 mg/kg to 1,410 mg/kg

Sheet 2 of 2

ug/kg = micrograms per kilogram  
mg/kg = milligrams per kilogram

Notes: This table was derived from the figures that show the analytical results. As a result, duplicates are shown only if the duplicate result for an analyte exceeded the screening criteria and the result from the original sample did not; or, if the analyte was detected in the duplicate and not in the original sample. There may be some duplicate results, not shown in the table, that are outside the range shown. In addition, the frequency and range of detections is based on the number of sample locations, not the total number of samples (the total number of samples includes originals plus duplicates).

Checked by: MMF 7/20/01

**TABLE 30-5  
GROUNDWATER SAMPLE ANALYTICAL RESULTS SUMMARY**

Constituents	Number of Detections	Range of Detections
<b>Volatile Organic Compounds</b>		
Carbon Disulfide	1/1	3 ug/L
Trichloroethylene (TCE)	1/1	0.6 ug/L
<b>Metals</b>		
Aluminum	1/1	141 ug/L
Barium	1/1	31.2 ug/L
Boron	1/1	97.6 ug/L
Calcium	1/1	540,000 ug/L
Iron	1/1	155 ug/L
Magnesium	1/1	304,000 ug/L
Manganese	1/1	1,410 ug/L
Nickel	1/1	10 ug/L
Potassium	1/1	5,020 ug/L
Sodium	1/1	151,000 ug/L

Sheet 1 of 1

ug/L = micrograms per Liter

Notes: This table was derived from the figures that show the analytical results. As a result, duplicates are shown only if the duplicate result for an analyte exceeded the screening criteria and the result from the original sample did not; or, if the analyte was detected in the duplicate and not in the original sample. There may be some duplicate results, not shown in the table, that are outside the range shown. In addition, the frequency and range of detections is based on the number of sample locations, not the total number of samples (the total number of samples includes originals plus duplicates).

Checked by: MMF 7/20/01



**TABLE 30-6  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0001**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
<b>Volatile Organic Compounds</b>								
71-55-6	1,1,1-Trichloroethane	6	U	UG/KG			1.80E-06	6.00E-02
79-34-5	1,1,2,2-Tetrachloroethane	6	U	UG/KG		6.68E-09	1.54E-06	3.00E+01
79-00-5	1,1,2-Trichloroethane	6	U	UG/KG		3.16E-09	3.94E-05	6.67E+00
75-34-3	1,1-Dichloroethane	6	U	UG/KG			2.91E-06	6.00E-03
75-35-4	1,1-Dichloroethene	6	U	UG/KG		5.05E-08	8.91E-05	2.00E+00
107-06-2	1,2-Dichloroethane (EDC)	6	U	UG/KG		7.85E-09	1.70E-04	6.00E+00
540-59-0	1,2-Dichloroethene (total)	6	U	UG/KG			4.07E-05	3.00E-01
78-87-5	1,2-Dichloropropane	6	U	UG/KG		7.81E-09	2.82E-04	6.00E+00
78-93-3	2-Butanone (MEK)	13	U	UG/KG			4.69E-07	
591-78-6	2-Hexanone	13	U	UG/KG				
108-10-1	4-Methyl-2-pentanone (MIBK)	13	U	UG/KG			4.50E-06	
67-64-1	Acetone	26	U	UG/KG			4.18E-06	3.25E-02
71-43-2	Benzene	6	U	UG/KG		4.10E-09	2.48E-04	3.00E+00
75-27-4	Bromodichloromethane	6	U	UG/KG		2.55E-09	5.75E-06	2.00E-01
75-25-2	Bromoform	6	U	UG/KG		1.92E-11	3.41E-07	1.50E-01
74-83-9	Bromomethane	6	U	UG/KG			4.57E-04	6.00E-01
75-15-0	Carbon disulfide	6	U	UG/KG			4.96E-06	3.00E-03
56-23-5	Carbon tetrachloride	6	U	UG/KG		1.13E-08	8.58E-04	2.00E+00
108-90-7	Chlorobenzene	6	U	UG/KG			1.11E-05	8.57E-02
75-00-3	Chloroethane	6	U	UG/KG		9.22E-10	3.18E-07	
67-66-3	Chloroform	6	U	UG/KG		1.15E-08	4.66E-03	2.00E-01
74-87-3	Chloromethane	6	U	UG/KG		2.25E-09		
156-59-2	cis-1,2-Dichloroethene	6	U	UG/KG			4.07E-05	3.00E-01

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 30-6  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0001**

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10061-01-5	cis-1,3-Dichloropropene	6	U	UG/KG		3.37E-08	1.36E-04	
124-48-1	Dibromochloromethane	6	U	UG/KG		2.26E-09	3.77E-06	3.00E-01
100-41-4	Ethylbenzene	6	U	UG/KG			1.00E-06	8.57E-03
75-09-2	Methylene chloride	6	U	UG/KG		2.92E-10	6.14E-07	6.00E+00
110-54-3	N-Hexane	6	U	UG/KG			1.49E-05	
100-42-5	Styrene	6	U	UG/KG			2.94E-07	3.00E-02
127-18-4	Tetrachloroethylene (PCE)	6	U	UG/KG		3.21E-10	3.52E-06	2.00E+00
108-88-3	Toluene	6	U	UG/KG			3.02E-06	1.00E-02
1330-20-7	total Xylenes	6	U	UG/KG			1.35E-06	6.00E-04
156-60-5	trans-1,2-Dichloroethene	6	U	UG/KG			2.80E-05	2.00E-01
10061-02-6	trans-1,3-Dichloropropene	6	U	UG/KG		3.37E-08	1.36E-04	
79-01-6	Trichloroethylene (TCE)	6	U	UG/KG		9.81E-10	7.59E-05	2.00E+00
75-01-4	Vinyl chloride	6	U	UG/KG		1.23E-07		8.57E+00
<b>Semivolatile Organic Compounds</b>								
120-82-1	1,2,4-Trichlorobenzene	480	U	UG/KG			6.30E-05	1.60E+00
95-50-1	1,2-Dichlorobenzene	480	U	UG/KG			1.45E-04	5.33E-01
541-73-1	1,3-Dichlorobenzene	480	U	UG/KG			9.27E-03	
106-46-7	1,4-Dichlorobenzene	480	U	UG/KG		5.91E-08	2.50E-04	4.80E+00
95-95-4	2,4,5-Trichlorophenol	2400	U	UG/KG			2.72E-05	2.40E-01
88-06-2	2,4,6-Trichlorophenol	480	U	UG/KG		2.14E-09		6.00E+01
120-83-2	2,4-Dichlorophenol	480	U	UG/KG			1.82E-04	9.60E+00
105-67-9	2,4-Dimethylphenol	480	U	UG/KG			2.72E-05	1.20E+00
51-28-5	2,4-Dinitrophenol	2400	U	UG/KG			1.36E-03	2.40E+02
91-58-7	2-Chloronaphthalene	480	U	UG/KG			1.76E-05	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 30-6  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0001**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
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95-57-8	2-Chlorophenol	480	U	UG/KG			1.99E-03	2.40E+00
90-12-0	1-Methylnaphthalene	41	U	UG/KG			2.17E-04	1.03E-02
91-57-6	2-Methylnaphthalene	58	J	UG/KG			1.07E-06	2.90E-04
95-48-7	2-Methylphenol	480	U	UG/KG			1.09E-05	6.00E-01
88-74-4	2-Nitroaniline	2400	U	UG/KG			4.77E-02	
88-75-5	2-Nitrophenol	480	U	UG/KG			6.81E-05	
91-94-1	3,3'-Dichlorobenzidine	480	U	UG/KG		8.76E-08		1.60E+03
99-09-2	3-Nitroaniline	2400	U	UG/KG			4.77E-02	
534-52-1	4,6-Dinitro-2-methylphenol	2400	U	UG/KG				
101-55-3	4-Bromophenyl phenyl ether	480	U	UG/KG				
59-50-7	4-Chloro-3-methylphenol	480	U	UG/KG			1.09E-05	
106-47-8	4-Chloroaniline	950	U	UG/KG			2.70E-04	3.17E+01
7005-72-3	4-Chlorophenyl phenyl ether	480	U	UG/KG				
106-44-5	4-Methylphenol	480	U	UG/KG			1.09E-04	
100-01-6	4-Nitroaniline	2400	U	UG/KG			4.77E-02	
100-02-7	4-Nitrophenol	2400	U	UG/KG			3.41E-04	
83-32-9	Acenaphthene	480	U	UG/KG			1.25E-05	1.60E-02
208-96-8	Acenaphthylene	150	J	UG/KG			2.77E-06	7.50E-04
120-12-7	Anthracene	170	J	UG/KG			4.36E-07	2.83E-04
56-55-3	Benzo(a)anthracene	620		UG/KG		2.15E-07		7.75E+00
50-32-8	Benzo(a)pyrene	330	J	UG/KG		1.14E-06		8.25E-01
205-99-2	Benzo(b)fluoranthene	1700		UG/KG		5.89E-07		8.50E+00
191-24-2	Benzo(g,h,i)perylene	360	J	UG/KG			6.64E-06	1.80E-03
207-08-9	Benzo(k)fluoranthene	450		UG/KG		1.56E-08		2.25E-01

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HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0001**

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111-91-1	bis(2-Chloroethoxy)methane	480	U	UG/KG				
111-44-4	bis(2-Chloroethyl) ether	480	U	UG/KG		7.74E-07		2.40E+04
108-60-1	bis(2-Chloroisopropyl) ether	480	U	UG/KG		5.94E-08	1.13E-04	
117-81-7	bis(2-Ethylhexyl) phthalate (DEHP)	280	J	UG/KG		1.59E-09	1.59E-05	
85-68-7	Butyl benzyl phthalate	480	U	UG/KG			2.72E-06	6.00E-04
86-74-8	Carbazole	56	J	UG/KG		4.54E-10		1.87E+00
218-01-9	Chrysene	1500		UG/KG		5.20E-09		1.88E-01
84-74-2	Di-n-butyl phthalate	86	J	UG/KG			9.76E-07	2.87E-04
117-84-0	Di-n-octyl phthalate	480	U	UG/KG			2.72E-05	4.80E-05
53-70-3	Dibenz(a,h)anthracene	480	U	UG/KG		1.66E-06		6.00E+00
132-64-9	Dibenzofuran	480	U	UG/KG			9.48E-05	
84-66-2	Diethyl phthalate	480	U	UG/KG			6.81E-07	
131-11-3	Dimethyl phthalate	480	U	UG/KG			5.45E-08	
206-44-0	Fluoranthene	2600		UG/KG			8.64E-05	1.30E-02
86-73-7	Fluorene	480	U	UG/KG			1.45E-05	1.60E-02
118-74-1	Hexachlorobenzene	480	U	UG/KG		3.11E-07	6.81E-04	4.80E+00
87-68-3	Hexachlorobutadiene	480	U	UG/KG		1.52E-08	2.72E-03	4.80E+00
77-47-4	Hexachlorocyclopentadiene	480	U	UG/KG			8.14E-05	2.40E-02
67-72-1	Hexachloroethane	480	U	UG/KG		2.72E-09	5.45E-04	2.40E+01
193-39-5	Indeno(1,2,3-c,d)pyrene	480		UG/KG		1.66E-07		6.86E-01
78-59-1	Isophorone	480	U	UG/KG		1.85E-10	2.72E-06	1.60E+01
621-64-7	N-Nitroso-di-n-propylamine	480	U	UG/KG		1.36E-06		2.40E+05
86-30-6	N-Nitrosodiphenylamine	480	U	UG/KG		9.54E-10		8.00E+00
91-20-3	Naphthalene	480	U	UG/KG			2.55E-03	1.20E-01

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J = Estimated U = Nondetect

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CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
98-95-3	Nitrobenzene	440	U	UG/KG			3.84E-03	
87-86-5	Pentachlorophenol	2400	U	UG/KG		2.16E-07	1.68E-04	2.40E+03
85-01-8	Phenanthrene	1200		UG/KG			2.21E-05	6.00E-03
108-95-2	Phenol	480	U	UG/KG			9.08E-07	9.60E-02
129-00-0	Pyrene	1600		UG/KG			2.95E-05	8.00E-03
<b>Explosives</b>								
99-35-4	1,3,5-Trinitrobenzene	360	UJ	UG/KG			1.36E-05	
99-65-0	1,3-Dinitrobenzene	360	UJ	UG/KG			4.09E-03	
118-96-7	2,4,6-Trinitrotoluene (TNT)	720	UJ	UG/KG		8.76E-09	1.63E-03	
121-14-2	2,4-Dinitrotoluene	440	U	UG/KG			2.50E-04	1.10E+04
606-20-2	2,6-Dinitrotoluene	480	U	UG/KG			5.45E-04	1.60E+04
35572-78-2	2-Amino-4,6-Dinitrotoluene	720	UJ	UG/KG				
88-72-2	2-Nitrotoluene (ONT)	720	UJ	UG/KG				
99-08-1	3-Nitrotoluene	720	UJ	UG/KG			3.54E-04	
19406-51-0	4-Amino-2,6-Dinitrotoluene	720	UJ	UG/KG				
99-99-0	4-Nitrotoluene (PNT)	720	UJ	UG/KG			3.54E-04	
2691-41-0	HMX	720	UJ	UG/KG			1.63E-05	
121-82-4	RDX	720	UJ	UG/KG		3.21E-08	2.72E-04	
479-45-8	Tetryl	1100	UJ	UG/KG			1.25E-04	
<b>Metals</b>								
7429-90-5	Aluminum	13200		MG/KG	4.58E-01		7.87E-03	
7440-36-0	Antimony	1.1		MG/KG	1.33E+00		1.35E-03	3.67E+00
7440-38-2	Arsenic	535		MG/KG	3.96E+01	1.96E-04	1.22E+00	5.35E+02
7440-39-3	Barium	176		MG/KG	9.03E-01		1.41E-03	2.20E+00

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 30-6  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0001**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
7440-41-7	Beryllium	0.85		MG/KG	1.12E+00	3.79E-10	2.30E-04	2.83E-01
7440-42-8	Boron	36.8		MG/KG	6.94E+00		4.65E-04	
7440-43-9	Cadmium	2.7		MG/KG	1.42E+01	9.03E-10	3.33E-03	6.75E+00
7440-70-2	Calcium	16400		MG/KG	6.57E+00			
7440-47-3	Chromium	27		MG/KG	1.07E+00	6.02E-08		1.35E+01
7440-48-4	Cobalt	8.3		MG/KG	3.82E-01		6.77E-05	
7440-50-8	Copper	94	J	MG/KG	8.32E+00		1.24E-03	
7439-89-6	Iron	24800		MG/KG	1.28E+00		4.05E-02	
7439-92-1	Lead	1050		MG/KG	4.49E+01			
7439-95-4	Magnesium	2270		MG/KG	1.46E+00			
7439-96-5	Manganese	437		MG/KG	1.20E-01		1.36E-02	
7439-97-6	Mercury	0.26		MG/KG	4.33E+00			
7440-02-0	Nickel	21.2		MG/KG	1.12E+00		5.19E-04	9.03E+00
2023695	Potassium	1430		MG/KG	2.29E+00			
7782-49-2	Selenium	12.9		MG/KG	5.51E+00		1.26E-03	4.30E+01
7440-22-4	Silver	3.4		MG/KG	5.86E+00		3.33E-04	1.70E+00
7440-23-5	Sodium	406		MG/KG	2.39E+00			
7440-28-0	Thallium	2.4		MG/KG	5.85E+00		1.68E-05	
7440-62-2	Vanadium	55.7		MG/KG	1.18E+00		3.89E-03	1.86E-01
7440-66-6	Zinc	1410		MG/KG	2.74E+01		2.30E-03	2.95E+00

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TABLE 30-6

## HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0001

ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
<b>Volatile Organic Compounds</b>							
71-55-6	1,1,1-Trichloroethane	6	U	UG/KG			3.00E-03
79-34-5	1,1,2,2-Tetrachloroethane	6	U	UG/KG			
79-00-5	1,1,2-Trichloroethane	6	U	UG/KG	7.32E-07	7.32E-07	3.00E-01
75-34-3	1,1-Dichloroethane	6	U	UG/KG	3.00E-08	3.00E-08	2.61E-04
75-35-4	1,1-Dichloroethene	6	U	UG/KG	3.33E-07	3.33E-06	1.00E-01
107-06-2	1,2-Dichloroethane (EDC)	6	U	UG/KG	9.52E-05	4.29E-06	3.00E-01
540-59-0	1,2-Dichloroethene (total)	6	U	UG/KG	3.00E-07	3.00E-07	1.50E-02
78-87-5	1,2-Dichloropropane	6	U	UG/KG	7.14E-05	3.33E-06	2.00E-01
78-93-3	2-Butanone (MEK)	13	U	UG/KG			
591-78-6	2-Hexanone	13	U	UG/KG			
108-10-1	4-Methyl-2-pentanone (MIBK)	13	U	UG/KG			
67-64-1	Acetone	26	U	UG/KG	1.30E-07	1.30E-07	1.63E-03
71-43-2	Benzene	6	U	UG/KG	3.00E-05	1.40E-06	2.00E-01
75-27-4	Bromodichloromethane	6	U	UG/KG	6.52E-05	3.00E-06	1.00E-02
75-25-2	Bromoform	6	U	UG/KG	8.33E-06	3.75E-07	7.50E-03
74-83-9	Bromomethane	6	U	UG/KG	2.07E-06	6.00E-06	3.00E-02
75-15-0	Carbon disulfide	6	U	UG/KG	3.00E-08	3.00E-07	1.88E-04
56-23-5	Carbon tetrachloride	6	U	UG/KG	1.36E-04	1.46E-05	8.57E-02
108-90-7	Chlorobenzene	6	U	UG/KG	1.46E-07	1.46E-06	6.00E-03
75-00-3	Chloroethane	6	U	UG/KG			
67-66-3	Chloroform	6	U	UG/KG	6.38E-06	3.00E-06	1.00E-02
74-87-3	Chloromethane	6	U	UG/KG			
156-59-2	cis-1,2-Dichloroethene	6	U	UG/KG	3.00E-07	3.00E-07	1.50E-02

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**TABLE 30-6  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0001**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
10061-01-5	cis-1,3-Dichloropropene	6	U	UG/KG			
124-48-1	Dibromochloromethane	6	U	UG/KG	1.46E-07	1.46E-07	1.50E-02
100-41-4	Ethylbenzene	6	U	UG/KG	3.00E-08	3.00E-07	4.62E-04
75-09-2	Methylene chloride	6	U	UG/KG	7.89E-06	5.00E-07	3.00E-01
110-54-3	N-Hexane	6	U	UG/KG			
100-42-5	Styrene	6	U	UG/KG	1.46E-08	1.46E-07	1.50E-03
127-18-4	Tetrachloroethylene (PCE)	6	U	UG/KG	5.45E-05	2.50E-06	1.00E-01
108-88-3	Toluene	6	U	UG/KG	1.46E-08	1.46E-08	5.00E-04
1330-20-7	total Xylenes	6	U	UG/KG	6.00E-09	1.46E-08	4.00E-05
156-60-5	trans-1,2-Dichloroethene	6	U	UG/KG	1.46E-07	1.46E-07	8.57E-03
10061-02-6	trans-1,3-Dichloropropene	6	U	UG/KG			
79-01-6	Trichloroethylene (TCE)	6	U	UG/KG	1.15E-05	5.00E-06	1.00E-01
75-01-4	Vinyl chloride	6	U	UG/KG	2.00E-03	9.23E-05	6.00E-01
<b>Semivolatile Organic Compounds</b>							
120-82-1	1,2,4-Trichlorobenzene	480	U	UG/KG	2.40E-05	2.40E-04	9.60E-02
95-50-1	1,2-Dichlorobenzene	480	U	UG/KG	2.67E-06	2.67E-05	2.82E-02
541-73-1	1,3-Dichlorobenzene	480	U	UG/KG			
106-46-7	1,4-Dichlorobenzene	480	U	UG/KG			2.40E-01
95-95-4	2,4,5-Trichlorophenol	2400	U	UG/KG	1.20E-05	1.20E-05	8.89E-03
88-06-2	2,4,6-Trichlorophenol	480	U	UG/KG	9.23E-04	4.36E-05	2.40E+00
120-83-2	2,4-Dichlorophenol	480	U	UG/KG	7.87E-05	7.87E-04	4.80E-01
105-67-9	2,4-Dimethylphenol	480	U	UG/KG	1.17E-05	1.17E-05	5.33E-02
51-28-5	2,4-Dinitrophenol	2400	U	UG/KG	5.85E-04	5.85E-03	1.20E+01
91-58-7	2-Chloronaphthalene	480	U	UG/KG			

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**TABLE 30-6  
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CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

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95-57-8	2-Chlorophenol	480	U	UG/KG	4.80E-05	4.80E-05	1.20E-01
90-12-0	1-Methylnaphthalene	41	U	UG/KG	5.00E-07	5.00E-06	4.88E-04
91-57-6	2-Methylnaphthalene	58	J	UG/KG	9.51E-07	9.51E-07	1.38E-05
95-48-7	2-Methylphenol	480	U	UG/KG	4.80E-06	4.80E-06	3.20E-02
88-74-4	2-Nitroaniline	2400	U	UG/KG			
88-75-5	2-Nitrophenol	480	U	UG/KG			
91-94-1	3,3'-Dichlorobenzidine	480	U	UG/KG	3.69E-02	1.71E-03	6.86E+01
99-09-2	3-Nitroaniline	2400	U	UG/KG			
534-52-1	4,6-Dinitro-2-methylphenol	2400	U	UG/KG			
101-55-3	4-Bromophenyl phenyl ether	480	U	UG/KG			
59-50-7	4-Chloro-3-methylphenol	480	U	UG/KG			
106-47-8	4-Chloroaniline	950	U	UG/KG	1.16E-04	1.16E-03	1.36E+00
7005-72-3	4-Chlorophenyl phenyl ether	480	U	UG/KG			
106-44-5	4-Methylphenol	480	U	UG/KG			
100-01-6	4-Nitroaniline	2400	U	UG/KG			
100-02-7	4-Nitrophenol	2400	U	UG/KG			
83-32-9	Acenaphthene	480	U	UG/KG	4.00E-06	4.00E-06	8.42E-04
208-96-8	Acenaphthylene	150	J	UG/KG	2.46E-06	2.46E-06	3.57E-05
120-12-7	Anthracene	170	J	UG/KG	2.79E-07	2.79E-07	1.42E-05
56-55-3	Benzo(a)anthracene	620		UG/KG	7.75E-02	3.65E-03	3.10E-01
50-32-8	Benzo(a)pyrene	330	J	UG/KG	4.13E-01	1.94E-02	4.13E-02
205-99-2	Benzo(b)fluoranthene	1700		UG/KG	2.13E-01	1.00E-02	3.40E-01
191-24-2	Benzo(g,h,i)perylene	360	J	UG/KG	5.90E-06	5.90E-06	8.57E-05
207-08-9	Benzo(k)fluoranthene	450		UG/KG	5.77E-03	2.65E-04	9.18E-03

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CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
111-91-1	bis(2-Chloroethoxy)methane	480	U	UG/KG			
111-44-4	bis(2-Chloroethyl) ether	480	U	UG/KG	9.60E-02	6.40E-03	1.20E+03
108-60-1	bis(2-Chloroisopropyl) ether	480	U	UG/KG			
117-81-7	bis(2-Ethylhexyl) phthalate (DEHP)	280	J	UG/KG	6.83E-04	6.83E-05	7.78E-05
85-68-7	Butyl benzyl phthalate	480	U	UG/KG	1.17E-06	1.17E-06	5.16E-04
86-74-8	Carbazole	56	J	UG/KG	1.93E-04	9.03E-06	9.33E-02
218-01-9	Chrysene	1500		UG/KG	1.92E-03	8.82E-05	9.38E-03
84-74-2	Di-n-butyl phthalate	86	J	UG/KG	4.30E-07	4.30E-07	3.74E-05
117-84-0	Di-n-octyl phthalate	480	U	UG/KG	1.17E-05	1.17E-04	4.80E-05
53-70-3	Dibenz(a,h)anthracene	480	U	UG/KG	6.00E-01	2.82E-02	2.40E-01
132-64-9	Dibenzofuran	480	U	UG/KG			
84-66-2	Diethyl phthalate	480	U	UG/KG	4.80E-07	4.80E-07	1.02E-03
131-11-3	Dimethyl phthalate	480	U	UG/KG			
206-44-0	Fluoranthene	2600		UG/KG	3.17E-05	3.17E-05	6.05E-04
86-73-7	Fluorene	480	U	UG/KG	5.85E-06	5.85E-06	8.57E-04
118-74-1	Hexachlorobenzene	480	U	UG/KG	1.20E-01	6.15E-03	2.40E-01
87-68-3	Hexachlorobutadiene	480	U	UG/KG			
77-47-4	Hexachlorocyclopentadiene	480	U	UG/KG	3.43E-05	3.43E-05	1.20E-03
67-72-1	Hexachloroethane	480	U	UG/KG	2.40E-04	2.40E-04	9.60E-01
193-39-5	Indeno(1,2,3-c,d)pyrene	480		UG/KG	6.00E-02	2.82E-03	3.43E-02
78-59-1	Isophorone	480	U	UG/KG	1.17E-06	1.17E-06	6.00E-02
621-64-7	N-Nitroso-di-n-propylamine	480	U	UG/KG	6.00E-01	2.67E-02	9.60E+03
86-30-6	N-Nitrosodiphenylamine	480	U	UG/KG	4.00E-04	1.92E-05	4.80E-01
91-20-3	Naphthalene	480	U	UG/KG	5.85E-06	5.85E-05	5.71E-03

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98-95-3	Nitrobenzene	440	U	UG/KG	4.40E-04	4.40E-04	4.40E+00
87-86-5	Pentachlorophenol	2400	U	UG/KG	1.00E-01	4.62E-03	8.00E+01
85-01-8	Phenanthrene	1200		UG/KG	1.97E-05	1.97E-05	2.86E-04
108-95-2	Phenol	480	U	UG/KG	4.80E-07	4.00E-06	4.80E-03
129-00-0	Pyrene	1600		UG/KG	2.62E-05	2.62E-05	3.81E-04
<b>Explosives</b>							
99-35-4	1,3,5-Trinitrobenzene	360	UJ	UG/KG			
99-65-0	1,3-Dinitrobenzene	360	UJ	UG/KG			
118-96-7	2,4,6-Trinitrotoluene (TNT)	720	UJ	UG/KG			
121-14-2	2,4-Dinitrotoluene	440	U	UG/KG	5.24E-02	2.44E-03	5.50E+02
606-20-2	2,6-Dinitrotoluene	480	U	UG/KG	5.71E-02	2.67E-03	6.86E+02
35572-78-2	2-Amino-4,6-Dinitrotoluene	720	UJ	UG/KG			
88-72-2	2-Nitrotoluene (ONT)	720	UJ	UG/KG			
99-08-1	3-Nitrotoluene	720	UJ	UG/KG			
19406-51-0	4-Amino-2,6-Dinitrotoluene	720	UJ	UG/KG			
99-99-0	4-Nitrotoluene (PNT)	720	UJ	UG/KG			
2691-41-0	HMX	720	UJ	UG/KG			
121-82-4	RDX	720	UJ	UG/KG			
479-45-8	Tetryl	1100	UJ	UG/KG			
<b>Metals</b>							
7429-90-5	Aluminum	13200		MG/KG			
7440-36-0	Antimony	1.1		MG/KG	1.34E-03	1.34E-02	2.20E-01
7440-38-2	Arsenic	535		MG/KG	1.78E+02	8.77E+00	1.91E+01
7440-39-3	Barium	176		MG/KG	1.26E-03	1.26E-02	1.47E-01

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7440-41-7	Beryllium	0.85		MG/KG	8.50E-01	2.93E-02	1.29E-01
7440-42-8	Boron	36.8		MG/KG	2.04E-04	2.04E-03	
7440-43-9	Cadmium	2.7		MG/KG	1.35E-03	1.35E-02	7.30E-01
7440-70-2	Calcium	16400		MG/KG			
7440-47-3	Chromium	27		MG/KG	2.70E-03	6.59E-03	9.64E-01
7440-48-4	Cobalt	8.3		MG/KG	6.92E-05	6.92E-04	
7440-50-8	Copper	94	J	MG/KG	1.15E-03	1.15E-02	8.55E-03
7439-89-6	Iron	24800		MG/KG			
7439-92-1	Lead	1050		MG/KG	2.63E+00	2.63E+00	
7439-95-4	Magnesium	2270		MG/KG			
7439-96-5	Manganese	437		MG/KG	4.55E-03	4.55E-02	
7439-97-6	Mercury	0.26		MG/KG	4.26E-04	4.26E-03	1.73E+00
7440-02-0	Nickel	21.2		MG/KG	5.17E-04	5.17E-03	2.79E-01
2023695	Potassium	1430		MG/KG			
7782-49-2	Selenium	12.9		MG/KG	1.29E-03	1.29E-02	5.38E+00
7440-22-4	Silver	3.4		MG/KG	3.40E-04	3.40E-03	2.27E+00
7440-23-5	Sodium	406		MG/KG			
7440-28-0	Thallium	2.4		MG/KG	1.50E-02	1.50E-02	1.00E+00
7440-62-2	Vanadium	55.7		MG/KG	3.98E-03	3.98E-02	5.68E-02
7440-66-6	Zinc	1410		MG/KG	2.31E-03	2.31E-02	3.92E-01

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TABLE 30-7

## HUMAN HEALTH SCREENING OF GROUNDWATER RESULTS FROM AUS-0001

ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Cancer Risk Based on USEPA Region 9 PRG for Carcinogens (Tap Water)	Hazard Quotient (HQ) Based on USEPA Region 9 PRG for Toxins (Tap Water)	Ratio of Max Concentration (or Max RL) to USEPA MCL and/or IEPA Class 1 Groundwater Standard
<b>Volatile Organic Compounds</b>							
71-55-6	1,1,1-Trichloroethane	1	U	UG/L		1.26E-03	5.00E-03
79-34-5	1,1,1,2-Tetrachloroethane	1	U	UG/L	1.81E-05	2.74E-03	
79-00-5	1,1,2-Trichloroethane	1	U	UG/L	5.01E-06	4.11E-02	2.00E-01
75-34-3	1,1-Dichloroethane	1	U	UG/L		1.23E-03	
75-35-4	1,1-Dichloroethene	1	U	UG/L	2.19E-05	1.83E-02	1.43E-01
107-06-2	1,2-Dichloroethane (EDC)	1	U	UG/L	8.12E-06	9.88E-02	2.00E-01
78-87-5	1,2-Dichloropropane	1	U	UG/L	6.07E-06	1.45E-01	2.00E-01
78-93-3	2-Butanone (MEK)	5	U	UG/L		2.63E-03	
591-78-6	2-Hexanone	5	U	UG/L			
108-10-1	4-Methyl-2-pentanone (MIBK)	5	U	UG/L		3.17E-02	
67-64-1	Acetone	5	U	UG/L		8.22E-03	
71-43-2	Benzene	1	U	UG/L	2.44E-06	8.92E-02	2.00E-01
75-27-4	Bromodichloromethane	1	U	UG/L	5.53E-06	8.22E-03	
75-25-2	Bromoform	1	U	UG/L	1.18E-07	1.37E-03	
74-83-9	Bromomethane	1	U	UG/L		1.15E-01	
75-15-0	Carbon disulfide	3		UG/L		2.88E-03	
56-23-5	Carbon tetrachloride	1	U	UG/L	5.84E-06	2.35E-01	2.00E-01
108-90-7	Chlorobenzene	1	U	UG/L		9.43E-03	1.00E-02
75-00-3	Chloroethane	1	U	UG/L	2.16E-07	1.16E-04	
67-66-3	Chloroform	1	U	UG/L	6.08E-06	1.60E+00	
74-87-3	Chloromethane	1	U	UG/L	6.62E-07		
156-59-2	cis-1,2-Dichloroethene	1	U	UG/L		1.64E-02	1.43E-02
10061-01-5	cis-1,3-Dichloropropene	1	U	UG/L	1.23E-05	1.15E-01	
124-48-1	Dibromochloromethane	1	U	UG/L	7.50E-06	8.22E-03	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 30-7  
HUMAN HEALTH SCREENING OF GROUNDWATER RESULTS FROM AUS-001**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Cancer Risk Based on USEPA Region 9 PRG for Carcinogens (Tap Water)	Hazard Quotient (HQ) Based on USEPA Region 9 PRG for Toxins (Tap Water)	Ratio of Max Concentration (or Max RL) to USEPA MCL and/or IEPA Class I Groundwater Standard
100-41-4	Ethylbenzene	1	U	UG/L		7.46E-04	1.43E-03
75-09-2	Methylene chloride	1	U	UG/L	2.34E-07	6.16E-04	2.00E-01
110-54-3	N-Hexane	1	U	UG/L		2.85E-03	
100-42-5	Styrene	1	U	UG/L		6.09E-04	1.00E-02
127-18-4	Tetrachloroethylene (PCE)	1	U	UG/L	9.24E-07	3.94E-03	2.00E-01
108-88-3	Toluene	1	U	UG/L		1.38E-03	1.00E-03
1330-20-7	total Xylenes	1	U	UG/L		6.99E-04	1.00E-04
156-60-5	trans-1,2-Dichloroethene	1	U	UG/L		8.22E-03	1.00E-02
10061-02-6	trans-1,3-Dichloropropene	1	U	UG/L	1.23E-05	1.15E-01	
79-01-6	Trichloroethylene (TCE)	0.6	J	UG/L	3.66E-07	1.64E-02	1.20E-01
75-01-4	Vinyl chloride	1	U	UG/L	5.06E-05		5.00E-01
<b>Polynuclear Aromatic Hydrocarbons</b>							
90-12-0	1-Methylnaphthalene	1	U	UG/L		1.61E-01	
91-57-6	2-Methylnaphthalene	1	U	UG/L		5.48E-03	
83-32-9	Acenaphthene	1	U	UG/L		2.74E-03	
208-96-8	Acenaphthylene	2	U	UG/L		1.10E-02	
120-12-7	Anthracene	0.15	U	UG/L		8.22E-05	
56-55-3	Benzo(a)anthracene	0.15	U	UG/L	1.63E-06		
50-32-8	Benzo(a)pyrene	0.15	U	UG/L	1.63E-05		7.50E-01
205-99-2	Benzo(b)fluoranthene	0.2	U	UG/L	2.17E-06		
191-24-2	Benzo(g,h,i)perylene	0.2	U	UG/L		1.10E-03	
207-08-9	Benzo(k)fluoranthene	0.15	U	UG/L	1.63E-07		
218-01-9	Chrysene	0.15	U	UG/L	1.63E-08		
53-70-3	Dibenz(a,h)anthracene	0.25	U	UG/L	2.71E-05		
206-44-0	Fluoranthene	0.2	U	UG/L		1.37E-04	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

TABLE 30-7  
HUMAN HEALTH SCREENING OF GROUNDWATER RESULTS FROM AUS-0001

ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Cancer Risk Based on USEPA Region 9 PRG for Carcinogens (Tap Water)	Hazard Quotient (HQ) Based on USEPA Region 9 PRG for Toxins (Tap Water)	Ratio of Max Concentration (or Max RL) to USEPA MCL and/or IEPA Class I Groundwater Standard
86-73-7	Fluorene	0.2	U	UG/L		8.22E-04	
193-39-5	Indeno(1,2,3-c,d)pyrene	0.15	U	UG/L	1.63E-06		
91-20-3	Naphthalene	1	U	UG/L		1.61E-01	
85-01-8	Phenanthrene	0.15	U	UG/L		8.22E-04	
129-00-0	Pyrene	0.2	U	UG/L		1.10E-03	
<b>Metals</b>							
7429-90-5	Aluminum	141	J	UG/L		3.86E-03	
7440-36-0	Antimony	12	U	UG/L		8.22E-01	2.00E+00
7440-38-2	Arsenic	20	U	UG/L	4.46E-04	1.83E+00	4.00E-01
7440-39-3	Barium	31.2	J	UG/L		1.22E-02	1.56E-02
7440-41-7	Beryllium	5	U	UG/L		6.85E-02	1.25E+00
7440-42-8	Boron	97.6	J	UG/L		2.97E-02	4.88E-02
7440-43-9	Cadmium	5	U	UG/L		2.74E-01	1.00E+00
7440-70-2	Calcium	540000		UG/L			
7440-47-3	Chromium	10	U	UG/L			1.00E-01
7440-48-4	Cobalt	50	U	UG/L		2.28E-02	5.00E-02
7440-50-8	Copper	20	U	UG/L		1.48E-02	3.08E-02
7439-89-6	Iron	155		UG/L		1.42E-02	3.10E-02
7439-92-1	Lead	6	U	UG/L			8.00E-01
7439-95-4	Magnesium	304000		UG/L			
7439-96-5	Manganese	1410		UG/L		1.61E+00	9.40E+00
7439-97-6	Mercury	0.2	U	UG/L			1.00E-01
7440-02-0	Nickel	10	J	UG/L		1.37E-02	1.00E-01
2023695	Potassium	5020		UG/L			
7782-49-2	Selenium	10	U	UG/L		5.48E-02	2.00E-01

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 30-7  
HUMAN HEALTH SCREENING OF GROUNDWATER RESULTS FROM AUS-0001**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Cancer Risk Based on USEPA Region 9 PRG for Carcinogens (Tap Water)	Hazard Quotient (HQ) Based on USEPA Region 9 PRG for Toxins (Tap Water)	Ratio of Max Concentration (or Max RL) to USEPA MCL and/or IEPA Class I Groundwater Standard
7440-22-4	Silver	10	U	UG/L		5.48E-02	2.00E-01
7440-23-5	Sodium	151000		UG/L			
7440-28-0	Thallium	20	U	UG/L		7.83E+00	1.00E+01
7440-62-2	Vanadium	50	U	UG/L		1.96E-01	
7440-66-6	Zinc	20	U	UG/L		1.83E-03	4.00E-03

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect



**TABLE 30-8  
ECOLOGICAL SCREENING OF SOIL RESULTS FROM AUS-0001**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Background (SOIL)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ) (SOIL)	Retained as Potential Bioaccumulator
<b>Volatile Organic Compounds</b>							
71-55-6	1,1,1-Trichloroethane		6	U	UG/KG	2.01E-04	
79-34-5	1,1,2,2-Tetrachloroethane		6	U	UG/KG	4.72E-02	
79-00-5	1,1,2-Trichloroethane		6	U	UG/KG	2.10E-04	
75-34-3	1,1-Dichloroethane		6	U	UG/KG	2.99E-04	
75-35-4	1,1-Dichloroethene		6	U	UG/KG	7.25E-04	
107-06-2	1,2-Dichloroethane (EDC)		6	U	UG/KG	2.83E-04	
540-59-0	1,2-Dichloroethene (total)		6	U	UG/KG	7.62E-03	
78-87-5	1,2-Dichloropropane		6	U	UG/KG	8.57E-06	
78-93-3	2-Butanone (MEK)		13	U	UG/KG	1.45E-04	
591-78-6	2-Hexanone		13	U	UG/KG	1.03E-03	
108-10-1	4-Methyl-2-pentanone (MIBK)		13	U	UG/KG	2.93E-05	
67-64-1	Acetone		26	U	UG/KG	1.04E-02	
71-43-2	Benzene		6	U	UG/KG	3.75E-04	
75-27-4	Bromodichloromethane		6	U	UG/KG	1.11E-02	
75-25-2	Bromoform		6	U	UG/KG	3.77E-04	
74-83-9	Bromomethane		6	U	UG/KG	2.55E-02	
75-15-0	Carbon disulfide		6	U	UG/KG	6.37E-02	
56-23-5	Carbon tetrachloride		6	U	UG/KG	6.00E-06	
108-90-7	Chlorobenzene		6	U	UG/KG	1.50E-04	
75-00-3	Chloroethane		6	U	UG/KG		
67-66-3	Chloroform		6	U	UG/KG	5.04E-03	
74-87-3	Chloromethane		6	U	UG/KG	5.77E-04	
156-59-2	cis-1,2-Dichloroethene		6	U	UG/KG	7.62E-03	
10061-01-5	cis-1,3-Dichloropropene		6	U	UG/KG	1.51E-02	
124-48-1	Dibromochloromethane		6	U	UG/KG	2.93E-03	
100-41-4	Ethylbenzene		6	U	UG/KG	1.20E-03	
75-09-2	Methylene chloride		6	U	UG/KG	1.48E-03	
110-54-3	N-Hexane		6	U	UG/KG		
100-42-5	Styrene		6	U	UG/KG	2.00E-05	
127-18-4	Tetrachloroethylene (PCE)		6	U	UG/KG	4.62E-04	
108-88-3	Toluene		6	U	UG/KG	2.00E-03	
1330-20-7	total Xylenes		6	U	UG/KG	1.00E-02	
156-60-5	trans-1,2-Dichloroethene		6	U	UG/KG	7.62E-03	
10061-02-6	trans-1,3-Dichloropropene		6	U	UG/KG	1.51E-02	
79-01-6	Trichloroethylene (TCE)		6	U	UG/KG	6.67E-04	
75-01-4	Vinyl chloride		6	U	UG/KG	9.29E-03	
<b>Semivolatile Organic Compounds</b>							
120-82-1	1,2,4-Trichlorobenzene		480	U	UG/KG	2.40E-02	
95-50-1	1,2-Dichlorobenzene		480	U	UG/KG	1.62E-01	
541-73-1	1,3-Dichlorobenzene		480	U	UG/KG	1.27E-02	
106-46-7	1,4-Dichlorobenzene		480	U	UG/KG	2.40E-02	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 30-8  
ECOLOGICAL SCREENING OF SOIL RESULTS FROM AUS-0001**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Background (SOIL)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ) (SOIL)	Retained as Potential Bioaccumulator
95-95-4	2,4,5-Trichlorophenol		2400	U	UG/KG	6.00E-01	
88-06-2	2,4,6-Trichlorophenol		480	U	UG/KG	4.80E-02	
120-83-2	2,4-Dichlorophenol		480	U	UG/KG	5.49E-03	
105-67-9	2,4-Dimethylphenol		480	U	UG/KG	4.80E+01	
51-28-5	2,4-Dinitrophenol		2400	U	UG/KG	1.20E-01	
91-58-7	2-Chloronaphthalene		480	U	UG/KG	3.94E+01	
95-57-8	2-Chlorophenol		480	U	UG/KG	1.98E+00	
90-12-0	1-Methylnaphthalene		41	U	UG/KG		
91-57-6	2-Methylnaphthalene		58	J	UG/KG	1.79E-02	YES
95-48-7	2-Methylphenol		480	U	UG/KG	1.19E-02	
88-74-4	2-Nitroaniline		2400	U	UG/KG	3.24E-02	
88-75-5	2-Nitrophenol		480	U	UG/KG	3.00E-01	
91-94-1	3,3'-Dichlorobenzidine		480	U	UG/KG	7.43E-01	
99-09-2	3-Nitroaniline		2400	U	UG/KG	7.59E-01	
534-52-1	4,6-Dinitro-2-methylphenol		2400	U	UG/KG		
101-55-3	4-Bromophenyl phenyl ether		480	U	UG/KG		
59-50-7	4-Chloro-3-methylphenol		480	U	UG/KG	6.04E-02	
106-47-8	4-Chloroaniline		950	U	UG/KG	8.64E-01	
7005-72-3	4-Chlorophenyl phenyl ether		480	U	UG/KG		
106-44-5	4-Methylphenol		480	U	UG/KG	2.94E-03	
100-01-6	4-Nitroaniline		2400	U	UG/KG	1.10E-01	
100-02-7	4-Nitrophenol		2400	U	UG/KG	3.43E-01	
83-32-9	Acenaphthene		480	U	UG/KG	7.03E-04	
208-96-8	Acenaphthylene		150	J	UG/KG	2.20E-04	
120-12-7	Anthracene		170	J	UG/KG	1.15E-04	YES
56-55-3	Benzo(a)anthracene		620		UG/KG	1.19E-01	YES
50-32-8	Benzo(a)pyrene		330	J	UG/KG	7.50E-05	YES
205-99-2	Benzo(b)fluoranthene		1700		UG/KG	2.84E-02	YES
191-24-2	Benzo(g,h,i)perylene		360	J	UG/KG	3.03E-03	YES
207-08-9	Benzo(k)fluoranthene		450		UG/KG	7.53E-03	YES
111-91-1	bis(2-Chloroethoxy)methane		480	U	UG/KG	1.58E+00	
111-44-4	bis(2-Chloroethyl) ether		480	U	UG/KG	2.03E-02	
108-60-1	bis(2-Chloroisopropyl) ether		480	U	UG/KG		
117-81-7	bis(2-Ethylhexyl) phthalate (DEHP)		280	J	UG/KG	3.02E-01	YES
85-68-7	Butyl benzyl phthalate		480	U	UG/KG	2.01E+00	
86-74-8	Carbazole		56	J	UG/KG		YES
218-01-9	Chrysene		1500		UG/KG	3.17E-01	YES
84-74-2	Di-n-butyl phthalate		86	J	UG/KG	4.30E-04	YES
117-84-0	Di-n-octyl phthalate		480	U	UG/KG	6.77E-04	
53-70-3	Dibenz(a,h)anthracene		480	U	UG/KG	2.61E-02	
132-64-9	Dibenzofuran		480	U	UG/KG		
84-66-2	Diethyl phthalate		480	U	UG/KG	4.80E-03	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 30-8  
ECOLOGICAL SCREENING OF SOIL RESULTS FROM AUS-0001**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Background (SOIL)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ) (SOIL)	Retained as Potential Bioaccumulator
131-11-3	Dimethyl phthalate		480	U	UG/KG	2.40E-03	
206-44-0	Fluoranthene		2600		UG/KG	2.13E-02	YES
86-73-7	Fluorene		480	U	UG/KG	1.60E-02	
118-74-1	Hexachlorobenzene		480	U	UG/KG	4.80E-04	
87-68-3	Hexachlorobutadiene		480	U	UG/KG	1.21E+01	
77-47-4	Hexachlorocyclopentadiene		480	U	UG/KG	4.80E-02	
67-72-1	Hexachloroethane		480	U	UG/KG	8.05E-01	
193-39-5	Indeno(1,2,3-c,d)pyrene		480		UG/KG	4.40E-03	YES
78-59-1	Isophorone		480	U	UG/KG	3.45E-03	
621-64-7	N-Nitroso-di-n-propylamine		480	U	UG/KG	8.83E-01	
86-30-6	N-Nitrosodiphenylamine		480	U	UG/KG	2.40E-02	
91-20-3	Naphthalene		480	U	UG/KG	1.93E-03	
98-95-3	Nitrobenzene		440	U	UG/KG	1.10E-02	
87-86-5	Pentachlorophenol		2400	U	UG/KG	4.00E-01	
85-01-8	Phenanthrene		1200		UG/KG	2.63E-02	YES
108-95-2	Phenol		480	U	UG/KG	1.20E-02	
129-00-0	Pyrene		1600		UG/KG	2.04E-02	YES
<b>Explosives</b>							
99-35-4	1,3,5-Trinitrobenzene		360	UJ	UG/KG	9.57E-01	
99-65-0	1,3-Dinitrobenzene		360	UJ	UG/KG	5.50E-01	
118-96-7	2,4,6-Trinitrotoluene (TNT)		720	UJ	UG/KG	2.40E-02	
121-14-2	2,4-Dinitrotoluene		440	U	UG/KG	3.44E-01	
606-20-2	2,6-Dinitrotoluene		480	U	UG/KG	1.46E+01	
35572-78-2	2-Amino-4,6-Dinitrotoluene		720	UJ	UG/KG	9.00E-03	
88-72-2	2-Nitrotoluene (ONT)		720	UJ	UG/KG		
99-08-1	3-Nitrotoluene		720	UJ	UG/KG		
19406-51-0	4-Amino-2,6-Dinitrotoluene		720	UJ	UG/KG		
99-99-0	4-Nitrotoluene (PNT)		720	UJ	UG/KG		
2691-41-0	HMX		720	UJ	UG/KG	2.88E-02	
121-82-4	RDX		720	UJ	UG/KG	7.20E-03	
479-45-8	Tetryl		1100	UJ	UG/KG		
<b>Metals</b>							
7429-90-5	Aluminum	28800	13200		MG/KG		
7440-36-0	Antimony	0.83	1.1		MG/KG	2.20E-01	
7440-38-2	Arsenic	13.5	535		MG/KG	5.94E+01	
7440-39-3	Barium	195	176		MG/KG	3.52E-01	
7440-41-7	Beryllium	0.76	0.85		MG/KG	8.50E-02	
7440-42-8	Boron	5.3	36.8		MG/KG	7.36E+01	
7440-43-9	Cadmium	0.19	2.7		MG/KG	9.31E-02	
7440-70-2	Calcium	2497	16400		MG/KG		
7440-47-3	Chromium	25.2	27		MG/KG	5.40E+00	
7440-48-4	Cobalt	21.7	8.3		MG/KG	4.15E-01	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 30-8  
ECOLOGICAL SCREENING OF SOIL RESULTS FROM AUS-0001**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Background (SOIL)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ) (SOIL)	Retained as Potential Bioaccumulator
7440-50-8	Copper	11.3	94	J	MG/KG	3.03E+00	
7439-89-6	Iron	19306	24800		MG/KG	1.24E+02	
7439-92-1	Lead	23.4	1050		MG/KG	2.42E+00	
7439-95-4	Magnesium	1552	2270		MG/KG		
7439-96-5	Manganese	3640	437		MG/KG	4.37E+00	
7439-97-6	Mercury	0.06	0.26		MG/KG	3.71E-02	YES
7440-02-0	Nickel	18.9	21.2		MG/KG	7.07E-01	
2023695	Potassium	625	1430		MG/KG		
7782-49-2	Selenium	2.34	12.9		MG/KG	1.29E+01	YES
7440-22-4	Silver	0.58	3.4		MG/KG	1.70E+00	
7440-23-5	Sodium	170	406		MG/KG		
7440-28-0	Thallium	0.41	2.4		MG/KG	2.40E+00	
7440-62-2	Vanadium	47.2	55.7		MG/KG	1.21E+00	
7440-66-6	Zinc	51.4	1410		MG/KG	1.18E+01	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 30-9, AUS-0001  
SUMMARY OF HUMAN HEALTH COPC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Groundwater		Sediment		Soil	
	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale
<b>Volatile Organic Compounds</b>								
1,1,1-Trichloroethane	NA	NA	No	A	NA	NA	No	A
1,1,2,2-Tetrachloroethane	NA	NA	Uncertainty	B	NA	NA	Uncertainty	B
1,1,2-Trichloroethane	NA	NA	Uncertainty	B	NA	NA	Uncertainty	B
1,1-Dichloroethane	NA	NA	No	A	NA	NA	No	A
1,1-Dichloroethene	NA	NA	Uncertainty	B	NA	NA	Uncertainty	B
1,2-Dichloroethane (EDC)	NA	NA	Uncertainty	B	NA	NA	Uncertainty	B
1,2-Dichloroethene (total)	NA	NA	NA	NA	NA	NA	No	A
1,2-Dichloropropane	NA	NA	Uncertainty	B	NA	NA	Uncertainty	B
2-Butanone (MEK)	NA	NA	No	A	NA	NA	No	A
2-Hexanone	NA	NA	No	C	NA	NA	No	C
4-Methyl-2-pentanone (MIBK)	NA	NA	No	A	NA	NA	No	A
Acetone	NA	NA	No	A	NA	NA	No	A
Benzene	NA	NA	Uncertainty	B	NA	NA	Uncertainty	B
Bromodichloromethane	NA	NA	Uncertainty	B	NA	NA	No	A
Bromoform	NA	NA	No	A	NA	NA	No	A
Bromomethane	NA	NA	No	A	NA	NA	No	A
Carbon disulfide	NA	NA	No	F	NA	NA	No	A
Carbon tetrachloride	NA	NA	Uncertainty	B	NA	NA	Uncertainty	B
Chlorobenzene	NA	NA	No	A	NA	NA	No	A
Chloroethane	NA	NA	No	A	NA	NA	No	A
Chloroform	NA	NA	Uncertainty	B	NA	NA	No	A
Chloromethane	NA	NA	No	A	NA	NA	No	A
cis-1,2-Dichloroethene	NA	NA	No	A	NA	NA	No	A
cis-1,3-Dichloropropene	NA	NA	Uncertainty	B	NA	NA	No	A
Dibromochloromethane	NA	NA	Uncertainty	B	NA	NA	No	A
Ethylbenzene	NA	NA	No	A	NA	NA	No	A
Methylene chloride	NA	NA	No	A	NA	NA	Uncertainty	B
N-Hexane	NA	NA	No	A	NA	NA	No	A
Styrene	NA	NA	No	A	NA	NA	No	A
Tetrachloroethylene (PCE)	NA	NA	No	A	NA	NA	Uncertainty	B
Toluene	NA	NA	No	A	NA	NA	No	A
total Xylenes	NA	NA	No	A	NA	NA	No	A
trans-1,2-Dichloroethene	NA	NA	No	A	NA	NA	No	A
trans-1,3-Dichloropropene	NA	NA	Uncertainty	B	NA	NA	No	A
Trichloroethylene (TCE)	NA	NA	No	F	NA	NA	Uncertainty	B
Vinyl chloride	NA	NA	Uncertainty	B	NA	NA	Uncertainty	B
<b>Semivolatile Organic Compounds</b>								
1,2,4-Trichlorobenzene	NA	NA	NA	NA	NA	NA	Uncertainty	B
1,2-Dichlorobenzene	NA	NA	NA	NA	NA	NA	No	A
1,3-Dichlorobenzene	NA	NA	NA	NA	NA	NA	No	A
1,4-Dichlorobenzene	NA	NA	NA	NA	NA	NA	Uncertainty	B
2,4,5-Trichlorophenol	NA	NA	NA	NA	NA	NA	No	A

**TABLE 30-9, AUS-0001  
SUMMARY OF HUMAN HEALTH COPC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Groundwater		Sediment		Soil	
	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale
2,4,6-Trichlorophenol	NA	NA	NA	NA	NA	NA	Uncertainty	B
2,4-Dichlorophenol	NA	NA	NA	NA	NA	NA	Uncertainty	B
2,4-Dimethylphenol	NA	NA	NA	NA	NA	NA	Uncertainty	B
2,4-Dinitrophenol	NA	NA	NA	NA	NA	NA	Uncertainty	B
2-Chloronaphthalene	NA	NA	NA	NA	NA	NA	No	A
2-Chlorophenol	NA	NA	NA	NA	NA	NA	Uncertainty	B
1-Methylnaphthalene	NA	NA	No	A	NA	NA	No	A
2-Methylnaphthalene	NA	NA	No	A	NA	NA	No	F
2-Methylphenol	NA	NA	NA	NA	NA	NA	No	A
2-Nitroaniline	NA	NA	NA	NA	NA	NA	No	A
2-Nitrophenol	NA	NA	NA	NA	NA	NA	No	A
3,3'-Dichlorobenzidine	NA	NA	NA	NA	NA	NA	Uncertainty	B
3-Nitroaniline	NA	NA	NA	NA	NA	NA	No	A
4,6-Dinitro-2-methylphenol	NA	NA	NA	NA	NA	NA	No	C
4-Bromophenyl phenyl ether	NA	NA	NA	NA	NA	NA	No	C
4-Chloro-3-methylphenol	NA	NA	NA	NA	NA	NA	No	A
4-Chloroaniline	NA	NA	NA	NA	NA	NA	Uncertainty	B
4-Chlorophenyl phenyl ether	NA	NA	NA	NA	NA	NA	No	C
4-Methylphenol	NA	NA	NA	NA	NA	NA	No	A
4-Nitroaniline	NA	NA	NA	NA	NA	NA	No	A
4-Nitrophenol	NA	NA	NA	NA	NA	NA	No	A
Acenaphthene	NA	NA	No	A	NA	NA	No	A
Acenaphthylene	NA	NA	No	A	NA	NA	No	F
Anthracene	NA	NA	No	A	NA	NA	No	F
Benzo(a)anthracene	NA	NA	Uncertainty	B	NA	NA	Yes	E
Benzo(a)pyrene	NA	NA	Uncertainty	B	NA	NA	Yes	E
Benzo(b)fluoranthene	NA	NA	Uncertainty	B	NA	NA	Yes	E
Benzo(g,h,i)perylene	NA	NA	No	A	NA	NA	No	F
Benzo(k)fluoranthene	NA	NA	No	A	NA	NA	No	F
bis(2-Chloroethoxy)methane	NA	NA	NA	NA	NA	NA	No	C
bis(2-Chloroethyl) ether	NA	NA	NA	NA	NA	NA	Uncertainty	B
bis(2-Chloroisopropyl) ether	NA	NA	NA	NA	NA	NA	No	A
bis(2-Ethylhexyl) phthalate	NA	NA	NA	NA	NA	NA	No	F
Butyl benzyl phthalate	NA	NA	NA	NA	NA	NA	No	A
Carbazole	NA	NA	NA	NA	NA	NA	Yes	E
Chrysene	NA	NA	No	A	NA	NA	No	F
Di-n-butyl phthalate	NA	NA	NA	NA	NA	NA	No	F
Di-n-octyl phthalate	NA	NA	NA	NA	NA	NA	No	A
Dibenz(a,h)anthracene	NA	NA	Uncertainty	B	NA	NA	Uncertainty	B
Dibenzofuran	NA	NA	NA	NA	NA	NA	No	A
Diethyl phthalate	NA	NA	NA	NA	NA	NA	No	A
Dimethyl phthalate	NA	NA	NA	NA	NA	NA	No	A
Fluoranthene	NA	NA	No	A	NA	NA	No	F

**TABLE 30-9, AUS-0001  
SUMMARY OF HUMAN HEALTH COPC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Groundwater		Sediment		Soil	
	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale
Fluorene	NA	NA	No	A	NA	NA	No	A
Hexachlorobenzene	NA	NA	NA	NA	NA	NA	Uncertainty	B
Hexachlorobutadiene	NA	NA	NA	NA	NA	NA	Uncertainty	B
Hexachlorocyclopentadiene	NA	NA	NA	NA	NA	NA	No	A
Hexachloroethane	NA	NA	NA	NA	NA	NA	Uncertainty	B
Indeno(1,2,3-c,d)pyrene	NA	NA	Uncertainty	B	NA	NA	No	F
Isophorone	NA	NA	NA	NA	NA	NA	Uncertainty	B
N-Nitroso-di-n-propylamine	NA	NA	NA	NA	NA	NA	Uncertainty	B
N-Nitrosodiphenylamine	NA	NA	NA	NA	NA	NA	Uncertainty	B
Naphthalene	NA	NA	No	A	NA	NA	No	A
Pentachlorophenol	NA	NA	NA	NA	NA	NA	Uncertainty	B
Phenanthrene	NA	NA	No	A	NA	NA	No	F
Phenol	NA	NA	NA	NA	NA	NA	No	A
Pyrene	NA	NA	No	A	NA	NA	No	F
<b>Metals and Inorganics</b>								
Aluminum	NA	NA	No	F	NA	NA	No	F
Antimony	NA	NA	Uncertainty	B	NA	NA	Yes	E
Arsenic	NA	NA	Uncertainty	B	NA	NA	Yes	E
Barium	NA	NA	No	F	NA	NA	Yes	D
Beryllium	NA	NA	Uncertainty	B	NA	NA	No	F
Boron	NA	NA	No	F	NA	NA	No	F
Cadmium	NA	NA	Uncertainty	B	NA	NA	Yes	E
Calcium	NA	NA	No	H	NA	NA	No	H
Chromium	NA	NA	No	A	NA	NA	Yes	E
Cobalt	NA	NA	No	A	NA	NA	No	F
Copper	NA	NA	No	A	NA	NA	No	F
Cyanide, Total	NA	NA	NA	NA	NA	NA	NA	NA
Iron	NA	NA	No	F	NA	NA	No	F
Lead	NA	NA	No	A	NA	NA	Yes	E
Magnesium	NA	NA	No	H	NA	NA	No	H
Manganese	NA	NA	Yes	E	NA	NA	No	F
Mercury	NA	NA	No	A	NA	NA	Yes	E
Nickel	NA	NA	No	F	NA	NA	Yes	E
Potassium	NA	NA	No	H	NA	NA	No	H
Selenium	NA	NA	No	A	NA	NA	Yes	E
Silver	NA	NA	No	A	NA	NA	Yes	E
Sodium	NA	NA	No	H	NA	NA	No	H
Thallium	NA	NA	Uncertainty	B	NA	NA	Yes	E
Vanadium	NA	NA	No	A	NA	NA	No	F
Zinc	NA	NA	No	A	NA	NA	Yes	E
<b>Explosives</b>								
1,3,5-Trinitrobenzene	NA	NA	NA	NA	NA	NA	No	A
1,3-Dinitrobenzene	NA	NA	NA	NA	NA	NA	No	A

**TABLE 30-9, AUS-0001  
SUMMARY OF HUMAN HEALTH COPC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Groundwater		Sediment		Soil	
	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale
2,4,6-Trinitrotoluene (TNT)	NA	NA	NA	NA	NA	NA	No	A
2,4-Dinitrotoluene	NA	NA	NA	NA	NA	NA	Uncertainty	B
2,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA	Uncertainty	B
2-Amino-4,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA	No	C
2-Nitrotoluene (ONT)	NA	NA	NA	NA	NA	NA	No	C
3-Nitrotoluene	NA	NA	NA	NA	NA	NA	No	A
4-Amino-2,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA	No	C
4-Nitrotoluene (PNT)	NA	NA	NA	NA	NA	NA	No	A
HMX	NA	NA	NA	NA	NA	NA	No	A
Nitrobenzene	NA	NA	NA	NA	NA	NA	Uncertainty	B
Nitroglycerin	NA	NA	NA	NA	NA	NA	NA	NA
Pentaerythritol tetranitrate (PETN)	NA	NA	NA	NA	NA	NA	NA	NA
Perchloric Acid	NA	NA	NA	NA	NA	NA	NA	NA
RDX	NA	NA	NA	NA	NA	NA	No	A
Tetryl	NA	NA	NA	NA	NA	NA	No	A
<b>Other Parameters</b>								
Nitrogen, Nitrate-Nitrite	NA	NA	NA	NA	NA	NA	NA	NA
Phosphorus, Total (as P)	NA	NA	NA	NA	NA	NA	NA	NA

- A - Chemical was not detected and the reporting limit does not exceed the screening concentration.
- B - Chemical was not detected, but reporting limit was equal to or exceeded screening concentration.
- C - Chemical was not detected and there is no screening concentration.
- D - Chemical was detected and was equal to or exceeded screening concentration, but did not exceed background.
- E - Chemical was detected and was equal to or exceeded screening concentration and background, if applicable
- F - Chemical was detected and did not exceed screening concentration
- G - Chemical was detected, but no screening value was available.
- H - Chemical was detected, but it is an essential nutrient
- J - Chemical was classified as a COPC based on USEPA 1998 data but was not a COPC based on SI data.
- NA - Not Analyzed or not applicable



**TABLE 30-10, AUS-0001  
SUMMARY OF ECOLOGICAL COPEC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Sediment		Soil	
	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale
<b>Volatile Organic Compounds</b>						
1,1,1-Trichloroethane	NA	NA	NA	NA	No	A
1,1,2,2-Tetrachloroethane	NA	NA	NA	NA	No	A
1,1,2-Trichloroethane	NA	NA	NA	NA	No	A
1,1-Dichloroethane	NA	NA	NA	NA	No	A
1,1-Dichloroethene	NA	NA	NA	NA	No	A
1,2-Dichloroethane (EDC)	NA	NA	NA	NA	No	A
1,2-Dichloroethene (total)	NA	NA	NA	NA	No	A
1,2-Dichloropropane	NA	NA	NA	NA	No	A
2-Butanone (MEK)	NA	NA	NA	NA	No	A
2-Hexanone	NA	NA	NA	NA	No	A
4-Methyl-2-pentanone (MIBK)	NA	NA	NA	NA	No	A
Acetone	NA	NA	NA	NA	No	A
Benzene	NA	NA	NA	NA	No	A
Bromodichloromethane	NA	NA	NA	NA	No	A
Bromoform	NA	NA	NA	NA	No	A
Bromomethane	NA	NA	NA	NA	No	A
Carbon disulfide	NA	NA	NA	NA	No	A
Carbon tetrachloride	NA	NA	NA	NA	No	A
Chlorobenzene	NA	NA	NA	NA	No	A
Chloroethane	NA	NA	NA	NA	No	C
Chloroform	NA	NA	NA	NA	No	A
Chloromethane	NA	NA	NA	NA	No	A
cis-1,2-Dichloroethene	NA	NA	NA	NA	No	A
cis-1,3-Dichloropropene	NA	NA	NA	NA	No	A
Dibromochloromethane	NA	NA	NA	NA	No	A
Ethylbenzene	NA	NA	NA	NA	No	A
Methylene chloride	NA	NA	NA	NA	No	A
N-Hexane	NA	NA	NA	NA	No	C
Styrene	NA	NA	NA	NA	No	A
Tetrachloroethylene (PCE)	NA	NA	NA	NA	No	A
Toluene	NA	NA	NA	NA	No	A
total Xylenes	NA	NA	NA	NA	No	A
trans-1,2-Dichloroethene	NA	NA	NA	NA	No	A
trans-1,3-Dichloropropene	NA	NA	NA	NA	No	A
Trichloroethylene (TCE)	NA	NA	NA	NA	No	A
Vinyl chloride	NA	NA	NA	NA	No	A
<b>Semivolatile Organic Compounds</b>						
1,2,4-Trichlorobenzene	NA	NA	NA	NA	No	A
1,2-Dichlorobenzene	NA	NA	NA	NA	No	A
1,3-Dichlorobenzene	NA	NA	NA	NA	No	A
1,4-Dichlorobenzene	NA	NA	NA	NA	No	A
2,4,5-Trichlorophenol	NA	NA	NA	NA	No	A

TABLE 30-10, AUS-0001  
SUMMARY OF ECOLOGICAL COPEC EVALUATION

AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Chemical	Surface Water		Sediment		Soil	
	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale
2,4,6-Trichlorophenol	NA	NA	NA	NA	No	A
2,4-Dichlorophenol	NA	NA	NA	NA	No	A
2,4-Dimethylphenol	NA	NA	NA	NA	Uncertainty	B
2,4-Dinitrophenol	NA	NA	NA	NA	No	A
2-Chloronaphthalene	NA	NA	NA	NA	Uncertainty	B
2-Chlorophenol	NA	NA	NA	NA	Uncertainty	B
1-Methylnaphthalene	NA	NA	NA	NA	No	C
2-Methylnaphthalene	NA	NA	NA	NA	Yes	E
2-Methylphenol	NA	NA	NA	NA	No	A
2-Nitroaniline	NA	NA	NA	NA	No	A
2-Nitrophenol	NA	NA	NA	NA	No	A
3,3'-Dichlorobenzidine	NA	NA	NA	NA	No	A
3-Nitroaniline	NA	NA	NA	NA	No	A
4,6-Dinitro-2-methylphenol	NA	NA	NA	NA	No	C
4-Bromophenyl phenyl ether	NA	NA	NA	NA	No	C
4-Chloro-3-methylphenol	NA	NA	NA	NA	No	A
4-Chloroaniline	NA	NA	NA	NA	No	A
4-Chlorophenyl phenyl ether	NA	NA	NA	NA	No	C
4-Methylphenol	NA	NA	NA	NA	No	A
4-Nitroaniline	NA	NA	NA	NA	No	A
4-Nitrophenol	NA	NA	NA	NA	No	A
Acenaphthene	NA	NA	NA	NA	No	A
Acenaphthylene	NA	NA	NA	NA	No	F
Anthracene	NA	NA	NA	NA	Yes	E
Benzo(a)anthracene	NA	NA	NA	NA	Yes	E
Benzo(a)pyrene	NA	NA	NA	NA	Yes	E
Benzo(b)fluoranthene	NA	NA	NA	NA	Yes	E
Benzo(g,h,i)perylene	NA	NA	NA	NA	Yes	E
Benzo(k)fluoranthene	NA	NA	NA	NA	Yes	E
bis(2-Chloroethoxy)methane	NA	NA	NA	NA	Uncertainty	B
bis(2-Chloroethyl) ether	NA	NA	NA	NA	No	A
bis(2-Chloroisopropyl) ether	NA	NA	NA	NA	No	C
bis(2-Ethylhexyl) phthalate	NA	NA	NA	NA	Yes	E
Butyl benzyl phthalate	NA	NA	NA	NA	Uncertainty	B
Carbazole	NA	NA	NA	NA	Yes	E
Chrysene	NA	NA	NA	NA	Yes	E
Di-n-butyl phthalate	NA	NA	NA	NA	Yes	E
Di-n-octyl phthalate	NA	NA	NA	NA	No	A
Dibenz(a,h)anthracene	NA	NA	NA	NA	No	A
Dibenzofuran	NA	NA	NA	NA	No	C
Diethyl phthalate	NA	NA	NA	NA	No	A
Dimethyl phthalate	NA	NA	NA	NA	No	A
Fluoranthene	NA	NA	NA	NA	Yes	E

**TABLE 30-10, AUS-0001**  
**SUMMARY OF ECOLOGICAL COPEC EVALUATION**

**AUS OU PA/SI**  
**CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Sediment		Soil	
	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale
Fluorene	NA	NA	NA	NA	No	A
Hexachlorobenzene	NA	NA	NA	NA	No	A
Hexachlorobutadiene	NA	NA	NA	NA	Uncertainty	B
Hexachlorocyclopentadiene	NA	NA	NA	NA	No	A
Hexachloroethane	NA	NA	NA	NA	No	A
Indeno(1,2,3-c,d)pyrene	NA	NA	NA	NA	Yes	E
Isophorone	NA	NA	NA	NA	No	A
N-Nitroso-di-n-propylamine	NA	NA	NA	NA	No	A
N-Nitrosodiphenylamine	NA	NA	NA	NA	No	A
Naphthalene	NA	NA	NA	NA	No	A
Pentachlorophenol	NA	NA	NA	NA	No	A
Phenanthrene	NA	NA	NA	NA	Yes	E
Phenol	NA	NA	NA	NA	No	A
Pyrene	NA	NA	NA	NA	Yes	E
<b>Metals and Inorganics</b>						
Aluminum	NA	NA	NA	NA	Uncertainty	I
Antimony	NA	NA	NA	NA	No	F
Arsenic	NA	NA	NA	NA	Yes	E
Barium	NA	NA	NA	NA	No	F
Beryllium	NA	NA	NA	NA	No	F
Boron	NA	NA	NA	NA	Yes	E
Cadmium	NA	NA	NA	NA	No	F
Calcium	NA	NA	NA	NA	Uncertainty	G,H
Chromium	NA	NA	NA	NA	Yes	E
Cobalt	NA	NA	NA	NA	No	F
Copper	NA	NA	NA	NA	Yes	E
Cyanide, Total	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	Yes	E
Lead	NA	NA	NA	NA	Yes	E
Magnesium	NA	NA	NA	NA	Uncertainty	G,H
Manganese	NA	NA	NA	NA	Yes	D
Mercury	NA	NA	NA	NA	Yes	E
Nickel	NA	NA	NA	NA	Yes	J
Potassium	NA	NA	NA	NA	Uncertainty	G,H
Selenium	NA	NA	NA	NA	Yes	E
Silver	NA	NA	NA	NA	Yes	E
Sodium	NA	NA	NA	NA	Uncertainty	G,H
Thallium	NA	NA	NA	NA	Yes	E
Vanadium	NA	NA	NA	NA	Yes	E
Zinc	NA	NA	NA	NA	Yes	E
<b>Explosives</b>						
1,3,5-Trinitrobenzene	NA	NA	NA	NA	No	A
1,3-Dinitrobenzene	NA	NA	NA	NA	No	A

**TABLE 30-10, AUS-0001  
SUMMARY OF ECOLOGICAL COPEC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Sediment		Soil	
	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale
2,4,6-Trinitrotoluene (TNT)	NA	NA	NA	NA	No	A
2,4-Dinitrotoluene	NA	NA	NA	NA	No	A
2,6-Dinitrotoluene	NA	NA	NA	NA	Uncertainty	B
2-Amino-4,6-Dinitrotoluene	NA	NA	NA	NA	No	A
2-Nitrotoluene (ONT)	NA	NA	NA	NA	No	C
3-Nitrotoluene	NA	NA	NA	NA	No	C
4-Amino-2,6-Dinitrotoluene	NA	NA	NA	NA	No	C
4-Nitrotoluene (PNT)	NA	NA	NA	NA	No	C
HMX	NA	NA	NA	NA	No	A
Nitrobenzene	NA	NA	NA	NA	No	A
Nitroglycerin	NA	NA	NA	NA	NA	NA
Pentaerythritol tetranitrate (PETN)	NA	NA	NA	NA	NA	NA
Perchloric Acid	NA	NA	NA	NA	NA	NA
RDX	NA	NA	NA	NA	No	A
Tetryl	NA	NA	NA	NA	No	C

- A - Chemical was not detected and the reporting limit does not exceed the screening concentration.
- B - Chemical was not detected, but reporting limit was equal to or exceeded screening concentration.
- C - Chemical was not detected and there is no screening concentration.
- D - Chemical was detected and was equal to or exceeded screening concentration, but did not exceed background.
- E - Chemical was detected and was equal to or exceeded screening concentration and background, if applicable.
- F - Chemical was detected and did not exceed screening concentration.
- G - Chemical was detected, but no screening value was available.
- H - Chemical was detected, but it is an essential nutrient.
- I - If pH<5.5, Aluminum is a COPEC, otherwise it is not.
- J - Chemical was classified as a COPEC based on USEPA 1998 data but was not a COPEC based on SI data.
- NA - Not Analyzed or not applicable.

**TABLE 30-11**  
**AUS-0001 - IOP FIRE AND POLICE HEADQUARTERS**  
**CHEMICALS DETECTED ABOVE SCREENING CRITERIA AND ABOVE REFUGE BACKGROUND**  
**(WHERE APPLICABLE)**

**ADDITIONAL AND UNCHARACTERIZED SITES OU SI**

Chemical	Drum <sup>1</sup>	Soil	Sediment	Ground Water	Surface Water
<b>SVOCs</b>					
2-Methylnaphthalene		E	NA		NA
Anthracene		E	NA		NA
Benzo(a)anthracene		H,E	NA		NA
Benzo(a)pyrene		H,E	NA		NA
Benzo(b)fluoranthene		H,E	NA		NA
Benzo(g,h,i)perylene		E	NA		NA
Benzo(k)fluoranthene		E	NA		NA
bis(2-Ethylhexyl)phthalate (DEHP)		E	NA	NA	NA
Carbazole		H,E	NA	NA	NA
Chrysene		E	NA		NA
Di-n-butyl phthalate		E	NA	NA	NA
Fluoranthene		E	NA		NA
Indeno(1,2,3-c,d)pyrene		E	NA		NA
Phenanthrene		E	NA		NA
Pyrene		E	NA		NA
<b>Metals</b>					
Antimony		H	NA		NA
Arsenic		H,E	NA		NA
Boron		E	NA		NA
Cadmium		H	NA		NA
Chromium		H,E	NA		NA
Copper		E	NA		NA
Iron		E	NA		NA
Lead		H,E	NA		NA
Manganese			NA	H	NA
Mercury		H,E	NA		NA
Nickel		H,E	NA		NA
Selenium		H,E	NA		NA
Silver		H,E	NA		NA
Thallium		H,E	NA		NA
Vanadium		E	NA		NA
Zinc		H,E	NA		NA

**Key:**

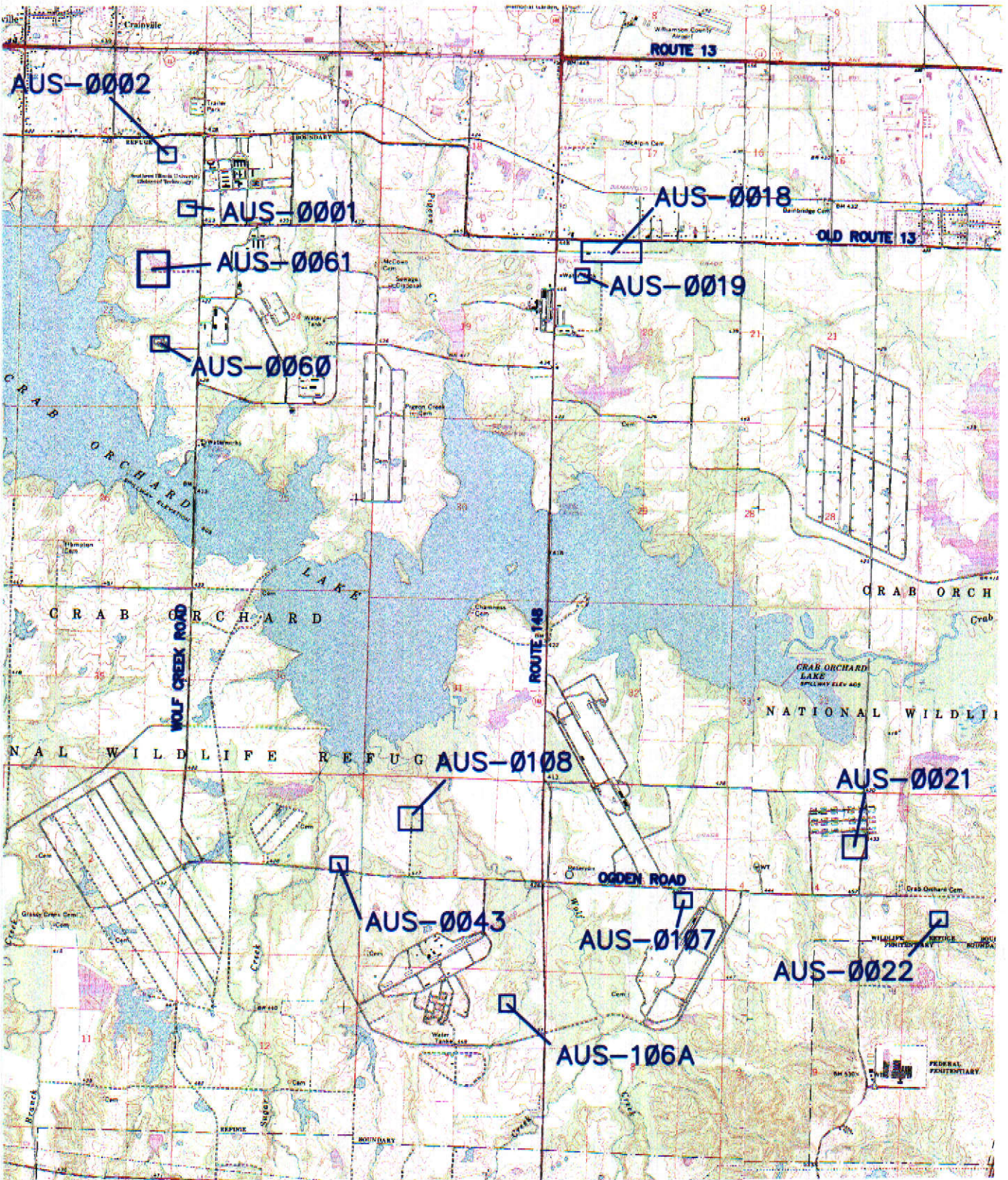
<sup>1</sup> Drums were not present at this site.

NA = not analyzed

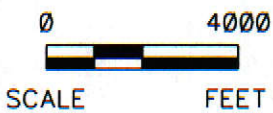
H = human health screening criteria exceeded

E = ecological screening criteria exceeded

File: E:\45FOM9602N\FIG\_30-1.DWG Last edited: 08/16/01 @ 1:17 p.m. © WCC-ST.LOUIS



SOURCE: USGS DIGITAL RASTER GRAPHIC



PA/SI REPORT-AUS OU  
CRAB ORCHARD NWR  
MARION, ILLINOIS

PROJECT NO.  
232000026.00

**URS**

DRN. BY:djd 9/7/99  
DSGN. BY:mam  
CHKD. BY:mch

Site Location Map for AUS OU  
Sites Addressed in Volume XI

FIG. NO.  
30-1

LEGEND

- ⊕ MONITORING WELL LOCATION
- ⊕ HAND AUGER LOCATION
- ⊕ USEPA 1998 SAMPLE LOCATION (APPROXIMATE)

AUS-0001-005	Units	Result:	Reference	Result:	Reference
		0 - 6 in	Code	2 ft	Code
<b>Volatile Organic Compounds</b>					
All VOCs	UG/KG	NA		ND	
<b>Semivolatile Organic Compounds</b>					
All SVOCs	UG/KG			NA	
2-Methylnaphthalene	UG/KG	58	e5		
Benzo(a)anthracene	UG/KG	84	e5, h5		
Benzo(a)pyrene	UG/KG	78	e5		
Benzo(b)fluoranthene	UG/KG	170	e5		
Benzo(g,h)perylene	UG/KG	70	e5		
bis(2-Ethylhexyl) phthalate (DEHP)	UG/KG	51	e5		
Chrysene	UG/KG	100	e5		
Di-n-butyl phthalate	UG/KG	56	e5		
Fluoranthene	UG/KG	110	e5		
Indeno(1,2,3-c,d)pyrene	UG/KG	77	e5		
Phenanthrene	UG/KG	250	e5		
Pyrene	UG/KG	140	e5		

AUS-0001-001	Units	Result:	Reference	Result:	Reference
		0 - 6 in	Code	2 ft	Code
<b>Volatile Organic Compounds</b>					
All VOCs	UG/KG	NA		ND	
<b>Semivolatile Organic Compounds</b>					
All SVOCs	UG/KG			NA	
bis(2-Ethylhexyl) phthalate (DEHP)	UG/KG	270	e5		
<b>Explosives</b>					
All Explosives	UG/KG	ND		NA	

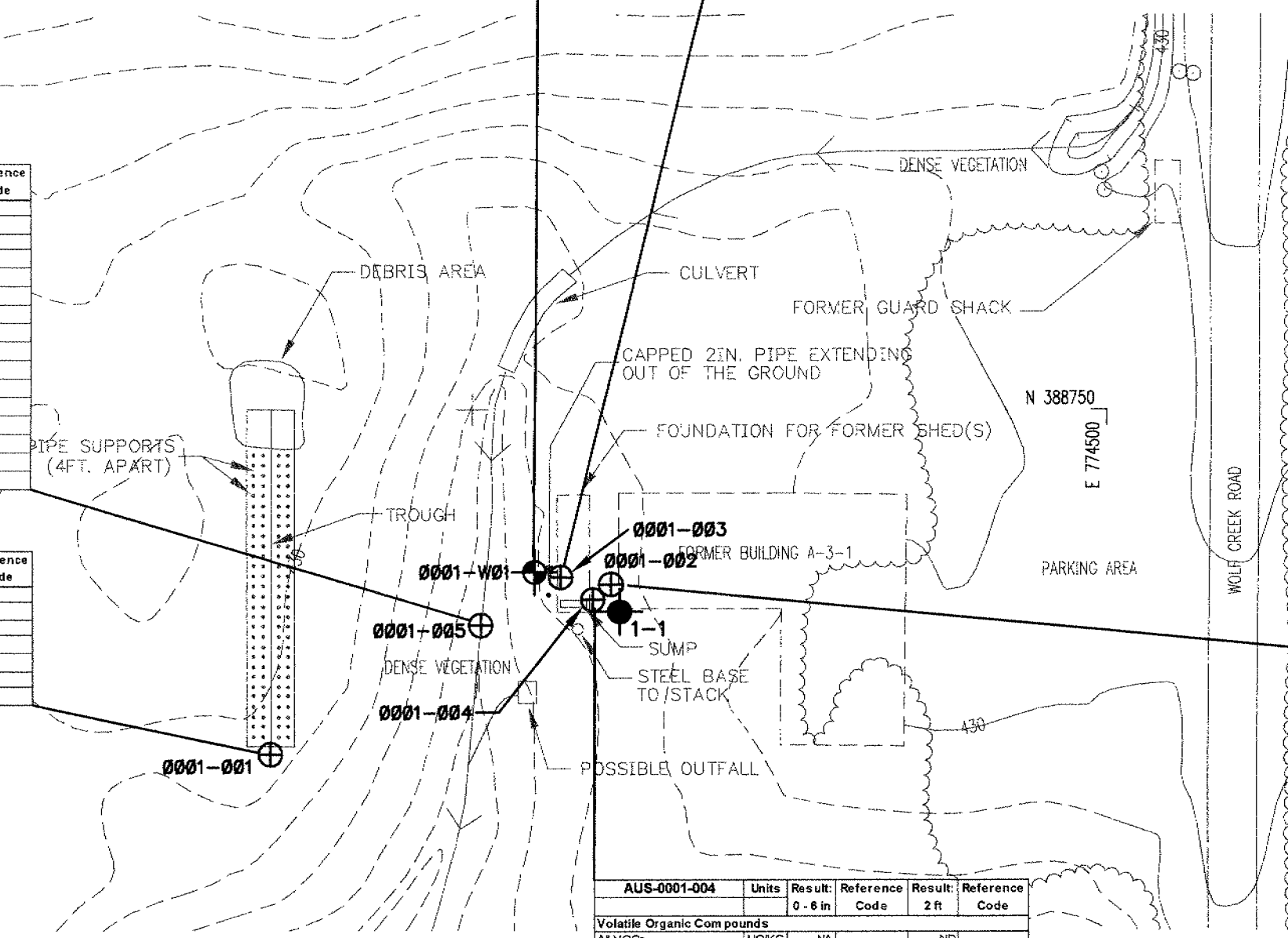
AUS-0001-W01	Units	Result:	Reference	Result:	Reference
		5 ft	Code	23 ft	Code
<b>Volatile Organic Compounds</b>					
All VOCs	UG/KG	ND		ND	
<b>Polynuclear Aromatic Hydrocarbons (PAHs)</b>					
All PAHs	UG/KG	ND		ND	

AUS-0001-003	Units	Result:	Reference	Result:	Reference
		0 - 6 in	Code	2 ft	Code
<b>Volatile Organic Compounds</b>					
All VOCs	UG/KG	NA		ND	
<b>Semivolatile Organic Compounds</b>					
All SVOCs	UG/KG			NA	
Di-n-butyl phthalate	UG/KG	86	e5		

Screening Reference	Reference Code
AUS Background Soil UTL	b1
Little Grassy Background Sediment UTL	b2
Little Grassy Background Surface Water UTL	b3
Ecological Direct Exposure Pathway TRV - Soil	e1
Ecological Direct Exposure Pathway TRV - Sediment	e2
Ecological Direct Exposure Pathway TRV - Surface Water	e3
IEPA General Use Surface Water Quality Aquatic Life Toxicity	e4
Superfund Chemical Data Matrix Kow values (potential bioaccumulator)	e5
USEPA Region IX Industrial Soil PRG- cancerous	h1
USEPA Region IX Industrial Soil PRG- noncancerous	h2
USEPA Region IX Tap Water PRG- cancerous	h3
USEPA Region IX Tap Water PRG- noncancerous	h4
USEPA Region IX Migration to Groundwater PRG (DAF=1)	h5
USEPA MCL Drinking Water Standards	h6
IEPA TACO Industrial/Commercial Soil Ingestion	h7
IEPA TACO Construction Worker Soil Ingestion	h8
IEPA TACO Class I Soil Component of Groundwater	h9
IEPA General Use Surface Water Quality Human Health	h10

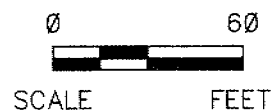
AUS-0001-002	Units	Result:	Reference	Result:	Reference
		0 - 6 in	Code	1 ft	Code
<b>Volatile Organic Compounds</b>					
All VOCs	UG/KG	NA		ND	
<b>Semivolatile Organic Compounds</b>					
All SVOCs	UG/KG			NA	
Fluoranthene	UG/KG	120	e5		

AUS-0001-004	Units	Result:	Reference	Result:	Reference
		0 - 6 in	Code	2 ft	Code
<b>Volatile Organic Compounds</b>					
All VOCs	UG/KG	NA		ND	
<b>Semivolatile Organic Compounds</b>					
All SVOCs	UG/KG			NA	
Acenaphthylene	UG/KG	150			
Anthracene	UG/KG	170	e5		
Benzo(a)anthracene	UG/KG	620	e5, h5		
Benzo(a)pyrene	UG/KG	330	e5, h1		
Benzo(b)fluoranthene	UG/KG	1700	e5, h5		
Benzo(g,h)perylene	UG/KG	360	e5		
Benzo(k)fluoranthene	UG/KG	450	e5		
Carbazole	UG/KG	56	e5, h5		
Chrysene	UG/KG	1500	e5		
Fluoranthene	UG/KG	2600	e5		
Indeno(1,2,3-c,d)pyrene	UG/KG	480	e5		
Phenanthrene	UG/KG	1200	e5		
Pyrene	UG/KG	1600	e5		



NOTES:

1. BASE TOPOGRAPHIC MAP PREPARED BY WALKER & ASSOCIATES, FROM FLYOVER IN JANUARY 2000. CONTOUR INTERVAL IS ONE FOOT.
2. DATA QUALIFIERS FOR ANALYTICAL RESULTS ARE NOT INDICATED. REFER TO THE QCSR FOR DATA QUALIFIERS.
3. THE FOLLOWING COMPOUNDS ARE INCLUDED IN THE ANALYTE LIST FOR BOTH SVOCs AND EXPLOSIVES: 2,4-DINITROTOLUENE, 2,6-DINITROTOLUENE AND NITROBENZENE. THESE COMPOUNDS MAY BE AS EITHER SVOCs OR EXPLOSIVES.



AUS-0001-IOP FIRE AND POLICE HEADQUARTERS

PA/SI REPORT-AUS OU CRAB ORCHARD NWR MARION, ILLINOIS	PROJECT NO. 232000026.00
<b>URS</b>	
DRN. BY: djd 7/28/00 DSGN. BY: mam CHKD. BY: mch/cmw	AUS-0001 Sample Locations and Detections of Organic Compounds in Soils
FIG. NO. 30-2	

File: E:\232000026.00\PA-SI REPORT-AUS\AUS-SAMPLE LOCATION\AUS-0001.DWG Last edited: SEP. 24, 01 11:57 am. URS Corp.

File: E:\223698225\00\PA-SI REPORT-AUS 001-AUS-SAMPLE LOCATION 2\AUS-0001-001.dwg Last updated: AUG. 10, 01 @ 11:53 a.m. URS Corp.

AUS-0001-005	Units	Result:	Reference
		0 - 6 In	Code
<b>Metals</b>			
Aluminum	MG/KG	8340	
Antimony	MG/KG	0.52	h5
Arsenic	MG/KG	16.8	b1,e1,h1,h5,h7
Barium	MG/KG	120	h5
Cadmium	MG/KG	0.48	b1,h5
Calcium	MG/KG	2830	b1
Chromium	MG/KG	15.1	e1,h5
Cobalt	MG/KG	5.3	
Copper	MG/KG	28.4	b1
Iron	MG/KG	18800	e1
Lead	MG/KG	94.9	b1
Magnesium	MG/KG	1630	b1
Manganese	MG/KG	189	e1
Nickel	MG/KG	15.2	h5
Potassium	MG/KG	428	
Selenium	MG/KG	1.8	e1,e5,h5
Silver	MG/KG	0.41	
Vanadium	MG/KG	26.2	
Zinc	MG/KG	122	b1,e1

AUS-0001-001	Units	Result:	Reference
		0 - 6 In	Code
<b>Metals</b>			
Aluminum	MG/KG	12200	
Antimony	MG/KG	0.47	h5
Arsenic	MG/KG	8.5	h1,h5,h7
Barium	MG/KG	150	h5
Cadmium	MG/KG	2.7	b1,h5
Calcium	MG/KG	15900	b1
Chromium	MG/KG	23	e1,h5
Cobalt	MG/KG	6.9	
Copper	MG/KG	37.2	b1,e1
Iron	MG/KG	23800	b1,e1
Lead	MG/KG	51.3	b1
Magnesium	MG/KG	2170	b1
Manganese	MG/KG	437	e1
Mercury	MG/KG	0.1	b1,e5
Nickel	MG/KG	14.4	h5
Potassium	MG/KG	777	b1
Selenium	MG/KG	0.8	e5,h5
Silver	MG/KG	0.33	
Vanadium	MG/KG	20.7	
Zinc	MG/KG	1410	b1,e1,h5

AUS-0001-003	Units	Result:	Reference
		0 - 6 In	Code
<b>Metals</b>			
Aluminum	MG/KG	7380	
Antimony	MG/KG	1.1	b1,h5
Arsenic	MG/KG	9.4	e1,h1,h5,h7
Barium	MG/KG	178	h5
Beryllium	MG/KG	0.85	b1
Cadmium	MG/KG	1.2	b1,h5
Calcium	MG/KG	2030	
Chromium	MG/KG	22.4	e1,h5
Cobalt	MG/KG	8.3	
Copper	MG/KG	12.3	b1
Iron	MG/KG	24500	b1,e1
Lead	MG/KG	1050	b1,e1,h7,h8
Magnesium	MG/KG	1400	
Manganese	MG/KG	388	e1
Nickel	MG/KG	14.7	h5
Potassium	MG/KG	325	
Selenium	MG/KG	0.78	e5,h5
Silver	MG/KG	0.49	
Vanadium	MG/KG	34.7	
Zinc	MG/KG	83.2	b1

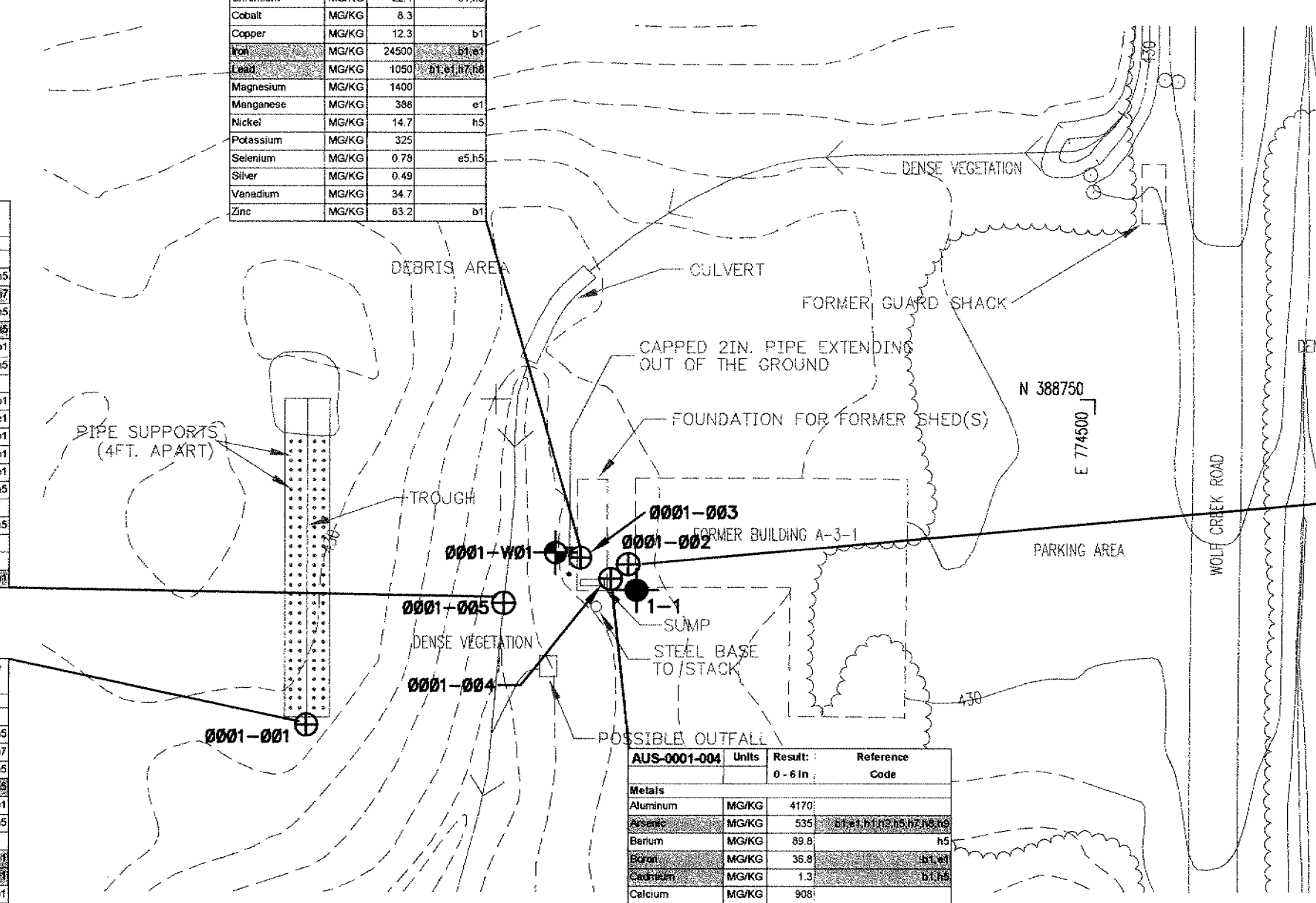
AUS-0001-004	Units	Result:	Reference
		0 - 6 In	Code
<b>Metals</b>			
Aluminum	MG/KG	4170	
Arsenic	MG/KG	535	b1,e1,h1,h5,h7,h8,h9
Barium	MG/KG	89.8	h5
Boron	MG/KG	36.8	b1,e1
Cadmium	MG/KG	1.3	b1,h5
Calcium	MG/KG	908	
Chromium	MG/KG	27	b1,e1,h5
Cobalt	MG/KG	6.4	
Copper	MG/KG	94	b1,e1
Iron	MG/KG	16900	e1
Lead	MG/KG	273	b1
Magnesium	MG/KG	884	
Manganese	MG/KG	290	e1
Mercury	MG/KG	0.26	b1,e5,h9
Nickel	MG/KG	21.2	b1,h5
Potassium	MG/KG	1430	b1
Selenium	MG/KG	12.9	b1,e1,e5,h5,h9
Silver	MG/KG	3.4	b1,e1,h5,h9
Sodium	MG/KG	408	b1
Thallium	MG/KG	2.4	b1,e1
Vanadium	MG/KG	55.7	b1,e1
Zinc	MG/KG	195	b1,e1

**LEGEND**

- ⊕ MONITORING WELL LOCATION
- ⊕ HAND AUGER LOCATION
- ⊕ USEPA 1998 SAMPLE LOCATION (APPROXIMATE)

Screening Reference	Reference Code
AUS Background Soil UTL	b1
Little Grassy Background Sediment UTL	b2
Little Grassy Background Surface Water UTL	b3
Ecological Direct Exposure Pathway TRV - Soil	e1
Ecological Direct Exposure Pathway TRV - Sediment	e2
Ecological Direct Exposure Pathway TRV - Surface Water	e3
IEPA General Use Surface Water Quality Aquatic Life Toxicity	e4
Superfund Chemical Data Matrix Kow values (potential bioaccumulators)	e5
USEPA Region IX Industrial Soil PRG - carcinous	h1
USEPA Region IX Industrial Soil PRG - noncarcinous	h2
USEPA Region IX Tap Water PRG - carcinous	h3
USEPA Region IX Tap Water PRG - noncarcinous	h4
USEPA Region IX Migration to Groundwater PRG (DAF=1)	h5
USEPA MCL Drinking Water Standards	h6
IEPA TACO Industrial/Commercial Soil Ingestion	h7
IEPA TACO Construction Worker Soil Ingestion	h8
IEPA TACO Class I Soil Component of Groundwater	h9
IEPA General Use Surface Water Quality Human Health	h10

AUS-0001-002	Units	Result:	Reference
		0 - 6 In	Code
<b>Metals</b>			
Aluminum	MG/KG	6780	
Arsenic	MG/KG	7.9	h1,h5,h7
Barium	MG/KG	99.4	h5
Cadmium	MG/KG	0.11	
Calcium	MG/KG	2340	
Chromium	MG/KG	12.8	e1,h5
Cobalt	MG/KG	5	
Copper	MG/KG	8.8	
Iron	MG/KG	15800	e1
Lead	MG/KG	22.9	
Magnesium	MG/KG	1480	
Manganese	MG/KG	354	e1
Mercury	MG/KG	0.05	e5
Nickel	MG/KG	14	h5
Potassium	MG/KG	347	
Selenium	MG/KG	0.83	e5,h5
Silver	MG/KG	0.24	
Vanadium	MG/KG	21.1	
Zinc	MG/KG	44.9	



**NOTES:**

1. BASE TOPOGRAPHIC MAP PREPARED BY WALKER & ASSOCIATES, FROM FLYOVER IN JANUARY 2000. CONTOUR INTERVAL IS ONE FOOT.
2. DATA QUALIFIERS FOR ANALYTICAL RESULTS ARE NOT INDICATED. REFER TO THE QCSR FOR DATA QUALIFIERS.

PA/SI REPORT-AUS OU CRAB ORCHARD NWR MARION, ILLINOIS	PROJECT NO. 232000026.00
<b>URS</b>	
DRN. BY: djd 7/28/00 DSGN. BY: mam CHKD. BY: mch/cmw	AUS-0001 Sample Locations and Detections of Inorganic Compounds in Soils
FIG. NO. 30-3	

**AUS-0001-IOP FIRE AND POLICE HEADQUARTERS**



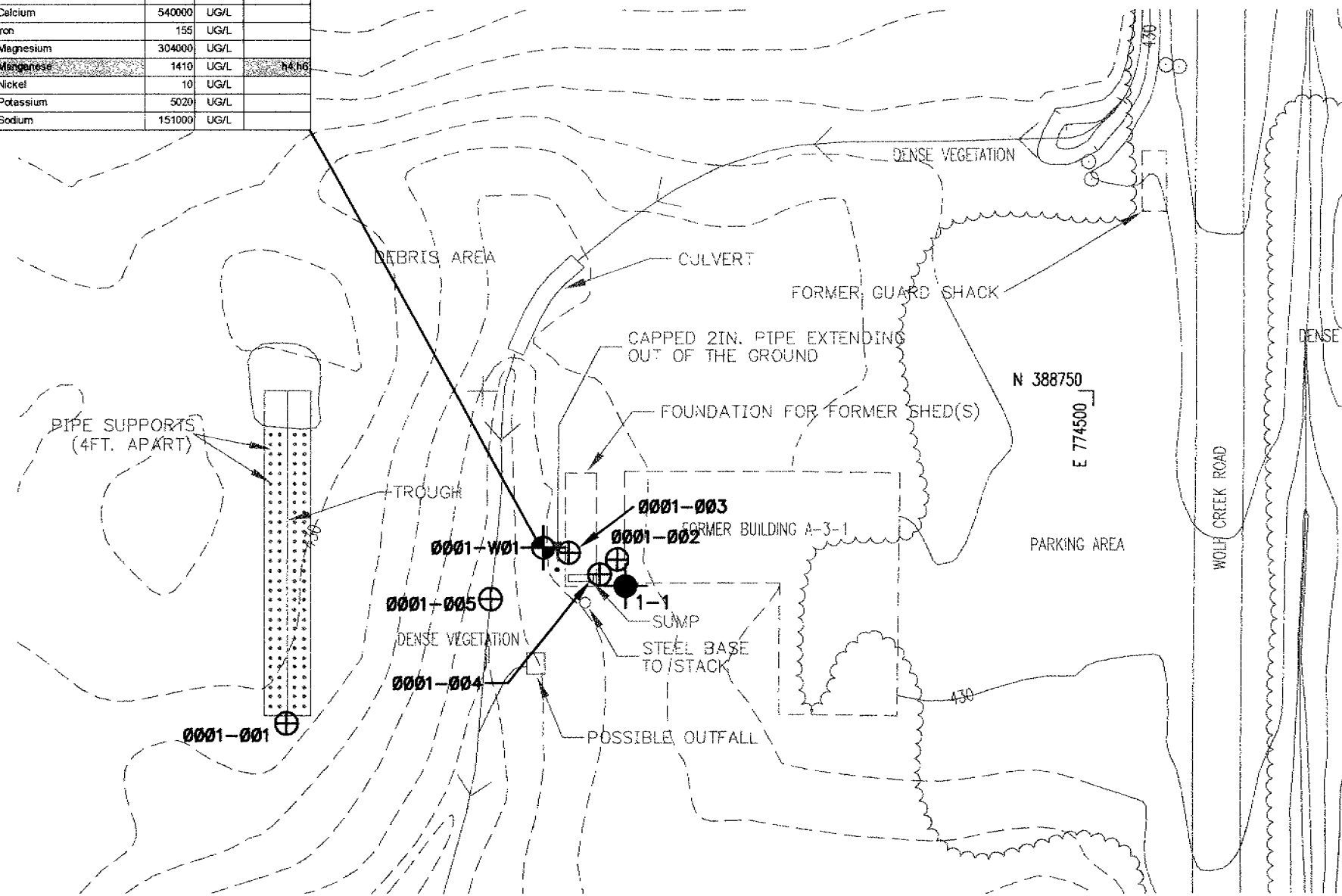


AUS-0001-W01-GW-00	Units	Result	Screening Codes
<b>Volatile Organic Compounds</b>			
Carbon disulfide	3 UG/L		
Trichloroethylene (TCE)	0.6 UG/L		
<b>Polynuclear Aromatic Hydrocarbons (PAHs)</b>			
All PAHs	ND UG/L		
<b>Metals</b>			
Aluminum	141 UG/L		
Barium	31.2 UG/L		
Boron	97.6 UG/L		
Calcium	54000 UG/L		
Iron	155 UG/L		
Magnesium	304000 UG/L		
Manganese	1410 UG/L	h4,h6	
Nickel	10 UG/L		
Potassium	5020 UG/L		
Sodium	151000 UG/L		

**LEGEND**

- ⊕ MONITORING WELL LOCATION
- ⊕ HAND AUGER LOCATION
- USEPA 1998 SAMPLE LOCATION (APPROXIMATE)

Screening Reference	Reference Code
AUS Background Soil UTL	b1
Little Grassy Background Sediment UTL	b2
Little Grassy Background Surface Water UTL	b3
Ecological Direct Exposure Pathway TRV - Soil	e1
Ecological Direct Exposure Pathway TRV - Sediment	e2
Ecological Direct Exposure Pathway TRV - Surface Water	e3
IEPA General Use Surface Water Quality Aquatic Life Toxicity	e4
Superfund Chemical Data Matrix Kow values (potential bioaccumulator)	e5
USEPA Region IX Industrial Soil PRG - cancerous	h1
USEPA Region IX Industrial Soil PRG - noncancerous	h2
USEPA Region IX Tap Water PRG - cancerous	h3
USEPA Region IX Tap Water PRG - noncancerous	h4
USEPA Region IX Migration to Groundwater PRG (DAF=1)	h5
USEPA MCL Drinking Water Standards	h6
IEPA TACO Industrial/Commercial Soil Ingestion	h7
IEPA TACO Construction Worker Soil Ingestion	h8
IEPA TACO Class I Soil Component of Groundwater	h9
IEPA General Use Surface Water Quality Human Health	h10



**NOTES:**

1. BASE TOPOGRAPHIC MAP PREPARED BY WALKER & ASSOCIATES, FROM FLYOVER IN JANUARY 2000. CONTOUR INTERVAL IS ONE FOOT.
2. DATA QUALIFIERS FOR ANALYTICAL RESULTS ARE NOT INDICATED. REFER TO THE QCSR FOR DATA QUALIFIERS.
3. THE FOLLOWING COMPOUNDS ARE INCLUDED IN THE ANALYTE LIST FOR BOTH SVOCs AND EXPLOSIVES: 2,4-DINITROTOLUENE, 2,6-DINITROTOLUENE AND NITROBENZENE. THESE COMPOUNDS MAY BE AS EITHER SVOCs OR EXPLOSIVES.

PA/SI REPORT-AUS OU CRAB ORCHARD NWR MARION, ILLINOIS	PROJECT NO. 2320000026.00
<b>URS</b>	
DRN. BY: djd 7/28/00 DSGN. BY: mam CHKD. BY: mch/cmw	FIG. NO. 30-4

**AUS-0001-IOP FIRE AND POLICE HEADQUARTERS**

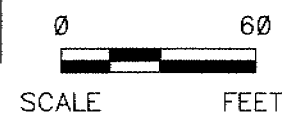


FIG. E:\2320000026.00\PA-SI REPORT-AUS OU\AUS-SAMPLE LOCATION 2\AUS-0001-IOP Loc1.dwg Lot1.dwg SEP. 24, 01 9:24 a.m. URS Corp.

AUS-0002, the Illinois Ordnance Plant (IOP) Administrative Area Wastewater Treatment Plant, is located approximately 0.1 miles south of Old Highway 13, on the west side of Wolf Creek Road.<sup>1</sup> The location of AUS-0002 is shown in Figure 30-1, along with the locations of other sites addressed in this volume.

### **AUS Original Site Designations**

AUS-0002 is one of the original Additional and Uncharacterized Sites Operable Unit (AUS OU) sites designated in 1997-1999 by the United States Fish & Wildlife Service (USFWS).

## **31.1 HISTORIC SEARCH INFORMATION**

### **31.1.1 Site Description**

During the IOP era, this small wastewater treatment plant (WWTP) served the Administration Area (Area 1)<sup>2</sup>. Area 1 is located just south of Old Highway 13, on the east side of Wolf Creek Road.

### **31.1.2 Operational History and Waste Characteristics**

This Administrative Area WWTP was originally constructed and operated by the Sherwin Williams Defense Corporation, under contract with the War Department (SWDC/War Department), as a part of the IOP. Although detailed drawings have not been identified, it appears from an IOP sewer distribution drawing that this WWTP may have also supported parts of Area 2.<sup>3</sup> Area 2 was an IOP industrial area (see Volume II of this report for a discussion of Area 2).

The WWTP consisted of a blockhouse with four treatment pits (on the west side of the building) and an assumed underground sewer line to the west emptying into two small lagoons.<sup>4</sup> The blockhouse and the four treatment pits were razed sometime between 1980 and 1993 according to historical aerial photographs.<sup>5</sup> The building debris may be buried on site. The building location, shown on Figure 31-1, was estimated based on the topography at the site and aerial photographic interpretation.

<sup>1</sup>To find the site from Old Highway 13—after turning south on Wolf Creek Road, it is the first field on the west. The east edge of the site is at the west edge of the field, and it extends approximately 300 ft west, into the wooded area.

<sup>2</sup> U.S. Army Corps of Engineers, 1944, War Department Facilities Inventory of the Illinois Ordnance Plant Carbondale, Illinois, Part I, Section 6, Page 3.

<sup>3</sup> U.S. Army Corps of Engineers, 1944, War Department Facilities Inventory of the Illinois Ordnance Plant Carbondale, Illinois, Part I, Section 6, Page 3.

<sup>4</sup> Entech, Inc., 1999, Historical Aerial Photographic Analysis – Inventory of Potential Disposal Sites: Additional and Uncharacterized Sites (AUS) Operable Unit, Crab Orchard National Wildlife Refuge, Marion, Illinois, Volume I (Text) Page 3-5, and Volume II (Maps) Page A. The Entech reports analyze historic aerial overflight photographs of industrial areas at the Refuge, from 1943 to 1993. The photos were obtained from the National Archives and Records Administration (NARA) and the U.S. Department of Agriculture Agricultural Stabilization and Conservation Service (ASCS).

<sup>5</sup> Entech, Inc., 1999, Historical Aerial Photographic Analysis – Inventory of Potential Disposal Sites: Additional and Uncharacterized Sites (AUS) Operable Unit, Crab Orchard National Wildlife Refuge, Marion, Illinois, Volume I (Text) Page 3-5.

The two lagoons were no longer visible on aerial photographs after 1943 (beginning in 1951).<sup>6</sup> They were not removed, but appear to have been obscured by tree cover; they were identified during the site reconnaissance in the middle of a wooded area. Although intact, they were difficult to find due to tree cover. The two lagoons were likely used for the storage of WWTP process waters. The lagoons do not appear to have outlet drains; however, an IOP document showed a ditch leading from the WWTP (likely from the lagoons) to Crab Orchard Lake, which is located about 0.2 mile to the southwest.<sup>7</sup>

No information was found indicating any industrial lessees for this plant. According to the historical aerial photograph interpretations, this plant appears to have been abandoned sometime between 1943 and 1951 (likely after SWDC/War Department left), as the former access road was no longer visible and the area had become vegetated.<sup>8</sup>

Solids that were discharged in the wastewater to the two lagoons may have contained some metals and explosives if this WWTP received wastewater from Area 2, as is suspected.

### **31.1.3 AUS-0002 Previous Sampling Results**

There has been no previous sampling at this site.

### **31.1.4 Observations During Site Visit**

There are no buildings remaining at this site, however the two WWTP lagoons are still in place. Other site features observed during the site reconnaissance are found in Figure 31-1 and are discussed in Section 31.1.2 above.

### **31.1.5 Recommendations Based on Preliminary Assessment**

AUS-0002 was included in the Site Investigation (SI) since this site was not investigated in the past and there is the possibility that contaminated sludge or other residues may be present in the two existing lagoons, especially if this WWTP received wastewater from Area 2 as well as Area 1.

## **31.2 SITE INVESTIGATION INFORMATION**

URS conducted a Site Investigation at AUS-0002 on May 3, 2000. The rationale for sample locations, media, and analytes is presented in the Field Sampling Plan (FSP)<sup>9</sup> for the AUS OU PA/SI. Since the time the FSP was prepared, additional information has become available, and

<sup>6</sup> Entech, Inc., 1999, Historical Aerial Photographic Analysis – Inventory of Potential Disposal Sites: Additional and Uncharacterized Sites (AUS) Operable Unit, Crab Orchard National Wildlife Refuge, Marion, Illinois, Volume I (Text) Page 3-5.

<sup>7</sup> U.S. Army Corps of Engineers, 1944, War Department Facilities Inventory of the Illinois Ordnance Plant Carbondale, Illinois, Part I, Section 6, Page 3.

<sup>8</sup> Entech, Inc., 1999, Historical Aerial Photographic Analysis – Inventory of Potential Disposal Sites: Additional and Uncharacterized Sites (AUS) Operable Unit, Crab Orchard National Wildlife Refuge, Marion, Illinois, Volume I (Text) Page 3-5.

<sup>9</sup> U.S. Fish & Wildlife Service, Department of the Interior, March 2000, Draft Final Field Sampling Plan Site Inspection, Additional and Uncharacterized Sites Operable Unit, Crab Orchard National Wildlife Refuge Superfund Site, Marion, Illinois (Williamson County), prepared by URS Corporation.

the historic discussion (Section 31.1) has been updated to include that information. The sampling locations discussed below are based on the information that was available at the time the FSP was developed, and may not address all areas of potential releases.

AUS OU SI sample locations are shown on Figure 31-1. Survey coordinates for all sample locations in AUS-0002 are listed in Table 31-1. Table 31-2 lists the sample locations and the matrix sampled at that location. All samples collected were soil except that a surface water sample was also collected at location 0002-005.

### **31.2.1 Field Investigation**

Sampling was done in accordance with the FSP, except as noted.

#### **WWTP Lagoons**

The main concerns at this former WWTP are the two lagoons that are located to the west of the former WWTP building. Samples 0002-002 and 0002-003 were collected from inside the lagoons and Sample 0002-001 was collected from the top of the berm that separates the two lagoons.

All samples were collected in accordance with the tables in the Field Sampling Plan except that the following planned surface water samples were not taken because no surface water was present at these locations during the field investigation:

- AUS-0002-002-SW-00
- AUS-0002-003-SW-00

#### **Drainageways**

Sample locations 0002-004 and 0002-005 were from a drainageway that flows to the northwest from south of the former WWTP building, towards the southwestern corner of the two lagoons. Location 0002-004 (soil) is in an area of the ditch that would likely receive runoff from the former WWTP building area and location 0002-005 (soil and surface water) is in an area of the drainageway that would likely receive overflow from the two lagoons.

All samples were collected in accordance with the tables in the Field Sampling Plan except that the following planned surface water sample was not taken because no surface water was present at this location during the field investigation:

- AUS-0002-004-SW-00

### **31.2.2 Field Results**

#### **31.2.2.1 Site Conditions**

##### **31.2.2.1.1 Geologic Conditions**

There were no test pits or monitoring wells installed at AUS-0002. Soil from hand auger borings, which extended to depths of two feet (ft), was described as silty clay fill.

**31.2.2.1.2 Hydrogeologic Conditions**

No hydrogeological information is available for this site.

**31.2.2.1.3 Hydrologic Conditions**

The main drainageway at the site is dammed at the southeast corner of the site to form a pond (Figure 31-1). This drainageway flows west-northwest and passes just to the south of the wastewater treatment lagoons. The wastewater treatment plant lagoons still hold surface water and are located in the northwest corner of the site. There is a small pond northeast of the site.

**31.2.2.2 Chemical Results**

The sample analytical results are summarized in the following tables:

- Table 31-3 – soil samples results, and
- Table 31-4 – surface water samples results.

These tables list all the chemicals detected in AUS-0002 during this investigation, along with the frequency and range of detections. Tabulated results of all analyses are included in the Quality Control Summary Report (QCSR). All analytical results are shown in Figure 31-1.

**31.3 SCREENING RISK ASSESSMENT**

Results of the screening are presented in Tables 31-5 through 31-8 as follows:

- Table 31-5--human health risk screening for soils,
- Table 31-6--human health risk screening for surface water,
- Table 31-7--ecological risk screening for soils, and
- Table 31-8--ecological risk screening for surface water.

Each table lists the maximum detected concentration for each constituent analyzed at AUS-0002. The screening results are presented in the tables in terms of hazard quotients (HQs). The HQ for any chemical detected, for any particular screening criterion is simply the ratio of the maximum detected concentration to the screening concentration. For human health for carcinogens, a screening level “cancer risk” is calculated instead of an HQ.

Chemicals that are shaded in the tables are those that exceeded the screening criteria, and are identified as chemicals of potential concern (COPCs) for human health risk, and chemicals of potential ecological concern (COPECs) for ecological risk. The only COPCs/COPECs not shaded in the table are those inorganic constituents that exceeded the screening criteria but were detected at levels below Refuge background.

In cases where the chemical was analyzed but not detected, the HQ is the ratio between the maximum reporting limit and the screening concentration. Chemicals not detected are identified with a “U” qualifier in the qualifier column. When these HQ values exceed one, they are not shaded. These constituents are not identified as COPCs/COPECs, but rather as uncertainties.

In Figure 31-1 the shading convention used is the same as for the tables discussed above. The particular screening criteria exceeded are indicated by the code in the analytical results labels. Duplicate results are shown only if the duplicate result for an analyte exceeded the screening criteria and the result from the original sample did not; or, if the analyte was detected in the duplicate and not in the original sample. Since in the screening process results which are qualified as estimated (coded with “J”) are treated the same as unqualified results, data qualifiers are not included in the results shown in the figures. Refer to the QCSR for data qualifiers.

Tables 31-9 (human health risk) and 31-10 (ecological risk) list all the analytes and corresponding media sampled and indicate whether each is a COPC (or COPEC), not a COPC (or COPEC), or an uncertainty. The codes in the tables indicate the rationale for each classification. All COPCs (Table 31-9) and COPECs (Table 31-10) are shaded in the tables.

### **31.3.1 Human Health Risk**

#### **31.3.1.1 Soil**

Human health screening results for soil samples are presented in Table 31-5. For carcinogens, a cancer risk was calculated using the United States Environmental Protection Agency (USEPA) Region 9 Industrial Soil Preliminary Remediation Goals (PRGs) as screening values. The cancer risk was derived by calculating a ratio of the maximum detected concentrations, or the maximum reporting limits, to their appropriate screening values. These ratios were then multiplied by  $1 \times 10^{-6}$ . In addition, ratios were calculated using the USEPA Region 9 Industrial Soil PRG for Toxins, the USEPA Region 9 Migration to Groundwater Criteria (Dilution Attenuation Factor (DAF)=1), the Illinois Tiered Approach to Corrective Action Objectives (TACO) Industrial/Commercial Soil Ingestion Criteria, the Illinois TACO Construction Worker Soil Ingestion Criteria, and the Illinois TACO Class I Soil Component of Groundwater Criteria.

#### **31.3.1.2 Surface Water**

Human health risk screening results for chemicals in surface water at AUS-0002 are presented in Table 31-6. The maximum concentrations from AUS-0002 were screened against the State of Illinois General Use Surface Water Quality Criteria – Human Health.

### **31.3.2 Ecological Risk**

#### **31.3.2.1 Soil**

Ecological screening results for soil samples are presented in Tables 31-7. Soil screening concentrations for direct exposures were developed using toxicity reference values (TRVs) derived from several sources, including the following:

- USEPA (2000)<sup>10</sup>
- Environment Canada (1995)<sup>11</sup>

<sup>10</sup> USEPA. 2000. Ecological Soil Screening Level Guidance (Draft). USEPA Office of Emergency and Remedial Response, Washington, DC.

- Talmage *et al.* (1999)<sup>12</sup>
- Efroymsen *et al.* (1997a, 1997b)<sup>13</sup>
- CCME (1999)<sup>14</sup>
- MHSPE (1994)<sup>15</sup>
- Other sources

A detailed discussion of the screening concentration selection is presented in Appendix G.

The screening approach for ingestion pathway exposures was based on the potential for a chemical to bioaccumulate. The potential for a chemical to bioaccumulate was based on the organic chemical-specific octanol-to-water partitioning coefficient ( $K_{ow}$ ), which provides an indication of the lipophilicity of an organic chemical, and its potential for sequestration in biological tissue. The document *Assessment and Control of Bioconcentratable Contaminants in Surface Waters* (USEPA 1991)<sup>16</sup> used a log  $K_{ow}$  of 3.5 as a target threshold value indicative of bioaccumulative chemicals to target organic chemicals of greatest concern. Using this as a guideline, organic chemicals with a log  $K_{ow}$  greater than 3.5 were considered potentially bioaccumulative chemicals. Among inorganics, mercury and selenium were considered as potentially bioaccumulative chemicals. Any potentially bioaccumulative chemical that is detected was retained as a COPEC.

### 31.3.2.2 Surface Water

Ecological screening results for surface water samples are presented in Table 31-8. TRVs for direct exposure by aquatic organisms in surface water were obtained from:

- Illinois water quality standards
- National Recommended Ambient Water Quality Criteria (USEPA 1999a)<sup>17</sup>
- EcoTox (USEPA 1996)<sup>18</sup>

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<sup>11</sup> Environment Canada. 1995. Toxicity Testing of NCSR Priority Substances for Development of Soil Quality Guidelines for Contaminated Sites. Guidelines Division, Evaluation and Interpretation Branch, Environmental Conservation Directorate, Environment Canada. Hull, Quebec.

<sup>12</sup> Talmage, S.S., D.M. Opresko, C.J. Maxwell, C.J.E. Welsh, F. M. Cretella, P.H. Reno, and F. B. Daniel. 1999. Nitroaromatic Munition Compounds: Environmental Effects and Screening Values. *Rev Environ. Contam. Toxicol* 161:1-156.

<sup>13</sup> Efroymsen, R.A., M.E. Will, G.W. Suter II, and A.C. Wooten. 1997a. *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision*. Oak Ridge National Laboratory, Oak Ridge, Tennessee. ES/ER/TM-85/R3.

Efroymsen, R.A., M.E. Will, and G.W. Suter II. 1997b. *Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision*. Oak Ridge National Laboratory, Oak Ridge, Tennessee. ES/ER/TM-126/R2.

<sup>14</sup> Canadian Council of Ministers of the Environment. 1999. Canadian Environmental Quality Guidelines.

<sup>15</sup> Ministry of Housing, Spatial Planning, and the Environment (MHSPE). 1994. *Intervention Values and Target Values – Soil Quality Standards*. Directorate General for Environmental Protection, Department of Soil Protection, The Hague, The Netherlands.

<sup>16</sup> USEPA 1991. *Assessment and Control of Bioconcentratable Contaminants in Surface Waters (Draft)*. US Environmental Protection Agency Office of Research and Development, Washington, D.C.

<sup>17</sup> USEPA. 1999a. National Recommended Water Quality Criteria--Correction. Office of Water. EPA 822-Z-99-001. April.

<sup>18</sup> USEPA. 1996. ECO Update: Ecotox Thresholds. EPA-540/F-95/038. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response. Washington, D.C. 12pp.

- USEPA Region IV Freshwater Screening Values (1999b)<sup>19</sup>
- Maximum Acceptable Toxicant Concentrations (MATCs) or lowest observed effect concentrations (LOECs) obtained from the USEPA Assessment Tools for the Evaluation of Risk database (ASTER 2000)<sup>20</sup>
- Other sources

The Illinois water quality standards are believed to be the most relevant, followed by national recommended ambient water quality criteria. EcoTox reports values based on ambient water quality criteria, and Tier II water quality criteria have been developed in the absence of sufficient information to support a national recommended water quality criterion using guidelines outlined in the Great Lakes Water Quality Initiative. Remaining sources were prioritized based on relevance to the area and professional judgment. The detailed discussion of the approach for selecting a single ecological screening value (ESV) from among the multiple sources is presented in Appendix G.

The screening approach for ingestion pathway exposures was the same as for soils as presented in Section 31.3.2.1.

#### **31.4 SCIENTIFIC MANAGEMENT DECISION POINT**

A Remedial Investigation (RI) is recommended for Site AUS-0002, based on exceedances of the SI screening criteria.

This report recommends that inorganic constituents that exceeded project screening criteria but were within Refuge background levels not necessarily be retained as COPCs/COPECs for further evaluation. These are the constituents coded with “D” on the COPC list, Table 31-9 and on the COPEC list, Table 31-10. COPCs in this category include arsenic, barium, nickel, and selenium in soil. COPECs coded with “D” on Table 31-10 include vanadium in surface water; and boron, manganese, and selenium in soil. These chemicals may later be included in the RI for other reasons, but the detections at the locations noted are not considered to be of concern since they are below Refuge background levels. All other COPCs/COPECs listed on these tables should be investigated in the RI. In addition, all analytes listed as uncertainties on these tables should be considered for further evaluation in the RI Work Plan.

Chemicals that exceeded screening criteria and Refuge background (if applicable) are listed in Table 31-11.

Note that a number of the human health COPCs exceed migration to groundwater screening criteria. Groundwater has not been investigated at this site, and based on these data, should be

<sup>19</sup> USEPA. 1999b. Region IV Ecological Risk Assessment Bulletins – Supplement to RAGS. Available at <http://www.epa.gov/region4/waste/oftecser/ecolbul.htm>.

<sup>20</sup> ASTER. 2000. Assessment Tools for Evaluation of Risk Database. United States Environmental Protection Agency, Office of Research and Development.



considered in the RI. Other areas of the site and media and contaminants in addition to those addressed in this study may warrant investigation in the RI. These issues will be addressed in the work plan for the RI.

**TABLE 31-1  
SURVEY COORDINATES FOR SAMPLE LOCATIONS IN AUS-0002**

<b>Sample Location</b>	<b>Northing</b>	<b>Easting</b>	<b>Ground Surface Elevation</b>	<b>Top of Casing Elevation</b>	<b>Comments</b>
0002-001	390190.1	773369.6	418.58	NA	
0002-002	390180.6	773355.1	413.85	NA	
0002-003	390203.2	773342.2	414.37	NA	
0002-004	390062.7	773632.8	424.89	NA	
0002-005	390195.3	773294.9	410.99	NA	

Sheet 1 of 1

NA = Not Applicable

**TABLE 31-2  
MATRICES SAMPLED AT EACH SAMPLE LOCATION AT AUS-0002**

<b>Soil</b>	<b>Surface Water</b>
AUS-0002-001	AUS-0002-005
AUS-0002-002*	
AUS-0002-003*	
AUS-0002-004*	
AUS-0002-005*	

Sheet 1 of 1

- \* Note that the samples at this location were originally designated as sediment, but are actually soil samples.

TABLE 31-3  
SOIL SAMPLE ANALYTICAL RESULTS SUMMARY

Constituents	Number of Detections	Range of Detections
<b>Volatile Organic Compounds</b>		
Toluene	1/1	2 ug/kg
<b>Metals</b>		
Aluminum	5/5	9,690 mg/kg to 18,800 mg/kg
Antimony	3/5	0.27 mg/kg to 7.7 mg/kg
Arsenic	4/5	5.5 mg/kg to 6.9 mg/kg
Barium	5/5	97.5 mg/kg to 163 mg/kg
Beryllium	5/5	0.41 mg/kg to 0.6 mg/kg
Boron	3/5	1.1 mg/kg to 1.7 mg/kg
Cadmium	2/5	1.4 mg/kg to 2 mg/kg
Calcium	5/5	712 mg/kg to 6,430 mg/kg
Chromium, Total	5/5	14.7 mg/kg to 737 mg/kg
Cobalt	5/5	5.3 mg/kg to 9.9 mg/kg
Copper	5/5	8.7 mg/kg to 35.8 mg/kg
Iron	5/5	14,700 mg/kg to 20,700 mg/kg
Lead	5/5	14 mg/kg to 70.8 mg/kg
Magnesium	5/5	1,320 mg/kg to 2,500 mg/kg
Manganese	5/5	162 mg/kg to 1,660 mg/kg
Mercury	5/5	0.022 mg/kg to 0.37 mg/kg
Nickel	5/5	8.9 mg/kg to 12.9 mg/kg
Potassium	5/5	687 mg/kg to 1,300 mg/kg
Selenium	1/5	0.47 mg/kg
Silver	4/5	0.46 mg/kg to 98.7 mg/kg
Sodium	5/5	52.3 mg/kg to 142 mg/kg
Thallium	1/5	0.81 mg/kg
Vanadium	5/5	25.4 mg/kg to 34.3 mg/kg
Zinc	5/5	30.6 mg/kg to 226 mg/kg

Sheet 1 of 1

mg/kg = milligrams per kilogram  
ug/kg = micrograms per kilogram

Notes: This table was derived from the figures that show the analytical results. As a result, duplicates are included only when the duplicate results are greater than original sample results, or when an analyte was detected in a duplicate and not in the original sample. There may be some duplicate results, not shown in the table, that are lower than the low end of the range shown. In addition, the frequency and range of detections is based on the number of sample locations, not the total number of samples (the total number of samples includes originals plus duplicates).

Checked by: MMF 7/20/01

TABLE 31-4  
SURFACE WATER SAMPLE ANALYTICAL RESULTS SUMMARY

Constituents	Number of Detections	Range of Detections
<b>Metals</b>		
Aluminum	1/1	12,500 ug/L
Arsenic	1/1	5.1 ug/L
Barium	1/1	139 ug/L
Boron	1/1	13.2 ug/L
Calcium	1/1	15,900 ug/L
Chromium, Total	1/1	13.3 ug/L
Copper	1/1	3.4 ug/L
Iron	1/1	8,260 ug/L
Lead	1/1	4.8 ug/L
Magnesium	1/1	6,140 ug/L
Manganese	1/1	1,810 ug/L
Nickel	1/1	11.7 ug/L
Potassium	1/1	6,490 ug/L
Selenium	1/1	3.4 ug/L
Sodium	1/1	7,290 ug/L
Vanadium	1/1	21 ug/L
Zinc	1/1	22.1 ug/L

Sheet 1 of 1

ug/L = micrograms per Liter

Notes: This table was derived from the figures that show the analytical results. As a result, duplicates are included only when the duplicate results are greater than original sample results, or when an analyte was detected in a duplicate and not in the original sample. There may be some duplicate results, not shown in the table, that are lower than the low end of the range shown. In addition, the frequency and range of detections is based on the number of sample locations, not the total number of samples (the total number of samples includes originals plus duplicates).

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**TABLE 31-5  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0002**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
<b>Volatile Organic Compounds</b>								
71-55-6	1,1,1-Trichloroethane	6	U	UG/KG			1.80E-06	6.00E-02
79-34-5	1,1,2,2-Tetrachloroethane	6	U	UG/KG		6.68E-09	1.54E-06	3.00E+01
79-00-5	1,1,2-Trichloroethane	6	U	UG/KG		3.16E-09	3.94E-05	6.67E+00
75-34-3	1,1-Dichloroethane	6	U	UG/KG			2.91E-06	6.00E-03
75-35-4	1,1-Dichloroethene	6	U	UG/KG		5.05E-08	8.91E-05	2.00E+00
107-06-2	1,2-Dichloroethane (EDC)	6	U	UG/KG		7.85E-09	1.70E-04	6.00E+00
540-59-0	1,2-Dichloroethene (total)	6	U	UG/KG			4.07E-05	3.00E-01
78-87-5	1,2-Dichloropropane	6	U	UG/KG		7.81E-09	2.82E-04	6.00E+00
78-93-3	2-Butanone (MEK)	12	U	UG/KG			4.33E-07	
591-78-6	2-Hexanone	12	U	UG/KG				
108-10-1	4-Methyl-2-pentanone (MIBK)	12	U	UG/KG			4.16E-06	
67-64-1	Acetone	30	U	UG/KG			4.82E-06	3.75E-02
71-43-2	Benzene	6	U	UG/KG		4.10E-09	2.48E-04	3.00E+00
75-27-4	Bromodichloromethane	6	U	UG/KG		2.55E-09	5.75E-06	2.00E-01
75-25-2	Bromoform	6	U	UG/KG		1.92E-11	3.41E-07	1.50E-01
74-83-9	Bromomethane	6	U	UG/KG			4.57E-04	6.00E-01
75-15-0	Carbon disulfide	6	U	UG/KG			4.96E-06	3.00E-03
56-23-5	Carbon tetrachloride	6	U	UG/KG		1.13E-08	8.58E-04	2.00E+00
108-90-7	Chlorobenzene	6	U	UG/KG			1.11E-05	8.57E-02
75-00-3	Chloroethane	6	U	UG/KG		9.22E-10	3.18E-07	
67-66-3	Chloroform	6	U	UG/KG		1.15E-08	4.66E-03	2.00E-01
74-87-3	Chloromethane	6	U	UG/KG		2.25E-09		
156-59-2	cis-1,2-Dichloroethene	6	U	UG/KG			4.07E-05	3.00E-01

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 31-5  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0002**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
10061-01-5	cis-1,3-Dichloropropene	6	U	UG/KG		3.37E-08	1.36E-04	
124-48-1	Dibromochloromethane	6	U	UG/KG		2.26E-09	3.77E-06	3.00E-01
100-41-4	Ethylbenzene	6	U	UG/KG			1.00E-06	8.57E-03
75-09-2	Methylene chloride	6	U	UG/KG		2.92E-10	6.14E-07	6.00E+00
110-54-3	N-Hexane	6	U	UG/KG			1.49E-05	
100-42-5	Styrene	6	U	UG/KG			2.94E-07	3.00E-02
127-18-4	Tetrachloroethylene (PCE)	6	U	UG/KG		3.21E-10	3.52E-06	2.00E+00
108-88-3	Toluene	2	J	UG/KG			1.01E-06	3.33E-03
1330-20-7	total Xylenes	6	U	UG/KG			1.35E-06	6.00E-04
156-60-5	trans-1,2-Dichloroethene	6	U	UG/KG			2.80E-05	2.00E-01
10061-02-6	trans-1,3-Dichloropropene	6	U	UG/KG		3.37E-08	1.36E-04	
79-01-6	Trichloroethylene (TCE)	6	U	UG/KG		9.81E-10	7.59E-05	2.00E+00
75-01-4	Vinyl chloride	6	U	UG/KG		1.23E-07		8.57E-00
<b>Explosives</b>								
99-35-4	1,3,5-Trinitrobenzene	430	U	UG/KG			1.63E-05	
99-65-0	1,3-Dinitrobenzene	430	U	UG/KG			4.88E-03	
118-96-7	2,4,6-Trinitrotoluene (TNT)	860	U	UG/KG		1.05E-08	1.95E-03	
121-14-2	2,4-Dinitrotoluene	430	U	UG/KG			2.44E-04	1.08E+04
606-20-2	2,6-Dinitrotoluene	860	U	UG/KG			9.76E-04	2.87E+04
35572-78-2	2-Amino-4,6-Dinitrotoluene	860	U	UG/KG				
88-72-2	2-Nitrotoluene (ONT)	860	U	UG/KG				
99-08-1	3-Nitrotoluene	860	U	UG/KG			4.23E-04	
19406-51-0	4-Amino-2,6-Dinitrotoluene	860	U	UG/KG				
99-99-0	4-Nitrotoluene (PNT)	860	U	UG/KG			4.23E-04	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 31-5  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0002**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
2691-41-0	HMX	860	U	UG/KG			1.95E-05	
98-95-3	Nitrobenzene	430	U	UG/KG			3.76E-03	
121-82-4	RDX	860	U	UG/KG		3.84E-08	3.25E-04	
479-45-8	Tetryl	1300	U	UG/KG			1.48E-04	
<b>Metals</b>								
7429-90-5	Aluminum	18800		MG/KG	6.53E-01		1.12E-02	
7440-36-0	Antimony	7.7		MG/KG	9.28E+00		9.42E-03	2.57E+01
7440-38-2	Arsenic	6.9		MG/KG	5.11E-01	2.53E-06	1.57E-02	6.90E+00
7440-39-3	Barium	163		MG/KG	8.36E-01		1.31E-03	2.04E+00
7440-41-7	Beryllium	0.6	J	MG/KG	7.89E-01	2.68E-10	1.62E-04	2.00E-01
7440-42-8	Boron	1.7	J	MG/KG	3.21E-01		2.15E-05	
7440-43-9	Cadmium	2		MG/KG	1.05E+01	6.69E-10	2.47E-03	5.00E+00
7440-70-2	Calcium	6430		MG/KG	2.58E+00			
7440-47-3	Chromium	737		MG/KG	2.92E+01	1.64E-06		3.69E+02
7440-48-4	Cobalt	9.9		MG/KG	4.56E-01		8.07E-05	
7440-50-8	Copper	35.8		MG/KG	3.17E+00		4.72E-04	
7439-89-6	Iron	20700		MG/KG	1.07E+00		3.38E-02	
7439-92-1	Lead	70.8		MG/KG	3.03E+00			
7439-95-4	Magnesium	2500		MG/KG	1.61E+00			
7439-96-5	Manganese	1660		MG/KG	4.56E-01		5.15E-02	
7439-97-6	Mercury	0.37		MG/KG	6.17E+00			
7440-02-0	Nickel	12.9		MG/KG	6.83E-01		3.16E-04	1.84E+00
2023695	Potassium	1300		MG/KG	2.08E+00			
7782-49-2	Selenium	0.47	J	MG/KG	2.01E-01		4.60E-05	1.57E+00

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect



**TABLE 31-5  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0002**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
7440-22-4	Silver	98.7		MG/KG	1.70E+02		9.66E-03	4.94E+01
7440-23-5	Sodium	142		MG/KG	8.35E-01			
7440-28-0	Thallium	0.81	J	MG/KG	1.98E+00		5.66E-06	
7440-62-2	Vanadium	34.3		MG/KG	7.27E-01		2.40E-03	1.14E-01
7440-66-6	Zinc	226		MG/KG	4.40E+00		3.69E-04	3.77E-01

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 31-5**  
**HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0002**

**ADDITIONAL AND UNCHARACTERIZED SITES OU**  
**CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
<b>Volatile Organic Compounds</b>							
71-55-6	1,1,1-Trichloroethane	6	U	UG/KG			3.00E-03
79-34-5	1,1,2,2-Tetrachloroethane	6	U	UG/KG			
79-00-5	1,1,2-Trichloroethane	6	U	UG/KG	7.32E-07	7.32E-07	3.00E-01
75-34-3	1,1-Dichloroethane	6	U	UG/KG	3.00E-08	3.00E-08	2.61E-04
75-35-4	1,1-Dichloroethene	6	U	UG/KG	3.33E-07	3.33E-06	1.00E-01
107-06-2	1,2-Dichloroethane (EDC)	6	U	UG/KG	9.52E-05	4.29E-06	3.00E-01
540-59-0	1,2-Dichloroethene (total)	6	U	UG/KG	3.00E-07	3.00E-07	1.50E-02
78-87-5	1,2-Dichloropropane	6	U	UG/KG	7.14E-05	3.33E-06	2.00E-01
78-93-3	2-Butanone (MEK)	12	U	UG/KG			
591-78-6	2-Hexanone	12	U	UG/KG			
108-10-1	4-Methyl-2-pentanone (MIBK)	12	U	UG/KG			
67-64-1	Acetone	30	U	UG/KG	1.50E-07	1.50E-07	1.88E-03
71-43-2	Benzene	6	U	UG/KG	3.00E-05	1.40E-06	2.00E-01
75-27-4	Bromodichloromethane	6	U	UG/KG	6.52E-05	3.00E-06	1.00E-02
75-25-2	Bromoform	6	U	UG/KG	8.33E-06	3.75E-07	7.50E-03
74-83-9	Bromomethane	6	U	UG/KG	2.07E-06	6.00E-06	3.00E-02
75-15-0	Carbon disulfide	6	U	UG/KG	3.00E-08	3.00E-07	1.88E-04
56-23-5	Carbon tetrachloride	6	U	UG/KG	1.36E-04	1.46E-05	8.57E-02
108-90-7	Chlorobenzene	6	U	UG/KG	1.46E-07	1.46E-06	6.00E-03
75-00-3	Chloroethane	6	U	UG/KG			
67-66-3	Chloroform	6	U	UG/KG	6.38E-06	3.00E-06	1.00E-02
74-87-3	Chloromethane	6	U	UG/KG			
156-59-2	cis-1,2-Dichloroethene	6	U	UG/KG	3.00E-07	3.00E-07	1.50E-02

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
 J = Estimated U = Nondetect

**TABLE 31-5  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0002**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
10061-01-5	cis-1,3-Dichloropropene	6	U	UG/KG			
124-48-1	Dibromochloromethane	6	U	UG/KG	1.46E-07	1.46E-07	1.50E-02
100-41-4	Ethylbenzene	6	U	UG/KG	3.00E-08	3.00E-07	4.62E-04
75-09-2	Methylene chloride	6	U	UG/KG	7.89E-06	5.00E-07	3.00E-01
110-54-3	N-Hexane	6	U	UG/KG			
100-42-5	Styrene	6	U	UG/KG	1.46E-08	1.46E-07	1.50E-03
127-18-4	Tetrachloroethylene (PCE)	6	U	UG/KG	5.45E-05	2.50E-06	1.00E-01
108-88-3	Toluene	2	J	UG/KG	4.88E-09	4.88E-09	1.67E-04
1330-20-7	total Xylenes	6	U	UG/KG	6.00E-09	1.46E-08	4.00E-05
156-60-5	trans-1,2-Dichloroethene	6	U	UG/KG	1.46E-07	1.46E-07	8.57E-03
10061-02-6	trans-1,3-Dichloropropene	6	U	UG/KG			
79-01-6	Trichloroethylene (TCE)	6	U	UG/KG	1.15E-05	5.00E-06	1.00E-01
75-01-4	Vinyl chloride	6	U	UG/KG	2.00E-03	9.23E-05	6.00E-01
<b>Explosives</b>							
99-35-4	1,3,5-Trinitrobenzene	430	U	UG/KG			
99-65-0	1,3-Dinitrobenzene	430	U	UG/KG			
118-96-7	2,4,6-Trinitrotoluene (TNT)	860	U	UG/KG			
121-14-2	2,4-Dinitrotoluene	430	U	UG/KG	5.12E-02	2.39E-03	5.38E+02
606-20-2	2,6-Dinitrotoluene	860	U	UG/KG	1.02E-01	4.78E-03	1.23E+03
35572-78-2	2-Amino-4,6-Dinitrotoluene	860	U	UG/KG			
88-72-2	2-Nitrotoluene (ONT)	860	U	UG/KG			
99-08-1	3-Nitrotoluene	860	U	UG/KG			
19406-51-0	4-Amino-2,6-Dinitrotoluene	860	U	UG/KG			
99-99-0	4-Nitrotoluene (PNT)	860	U	UG/KG			

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 31-5  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0002**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
2691-41-0	HMX	860	U	UG/KG			
98-95-3	Nitrobenzene	430	U	UG/KG	4.30E-04	4.30E-04	4.30E+00
121-82-4	RDX	860	U	UG/KG			
479-45-8	Tetryl	1300	U	UG/KG			
<b>Metals</b>							
7429-90-5	Aluminum	18800		MG/KG			
7440-36-0	Antimony	7.7		MG/KG	9.39E-03	9.39E-02	1.54E+00
7440-38-2	Arsenic	6.9		MG/KG	2.30E+00	1.13E-01	2.46E-01
7440-39-3	Barium	163		MG/KG	1.16E-03	1.16E-02	1.36E-01
7440-41-7	Beryllium	0.6	J	MG/KG	6.00E-01	2.07E-02	9.09E-02
7440-42-8	Boron	1.7	J	MG/KG	9.44E-06	9.44E-05	
7440-43-9	Cadmium	2		MG/KG	1.00E-03	1.00E-02	5.41E-01
7440-70-2	Calcium	6430		MG/KG			
7440-47-3	Chromium	737		MG/KG	7.37E-02	1.80E-01	2.63E+01
7440-48-4	Cobalt	9.9		MG/KG	8.25E-05	8.25E-04	
7440-50-8	Copper	35.8		MG/KG	4.37E-04	4.37E-03	3.25E-03
7439-89-6	Iron	20700		MG/KG			
7439-92-1	Lead	70.8		MG/KG	1.77E-01	1.77E-01	
7439-95-4	Magnesium	2500		MG/KG			
7439-96-5	Manganese	1660		MG/KG	1.73E-02	1.73E-01	
7439-97-6	Mercury	0.37		MG/KG	6.07E-04	6.07E-03	2.47E+00
7440-02-0	Nickel	12.9		MG/KG	3.15E-04	3.15E-03	1.70E-01
2023695	Potassium	1300		MG/KG			
7782-49-2	Selenium	0.47	J	MG/KG	4.70E-05	4.70E-04	1.96E-01

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 31-5  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0002**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
7440-22-4	Silver	98.7		MG/KG	9.87E-03	9.87E-02	6.58E+01
7440-23-5	Sodium	142		MG/KG			
7440-28-0	Thallium	0.81	J	MG/KG	5.06E-03	5.06E-03	3.38E-01
7440-62-2	Vanadium	34.3		MG/KG	2.45E-03	2.45E-02	3.50E-02
7440-66-6	Zinc	226		MG/KG	3.70E-04	3.70E-03	6.28E-02

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 31-6  
HUMAN HEALTH SCREENING OF SURFACE WATER RESULTS FROM AUS-0002**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (Surface Water)	Ratio of Max Concentration (or Max RL) to IEPA General Use Surface Water Quality Criteria - Human Health
<b>Semivolatile Organic Compounds</b>						
120-82-1	1,2,4-Trichlorobenzene	10	U	UG/L		
95-50-1	1,2-Dichlorobenzene	10	U	UG/L		
541-73-1	1,3-Dichlorobenzene	10	U	UG/L		
106-46-7	1,4-Dichlorobenzene	10	U	UG/L		
95-95-4	2,4,5-Trichlorophenol	50	U	UG/L		
88-06-2	2,4,6-Trichlorophenol	10	U	UG/L		
120-83-2	2,4-Dichlorophenol	10	U	UG/L		
105-67-9	2,4-Dimethylphenol	10	U	UG/L		
51-28-5	2,4-Dinitrophenol	50	U	UG/L		
91-58-7	2-Chloronaphthalene	10	U	UG/L		
95-57-8	2-Chlorophenol	10	U	UG/L		
91-57-6	2-Methylnaphthalene	10	U	UG/L		2.86E-03
95-48-7	2-Methylphenol	10	U	UG/L		
88-74-4	2-Nitroaniline	50	U	UG/L		
88-75-5	2-Nitrophenol	10	U	UG/L		
91-94-1	3,3'-Dichlorobenzidine	20	U	UG/L		
99-09-2	3-Nitroaniline	50	U	UG/L		
534-52-1	4,6-Dinitro-2-methylphenol	50	U	UG/L		
101-55-3	4-Bromophenyl phenyl ether	10	U	UG/L		
59-50-7	4-Chloro-3-methylphenol	10	U	UG/L		
106-47-8	4-Chloroaniline	20	U	UG/L		
7005-72-3	4-Chlorophenyl phenyl ether	10	U	UG/L		
106-44-5	4-Methylphenol	10	U	UG/L		
100-01-6	4-Nitroaniline	50	U	UG/L		
100-02-7	4-Nitrophenol	50	U	UG/L		
83-32-9	Acenaphthene	10	U	UG/L		
208-96-8	Acenaphthylene	10	U	UG/L		2.86E-03
120-12-7	Anthracene	10	U	UG/L		2.86E-04
56-55-3	Benzo(a)anthracene	10	U	UG/L		1.00E+02
50-32-8	Benzo(a)pyrene	10	U	UG/L		1.00E+03
205-99-2	Benzo(b)fluoranthene	10	U	UG/L		1.00E+02
191-24-2	Benzo(g,h,i)perylene	10	U	UG/L		2.86E-03
207-08-9	Benzo(k)fluoranthene	10	U	UG/L		
111-91-1	bis(2-Chloroethoxy)methane	10	U	UG/L		
111-44-4	bis(2-Chloroethyl) ether	10	U	UG/L		
108-60-1	bis(2-Chloroisopropyl) ether	10	U	UG/L		
117-81-7	bis(2-Ethylhexyl) phthalate (DEHP)	10	U	UG/L		
85-68-7	Butyl benzyl phthalate	10	U	UG/L		
86-74-8	Carbazole	10	U	UG/L		

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J = Estimated U = Nondetect

**TABLE 31-6  
HUMAN HEALTH SCREENING OF SURFACE WATER RESULTS FROM AUS-0002**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (Surface Water)	Ratio of Max Concentration (or Max RL) to IEPA General Use Surface Water Quality Criteria - Human Health
218-01-9	Chrysene	10	U	UG/L		1.00E+00
84-74-2	Di-n-butyl phthalate	10	U	UG/L		
117-84-0	Di-n-octyl phthalate	10	U	UG/L		
53-70-3	Dibenz(a,h)anthracene	10	U	UG/L		
132-64-9	Dibenzofuran	10	U	UG/L		
84-66-2	Diethyl phthalate	10	U	UG/L		
131-11-3	Dimethyl phthalate	10	U	UG/L		
206-44-0	Fluoranthene	10	U	UG/L		8.33E-02
86-73-7	Fluorene	10	U	UG/L		2.22E-03
118-74-1	Hexachlorobenzene	10	U	UG/L		
87-68-3	Hexachlorobutadiene	10	U	UG/L		
77-47-4	Hexachlorocyclopentadiene	10	U	UG/L		
67-72-1	Hexachloroethane	10	U	UG/L		
193-39-5	Indeno(1,2,3-c,d)pyrene	10	U	UG/L		1.00E+02
78-59-1	Isophorone	10	U	UG/L		
621-64-7	N-Nitroso-di-n-propylamine	10	U	UG/L		
86-30-6	N-Nitrosodiphenylamine	10	U	UG/L		
91-20-3	Naphthalene	10	U	UG/L		
87-86-5	Pentachlorophenol	50	U	UG/L		
85-01-8	Phenanthrene	10	U	UG/L		2.86E-03
108-95-2	Phenol	10	U	UG/L	1.00E+00	1.00E-01
129-00-0	Pyrene	10	U	UG/L		2.86E-03
<b>Explosives</b>						
99-35-4	1,3,5-Trinitrobenzene	0.25	UJ	UG/L		
99-65-0	1,3-Dinitrobenzene	0.25	UJ	UG/L		
118-96-7	2,4,6-Trinitrotoluene (TNT)	0.5	UJ	UG/L		
121-14-2	2,4-Dinitrotoluene	0.25	UJ	UG/L		
606-20-2	2,6-Dinitrotoluene	0.5	UJ	UG/L		
35572-78-2	2-Amino-4,6-Dinitrotoluene	0.5	UJ	UG/L		
88-72-2	2-Nitrotoluene (ONT)	0.5	UJ	UG/L		
99-08-1	3-Nitrotoluene	0.5	UJ	UG/L		
19406-51-0	4-Amino-2,6-Dinitrotoluene	0.5	UJ	UG/L		
99-99-0	4-Nitrotoluene (PNT)	0.5	UJ	UG/L		
2691-41-0	HMX	0.5	UJ	UG/L		
98-95-3	Nitrobenzene	0.25	UJ	UG/L		
121-82-4	RDX	0.5	UJ	UG/L		
479-45-8	Tetryl	0.75	UJ	UG/L		
<b>Metals</b>						
7429-90-5	Aluminum	12500		UG/L	6.25E+01	
7440-36-0	Antimony	6	U	UG/L	1.00E+00	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 31-6  
HUMAN HEALTH SCREENING OF SURFACE WATER RESULTS FROM AUS-0002**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (Surface Water)	Ratio of Max Concentration (or Max RL) to IEPA General Use Surface Water Quality Criteria - Human Health
7440-38-2	Arsenic	5.1	J	UG/L	5.10E-01	
7440-39-3	Barium	139	J	UG/L	6.12E+00	2.78E-02
7440-41-7	Beryllium	5	U	UG/L	1.00E+00	
7440-42-8	Boron	13.2	J	UG/L		1.32E-02
7440-43-9	Cadmium	5	U	UG/L	1.00E+00	
7440-70-2	Calcium	15900		UG/L	2.21E+00	
7440-47-3	Chromium	13.3		UG/L	1.33E+00	
7440-48-4	Cobalt	50	U	UG/L	1.00E+00	
7440-50-8	Copper	3.4	J	UG/L	3.40E-01	
7439-89-6	Iron	8260		UG/L	8.26E+01	8.26E+00
7439-92-1	Lead	4.8		UG/L	2.40E+00	
7439-95-4	Magnesium	6140		UG/L	2.42E+00	
7439-96-5	Manganese	1810		UG/L	3.11E+00	1.81E+00
7439-97-6	Mercury	0.2	U	UG/L	1.00E+00	1.67E+01
7440-02-0	Nickel	11.7		UG/L	1.17E+00	1.17E-02
2023695	Potassium	6490		UG/L	4.02E+00	
7782-49-2	Selenium	3.4	J	UG/L	1.26E+00	3.40E-03
7440-22-4	Silver	10	U	UG/L		2.00E+00
7440-23-5	Sodium	7290		UG/L	2.30E+00	
7440-28-0	Thallium	10	U	UG/L	1.00E+00	
7440-62-2	Vanadium	21	J	UG/L	4.20E-01	
7440-66-6	Zinc	22.1		UG/L	1.11E+00	2.21E-02

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J = Estimated U = Nondetect



**TABLE 31-7  
ECOLOGICAL SCREENING OF SOIL RESULTS FROM AUS-0002**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Background (SOIL)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ) (SOIL)	Retained as Potential Bioaccumulator
<b>Volatile Organic Compounds</b>							
71-55-6	1,1,1-Trichloroethane		6	U	UG/KG	2.01E-04	
79-34-5	1,1,2,2-Tetrachloroethane		6	U	UG/KG	4.72E-02	
79-00-5	1,1,2-Trichloroethane		6	U	UG/KG	2.10E-04	
75-34-3	1,1-Dichloroethane		6	U	UG/KG	2.99E-04	
75-35-4	1,1-Dichloroethene		6	U	UG/KG	7.25E-04	
107-06-2	1,2-Dichloroethane (EDC)		6	U	UG/KG	2.83E-04	
540-59-0	1,2-Dichloroethene (total)		6	U	UG/KG	7.62E-03	
78-87-5	1,2-Dichloropropane		6	U	UG/KG	8.57E-06	
78-93-3	2-Butanone (MEK)		12	U	UG/KG	1.34E-04	
591-78-6	2-Hexanone		12	U	UG/KG	9.52E-04	
108-10-1	4-Methyl-2-pentanone (MIBK)		12	U	UG/KG	2.71E-05	
67-64-1	Acetone		30	U	UG/KG	1.20E-02	
71-43-2	Benzene		6	U	UG/KG	3.75E-04	
75-27-4	Bromodichloromethane		6	U	UG/KG	1.11E-02	
75-25-2	Bromoform		6	U	UG/KG	3.77E-04	
74-83-9	Bromomethane		6	U	UG/KG	2.55E-02	
75-15-0	Carbon disulfide		6	U	UG/KG	6.37E-02	
56-23-5	Carbon tetrachloride		6	U	UG/KG	6.00E-06	
108-90-7	Chlorobenzene		6	U	UG/KG	1.50E-04	
75-00-3	Chloroethane		6	U	UG/KG		
67-66-3	Chloroform		6	U	UG/KG	5.04E-03	
74-87-3	Chloromethane		6	U	UG/KG	5.77E-04	
156-59-2	cis-1,2-Dichloroethene		6	U	UG/KG	7.62E-03	
10061-01-5	cis-1,3-Dichloropropene		6	U	UG/KG	1.51E-02	
124-48-1	Dibromochloromethane		6	U	UG/KG	2.93E-03	
100-41-4	Ethylbenzene		6	U	UG/KG	1.20E-03	
75-09-2	Methylene chloride		6	U	UG/KG	1.48E-03	
110-54-3	N-Hexane		6	U	UG/KG		
100-42-5	Styrene		6	U	UG/KG	2.00E-05	
127-18-4	Tetrachloroethylene (PCE)		6	U	UG/KG	4.62E-04	
108-88-3	Toluene		2	J	UG/KG	6.67E-04	
1330-20-7	total Xylenes		6	U	UG/KG	1.00E-02	
156-60-5	trans-1,2-Dichloroethene		6	U	UG/KG	7.62E-03	
10061-02-6	trans-1,3-Dichloropropene		6	U	UG/KG	1.51E-02	
79-01-6	Trichloroethylene (TCE)		6	U	UG/KG	6.67E-04	
75-01-4	Vinyl chloride		6	U	UG/KG	9.29E-03	
<b>Explosives</b>							
99-35-4	1,3,5-Trinitrobenzene		430	U	UG/KG	1.14E+00	
99-65-0	1,3-Dinitrobenzene		430	U	UG/KG	6.57E-01	
118-96-7	2,4,6-Trinitrotoluene (TNT)		860	U	UG/KG	2.87E-02	
121-14-2	2,4-Dinitrotoluene		430	U	UG/KG	3.36E-01	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 31-8  
ECOLOGICAL SCREENING OF SURFACE WATER RESULTS FROM AUS-0002**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Background (Surface Water)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ)	Retained as Potential Bioaccumulator
117-84-0	Di-n-octyl phthalate		10	U	UG/L	1.41E-02	
53-70-3	Dibenz(a,h)anthracene		10	U	UG/L	6.25E+03	
132-64-9	Dibenzofuran		10	U	UG/L	2.70E+00	
84-66-2	Diethyl phthalate		10	U	UG/L	4.76E-02	
131-11-3	Dimethyl phthalate		10	U	UG/L	3.03E-02	
206-44-0	Fluoranthene		10	U	UG/L	1.23E+00	
86-73-7	Fluorene		10	U	UG/L	2.56E+00	
118-74-1	Hexachlorobenzene		10	U	UG/L	2.72E+00	
87-68-3	Hexachlorobutadiene		10	U	UG/L	1.08E+01	
77-47-4	Hexachlorocyclopentadiene		10	U	UG/L	1.43E+02	
67-72-1	Hexachloroethane		10	U	UG/L	1.02E+00	
193-39-5	Indeno(1,2,3-c,d)pyrene		10	U	UG/L	2.32E+00	
78-59-1	Isophorone		10	U	UG/L	8.55E-03	
621-64-7	N-Nitroso-di-n-propylamine		10	U	UG/L		
86-30-6	N-Nitrosodiphenylamine		10	U	UG/L	1.71E-01	
91-20-3	Naphthalene		10	U	UG/L	8.33E-01	
87-86-5	Pentachlorophenol		50	U	UG/L	3.33E+00	
85-01-8	Phenanthrene		10	U	UG/L	1.59E+00	
108-95-2	Phenol		10	U	UG/L	1.00E-01	
129-00-0	Pyrene		10	U	UG/L	1.64E-01	
<b>Explosives</b>							
99-35-4	1,3,5-Trinitrobenzene		0.25	UJ	UG/L	8.33E-03	
99-65-0	1,3-Dinitrobenzene		0.25	UJ	UG/L	1.25E-02	
118-96-7	2,4,6-Trinitrotoluene (TNT)		0.5	UJ	UG/L	1.25E-02	
121-14-2	2,4-Dinitrotoluene		0.25	UJ	UG/L	1.09E-03	
606-20-2	2,6-Dinitrotoluene		0.5	UJ	UG/L	1.19E-02	
35572-78-2	2-Amino-4,6-Dinitrotoluene		0.5	UJ	UG/L	2.50E-02	
88-72-2	2-Nitrotoluene (ONT)		0.5	UJ	UG/L	6.85E-05	
99-08-1	3-Nitrotoluene		0.5	UJ	UG/L	6.02E-05	
19406-51-0	4-Amino-2,6-Dinitrotoluene		0.5	UJ	UG/L	9.26E-04	
99-99-0	4-Nitrotoluene (PNT)		0.5	UJ	UG/L	7.14E-05	
2691-41-0	HMX		0.5	UJ	UG/L	1.52E-03	
98-95-3	Nitrobenzene		0.25	UJ	UG/L	9.26E-04	
121-82-4	RDX		0.5	UJ	UG/L	2.63E-03	
479-45-8	Tetryl		0.75	UJ	UG/L		
<b>Metals</b>							
7429-90-5	Aluminum	200	12500		UG/L	1.44E+02	
7440-36-0	Antimony	6	6	U	UG/L	2.00E-01	
7440-38-2	Arsenic	10	5.1	J	UG/L	2.68E-02	
7440-39-3	Barium	22.7	139	J	UG/L	2.78E-02	
7440-41-7	Beryllium	5	5	U	UG/L	9.43E+00	
7440-42-8	Boron		13.2	J	UG/L	1.32E-02	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 31-8  
ECOLOGICAL SCREENING OF SURFACE WATER RESULTS FROM AUS-0002**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Background (Surface Water)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ)	Retained as Potential Bioaccumulator
7440-43-9	Cadmium	5	5	U	UG/L	4.55E+00	
7440-70-2	Calcium	7197	15900		UG/L	1.37E-01	
7440-47-3	Chromium	10	13.3		UG/L	6.43E-02	
7440-48-4	Cobalt	50	50	U	UG/L	2.17E+01	
7440-50-8	Copper	10	3.4	J	UG/L	2.88E-01	
7439-89-6	Iron	100	8260		UG/L	8.26E+00	
7439-92-1	Lead	2	4.8		UG/L	2.39E-01	
7439-95-4	Magnesium	2534	6140		UG/L	7.49E-02	
7439-96-5	Manganese	582	1810		UG/L	1.81E+00	
7439-97-6	Mercury	0.2	0.2	U	UG/L	1.54E-01	
7440-02-0	Nickel	10	11.7		UG/L	1.17E-02	
2023695	Potassium	1613	6490		UG/L	1.22E-01	
7782-49-2	Selenium	2.7	3.4	J	UG/L	3.40E-03	YES
7440-22-4	Silver	10	10	U	UG/L	2.00E+00	
7440-23-5	Sodium	3169	7290		UG/L	1.07E-02	
7440-28-0	Thallium	10	10	U	UG/L	2.50E+00	
7440-62-2	Vanadium	50	21	J	UG/L	1.11E+00	
7440-66-6	Zinc	20	22.1		UG/L	2.21E-02	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 31-7  
ECOLOGICAL SCREENING OF SOIL RESULTS FROM AUS-0002**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Background (SOIL)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ) (SOIL)	Retained as Potential Bioaccumulator
606-20-2	2,6-Dinitrotoluene		860	U	UG/KG	2.62E+01	
35572-78-2	2-Amino-4,6-Dinitrotoluene		860	U	UG/KG	1.08E-02	
88-72-2	2-Nitrotoluene (ONT)		860	U	UG/KG		
99-08-1	3-Nitrotoluene		860	U	UG/KG		
19406-51-0	4-Amino-2,6-Dinitrotoluene		860	U	UG/KG		
99-99-0	4-Nitrotoluene (PNT)		860	U	UG/KG		
2691-41-0	HMX		860	U	UG/KG	3.44E-02	
98-95-3	Nitrobenzene		430	U	UG/KG	1.08E-02	
121-82-4	RDX		860	U	UG/KG	8.60E-03	
479-45-8	Tetryl		1300	U	UG/KG		
<b>Metals</b>							
7429-90-5	Aluminum	28800	18800		MG/KG		
7440-36-0	Antimony	0.83	7.7		MG/KG	1.54E+00	
7440-38-2	Arsenic	13.5	6.9		MG/KG	7.67E-01	
7440-39-3	Barium	195	163		MG/KG	3.26E-01	
7440-41-7	Beryllium	0.76	0.6	J	MG/KG	6.00E-02	
7440-42-8	Boron	5.3	1.7	J	MG/KG	3.40E+00	
7440-43-9	Cadmium	0.19	2		MG/KG	6.90E-02	
7440-70-2	Calcium	2497	6430		MG/KG		
7440-47-3	Chromium	25.2	737		MG/KG	1.47E+02	
7440-48-4	Cobalt	21.7	9.9		MG/KG	4.95E-01	
7440-50-8	Copper	11.3	35.8		MG/KG	1.15E+00	
7439-89-6	Iron	19306	20700		MG/KG	1.04E+02	
7439-92-1	Lead	23.4	70.8		MG/KG	1.64E-01	
7439-95-4	Magnesium	1552	2500		MG/KG		
7439-96-5	Manganese	3640	1660		MG/KG	1.66E+01	
7439-97-6	Mercury	0.06	0.37		MG/KG	5.29E-02	YES
7440-02-0	Nickel	18.9	12.9		MG/KG	4.30E-01	
2023695	Potassium	625	1300		MG/KG		
7782-49-2	Selenium	2.34	0.47	J	MG/KG	4.70E-01	YES
7440-22-4	Silver	0.58	98.7		MG/KG	4.94E+01	
7440-23-5	Sodium	170	142		MG/KG		
7440-28-0	Thallium	0.41	0.81	J	MG/KG	8.10E-01	
7440-62-2	Vanadium	47.2	34.3		MG/KG	7.46E-01	
7440-66-6	Zinc	51.4	226		MG/KG	1.88E+00	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

TABLE 31-8  
 ECOLOGICAL SCREENING OF SURFACE WATER RESULTS FROM AUS-0002

ADDITIONAL AND UNCHARACTERIZED SITES OU  
 CRAB ORCHARD NATIONAL WILDLIFE REFUGE

CAS Number	Chemical	Background (Surface Water)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ)	Retained as Potential Bioaccumulator
<b>Semivolatile Organic Compounds</b>							
120-82-1	1,2,4-Trichlorobenzene		10	U	UG/L	2.23E-01	
95-50-1	1,2-Dichlorobenzene		10	U	UG/L	7.14E-01	
541-73-1	1,3-Dichlorobenzene		10	U	UG/L	1.99E-01	
106-46-7	1,4-Dichlorobenzene		10	U	UG/L	8.93E-01	
95-95-4	2,4,5-Trichlorophenol		50	U	UG/L	7.94E-01	
88-06-2	2,4,6-Trichlorophenol		10	U	UG/L	3.13E+00	
120-83-2	2,4-Dichlorophenol		10	U	UG/L	2.74E-01	
105-67-9	2,4-Dimethylphenol		10	U	UG/L	4.72E-01	
51-28-5	2,4-Dinitrophenol		50	U	UG/L	8.06E+00	
91-58-7	2-Chloronaphthalene		10	U	UG/L	3.23E-02	
95-57-8	2-Chlorophenol		10	U	UG/L	2.28E-01	
91-57-6	2-Methylnaphthalene		10	U	UG/L	2.40E-02	
95-48-7	2-Methylphenol		10	U	UG/L	7.69E-01	
88-74-4	2-Nitroaniline		50	U	UG/L	2.16E-03	
88-75-5	2-Nitrophenol		10	U	UG/L	2.90E-03	
91-94-1	3,3'-Dichlorobenzidine		20	U	UG/L	1.90E-01	
99-09-2	3-Nitroaniline		50	U	UG/L	7.32E-04	
534-52-1	4,6-Dinitro-2-methylphenol		50	U	UG/L	2.17E+01	
101-55-3	4-Bromophenyl phenyl ether		10	U	UG/L	6.67E+00	
59-50-7	4-Chloro-3-methylphenol		10	U	UG/L	3.33E+01	
106-47-8	4-Chloroaniline		20	U	UG/L	8.89E-03	
7005-72-3	4-Chlorophenyl phenyl ether		10	U	UG/L	2.17E-01	
106-44-5	4-Methylphenol		10	U	UG/L	4.44E-03	
100-01-6	4-Nitroaniline		50	U	UG/L	1.08E-03	
100-02-7	4-Nitrophenol		50	U	UG/L	6.04E-01	
83-32-9	Acenaphthene		10	U	UG/L	5.88E-01	
208-96-8	Acenaphthylene		10	U	UG/L	1.50E-02	
120-12-7	Anthracene		10	U	UG/L	1.67E+00	
56-55-3	Benzo(a)anthracene		10	U	UG/L	3.70E+02	
50-32-8	Benzo(a)pyrene		10	U	UG/L	7.14E+02	
205-99-2	Benzo(b)fluoranthene		10	U	UG/L	1.79E+03	
191-24-2	Benzo(g,h,i)perylene		10	U	UG/L	1.31E+00	
207-08-9	Benzo(k)fluoranthene		10	U	UG/L	1.79E+03	
111-91-1	bis(2-Chloroethoxy)methane		10	U	UG/L	1.56E-03	
111-44-4	bis(2-Chloroethyl) ether		10	U	UG/L	4.20E-03	
108-60-1	bis(2-Chloroisopropyl) ether		10	U	UG/L		
117-81-7	bis(2-Ethylhexyl) phthalate (DEHP)		10	U	UG/L	3.33E+00	
85-68-7	Butyl benzyl phthalate		10	U	UG/L	5.26E-01	
86-74-8	Carbazole		10	U	UG/L	1.12E-02	
218-01-9	Chrysene		10	U	UG/L	6.25E-01	
84-74-2	Di-n-butyl phthalate		10	U	UG/L	1.06E+00	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
 J = Estimated U = Nondetect

TABLE 31-9, AUS-0002  
SUMMARY OF HUMAN HEALTH COPC EVALUATION

AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Chemical	Surface Water		Groundwater		Sediment		Soil	
	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale
<b>Volatile Organic Compounds</b>								
1,1,1-Trichloroethane	NA	NA	NA	NA	NA	NA	No	A
1,1,2,2-Tetrachloroethane	NA	NA	NA	NA	NA	NA	Uncertainty	B
1,1,2-Trichloroethane	NA	NA	NA	NA	NA	NA	Uncertainty	B
1,1-Dichloroethane	NA	NA	NA	NA	NA	NA	No	A
1,1-Dichloroethene	NA	NA	NA	NA	NA	NA	Uncertainty	B
1,2-Dichloroethane (EDC)	NA	NA	NA	NA	NA	NA	Uncertainty	B
1,2-Dichloroethene (total)	NA	NA	NA	NA	NA	NA	No	A
1,2-Dichloropropane	NA	NA	NA	NA	NA	NA	Uncertainty	B
2-Butanone (MEK)	NA	NA	NA	NA	NA	NA	No	A
2-Hexanone	NA	NA	NA	NA	NA	NA	No	C
4-Methyl-2-pentanone (MIBK)	NA	NA	NA	NA	NA	NA	No	A
Acetone	NA	NA	NA	NA	NA	NA	No	A
Benzene	NA	NA	NA	NA	NA	NA	Uncertainty	B
Bromodichloromethane	NA	NA	NA	NA	NA	NA	No	A
Bromoform	NA	NA	NA	NA	NA	NA	No	A
Bromomethane	NA	NA	NA	NA	NA	NA	No	A
Carbon disulfide	NA	NA	NA	NA	NA	NA	No	A
Carbon tetrachloride	NA	NA	NA	NA	NA	NA	Uncertainty	B
Chlorobenzene	NA	NA	NA	NA	NA	NA	No	A
Chloroethane	NA	NA	NA	NA	NA	NA	No	A
Chloroform	NA	NA	NA	NA	NA	NA	No	A
Chloromethane	NA	NA	NA	NA	NA	NA	No	A
cis-1,2-Dichloroethene	NA	NA	NA	NA	NA	NA	No	A
cis-1,3-Dichloropropene	NA	NA	NA	NA	NA	NA	No	A
Dibromochloromethane	NA	NA	NA	NA	NA	NA	No	A
Ethylbenzene	NA	NA	NA	NA	NA	NA	No	A
Methylene chloride	NA	NA	NA	NA	NA	NA	Uncertainty	B
N-Hexane	NA	NA	NA	NA	NA	NA	No	A
Styrene	NA	NA	NA	NA	NA	NA	No	A
Tetrachloroethylene (PCE)	NA	NA	NA	NA	NA	NA	Uncertainty	B
Toluene	NA	NA	NA	NA	NA	NA	No	F
total Xylenes	NA	NA	NA	NA	NA	NA	No	A
trans-1,2-Dichloroethene	NA	NA	NA	NA	NA	NA	No	A
trans-1,3-Dichloropropene	NA	NA	NA	NA	NA	NA	No	A
Trichloroethylene (TCE)	NA	NA	NA	NA	NA	NA	Uncertainty	B
Vinyl chloride	NA	NA	NA	NA	NA	NA	Uncertainty	B
<b>Semivolatile Organic Compounds</b>								
1,2,4-Trichlorobenzene	No	C	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	No	C	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	No	C	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	No	C	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	No	C	NA	NA	NA	NA	NA	NA

TABLE 31-9, AUS-0002  
SUMMARY OF HUMAN HEALTH COPC EVALUATION

AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Chemical	Surface Water		Groundwater		Sediment		Soil	
	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale
2,4,6-Trichlorophenol	No	C	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	No	C	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol	No	C	NA	NA	NA	NA	NA	NA
2,4-Dinitrophenol	No	C	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	No	C	NA	NA	NA	NA	NA	NA
2-Chlorophenol	No	C	NA	NA	NA	NA	NA	NA
1-Methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	No	A	NA	NA	NA	NA	NA	NA
2-Methylphenol	No	C	NA	NA	NA	NA	NA	NA
2-Nitroaniline	No	C	NA	NA	NA	NA	NA	NA
2-Nitrophenol	No	C	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	No	C	NA	NA	NA	NA	NA	NA
3-Nitroaniline	No	C	NA	NA	NA	NA	NA	NA
4,6-Dinitro-2-methylphenol	No	C	NA	NA	NA	NA	NA	NA
4-Bromophenyl phenyl ether	No	C	NA	NA	NA	NA	NA	NA
4-Chloro-3-methylphenol	No	C	NA	NA	NA	NA	NA	NA
4-Chloroaniline	No	C	NA	NA	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	No	C	NA	NA	NA	NA	NA	NA
4-Methylphenol	No	C	NA	NA	NA	NA	NA	NA
4-Nitroaniline	No	C	NA	NA	NA	NA	NA	NA
4-Nitrophenol	No	C	NA	NA	NA	NA	NA	NA
Acenaphthene	No	C	NA	NA	NA	NA	NA	NA
Acenaphthylene	No	A	NA	NA	NA	NA	NA	NA
Anthracene	No	A	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	Uncertainty	B	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	Uncertainty	B	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	Uncertainty	B	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	No	A	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	No	C	NA	NA	NA	NA	NA	NA
bis(2-Chloroethoxy)methane	No	C	NA	NA	NA	NA	NA	NA
bis(2-Chloroethyl) ether	No	C	NA	NA	NA	NA	NA	NA
bis(2-Chloroisopropyl) ether	No	C	NA	NA	NA	NA	NA	NA
bis(2-Ethylhexyl) phthalate	No	C	NA	NA	NA	NA	NA	NA
Butyl benzyl phthalate	No	C	NA	NA	NA	NA	NA	NA
Carbazole	No	C	NA	NA	NA	NA	NA	NA
Chrysene	Uncertainty	B	NA	NA	NA	NA	NA	NA
Di-n-butyl phthalate	No	C	NA	NA	NA	NA	NA	NA
Di-n-octyl phthalate	No	C	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	No	C	NA	NA	NA	NA	NA	NA
Dibenzofuran	No	C	NA	NA	NA	NA	NA	NA
Diethyl phthalate	No	C	NA	NA	NA	NA	NA	NA
Dimethyl phthalate	No	C	NA	NA	NA	NA	NA	NA
Fluoranthene	No	A	NA	NA	NA	NA	NA	NA

TABLE 31-9, AUS-0002  
SUMMARY OF HUMAN HEALTH COPC EVALUATION

AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Chemical	Surface Water		Groundwater		Sediment		Soil	
	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale
Fluorene	No	A	NA	NA	NA	NA	NA	NA
Hexachlorobenzene	No	C	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	No	C	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	No	C	NA	NA	NA	NA	NA	NA
Hexachloroethane	No	C	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-c,d)pyrene	Uncertainty	B	NA	NA	NA	NA	NA	NA
Isophorone	No	C	NA	NA	NA	NA	NA	NA
N-Nitroso-di-n-propylamine	No	C	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	No	C	NA	NA	NA	NA	NA	NA
Naphthalene	No	C	NA	NA	NA	NA	NA	NA
Pentachlorophenol	No	C	NA	NA	NA	NA	NA	NA
Phenanthrene	No	A	NA	NA	NA	NA	NA	NA
Phenol	No	A	NA	NA	NA	NA	NA	NA
Pyrene	No	A	NA	NA	NA	NA	NA	NA
<b>Metals and Inorganics</b>								
Aluminum	Uncertainty	G	NA	NA	NA	NA	No	F
Antimony	No	C	NA	NA	NA	NA	Yes	E
Arsenic	Uncertainty	G	NA	NA	NA	NA	Yes	D
Barium	No	F	NA	NA	NA	NA	Yes	D
Beryllium	No	C	NA	NA	NA	NA	No	F
Boron	No	F	NA	NA	NA	NA	No	F
Cadmium	No	C	NA	NA	NA	NA	Yes	E
Calcium	No	H	NA	NA	NA	NA	No	H
Chromium	Uncertainty	G	NA	NA	NA	NA	Yes	E
Cobalt	No	C	NA	NA	NA	NA	No	F
Copper	Uncertainty	G	NA	NA	NA	NA	No	F
Cyanide, Total	NA	NA	NA	NA	NA	NA	NA	NA
Iron	Yes	E	NA	NA	NA	NA	No	F
Lead	Uncertainty	G	NA	NA	NA	NA	No	F
Magnesium	No	H	NA	NA	NA	NA	No	H
Manganese	Yes	E	NA	NA	NA	NA	No	F
Mercury	Uncertainty	B	NA	NA	NA	NA	Yes	E
Nickel	No	F	NA	NA	NA	NA	Yes	D
Potassium	No	H	NA	NA	NA	NA	No	H
Selenium	No	F	NA	NA	NA	NA	Yes	D
Silver	Uncertainty	B	NA	NA	NA	NA	Yes	E
Sodium	No	H	NA	NA	NA	NA	No	H
Thallium	No	C	NA	NA	NA	NA	No	F
Vanadium	Uncertainty	G	NA	NA	NA	NA	No	F
Zinc	No	F	NA	NA	NA	NA	No	F
<b>Explosives</b>								
1,3,5-Trinitrobenzene	No	C	NA	NA	NA	NA	No	A
1,3-Dinitrobenzene	No	C	NA	NA	NA	NA	No	A



**TABLE 31-9, AUS-0002  
SUMMARY OF HUMAN HEALTH COPC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Groundwater		Sediment		Soil	
	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale
2,4,6-Trinitrotoluene (TNT)	No	C	NA	NA	NA	NA	No	A
2,4-Dinitrotoluene	No	C	NA	NA	NA	NA	Uncertainty	B
2,6-Dinitrotoluene	No	C	NA	NA	NA	NA	Uncertainty	B
2-Amino-4,6-Dinitrotoluene	No	C	NA	NA	NA	NA	No	C
2-Nitrotoluene (ONT)	No	C	NA	NA	NA	NA	No	C
3-Nitrotoluene	No	C	NA	NA	NA	NA	No	A
4-Amino-2,6-Dinitrotoluene	No	C	NA	NA	NA	NA	No	C
4-Nitrotoluene (PNT)	No	C	NA	NA	NA	NA	No	A
HMX	No	C	NA	NA	NA	NA	No	A
Nitrobenzene	No	C	NA	NA	NA	NA	Uncertainty	B
Nitroglycerin	NA	NA	NA	NA	NA	NA	NA	NA
Pentaerythritol tetranitrate (PETN)	NA	NA	NA	NA	NA	NA	NA	NA
Perchloric Acid	NA	NA	NA	NA	NA	NA	NA	NA
RDX	No	C	NA	NA	NA	NA	No	A
Tetryl	No	C	NA	NA	NA	NA	No	A
<b>Other Parameters</b>								
Nitrogen, Nitrate-Nitrite	NA	NA	NA	NA	NA	NA	NA	NA
Phosphorus, Total (as P)	NA	NA	NA	NA	NA	NA	NA	NA

- A - Chemical was not detected and the reporting limit does not exceed the screening concentration.
- B - Chemical was not detected, but reporting limit was equal to or exceeded screening concentration.
- C - Chemical was not detected and there is no screening concentration.
- D - Chemical was detected and was equal to or exceeded screening concentration, but did not exceed background.
- E - Chemical was detected and was equal to or exceeded screening concentration and background, if applicable.
- F - Chemical was detected and did not exceed screening concentration.
- G - Chemical was detected, but no screening value was available.
- H - Chemical was detected, but it is an essential nutrient.
- J - Chemical was classified as a COPC based on USEPA 1998 data but was not a COPC based on SI data.
- NA - Not Analyzed or not applicable.

TABLE 31-10, AUS-0002  
SUMMARY OF ECOLOGICAL COPEC EVALUATION

AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Chemical	Surface Water		Sediment		Soil	
	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale
<b>Volatile Organic Compounds</b>						
1,1,1-Trichloroethane	NA	NA	NA	NA	No	A
1,1,2,2-Tetrachloroethane	NA	NA	NA	NA	No	A
1,1,2-Trichloroethane	NA	NA	NA	NA	No	A
1,1-Dichloroethane	NA	NA	NA	NA	No	A
1,1-Dichloroethene	NA	NA	NA	NA	No	A
1,2-Dichloroethane (EDC)	NA	NA	NA	NA	No	A
1,2-Dichloroethene (total)	NA	NA	NA	NA	No	A
1,2-Dichloropropane	NA	NA	NA	NA	No	A
2-Butanone (MEK)	NA	NA	NA	NA	No	A
2-Hexanone	NA	NA	NA	NA	No	A
4-Methyl-2-pentanone (MIBK)	NA	NA	NA	NA	No	A
Acetone	NA	NA	NA	NA	No	A
Benzene	NA	NA	NA	NA	No	A
Bromodichloromethane	NA	NA	NA	NA	No	A
Bromoform	NA	NA	NA	NA	No	A
Bromomethane	NA	NA	NA	NA	No	A
Carbon disulfide	NA	NA	NA	NA	No	A
Carbon tetrachloride	NA	NA	NA	NA	No	A
Chlorobenzene	NA	NA	NA	NA	No	A
Chloroethane	NA	NA	NA	NA	No	C
Chloroform	NA	NA	NA	NA	No	A
Chloromethane	NA	NA	NA	NA	No	A
cis-1,2-Dichloroethene	NA	NA	NA	NA	No	A
cis-1,3-Dichloropropene	NA	NA	NA	NA	No	A
Dibromochloromethane	NA	NA	NA	NA	No	A
Ethylbenzene	NA	NA	NA	NA	No	A
Methylene chloride	NA	NA	NA	NA	No	A
N-Hexane	NA	NA	NA	NA	No	C
Styrene	NA	NA	NA	NA	No	A
Tetrachloroethylene (PCE)	NA	NA	NA	NA	No	A
Toluene	NA	NA	NA	NA	No	F
total Xylenes	NA	NA	NA	NA	No	A
trans-1,2-Dichloroethene	NA	NA	NA	NA	No	A
trans-1,3-Dichloropropene	NA	NA	NA	NA	No	A
Trichloroethylene (TCE)	NA	NA	NA	NA	No	A
Vinyl chloride	NA	NA	NA	NA	No	A
<b>Semivolatile Organic Compounds</b>						
1,2,4-Trichlorobenzene	No	A	NA	NA	NA	NA
1,2-Dichlorobenzene	No	A	NA	NA	NA	NA
1,3-Dichlorobenzene	No	A	NA	NA	NA	NA
1,4-Dichlorobenzene	No	A	NA	NA	NA	NA
2,4,5-Trichlorophenol	No	A	NA	NA	NA	NA

TABLE 31-10, AUS-0002  
SUMMARY OF ECOLOGICAL COPEC EVALUATION

AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Chemical	Surface Water		Sediment		Soil	
	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale
2,4,6-Trichlorophenol	Uncertainty	B	NA	NA	NA	NA
2,4-Dichlorophenol	No	A	NA	NA	NA	NA
2,4-Dimethylphenol	No	A	NA	NA	NA	NA
2,4-Dinitrophenol	Uncertainty	B	NA	NA	NA	NA
2-Chloronaphthalene	No	A	NA	NA	NA	NA
2-Chlorophenol	No	A	NA	NA	NA	NA
1-Methylnaphthalene	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	No	A	NA	NA	NA	NA
2-Methylphenol	No	A	NA	NA	NA	NA
2-Nitroaniline	No	A	NA	NA	NA	NA
2-Nitrophenol	No	A	NA	NA	NA	NA
3,3'-Dichlorobenzidine	No	A	NA	NA	NA	NA
3-Nitroaniline	No	A	NA	NA	NA	NA
4,6-Dinitro-2-methylphenol	Uncertainty	B	NA	NA	NA	NA
4-Bromophenyl phenyl ether	Uncertainty	B	NA	NA	NA	NA
4-Chloro-3-methylphenol	Uncertainty	B	NA	NA	NA	NA
4-Chloroaniline	No	A	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	No	A	NA	NA	NA	NA
4-Methylphenol	No	A	NA	NA	NA	NA
4-Nitroaniline	No	A	NA	NA	NA	NA
4-Nitrophenol	No	A	NA	NA	NA	NA
Acenaphthene	No	A	NA	NA	NA	NA
Acenaphthylene	No	A	NA	NA	NA	NA
Anthracene	Uncertainty	B	NA	NA	NA	NA
Benzo(a)anthracene	Uncertainty	B	NA	NA	NA	NA
Benzo(a)pyrene	Uncertainty	B	NA	NA	NA	NA
Benzo(b)fluoranthene	Uncertainty	B	NA	NA	NA	NA
Benzo(g,h,i)perylene	Uncertainty	B	NA	NA	NA	NA
Benzo(k)fluoranthene	Uncertainty	B	NA	NA	NA	NA
bis(2-Chloroethoxy)methane	No	A	NA	NA	NA	NA
bis(2-Chloroethyl) ether	No	A	NA	NA	NA	NA
bis(2-Chloroisopropyl) ether	No	C	NA	NA	NA	NA
bis(2-Ethylhexyl) phthalate	Uncertainty	B	NA	NA	NA	NA
Butyl benzyl phthalate	No	A	NA	NA	NA	NA
Carbazole	No	A	NA	NA	NA	NA
Chrysene	No	A	NA	NA	NA	NA
Di-n-butyl phthalate	Uncertainty	B	NA	NA	NA	NA
Di-n-octyl phthalate	No	A	NA	NA	NA	NA
Dibenz(a,h)anthracene	Uncertainty	B	NA	NA	NA	NA
Dibenzofuran	Uncertainty	B	NA	NA	NA	NA
Diethyl phthalate	No	A	NA	NA	NA	NA
Dimethyl phthalate	No	A	NA	NA	NA	NA
Fluoranthene	Uncertainty	B	NA	NA	NA	NA

TABLE 31-10, AUS-0002  
SUMMARY OF ECOLOGICAL COPEC EVALUATION

AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Chemical	Surface Water		Sediment		Soil	
	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale
Fluorene	Uncertainty	B	NA	NA	NA	NA
Hexachlorobenzene	Uncertainty	B	NA	NA	NA	NA
Hexachlorobutadiene	Uncertainty	B	NA	NA	NA	NA
Hexachlorocyclopentadiene	Uncertainty	B	NA	NA	NA	NA
Hexachloroethane	Uncertainty	B	NA	NA	NA	NA
Indeno(1,2,3-c,d)pyrene	Uncertainty	B	NA	NA	NA	NA
Isophorone	No	A	NA	NA	NA	NA
N-Nitroso-di-n-propylamine	No	C	NA	NA	NA	NA
N-Nitrosodiphenylamine	No	A	NA	NA	NA	NA
Naphthalene	No	A	NA	NA	NA	NA
Pentachlorophenol	Uncertainty	B	NA	NA	NA	NA
Phenanthrene	Uncertainty	B	NA	NA	NA	NA
Phenol	No	A	NA	NA	NA	NA
Pyrene	No	A	NA	NA	NA	NA
<b>Metals and Inorganics</b>						
Aluminum	Yes	E	NA	NA	Uncertainty	I
Antimony	No	A	NA	NA	Yes	E
Arsenic	No	F	NA	NA	No	F
Barium	No	F	NA	NA	No	F
Beryllium	Uncertainty	B	NA	NA	No	F
Boron	No	F	NA	NA	Yes	D
Cadmium	Uncertainty	B	NA	NA	No	F
Calcium	No	F,H	NA	NA	Uncertainty	G,H
Chromium	No	F	NA	NA	Yes	E
Cobalt	Uncertainty	B	NA	NA	No	F
Copper	No	F	NA	NA	Yes	E
Cyanide, Total	NA	NA	NA	NA	NA	NA
Iron	Yes	E	NA	NA	Yes	E
Lead	No	F	NA	NA	No	F
Magnesium	No	F,H	NA	NA	Uncertainty	G,H
Manganese	Yes	E	NA	NA	Yes	D
Mercury	No	A	NA	NA	Yes	E
Nickel	No	F	NA	NA	No	F
Potassium	No	F,H	NA	NA	Uncertainty	G,H
Selenium	Yes	E	NA	NA	Yes	D
Silver	Uncertainty	B	NA	NA	Yes	E
Sodium	No	F,H	NA	NA	Uncertainty	G,H
Thallium	Uncertainty	B	NA	NA	No	F
Vanadium	Yes	D	NA	NA	No	F
Zinc	No	F	NA	NA	Yes	E
<b>Explosives</b>						
1,3,5-Trinitrobenzene	No	A	NA	NA	Uncertainty	B
1,3-Dinitrobenzene	No	A	NA	NA	No	A

**TABLE 31-10, AUS-0002  
SUMMARY OF ECOLOGICAL COPEC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Sediment		Soil	
	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale
2,4,6-Trinitrotoluene (TNT)	No	A	NA	NA	No	A
2,4-Dinitrotoluene	No	A	NA	NA	No	A
2,6-Dinitrotoluene	No	A	NA	NA	Uncertainty	B
2-Amino-4,6-Dinitrotoluene	No	A	NA	NA	No	A
2-Nitrotoluene (ONT)	No	A	NA	NA	No	C
3-Nitrotoluene	No	A	NA	NA	No	C
4-Amino-2,6-Dinitrotoluene	No	A	NA	NA	No	C
4-Nitrotoluene (PNT)	No	A	NA	NA	No	C
HMX	No	A	NA	NA	No	A
Nitrobenzene	No	A	NA	NA	No	A
Nitroglycerin	NA	NA	NA	NA	NA	NA
Pentaerythritol tetranitrate (PETN)	NA	NA	NA	NA	NA	NA
Perchloric Acid	NA	NA	NA	NA	NA	NA
RDX	No	A	NA	NA	No	A
Tetryl	No	C	NA	NA	No	C

- A - Chemical was not detected and the reporting limit does not exceed the screening concentration.
- B - Chemical was not detected, but reporting limit was equal to or exceeded screening concentration.
- C - Chemical was not detected and there is no screening concentration.
- D - Chemical was detected and was equal to or exceeded screening concentration, but did not exceed background.
- E - Chemical was detected and was equal to or exceeded screening concentration and background, if applicable.
- F - Chemical was detected and did not exceed screening concentration.
- G - Chemical was detected, but no screening value was available.
- H - Chemical was detected, but it is an essential nutrient.
- I - If pH<5.5, Aluminum is a COPEC, otherwise it is not.
- J - Chemical was classified as a COPEC based on USEPA 1998 data but was not a COPEC based on SI data.
- NA - Not Analyzed or not applicable.

**TABLE 31-11**  
**AUS-0002 - FORMER IOP ADMINISTRATIVE AREA WASTEWATER TREATMENT PLANT**  
**CHEMICALS DETECTED ABOVE SCREENING CRITERIA AND ABOVE REFUGE BACKGROUND**  
**(WHERE APPLICABLE)**

**ADDITIONAL AND UNCHARACTERIZED SITES OU SI**

Chemical	Drum <sup>1</sup>	Soil	Sediment	Ground Water	Surface Water
<b>Metals</b>					
Aluminum			NA	NA	E
Antimony		H,E	NA	NA	
Cadmium		H	NA	NA	
Chromium		H,E	NA	NA	
Copper		E	NA	NA	
Iron		E	NA	NA	H,E
Manganese			NA	NA	H,E
Mercury		H,E	NA	NA	
Selenium			NA	NA	E
Silver		H,E	NA	NA	
Zinc		E	NA	NA	

**Key:**

<sup>1</sup> Drums were not present at this site.

NA = not analyzed

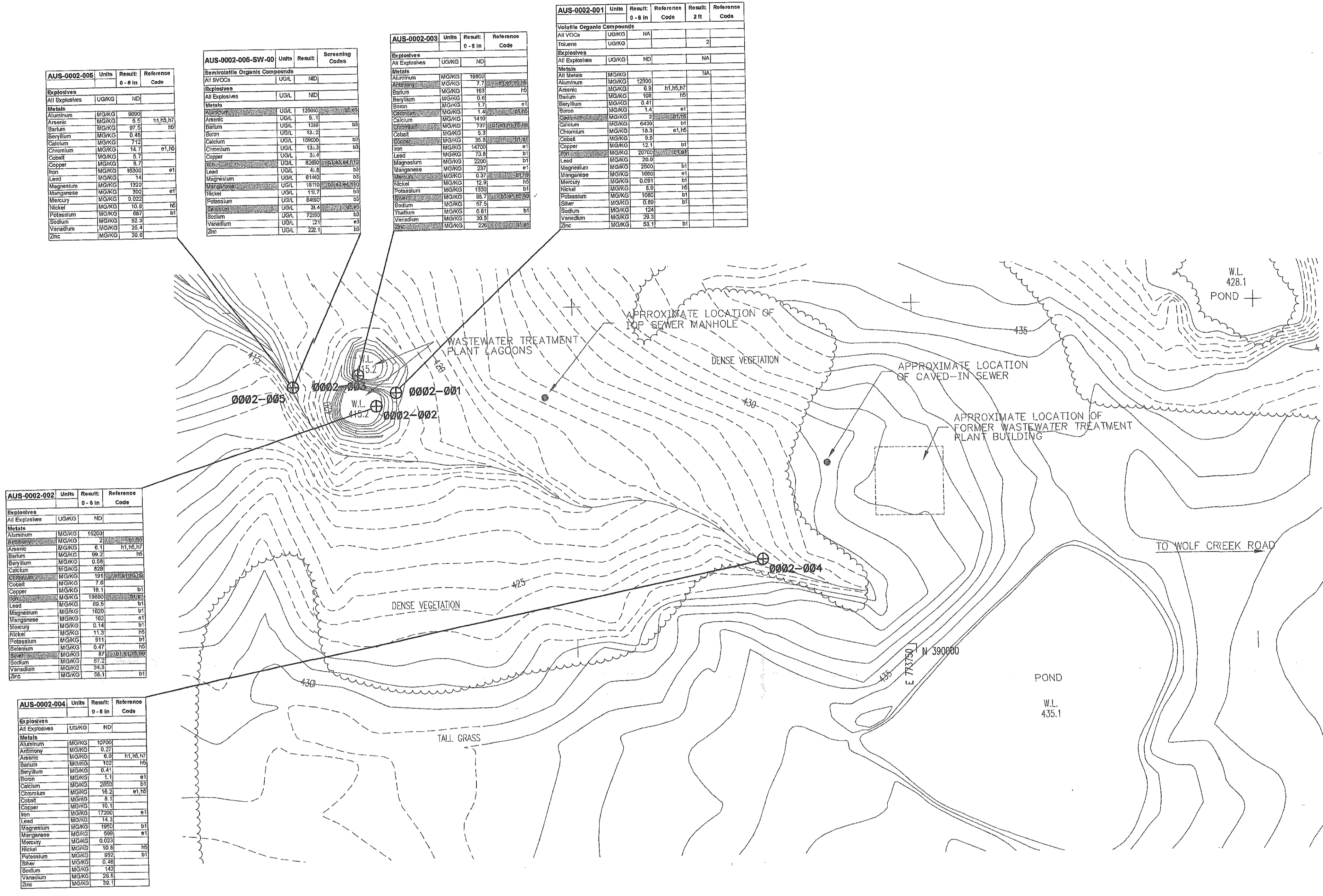
H = human health screening criteria exceeded

E = ecological screening criteria exceeded

LEGEND

- ⊕ MONITORING WELL LOCATION
- ⊙ HAND AUGER LOCATION

Screening Reference	Reference Code
AUS Background Soil LTL	B1
1 mile Grassy Background Sediment LTL	B2
1 mile Grassy Background Surface Water LTL	B3
Ecological Direct Exposure Pathway TRV - Soil	E1
Ecological Direct Exposure Pathway TRV - Sediment	E2
Ecological Direct Exposure Pathway TRV - Surface Water	E3
IRPA General Use Surface Water Quality Aquatic Life Toxicity	G1
IRPA General Use Surface Water Quality Aquatic Life Toxicity	G2
Superfund Chemical Data Matrix Risk values (potential hazardous sites)	S1
USEPA Region IX Industrial Soil PFOA - noncancerous	U1
USEPA Region IX Industrial Soil PFOA - cancerous	U2
USEPA Region IX Tap Water PFOA - noncancerous	U3
USEPA Region IX Tap Water PFOA - cancerous	U4
USEPA Region IX Migration to Groundwater PFOA (UAC-1)	U5
USEPA MCL Drinking Water Standards	M1
USEPA TACO Industrial/Commercial Soil Migration	T1
USEPA TACO Industrial/Commercial Worker Soil Migration	T2
USEPA TACO Child Soil Component of Groundwater	T3
USEPA General Use Surface Water Quality Human Health	H1



**AUS-0002-005**

Units	Result	Reference Code
Explosives		
All Explosives (UGKGI) ND		
Metals		
Arsenic	UGKGI	ND
Barium	UGKGI	ND
Beryllium	UGKGI	ND
Cadmium	UGKGI	ND
Chromium	UGKGI	ND
Copper	UGKGI	ND
Lead	UGKGI	ND
Magnesium	UGKGI	ND
Mercury	UGKGI	ND
Nickel	UGKGI	ND
Potassium	UGKGI	ND
Selenium	UGKGI	ND
Silver	UGKGI	ND
Sulfur	UGKGI	ND
Zinc	UGKGI	ND

**AUS-0002-005-SV-00**

Units	Result	Reference Code
Benzimidazole Organic Compounds		
All SVOCs (UGKGI) ND		
Explosives		
All Explosives (UGKGI) ND		
Metals		
Arsenic	UGKGI	ND
Barium	UGKGI	ND
Beryllium	UGKGI	ND
Cadmium	UGKGI	ND
Chromium	UGKGI	ND
Copper	UGKGI	ND
Lead	UGKGI	ND
Magnesium	UGKGI	ND
Mercury	UGKGI	ND
Nickel	UGKGI	ND
Potassium	UGKGI	ND
Selenium	UGKGI	ND
Silver	UGKGI	ND
Sulfur	UGKGI	ND
Zinc	UGKGI	ND

**AUS-0002-003**

Units	Result	Reference Code
Explosives		
All Explosives (UGKGI) ND		
Metals		
Arsenic	UGKGI	ND
Barium	UGKGI	ND
Beryllium	UGKGI	ND
Cadmium	UGKGI	ND
Chromium	UGKGI	ND
Copper	UGKGI	ND
Lead	UGKGI	ND
Magnesium	UGKGI	ND
Mercury	UGKGI	ND
Nickel	UGKGI	ND
Potassium	UGKGI	ND
Selenium	UGKGI	ND
Silver	UGKGI	ND
Sulfur	UGKGI	ND
Zinc	UGKGI	ND

**AUS-0002-001**

Units	Result	Reference Code
Explosives		
All Explosives (UGKGI) ND		
Metals		
Arsenic	UGKGI	ND
Barium	UGKGI	ND
Beryllium	UGKGI	ND
Cadmium	UGKGI	ND
Chromium	UGKGI	ND
Copper	UGKGI	ND
Lead	UGKGI	ND
Magnesium	UGKGI	ND
Mercury	UGKGI	ND
Nickel	UGKGI	ND
Potassium	UGKGI	ND
Selenium	UGKGI	ND
Silver	UGKGI	ND
Sulfur	UGKGI	ND
Zinc	UGKGI	ND

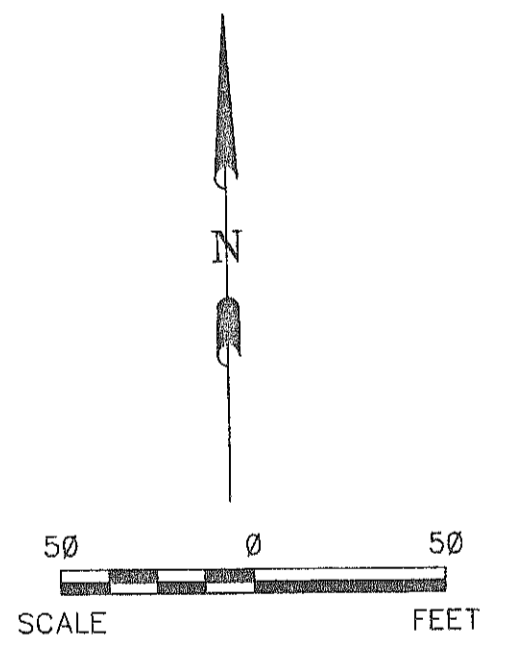
**AUS-0002-002**

Units	Result	Reference Code
Explosives		
All Explosives (UGKGI) ND		
Metals		
Arsenic	UGKGI	ND
Barium	UGKGI	ND
Beryllium	UGKGI	ND
Cadmium	UGKGI	ND
Chromium	UGKGI	ND
Copper	UGKGI	ND
Lead	UGKGI	ND
Magnesium	UGKGI	ND
Mercury	UGKGI	ND
Nickel	UGKGI	ND
Potassium	UGKGI	ND
Selenium	UGKGI	ND
Silver	UGKGI	ND
Sulfur	UGKGI	ND
Zinc	UGKGI	ND

**AUS-0002-004**

Units	Result	Reference Code
Explosives		
All Explosives (UGKGI) ND		
Metals		
Arsenic	UGKGI	ND
Barium	UGKGI	ND
Beryllium	UGKGI	ND
Cadmium	UGKGI	ND
Chromium	UGKGI	ND
Copper	UGKGI	ND
Lead	UGKGI	ND
Magnesium	UGKGI	ND
Mercury	UGKGI	ND
Nickel	UGKGI	ND
Potassium	UGKGI	ND
Selenium	UGKGI	ND
Silver	UGKGI	ND
Sulfur	UGKGI	ND
Zinc	UGKGI	ND

- NOTES:
- BASE TOPOGRAPHIC MAP PREPARED BY WALKER & ASSOCIATES, FROM FLYOVER IN JANUARY 2000. CONTOUR INTERVAL IS ONE FOOT.
  - DATA QUALIFIERS FOR ANALYTICAL RESULTS ARE NOT INDICATED. REFER TO QCSR FOR DATA QUALIFIERS.
  - THE FOLLOWING COMPOUNDS ARE INCLUDED IN THE ANALYTE LIST FOR BOTH SVOCs AND EXPLOSIVES: 2,4-DINITROTOLUENE, 2,6-DINITROTOLUENE, AND NITROBENZENE. THESE COMPOUNDS MAY BE REPORTED AS EITHER SVOCs OR EXPLOSIVES.



Revision No.	Description	Date	By	App.

REVISIONS

PA/SI REPORT-AUS OU  
CRAB ORCHARD NWR  
MARION, ILLINOIS

AUS-0002 Sample Locations and  
Detections in Soils and Surface Water

Date: 11/14/00	Project Number: 232000026.00	Figure Number: 31-1
Drawn by: DJD	Design by: MAM	Checked by: MCH/CMW

# AUS-0002-FORMER IOP ADMINISTRATIVE AREA WASTEWATER TREATMENT PLANT



AUS-0018 is located at the southeast corner of the intersection of Old Highway 13 and Route 148. It is reached from Route 148, by way of the first access road to the south of the intersection. The location where the samples were taken for this investigation is approximately 1,500 feet (ft) east of Route 148, on the south side of this access road. The location of AUS-0018 and other sites included in this volume are shown in Figure 30-1.

### **AUS Original Site Designations**

AUS-0018 is one of the original Additional and Uncharacterized Sites Operable Unit (AUS OU) sites designated in 1997-1999 by the United States Fish & Wildlife Service (USFWS).

## **32.1 HISTORIC SEARCH INFORMATION**

### **32.1.1 Site Description**

AUS-0018 is the former Illinois Ordnance Plant (IOP) Railroad Classification Yard. Based on IOP drawings, there were four buildings in this area: Y-1-1, Y-1-2, Y-1-3 and Y-1-4.<sup>1</sup> There were also numerous sets of railroad tracks in this area that were oriented in an east-west direction. This former Railroad Classification Yard was originally constructed and operated by the Sherwin Williams Defense Corporation under contract with the War Department, (SWDC/War Department) as a part of the IOP. The Railroad Classification Yard had a 200-car capacity.<sup>2</sup>

### **32.1.2 Operational History and Waste Characteristics**

At the IOP Railroad Classification Yard, trains were sorted to ensure quick and efficient loading and unloading operations at each of the various IOP facilities. Diesel locomotives were used in the yard for moving the cars.<sup>3</sup> One of the primary functions of the Railroad Classification Yard was to inspect incoming rail cars for leaking or broken containers of raw materials.<sup>4</sup> Raw materials would likely have included trinitrotoluene (TNT), lead azide, tetryl and/or mercury fulminate.<sup>5</sup> The Railroad Classification Yard was not used for long-term storage.

From north to south, the tracks in the yard were as follows (Figure 32-1): Sand & Oil Track, Engine Track, Main Track, Drill Track and Scale Track.<sup>6</sup> It is possible that the Sand & Oil Track or the Engine Track may have been used for fueling the trains.

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<sup>1</sup> U.S. Army Corps of Engineers, 1944, War Department Facilities Inventory of the Illinois Ordnance Plant Carbondale, Illinois, Part I, Section 5, Page 10.

<sup>2</sup> NAR 000019. Illinois Ordnance Plant, Illinois Ordnance Plant Historical Record, April 18th, 1941 to December 31st, 1942, Page 14.

<sup>3</sup> NAR 000019. Illinois Ordnance Plant, Illinois Ordnance Plant Historical Record, April 18th, 1941 to December 31st, 1942, Page 14.

<sup>4</sup> DPRA Document No. 00028252. Environmental Science & Engineering, Inc., Crab Orchard National Wildlife Refuge, Draft Uncharacterized Sites Report, dated March 9, 1992, Page 10.

<sup>5</sup> DPRA Document No. 00028252. Environmental Science & Engineering, Inc., Crab Orchard National Wildlife Refuge, Draft Uncharacterized Sites Report, dated March 9, 1992, Page 10.

<sup>6</sup> U.S. Army Corps of Engineers, 1944, War Department Facilities Inventory of the Illinois Ordnance Plant Carbondale, Illinois, Part I, Section 5, Page 10.



There were four IOP buildings originally located in this area:<sup>7</sup>

- Building Y-1-1 – Station Ordill & Yard Office (with associated Dock Platform just north of the Sand & Oil Track)
- Building Y-1-2 – Sand House (just south of the Sand & Oil Track, with a fuel oil column located just off the southwest corner of the building and with a sand bin located on the east side of the building)
- Building Y-1-3 – Scale House (just south of Scale Track, with associated scales)
- Building Y-1-4 – Train Dispatching Control Radio Transmitter Building (to north of Main Track and east of the other buildings)

To the east of this area is a Receiving Yard<sup>8</sup>/Staging Area that was used for the staging of train cars loaded with raw materials for the production operations during World War II. There were several sets of railroad tracks previously in this area.

Post-World War II lessees of this area are as follows:

- State of Illinois Natural History Survey (in at least 1949 – no rental charge)<sup>9</sup>
- Olin used Building Y-1-1 (from 1958<sup>10</sup> through September 1963)<sup>11</sup> as an administration and engineering office<sup>12</sup>
- Commercial Solvents Corporation leased Building Y-1-1 (from October 1963<sup>13</sup> through December 1963<sup>14</sup>)
- Marion Civil Defense Agency leased Building Y-1-1 (from 1965 to 1980)<sup>15</sup>
- Trojan-U.S. Powder/Commercial Solvents Corporation used 500 ft of railroad track from March 1969<sup>16</sup> through February 1971, for spotting and storing of railroad tank cars<sup>17</sup>
- Emergency Service and Disaster Agency (from 1980 to 1990)<sup>18</sup>

Post-war, the USFWS operated the rail system at the Refuge. According to Mr. Harry Stiles, a former Refuge manager, they would average about two to three cars per day through the

<sup>7</sup> U.S. Army Corps of Engineers, 1944, War Department Facilities Inventory of the Illinois Ordnance Plant Carbondale, Illinois, Part I, Section 5, Page 10.

<sup>8</sup> U.S. Army Corps of Engineers, 1944, War Department Facilities Inventory of the Illinois Ordnance Plant Carbondale, Illinois, Part I, Section 5, Page 10.

<sup>9</sup> DPRA Document No. 00009059. CONWR, Lease Data and Income Pertaining to Industrial Unit, Crab Orchard National Wildlife Refuge, dated April 12, 1949, Page 18.

<sup>10</sup> DPRA Document No. 00007764. Fourth Amendment and Codification of Lease, for Olin Mathieson Chemical Corporation, dated September 16, 1958, Pages 1-2.

<sup>11</sup> DPRA Document No. 00018767. Ninth Amendment and Codification of Lease, for Olin Mathieson Chemical Corporation, dated October 1, 1963, Pages 1-4.

<sup>12</sup> CRO 000805. U.S. Department of the Interior, Bureau of Sport Fisheries & Wildlife, Fish and Wildlife Service, Crab Orchard National Wildlife Refuge, Narrative Report, January thru April, 1958, Page 18.

<sup>13</sup> DOI 004896 – DOI 004897. Contract 14-1-6-0003-6137, USFWS Lease information for Commercial Solvents Corporation, dated September 12, 1963, Pages 1-2.

<sup>14</sup> DPRA Document No. 00007274. First Amendment of Lease Contract No. 14-16-0003-6137, Commercial Solvents Corporation, dated December 18, 1963, Pages 1-2.

<sup>15</sup> CRO 001316. Lease Contract No. 14-16-0003-12122 by and between U. S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife and Marion Civil Defense Agency, dated September 3, 1965, Page 1.

<sup>16</sup> DPRA Document No. 00008907. Special Use Permit No. SUP-33-69, dated February 25, 1969.

<sup>17</sup> DPRA Document No. 00006526. Special Use Permit No. SUP-38-70, dated February 5, 1970.

<sup>18</sup> DPRA Document No. 00024967. Building Lease Contract No. 14-16-0003-81-514 by and between U. S. Fish and Wildlife Service and Emergency Service & Disaster Agency, dated October 1, 1980, Page 1.

classification yard.<sup>19</sup> Due to the increased cost of maintaining the railroads, the reduced demand for rail service by the tenants, and the lack of funds to keep the railroad running, the USFWS informed Olin in July of 1975 that switching operations within the Refuge would be discontinued as of October 17, 1975.<sup>20</sup> It is assumed that this was done.

### **32.1.3 AUS-0018 Previous Sampling Results**

#### **USEPA Sampling, 1998**

In 1998, the United States Environmental Protection Agency (USEPA) collected a sample (AUS 18-01) from this site at the approximate location shown in Figure 32-1. The results for all detected constituents are listed in Table 32-1A. The sample was analyzed for the Target Compound List (TCL) Base Neutral Acids (BNAs), Polynuclear Aromatic Hydrocarbons (PAHs), and Target Analyte List (TAL) Metals. The following SVOC compounds were detected above either USEPA SSLs and/or CSOQGs: benzo[b]fluoranthene (1.9 mg/kg), benzo[a]pyrene (0.6 mg/kg), indeno[1,2,3-c,d]pyrene (1.5 mg/kg), dibenz[a,h]anthracene (1.2 mg/kg), and benzo[k]fluoranthene (1.9 mg/kg). Total PAHs also exceeded DSOLs. Arsenic (120 mg/kg), beryllium (0.9 mg/kg), cadmium (4.5 mg/kg), mercury (0.32 mg/kg), nickel (26 mg/kg), and silver (2 mg/kg) exceeded USEPA SSLs and Refuge background levels.<sup>21</sup> Copper (110 mg/kg), lead (4,500 mg/kg), and zinc (1,600 mg/kg) exceeded DSOLs and Refuge background levels.

### **32.1.4 Observations During Site Visit**

This site has been abandoned. It is partially grass-covered and partially wooded. The only building remaining on site at the time of the reconnaissance in the spring of 1999 was the IOP Building Y-1-1 – Station Ordill & Yard Office.<sup>22</sup> The USFWS had this building removed from the site sometime after the site reconnaissance was done. The railroad tracks had already been removed from the site at the time of the site reconnaissance; however, the railroad beds were still present.

### **32.1.5 Recommendations Based on Preliminary Assessment**

AUS-0018 was included in the Site Investigation (SI) since USEPA sample results exceeded preliminary screening levels at this site, and the site had been previously used for a railroad classification yard.

## **32.2 SITE INVESTIGATION INFORMATION**

URS conducted a Site Investigation at AUS-0018 on May 9, 2000. The rationale for sample locations, media, and analytes is presented in the Field Sampling Plan (FSP)<sup>23</sup> for the AUS OU

<sup>19</sup> Deposition of Harry Stiles on November 18, 1997, Page 60.

<sup>20</sup> PRI-00521. USDOJ, Letter to Olin Corporation regarding USFWS ceasing to provide rail service at the Refuge, dated July 21, 1975.

<sup>21</sup> See Table 1-11 of this report for Refuge background soil values used for the PA.

<sup>22</sup> This building was also removed sometime before the SI.

<sup>23</sup> U.S. Fish & Wildlife Service, Department of the Interior, March 2000, Draft Final Field Sampling Plan Site Inspection, Additional and Uncharacterized Sites Operable Unit, Crab Orchard National Wildlife Refuge Superfund Site, Marion, Illinois (Williamson County), prepared by URS Corporation.

Preliminary Assessment/Site Investigation (PA/SI). Since the time the FSP was prepared, additional information has become available, and the historic discussion (Section 32.1) has been updated to include that information. The sampling locations discussed below are based on the information that was available at the time the FSP was developed, and may not address all areas of potential releases.

AUS OU SI sample locations are shown on Figure 32-1. Survey coordinates for all sample locations in AUS-0018 are listed in Table 32-1. Table 32-2 lists the sample locations and the matrix sampled at that location. All samples are soil samples.

### **32.2.1 Field Investigation**

The following areas of concern were investigated during the SI. Sampling was done in accordance with the FSP, except as noted.

#### **Possible Engine Fueling Area**

Both the Sand and Oil Track and the Engine Track may have been used for fueling or oiling the locomotive engines. This assumption is based on the fact that there was a fuel oil column (of unknown purpose) located next to the sand house which is situated between these two tracks.<sup>24</sup> Sample 0018-002 was collected from near the fuel oil column to detect any possible spillage of fuel oil in this area. Sample 0018-001 was collected from next to the Sand and Oil Track near the fuel oil column, and Sample 0018-003 was collected from next to the Engine Track near the fuel oil column.

#### **Receiving Yard/Staging Area**

There were two samples collected from this area (0018-004 and 0018-005). Both were collected from the Receiving Yard, which was used for the staging of train cars loaded with raw materials for the production operations during World War II. There were several tracks located in this area and two were randomly selected for sampling.

### **32.2.2 Field Results**

#### **32.2.2.1 Site Conditions**

##### **32.2.2.1.1 *Geologic Conditions***

There were no test pits or monitoring wells installed at AUS-0018. The soil from the hand auger borings, which extended to depths of 2 ft, was described as silty clay fill.

##### **32.2.2.1.2 *Hydrogeologic Conditions***

No hydrogeological information is available for this site.

<sup>24</sup> U.S. Army Corps of Engineers, 1944, War Department Facilities Inventory of the Illinois Ordnance Plant Carbondale, Illinois, Part I, Section 5, Page 10.

**32.2.2.1.3 Hydrologic Conditions**

There was no surface water observed at AUS-0018, and no clear drainageways.

**32.2.2.2 Chemical Results**

Table 32-3 lists the chemicals detected in AUS-0018 during this investigation, along with the frequency and range of detections. Tabulated results of all analyses are included in the Quality Control Summary Report (QCSR). All results are shown in Figure 32-1.

**32.2.3 Additional Sampling, November 2000**

Two additional shallow soil samples (0 to 6-inch depth) were taken at the approximate locations (0018-010 and 0018-011) shown in Figure 32-1 in November 2000. The purpose of taking these samples was to provide additional information on the nature and extent of contamination found in the USEPA sample 18-01. USEPA sample 18-01, which was taken near former IOP Building Y-1-1, showed elevated levels of some metals. The building was demolished and removed from the site some time before the SI. It was thought that the elevated metals levels in the soil may have originated from building debris which has since been removed from the site. The results from the samples taken in November 2000 are presented in Table 32-3a. The results from the November 2000 sampling did not have the same levels of elevated metals results. This suggests that the elevated metals in the USEPA sample are either from the building that has been removed, or else are very localized.

**32.3 SCREENING RISK ASSESSMENT**

Results of the screening are presented in Tables 32-4 and 32-5 as follows:

- Table 32-4--human health risk screening for soils, and
- Table 32-5--ecological risk screening for soils.

Each table lists the maximum detected concentration for each constituent analyzed at AUS-0018. The screening results are presented in the tables in terms of hazard quotients (HQs). The HQ for any chemical detected, for any particular screening criterion is simply the ratio of the maximum detected concentration to the screening concentration. For human health for carcinogens, a screening level "cancer risk" is calculated instead of an HQ.

Chemicals that are shaded in the tables are those that exceeded the screening criteria, and are identified as chemicals of potential concern (COPCs) for human health risk, and chemicals of potential ecological concern (COPECs) for ecological risk. The only COPCs/COPECs not shaded in the table are those inorganic constituents that exceeded the screening criteria but were detected at levels below Refuge background.

In cases where the chemical was analyzed for but not detected, the HQ is the ratio between the maximum reporting limit and the screening concentration. Chemicals not detected are identified with a "U" qualifier in the qualifier column. When these HQ values exceed one, they also are not shaded. These constituents are not identified as COPCs, but rather as uncertainties.

In Figure 32-1, the shading convention used is the same as for the tables, discussed above. The particular screening criteria exceeded are indicated by the code in the analytical results labels. Duplicate results are shown only if the duplicate result for an analyte exceeded the screening criteria and the result from the original sample did not; or, if the analyte was detected in the duplicate and not in the original sample. Since in the screening process results which are qualified as estimated (coded with “J”) are treated the same as unqualified results, data qualifiers are not included in the results shown in the figures. Refer to the QCSR for data qualifiers.

Tables 32-6 (human health risk) and 32-7 (ecological risk) list all the analytes and corresponding media sampled and indicate whether each is a COPC (or COPEC), not a COPC (or COPEC), or an uncertainty. The codes in the tables indicate the rationale for each classification. All COPCs (Table 32-6) and COPECs (Table 32-7) are shaded in the tables.

### 32.3.1 Human Health Risk

#### 32.3.1.1 Soil

Human health screening results for soil and samples are presented in Table 32-4. A cancer risk was calculated for the USEPA Region 9 Industrial Soil Preliminary Remediation Goal (PRG) for carcinogens screening values. The cancer risk was derived by calculating a ratio of the maximum detected concentrations, or the maximum reporting limits, to their appropriate screening values. These ratios were then multiplied by  $1 \times 10^{-6}$ . In addition, ratios were calculated for the USEPA Region 9 Industrial Soil PRG for Toxins, the USEPA Region 9 Migration to Groundwater Criteria (Dilution Attenuation Factor (DAF)=1), the State of Illinois Industrial/Commercial Soil Ingestion Criteria, the State of Illinois Construction Worker Soil Ingestion Criteria, and the State of Illinois Class I Soil Component of Groundwater Criteria.

### 32.3.2 Ecological Risk

#### 32.3.2.1 Soil

Ecological screening results for soil samples are presented in Table 32-5. Soil screening concentrations for direct exposures were developed using toxicity reference values (TRVs) derived from several sources, including the following:

- USEPA (2000)<sup>25</sup>
- Environment Canada (1995)<sup>26</sup>
- Talmage *et al.* (1999)<sup>27</sup>
- Efroymsen *et al.* (1997a, 1997b)<sup>28</sup>

<sup>25</sup> USEPA. 2000. Ecological Soil Screening Level Guidance (Draft). USEPA Office of Emergency and Remedial Response, Washington, DC.

<sup>26</sup> Environment Canada. 1995. Toxicity Testing of NCSRP Priority Substances for Development of Soil Quality Guidelines for Contaminated Sites. Guidelines Division, Evaluation and Interpretation Branch, Environmental Conservation Directorate, Environment Canada. Hull, Quebec.

<sup>27</sup> Talmage, S.S., D.M. Opresko, C.J. Maxwell, C.J.E. Welsh, F. M. Cretella, P.H. Reno, and F. B. Daniel. 1999. Nitroaromatic Munition Compounds: Environmental Effects and Screening Values. *Rev Environ. Contam. Toxicol* 161:1-156.

- CCME (1999)<sup>29</sup>
- MHSPE (1994)<sup>30</sup>
- Other sources

A detailed discussion of the screening concentration selection is presented in Appendix G.

The screening approach for ingestion pathway exposures was based on the potential for a chemical to bioaccumulate. The potential for a chemical to bioaccumulate was based on the organic chemical-specific octanol-to-water partitioning coefficient ( $K_{ow}$ ), which provides an indication of the lipophilicity of an organic chemical, and its potential for sequestration in biological tissue. The document *Assessment and Control of Bioconcentratable Contaminants in Surface Waters* (USEPA 1991)<sup>31</sup> used a log  $K_{ow}$  of 3.5 as a target threshold value indicative of bioaccumulative chemicals to target organic chemicals of greatest concern. Using this as a guideline, organic chemicals with a log  $K_{ow}$  greater than 3.5 were considered potentially bioaccumulative chemicals. Among inorganics, mercury and selenium were considered as potentially bioaccumulative chemicals. Any potentially bioaccumulative chemical that is detected was retained as a COPEC.

#### 32.4 SCIENTIFIC MANAGEMENT DECISION POINT

An RI is recommended for Site AUS-0018, based on exceedances of the SI screening criteria. Several SVOCs and metals exceeded project screening criteria as would be expected in a former rail yard. These constituents are listed in Table 32-8 and are discussed in the following paragraphs.

This report recommends that inorganic constituents that exceeded project screening criteria but were within Refuge background levels not be retained as COPCs/COPECs for further evaluation. These are the constituents coded with “D” on the COPC list, Table 32-6; and on the COPEC list, Table 32-7. COPCs in this category include chromium and selenium in soil. COPECs coded with “D” on Table 32-7 include boron, chromium, manganese, and selenium in soil. These chemicals may later be included in the RI for other reasons (for example, as standard components in an analytical method; if new information on site usage suggests they should be evaluated; or if they are of concern in other media) but the detections at the locations noted are not considered to be of concern since they are below Refuge background levels. All other COPCs/COPECs listed on these tables should be evaluated in the RI. In addition, all analytes

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<sup>28</sup> Efrogmson, R.A., M.E. Will, G.W. Suter II, and A.C. Wooten. 1997a. *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision*. Oak Ridge National Laboratory, Oak Ridge, Tennessee. ES/ER/TM-85/R3.

Efrogmson, R.A., M.E. Will, and G.W. Suter II. 1997b. *Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision*. Oak Ridge National Laboratory, Oak Ridge, Tennessee. ES/ER/TM-126/R2.

<sup>29</sup> Canadian Council of Ministers of the Environment. 1999. *Canadian Environmental Quality Guidelines*.

<sup>30</sup> Ministry of Housing, Spatial Planning, and the Environment (MHSPE). 1994. *Intervention Values and Target Values – Soil Quality Standards*. Directorate General for Environmental Protection, Department of Soil Protection, The Hague, The Netherlands.

<sup>31</sup> USEPA 1991. *Assessment and Control of Bioconcentratable Contaminants in Surface Waters (Draft)*. US Environmental Protection Agency Office of Research and Development, Washington, D.C.

listed as uncertainties on these tables should be considered for further evaluation in the RI Work Plan.

Chemicals that exceeded screening criteria and Refuge background (if applicable) are listed in Table 32-8.

Note that a number of the human health COPCs exceed migration to groundwater screening criteria. Groundwater has not been investigated at this site, and based on these data, should be considered in the RI. Other areas of the site and media and contaminants in addition to those addressed in this study may warrant investigation in the RI. These issues will be addressed in the work plan for the RI.

TABLE 32-1  
SURVEY COORDINATES FOR SAMPLE LOCATIONS IN AUS-0018

Sample Location	Northing	Easting	Ground Surface Elevation	Top of Casing Elevation	Comments
0018-001	387501.6	785881.8	444.64	NA	
0018-002	387488.8	785853.1	444.54	NA	
0018-003	387469.9	785884.6	446.11	NA	
0018-004	387509.2	786738.6	443.41	NA	
0018-005	387331.3	786765.0	445.38	NA	
0018-010					Location not surveyed
0018-011					Location not surveyed

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NA – Not Applicable (no wells)



TABLE 32-1A  
1998 USEPA SOIL SAMPLE ANALYTICAL RESULTS SUMMARY

Sample ID	Constituent	Result (mg/kg)
18-01	Acenaphthene	0.8J
	Acenaphthylene	0.7J
	Anthracene	0.9J
	Benzo[a]pyrene	0.6J
	Benzo[b]fluoranthene	1.9J
	Benzo[k]fluoranthene	1.9J
	Chrysene	0.5J
	Dibenz[a,h]anthracene	1.2J
	Fluoranthene	0.7J
	Indeno[1,2,3-c,d]pyrene	1.5J
	Phenanthrene	1.3J
	Pyrene	0.8J
	Aluminum	3,600
	Arsenic	120
	Barium	66
	Beryllium	0.9
	Cadmium	4.5
	Calcium	7,900
	Chromium	22
	Cobalt	18
	Copper	110
	Iron	42,000
	Lead	4,500
	Magnesium	4,200
	Manganese	250
	Mercury	0.32
	Nickel	26
	Potassium	500
	Silver	2
	Vanadium	23
	Zinc	1,600

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mg/kg = milligrams per kilogram

J = Estimated

**TABLE 32-2  
MATRICES SAMPLED AT EACH  
SAMPLE LOCATION AT AUS-0018**

Soil
AUS-0018-001
AUS-0018-002
AUS-0018-003
AUS-0018-004
AUS-0018-005
AUS-0018-010*
AUS-0018-011*

Sheet 1 of 1

\*Note that these samples were collected November 16, 2000.

TABLE 32-3  
SOIL SAMPLE ANALYTICAL RESULTS SUMMARY

Constituents	Number of Detections	Range of Detections
<b>Volatile Organic Compounds</b>		
Acetone	1/5	40 ug/kg
<b>Metals</b>		
Aluminum	7/7	731 mg/kg 16,800 mg/kg
Antimony	2/7	0.42 mg/kg to 0.59 mg/kg
Arsenic	7/7	2.3 mg/kg to 12.6 mg/kg
Barium	7/7	11 mg/kg to 225 mg/kg
Beryllium	7/7	0.05 mg/kg to 0.79 mg/kg
Boron	1/7	0.84 mg/kg
Cadmium	2/7	0.81 mg/kg to 0.82 mg/kg
Calcium	7/7	1,250 mg/kg to 19,200 mg/kg
Chromium, Total	6/7	1.8 mg/kg to 20.5 mg/kg
Cobalt	7/7	1.5 mg/kg to 13.5 mg/kg
Copper	7/7	7 mg/kg to 17.3 mg/kg
Iron	7/7	2570 mg/kg to 25,800 mg/kg
Lead	7/7	13.6 mg/kg to 34.3 mg/kg
Magnesium	7/7	1,630 mg/kg to 113,000 mg/kg
Manganese	7/7	134 mg/kg to 1,210 mg/kg
Mercury	7/7	0.01 mg/kg to 0.0909 mg/kg
Nickel	7/7	1.8 mg/kg to 16.2 mg/kg
Potassium	7/7	150 mg/kg to 817 mg/kg
Selenium	4/7	0.39 mg/kg to 0.69 mg/kg
Sodium	5/7	51.4 mg/kg to 81.7 mg/kg
Thallium	1/7	0.69 mg/kg
Vanadium	7/7	2.2 mg/kg to 40.4 mg/kg
Zinc	7/7	27.8 mg/kg to 110 mg/kg

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mg/kg = milligrams per kilogram

ug/kg = micrograms per kilogram

Notes: This table was derived from the figures that show the analytical results. As a result, duplicates are shown only if the duplicate result for an analyte exceeded the screening criteria and the result from the original sample did not; or, if the analyte was detected in the duplicate and not in the original sample. There may be some duplicate results, not shown in the table, that are outside the range shown. In addition, the frequency and range of detections is based on the number of sample locations, not the total number of samples (the total number of samples includes originals plus duplicates).

November 2000 results are not included.

Checked by: MMF 7/20/01

TABLE 32-3A  
RESULTS FROM SOIL SAMPLES TAKEN IN NOVEMBER 2000

FIELD ID DATE COLLECTED			AUS-0A18-010-0X November 16, 2000			AUS-0A18-011-0X November 16, 2000		
	Maximum	Frequency	Result	RL	Qual	Result	RL	Qual
<b>METALS</b>								
Aluminum	864	2/2	731	22		864	22	
Copper	17.3	2/2	17.3	1.1		14.4	1.1	
Chromium, Total	1.8	1/2	1.8	1.1		<	1.1	U
Cobalt	1.7J	2/2	1.5	5.4	J	1.7	5.4	J
Cadmium	0.82	2/2	0.82	0.54		0.81	0.54	
Calcium	192000	2/2	192000	1100		18500	1100	
Beryllium	.05J	2/2	0.05	0.54	J	0.05	0.54	J
Silver		0/2	<	1.1	U	<	1.1	U
Arsenic	2.4	2/2	2.4	1.1		2.3	1.1	
Iron	3120	2/2	2570	110		3120	110	
Barium	17.1J	2/2	17.1	22	J	11	22	J
Potassium	175	2/2	150	110		175	110	
Magnesium	109000	2/2	109000	1100		113000	1100	
Manganese	143	2/2	134	1.6		143	1.6	
Sodium		0/2	<	259	U	<	259	U
Nickel	2.8	2/2	1.8	1.1		2.8	1.1	
Lead	34.3	2/2	24.7	0.32		34.3	0.32	
Antimony	.59J	2/2	0.42	0.65	J	0.59	0.65	J
Selenium		0/2	<	0.54	U	<	0.54	U
Vanadium	2.6	2/2	2.2	5.4	J	2.6	5.4	J
Mercury	.0909J	2/2	0.0909	0.11	J	0.09	0.11	J
Thallium		0/2	<	1.1	U	<	1.1	<
Zinc	45.6	2/2	45.6	2.2		43.9	2.2	

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Results reported in milligrams per kilogram.

ND = Not Detected

RL = Reporting Limit

Qual = Qualifier

E = Value exceeds linear range.

J = Estimated

U = Nondetect

The calculation of detection frequency does not include results from reanalyzed samples.

**TABLE 32-4  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0018**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
<b>Volatile Organic Compounds</b>								
71-55-6	1,1,1-Trichloroethane	6	U	UG/KG			1.80E-06	6.00E-02
79-34-5	1,1,2,2-Tetrachloroethane	6	U	UG/KG		6.68E-09	1.54E-06	3.00E+01
79-00-5	1,1,2-Trichloroethane	6	U	UG/KG		3.16E-09	3.94E-05	6.67E+00
75-34-3	1,1-Dichloroethane	6	U	UG/KG			2.91E-06	6.00E-03
75-35-4	1,1-Dichloroethene	6	U	UG/KG		5.05E-08	8.91E-05	2.00E+00
107-06-2	1,2-Dichloroethane (EDC)	6	U	UG/KG		7.85E-09	1.70E-04	6.00E+00
540-59-0	1,2-Dichloroethene (total)	6	U	UG/KG			4.07E-05	3.00E-01
78-87-5	1,2-Dichloropropane	6	U	UG/KG		7.81E-09	2.82E-04	6.00E+00
78-93-3	2-Butanone (MEK)	13	U	UG/KG			4.69E-07	
591-78-6	2-Hexanone	13	U	UG/KG				
108-10-1	4-Methyl-2-pentanone (MIBK)	13	U	UG/KG			4.50E-06	
67-64-1	Acetone	40		UG/KG			6.43E-06	5.00E-02
71-43-2	Benzene	6	U	UG/KG		4.10E-09	2.48E-04	3.00E+00
75-27-4	Bromodichloromethane	6	U	UG/KG		2.55E-09	5.75E-06	2.00E-01
75-25-2	Bromoform	6	U	UG/KG		1.92E-11	3.41E-07	1.50E-01
74-83-9	Bromomethane	6	U	UG/KG			4.57E-04	6.00E-01
75-15-0	Carbon disulfide	6	U	UG/KG			4.96E-06	3.00E-03
56-23-5	Carbon tetrachloride	6	U	UG/KG		1.13E-08	8.58E-04	2.00E+00
108-90-7	Chlorobenzene	6	U	UG/KG			1.11E-05	8.57E-02
75-00-3	Chloroethane	6	U	UG/KG		9.22E-10	3.18E-07	
67-66-3	Chloroform	6	U	UG/KG		1.15E-08	4.66E-03	2.00E-01
74-87-3	Chloromethane	6	U	UG/KG		2.25E-09		
156-59-2	cis-1,2-Dichloroethene	6	U	UG/KG			4.07E-05	3.00E-01

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 32-4  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0018**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
10061-01-5	cis-1,3-Dichloropropene	6	U	UG/KG		3.37E-08	1.36E-04	
124-48-1	Dibromochloromethane	6	U	UG/KG		2.26E-09	3.77E-06	3.00E-01
100-41-4	Ethylbenzene	6	U	UG/KG			1.00E-06	8.57E-03
75-09-2	Methylene chloride	6	U	UG/KG		2.92E-10	6.14E-07	6.00E+00
110-54-3	N-Hexane	6	U	UG/KG			1.49E-05	
100-42-5	Styrene	6	U	UG/KG			2.94E-07	3.00E-02
127-18-4	Tetrachloroethylene (PCE)	6	U	UG/KG		3.21E-10	3.52E-06	2.00E+00
108-88-3	Toluene	6	U	UG/KG			3.02E-06	1.00E-02
1330-20-7	total Xylenes	6	U	UG/KG			1.35E-06	6.00E-04
156-60-5	trans-1,2-Dichloroethene	6	U	UG/KG			2.80E-05	2.00E-01
10061-02-6	trans-1,3-Dichloropropene	6	U	UG/KG		3.37E-08	1.36E-04	
79-01-6	Trichloroethylene (TCE)	6	U	UG/KG		9.81E-10	7.59E-05	2.00E+00
75-01-4	Vinyl chloride	6	U	UG/KG		1.23E-07		8.57E+00
<b>Explosives</b>								
99-35-4	1,3,5-Trinitrobenzene	330	U	UG/KG			1.25E-05	
99-65-0	1,3-Dinitrobenzene	330	U	UG/KG			3.75E-03	
118-96-7	2,4,6-Trinitrotoluene (TNT)	670	U	UG/KG		8.15E-09	1.52E-03	
121-14-2	2,4-Dinitrotoluene	330	U	UG/KG			1.87E-04	8.25E+03
606-20-2	2,6-Dinitrotoluene	670	U	UG/KG			7.61E-04	2.23E+04
35572-78-2	2-Amino-4,6-Dinitrotoluene	670	U	UG/KG				
88-72-2	2-Nitrotoluene (ONT)	670	U	UG/KG				
99-08-1	3-Nitrotoluene	670	U	UG/KG			3.30E-04	
19406-51-0	4-Amino-2,6-Dinitrotoluene	670	U	UG/KG				
99-99-0	4-Nitrotoluene (PNT)	670	U	UG/KG			3.30E-04	

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**TABLE 32-4  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0018**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
2691-41-0	HMX	670	U	UG/KG			1.52E-05	
98-95-3	Nitrobenzene	330	U	UG/KG			2.88E-03	
121-82-4	RDX	670	U	UG/KG		2.99E-08	2.54E-04	
479-45-8	Tetryl	1000	U	UG/KG			1.14E-04	
<b>Metals</b>								
7429-90-5	Aluminum	16800		MG/KG	5.83E-01		1.00E-02	
7440-36-0	Antimony	0.8	U	MG/KG	9.64E-01		9.78E-04	2.67E+00
7440-38-2	Arsenic	12.6		MG/KG	9.33E-01	4.62E-06	2.87E-02	1.26E+01
7440-39-3	Barium	225		MG/KG	1.15E+00		1.81E-03	2.81E+00
7440-41-7	Beryllium	0.79		MG/KG	1.04E+00	3.52E-10	2.14E-04	2.63E-01
7440-42-8	Boron	0.84	J	MG/KG	1.58E-01		1.06E-05	
7440-43-9	Cadmium	0.67	U	MG/KG	3.53E+00	2.24E-10	8.27E-04	1.68E+00
7440-70-2	Calcium	9390	J	MG/KG	3.76E+00			
7440-47-3	Chromium	20.5	J	MG/KG	8.13E-01	4.57E-08		1.03E+01
7440-48-4	Cobalt	13.5		MG/KG	6.22E-01		1.10E-04	
7440-50-8	Copper	17		MG/KG	1.50E+00		2.24E-04	
7439-89-6	Iron	25800		MG/KG	1.34E+00		4.21E-02	
7439-92-1	Lead	31.4		MG/KG	1.34E+00			
7439-95-4	Magnesium	6170	J	MG/KG	3.98E+00			
7439-96-5	Manganese	1210		MG/KG	3.32E-01		3.75E-02	
7439-97-6	Mercury	0.033	J	MG/KG	5.50E-01			
7440-02-0	Nickel	16.2		MG/KG	8.57E-01		3.96E-04	2.31E+00
2023695	Potassium	817		MG/KG	1.31E+00			
7782-49-2	Selenium	0.69		MG/KG	2.95E-01		6.75E-05	2.30E+00

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 32-4  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0018**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
7440-22-4	Silver	1.3	U	MG/KG	2.24E+00		1.27E-04	6.50E-01
7440-23-5	Sodium	93.9	J	MG/KG	5.52E-01			
7440-28-0	Thallium	0.69	J	MG/KG	1.68E+00		4.82E-06	
7440-62-2	Vanadium	40.4		MG/KG	8.56E-01		2.82E-03	1.35E-01
7440-66-6	Zinc	110		MG/KG	2.14E+00		1.80E-04	1.83E-01

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**TABLE 32-4  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0018**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
<b>Volatile Organic Compounds</b>							
71-55-6	1,1,1-Trichloroethane	6	U	UG/KG			3.00E-03
79-34-5	1,1,2,2-Tetrachloroethane	6	U	UG/KG			
79-00-5	1,1,2-Trichloroethane	6	U	UG/KG	7.32E-07	7.32E-07	3.00E-01
75-34-3	1,1-Dichloroethane	6	U	UG/KG	3.00E-08	3.00E-08	2.61E-04
75-35-4	1,1-Dichloroethene	6	U	UG/KG	3.33E-07	3.33E-06	1.00E-01
107-06-2	1,2-Dichloroethane (EDC)	6	U	UG/KG	9.52E-05	4.29E-06	3.00E-01
540-59-0	1,2-Dichloroethene (total)	6	U	UG/KG	3.00E-07	3.00E-07	1.50E-02
78-87-5	1,2-Dichloropropane	6	U	UG/KG	7.14E-05	3.33E-06	2.00E-01
78-93-3	2-Butanone (MEK)	13	U	UG/KG			
591-78-6	2-Hexanone	13	U	UG/KG			
108-10-1	4-Methyl-2-pentanone (MIBK)	13	U	UG/KG			
67-64-1	Acetone	40		UG/KG	2.00E-07	2.00E-07	2.50E-03
71-43-2	Benzene	6	U	UG/KG	3.00E-05	1.40E-06	2.00E-01
75-27-4	Bromodichloromethane	6	U	UG/KG	6.52E-05	3.00E-06	1.00E-02
75-25-2	Bromoform	6	U	UG/KG	8.33E-06	3.75E-07	7.50E-03
74-83-9	Bromomethane	6	U	UG/KG	2.07E-06	6.00E-06	3.00E-02
75-15-0	Carbon disulfide	6	U	UG/KG	3.00E-08	3.00E-07	1.88E-04
56-23-5	Carbon tetrachloride	6	U	UG/KG	1.36E-04	1.46E-05	8.57E-02
108-90-7	Chlorobenzene	6	U	UG/KG	1.46E-07	1.46E-06	6.00E-03
75-00-3	Chloroethane	6	U	UG/KG			
67-66-3	Chloroform	6	U	UG/KG	6.38E-06	3.00E-06	1.00E-02
74-87-3	Chloromethane	6	U	UG/KG			
156-59-2	cis-1,2-Dichloroethene	6	U	UG/KG	3.00E-07	3.00E-07	1.50E-02

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**TABLE 32-4  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0018**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
10061-01-5	cis-1,3-Dichloropropene	6	U	UG/KG			
124-48-1	Dibromochloromethane	6	U	UG/KG	1.46E-07	1.46E-07	1.50E-02
100-41-4	Ethylbenzene	6	U	UG/KG	3.00E-08	3.00E-07	4.62E-04
75-09-2	Methylene chloride	6	U	UG/KG	7.89E-06	5.00E-07	3.00E-01
110-54-3	N-Hexane	6	U	UG/KG			
100-42-5	Styrene	6	U	UG/KG	1.46E-08	1.46E-07	1.50E-03
127-18-4	Tetrachloroethylene (PCE)	6	U	UG/KG	5.45E-05	2.50E-06	1.00E-01
108-88-3	Toluene	6	U	UG/KG	1.46E-08	1.46E-08	5.00E-04
1330-20-7	total Xylenes	6	U	UG/KG	6.00E-09	1.46E-08	4.00E-05
156-60-5	trans-1,2-Dichloroethene	6	U	UG/KG	1.46E-07	1.46E-07	8.57E-03
10061-02-6	trans-1,3-Dichloropropene	6	U	UG/KG			
79-01-6	Trichloroethylene (TCE)	6	U	UG/KG	1.15E-05	5.00E-06	1.00E-01
75-01-4	Vinyl chloride	6	U	UG/KG	2.00E-03	9.23E-05	6.00E-01
<b>Explosives</b>							
99-35-4	1,3,5-Trinitrobenzene	330	U	UG/KG			
99-65-0	1,3-Dinitrobenzene	330	U	UG/KG			
118-96-7	2,4,6-Trinitrotoluene (TNT)	670	U	UG/KG			
121-14-2	2,4-Dinitrotoluene	330	U	UG/KG	3.93E-02	1.83E-03	4.13E+02
606-20-2	2,6-Dinitrotoluene	670	U	UG/KG	7.98E-02	3.72E-03	9.57E+02
35572-78-2	2-Amino-4,6-Dinitrotoluene	670	U	UG/KG			
88-72-2	2-Nitrotoluene (ONT)	670	U	UG/KG			
99-08-1	3-Nitrotoluene	670	U	UG/KG			
19406-51-0	4-Amino-2,6-Dinitrotoluene	670	U	UG/KG			
99-99-0	4-Nitrotoluene (PNT)	670	U	UG/KG			

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**TABLE 32-4  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0018**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
2691-41-0	HMX	670	U	UG/KG			
98-95-3	Nitrobenzene	330	U	UG/KG	3.30E-04	3.30E-04	3.30E+00
121-82-4	RDX	670	U	UG/KG			
479-45-8	Tetryl	1000	U	UG/KG			
<b>Metals</b>							
7429-90-5	Aluminum	16800		MG/KG			
7440-36-0	Antimony	0.8	U	MG/KG	9.76E-04	9.76E-03	1.60E-01
7440-38-2	Arsenic	12.6		MG/KG	4.20E+00	2.07E-01	4.50E-01
7440-39-3	Barium	225		MG/KG	1.61E-03	1.61E-02	1.88E-01
7440-41-7	Beryllium	0.79		MG/KG	7.90E-01	2.72E-02	1.20E-01
7440-42-8	Boron	0.84	J	MG/KG	4.67E-06	4.67E-05	
7440-43-9	Cadmium	0.67	U	MG/KG	3.35E-04	3.35E-03	1.81E-01
7440-70-2	Calcium	9390	J	MG/KG			
7440-47-3	Chromium	20.5	J	MG/KG	2.05E-03	5.00E-03	7.32E-01
7440-48-4	Cobalt	13.5		MG/KG	1.13E-04	1.13E-03	
7440-50-8	Copper	17		MG/KG	2.07E-04	2.07E-03	1.55E-03
7439-89-6	Iron	25800		MG/KG			
7439-92-1	Lead	31.4		MG/KG	7.85E-02	7.85E-02	
7439-95-4	Magnesium	6170	J	MG/KG			
7439-96-5	Manganese	1210		MG/KG	1.26E-02	1.26E-01	
7439-97-6	Mercury	0.033	J	MG/KG	5.41E-05	5.41E-04	2.20E-01
7440-02-0	Nickel	16.2		MG/KG	3.95E-04	3.95E-03	2.13E-01
2023695	Potassium	817		MG/KG			
7782-49-2	Selenium	0.69		MG/KG	6.90E-05	6.90E-04	2.88E-01

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**TABLE 32-4  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0018**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
7440-22-4	Silver	1.3	U	MG/KG	1.30E-04	1.30E-03	8.67E-01
7440-23-5	Sodium	93.9	J	MG/KG			
7440-28-0	Thallium	0.69	J	MG/KG	4.31E-03	4.31E-03	2.88E-01
7440-62-2	Vanadium	40.4		MG/KG	2.89E-03	2.89E-02	4.12E-02
7440-66-6	Zinc	110		MG/KG	1.80E-04	1.80E-03	3.06E-02

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J = Estimated U = Nondetect

**TABLE 32-5  
ECOLOGICAL SCREENING OF SOIL RESULTS FROM AUS-0018**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Background (SOIL)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ) (SOIL)	Retained as Potential Bioaccumulator
<b>Volatile Organic Compounds</b>							
71-55-6	1,1,1-Trichloroethane		6	U	UG/KG	2.01E-04	
79-34-5	1,1,2,2-Tetrachloroethane		6	U	UG/KG	4.72E-02	
79-00-5	1,1,2-Trichloroethane		6	U	UG/KG	2.10E-04	
75-34-3	1,1-Dichloroethane		6	U	UG/KG	2.99E-04	
75-35-4	1,1-Dichloroethene		6	U	UG/KG	7.25E-04	
107-06-2	1,2-Dichloroethane (EDC)		6	U	UG/KG	2.83E-04	
540-59-0	1,2-Dichloroethene (total)		6	U	UG/KG	7.62E-03	
78-87-5	1,2-Dichloropropane		6	U	UG/KG	8.57E-06	
78-93-3	2-Butanone (MEK)		13	U	UG/KG	1.45E-04	
591-78-6	2-Hexanone		13	U	UG/KG	1.03E-03	
108-10-1	4-Methyl-2-pentanone (MIBK)		13	U	UG/KG	2.93E-05	
67-64-1	Acetone		40		UG/KG	1.60E-02	
71-43-2	Benzene		6	U	UG/KG	3.75E-04	
75-27-4	Bromodichloromethane		6	U	UG/KG	1.11E-02	
75-25-2	Bromoform		6	U	UG/KG	3.77E-04	
74-83-9	Bromomethane		6	U	UG/KG	2.55E-02	
75-15-0	Carbon disulfide		6	U	UG/KG	6.37E-02	
56-23-5	Carbon tetrachloride		6	U	UG/KG	6.00E-06	
108-90-7	Chlorobenzene		6	U	UG/KG	1.50E-04	
75-00-3	Chloroethane		6	U	UG/KG		
67-66-3	Chloroform		6	U	UG/KG	5.04E-03	
74-87-3	Chloromethane		6	U	UG/KG	5.77E-04	
156-59-2	cis-1,2-Dichloroethene		6	U	UG/KG	7.62E-03	
10061-01-5	cis-1,3-Dichloropropene		6	U	UG/KG	1.51E-02	
124-48-1	Dibromochloromethane		6	U	UG/KG	2.93E-03	
100-41-4	Ethylbenzene		6	U	UG/KG	1.20E-03	
75-09-2	Methylene chloride		6	U	UG/KG	1.48E-03	
110-54-3	N-Hexane		6	U	UG/KG		
100-42-5	Styrene		6	U	UG/KG	2.00E-05	
127-18-4	Tetrachloroethylene (PCE)		6	U	UG/KG	4.62E-04	
108-88-3	Toluene		6	U	UG/KG	2.00E-03	
1330-20-7	total Xylenes		6	U	UG/KG	1.00E-02	
156-60-5	trans-1,2-Dichloroethene		6	U	UG/KG	7.62E-03	
10061-02-6	trans-1,3-Dichloropropene		6	U	UG/KG	1.51E-02	
79-01-6	Trichloroethylene (TCE)		6	U	UG/KG	6.67E-04	
75-01-4	Vinyl chloride		6	U	UG/KG	9.29E-03	
<b>Explosives</b>							
99-35-4	1,3,5-Trinitrobenzene		330	U	UG/KG	8.77E-01	
99-65-0	1,3-Dinitrobenzene		330	U	UG/KG	5.04E-01	
118-96-7	2,4,6-Trinitrotoluene (TNT)		670	U	UG/KG	2.23E-02	
121-14-2	2,4-Dinitrotoluene		330	U	UG/KG	2.58E-01	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 32-5  
ECOLOGICAL SCREENING OF SOIL RESULTS FROM AUS-0018**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Background (SOIL)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ) (SOIL)	Retained as Potential Bioaccumulator
606-20-2	2,6-Dinitrotoluene		670	U	UG/KG	2.04E+01	
35572-78-2	2-Amino-4,6-Dinitrotoluene		670	U	UG/KG	8.38E-03	
88-72-2	2-Nitrotoluene (ONT)		670	U	UG/KG		
99-08-1	3-Nitrotoluene		670	U	UG/KG		
19406-51-0	4-Amino-2,6-Dinitrotoluene		670	U	UG/KG		
99-99-0	4-Nitrotoluene (PNT)		670	U	UG/KG		
2691-41-0	HMX		670	U	UG/KG	2.68E-02	
98-95-3	Nitrobenzene		330	U	UG/KG	8.25E-03	
121-82-4	RDX		670	U	UG/KG	6.70E-03	
479-45-8	Tetryl		1000	U	UG/KG		
<b>Metals</b>							
7429-90-5	Aluminum	28800	16800		MG/KG		
7440-36-0	Antimony	0.83	0.8	U	MG/KG	1.60E-01	
7440-38-2	Arsenic	13.5	12.6		MG/KG	1.40E+00	
7440-39-3	Barium	195	225		MG/KG	4.50E-01	
7440-41-7	Beryllium	0.76	0.79		MG/KG	7.90E-02	
7440-42-8	Boron	5.3	0.84	J	MG/KG	1.68E+00	
7440-43-9	Cadmium	0.19	0.67	U	MG/KG	2.31E-02	
7440-70-2	Calcium	2497	9390	J	MG/KG		
7440-47-3	Chromium	25.2	20.5	J	MG/KG	4.10E+00	
7440-48-4	Cobalt	21.7	13.5		MG/KG	6.75E-01	
7440-50-8	Copper	11.3	17		MG/KG	5.48E-01	
7439-89-6	Iron	19306	25800		MG/KG	1.29E+02	
7439-92-1	Lead	23.4	31.4		MG/KG	7.25E-02	
7439-95-4	Magnesium	1552	6170	J	MG/KG		
7439-96-5	Manganese	3640	1210		MG/KG	1.21E+01	
7439-97-6	Mercury	0.06	0.033	J	MG/KG	4.71E-03	YES
7440-02-0	Nickel	18.9	16.2		MG/KG	5.40E-01	
2023695	Potassium	625	817		MG/KG		
7782-49-2	Selenium	2.34	0.69		MG/KG	6.90E-01	YES
7440-22-4	Silver	0.58	1.3	U	MG/KG	6.50E-01	
7440-23-5	Sodium	170	93.9	J	MG/KG		
7440-28-0	Thallium	0.41	0.69	J	MG/KG	6.90E-01	
7440-62-2	Vanadium	47.2	40.4		MG/KG	8.78E-01	
7440-66-6	Zinc	51.4	110		MG/KG	9.17E-01	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 32-6, AUS-0018  
SUMMARY OF HUMAN HEALTH COPC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Groundwater		Sediment		Soil	
	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale
<b>Volatile Organic Compounds</b>								
1,1,1-Trichloroethane	NA	NA	NA	NA	NA	NA	No	A
1,1,2,2-Tetrachloroethane	NA	NA	NA	NA	NA	NA	Uncertainty	B
1,1,2-Trichloroethane	NA	NA	NA	NA	NA	NA	Uncertainty	B
1,1-Dichloroethane	NA	NA	NA	NA	NA	NA	No	A
1,1-Dichloroethene	NA	NA	NA	NA	NA	NA	Uncertainty	B
1,2-Dichloroethane (EDC)	NA	NA	NA	NA	NA	NA	Uncertainty	B
1,2-Dichloroethene (total)	NA	NA	NA	NA	NA	NA	No	A
1,2-Dichloropropane	NA	NA	NA	NA	NA	NA	Uncertainty	B
2-Butanone (MEK)	NA	NA	NA	NA	NA	NA	No	A
2-Hexanone	NA	NA	NA	NA	NA	NA	No	C
4-Methyl-2-pentanone (MIBK)	NA	NA	NA	NA	NA	NA	No	A
Acetone	NA	NA	NA	NA	NA	NA	No	F
Benzene	NA	NA	NA	NA	NA	NA	Uncertainty	B
Bromodichloromethane	NA	NA	NA	NA	NA	NA	No	A
Bromoform	NA	NA	NA	NA	NA	NA	No	A
Bromomethane	NA	NA	NA	NA	NA	NA	No	A
Carbon disulfide	NA	NA	NA	NA	NA	NA	No	A
Carbon tetrachloride	NA	NA	NA	NA	NA	NA	Uncertainty	B
Chlorobenzene	NA	NA	NA	NA	NA	NA	No	A
Chloroethane	NA	NA	NA	NA	NA	NA	No	A
Chloroform	NA	NA	NA	NA	NA	NA	No	A
Chloromethane	NA	NA	NA	NA	NA	NA	No	A
cis-1,2-Dichloroethene	NA	NA	NA	NA	NA	NA	No	A
cis-1,3-Dichloropropene	NA	NA	NA	NA	NA	NA	No	A
Dibromochloromethane	NA	NA	NA	NA	NA	NA	No	A
Ethylbenzene	NA	NA	NA	NA	NA	NA	No	A
Methylene chloride	NA	NA	NA	NA	NA	NA	Uncertainty	B
N-Hexane	NA	NA	NA	NA	NA	NA	No	A
Styrene	NA	NA	NA	NA	NA	NA	No	A
Tetrachloroethylene (PCE)	NA	NA	NA	NA	NA	NA	Uncertainty	B
Toluene	NA	NA	NA	NA	NA	NA	No	A
total Xylenes	NA	NA	NA	NA	NA	NA	No	A
trans-1,2-Dichloroethene	NA	NA	NA	NA	NA	NA	No	A
trans-1,3-Dichloropropene	NA	NA	NA	NA	NA	NA	No	A
Trichloroethylene (TCE)	NA	NA	NA	NA	NA	NA	Uncertainty	B
Vinyl chloride	NA	NA	NA	NA	NA	NA	Uncertainty	B
<b>Semivolatile Organic Compounds</b>								
1,2,4-Trichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA

**TABLE 32-6, AUS-0018  
SUMMARY OF HUMAN HEALTH COPC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Groundwater		Sediment		Soil	
	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale
2,4,6-Trichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrophenol	NA	NA	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	NA	NA	NA	NA	NA	NA	NA	NA
2-Chlorophenol	NA	NA	NA	NA	NA	NA	NA	NA
1-Methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylphenol	NA	NA	NA	NA	NA	NA	NA	NA
2-Nitroaniline	NA	NA	NA	NA	NA	NA	NA	NA
2-Nitrophenol	NA	NA	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	NA	NA	NA	NA	NA	NA	NA	NA
3-Nitroaniline	NA	NA	NA	NA	NA	NA	NA	NA
4,6-Dinitro-2-methylphenol	NA	NA	NA	NA	NA	NA	NA	NA
4-Bromophenyl phenyl ether	NA	NA	NA	NA	NA	NA	NA	NA
4-Chloro-3-methylphenol	NA	NA	NA	NA	NA	NA	NA	NA
4-Chloroaniline	NA	NA	NA	NA	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	NA	NA	NA	NA	NA	NA	NA	NA
4-Methylphenol	NA	NA	NA	NA	NA	NA	NA	NA
4-Nitroaniline	NA	NA	NA	NA	NA	NA	NA	NA
4-Nitrophenol	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	NA	NA	NA	NA	NA	NA	Yes	J
Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA	Yes	J
Benzo(g,h,i)perylene	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Chloroethoxy)methane	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Chloroethyl) ether	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Chloroisopropyl) ether	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Ethylhexyl) phthalate	NA	NA	NA	NA	NA	NA	NA	NA
Butyl benzyl phthalate	NA	NA	NA	NA	NA	NA	NA	NA
Carbazole	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-butyl phthalate	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-octyl phthalate	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	NA	NA	NA	NA	NA	NA	Yes	J
Dibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA
Diethyl phthalate	NA	NA	NA	NA	NA	NA	NA	NA
Dimethyl phthalate	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA



**TABLE 32-6, AUS-0018  
SUMMARY OF HUMAN HEALTH COPC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Groundwater		Sediment		Soil	
	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale
Fluorene	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	NA	NA	NA	NA	NA	NA	NA	NA
Hexachloroethane	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-c,d)pyrene	NA	NA	NA	NA	NA	NA	Yes	J
Isophorone	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitroso-di-n-propylamine	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorophenol	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	NA	NA	NA	NA	NA	NA	NA	NA
Phenol	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	NA	NA	NA	NA	NA	NA	NA	NA
<b>Metals and Inorganics</b>								
Aluminum	NA	NA	NA	NA	NA	NA	No	F
Antimony	NA	NA	NA	NA	NA	NA	Uncertainty	B
Arsenic	NA	NA	NA	NA	NA	NA	Yes	J
Barium	NA	NA	NA	NA	NA	NA	Yes	E
Beryllium	NA	NA	NA	NA	NA	NA	No	F
Boron	NA	NA	NA	NA	NA	NA	No	F
Cadmium	NA	NA	NA	NA	NA	NA	Yes	J
Calcium	NA	NA	NA	NA	NA	NA	No	H
Chromium	NA	NA	NA	NA	NA	NA	Yes	D
Cobalt	NA	NA	NA	NA	NA	NA	No	F
Copper	NA	NA	NA	NA	NA	NA	No	F
Cyanide, Total	NA	NA	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	NA	NA	No	F
Lead	NA	NA	NA	NA	NA	NA	Yes	J
Magnesium	NA	NA	NA	NA	NA	NA	No	H
Manganese	NA	NA	NA	NA	NA	NA	No	F
Mercury	NA	NA	NA	NA	NA	NA	Yes	J
Nickel	NA	NA	NA	NA	NA	NA	Yes	J
Potassium	NA	NA	NA	NA	NA	NA	No	H
Selenium	NA	NA	NA	NA	NA	NA	Yes	D
Silver	NA	NA	NA	NA	NA	NA	Yes	J
Sodium	NA	NA	NA	NA	NA	NA	No	H
Thallium	NA	NA	NA	NA	NA	NA	No	F
Vanadium	NA	NA	NA	NA	NA	NA	No	F
Zinc	NA	NA	NA	NA	NA	NA	Yes	J
<b>Explosives</b>								
1,3,5-Trinitrobenzene	NA	NA	NA	NA	NA	NA	No	A
1,3-Dinitrobenzene	NA	NA	NA	NA	NA	NA	No	A

**TABLE 32-6, AUS-0018  
SUMMARY OF HUMAN HEALTH COPC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Groundwater		Sediment		Soil	
	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale
2,4,6-Trinitrotoluene (TNT)	NA	NA	NA	NA	NA	NA	No	A
2,4-Dinitrotoluene	NA	NA	NA	NA	NA	NA	Uncertainty	B
2,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA	Uncertainty	B
2-Amino-4,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA	No	C
2-Nitrotoluene (ONT)	NA	NA	NA	NA	NA	NA	No	C
3-Nitrotoluene	NA	NA	NA	NA	NA	NA	No	A
4-Amino-2,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA	No	C
4-Nitrotoluene (PNT)	NA	NA	NA	NA	NA	NA	No	A
HMX	NA	NA	NA	NA	NA	NA	No	A
Nitrobenzene	NA	NA	NA	NA	NA	NA	Uncertainty	B
Nitroglycerin	NA	NA	NA	NA	NA	NA	NA	NA
Pentaerythritol tetranitrate (PETN)	NA	NA	NA	NA	NA	NA	NA	NA
Perchloric Acid	NA	NA	NA	NA	NA	NA	NA	NA
RDX	NA	NA	NA	NA	NA	NA	No	A
Tetryl	NA	NA	NA	NA	NA	NA	No	A
<b>Other Parameters</b>								
Nitrogen, Nitrate-Nitrite	NA	NA	NA	NA	NA	NA	NA	NA
Phosphorus, Total (as P)	NA	NA	NA	NA	NA	NA	NA	NA

- A - Chemical was not detected and the reporting limit does not exceed the screening concentration.
- B - Chemical was not detected, but reporting limit was equal to or exceeded screening concentration.
- C - Chemical was not detected and there is no screening concentration.
- D - Chemical was detected and was equal to or exceeded screening concentration, but did not exceed background.
- E - Chemical was detected and was equal to or exceeded screening concentration and background, if applicable.
- F - Chemical was detected and did not exceed screening concentration.
- G - Chemical was detected, but no screening value was available.
- H - Chemical was detected, but it is an essential nutrient.
- J - Chemical was classified as a COPC based on USEPA 1998 data but was not a COPC based on SI data.
- NA - Not Analyzed or not applicable.

**TABLE 32-7, AUS-0018  
SUMMARY OF ECOLOGICAL COPEC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Sediment		Soil	
	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale
<b>Volatile Organic Compounds</b>						
1,1,1-Trichloroethane	NA	NA	NA	NA	No	A
1,1,2,2-Tetrachloroethane	NA	NA	NA	NA	No	A
1,1,2-Trichloroethane	NA	NA	NA	NA	No	A
1,1-Dichloroethane	NA	NA	NA	NA	No	A
1,1-Dichloroethene	NA	NA	NA	NA	No	A
1,2-Dichloroethane (EDC)	NA	NA	NA	NA	No	A
1,2-Dichloroethene (total)	NA	NA	NA	NA	No	A
1,2-Dichloropropane	NA	NA	NA	NA	No	A
2-Butanone (MEK)	NA	NA	NA	NA	No	A
2-Hexanone	NA	NA	NA	NA	No	A
4-Methyl-2-pentanone (MIBK)	NA	NA	NA	NA	No	A
Acetone	NA	NA	NA	NA	No	F
Benzene	NA	NA	NA	NA	No	A
Bromodichloromethane	NA	NA	NA	NA	No	A
Bromoform	NA	NA	NA	NA	No	A
Bromomethane	NA	NA	NA	NA	No	A
Carbon disulfide	NA	NA	NA	NA	No	A
Carbon tetrachloride	NA	NA	NA	NA	No	A
Chlorobenzene	NA	NA	NA	NA	No	A
Chloroethane	NA	NA	NA	NA	No	C
Chloroform	NA	NA	NA	NA	No	A
Chloromethane	NA	NA	NA	NA	No	A
cis-1,2-Dichloroethene	NA	NA	NA	NA	No	A
cis-1,3-Dichloropropene	NA	NA	NA	NA	No	A
Dibromochloromethane	NA	NA	NA	NA	No	A
Ethylbenzene	NA	NA	NA	NA	No	A
Methylene chloride	NA	NA	NA	NA	No	A
N-Hexane	NA	NA	NA	NA	No	C
Styrene	NA	NA	NA	NA	No	A
Tetrachloroethylene (PCE)	NA	NA	NA	NA	No	A
Toluene	NA	NA	NA	NA	No	A
total Xylenes	NA	NA	NA	NA	No	A
trans-1,2-Dichloroethene	NA	NA	NA	NA	No	A
trans-1,3-Dichloropropene	NA	NA	NA	NA	No	A
Trichloroethylene (TCE)	NA	NA	NA	NA	No	A
Vinyl chloride	NA	NA	NA	NA	No	A
<b>Semivolatile Organic Compounds</b>						
1,2,4-Trichlorobenzene	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	NA	NA	NA	NA	NA	NA

**TABLE 32-7, AUS-0018  
SUMMARY OF ECOLOGICAL COPEC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Sediment		Soil	
	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale
2,4,6-Trichlorophenol	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol	NA	NA	NA	NA	NA	NA
2,4-Dinitrophenol	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	NA	NA	NA	NA	NA	NA
2-Chlorophenol	NA	NA	NA	NA	NA	NA
1-Methylnaphthalene	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	NA	NA	NA	NA	NA	NA
2-Methylphenol	NA	NA	NA	NA	NA	NA
2-Nitroaniline	NA	NA	NA	NA	NA	NA
2-Nitrophenol	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	NA	NA	NA	NA	NA	NA
3-Nitroaniline	NA	NA	NA	NA	NA	NA
4,6-Dinitro-2-methylphenol	NA	NA	NA	NA	NA	NA
4-Bromophenyl phenyl ether	NA	NA	NA	NA	NA	NA
4-Chloro-3-methylphenol	NA	NA	NA	NA	NA	NA
4-Chloroaniline	NA	NA	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	NA	NA	NA	NA	NA	NA
4-Methylphenol	NA	NA	NA	NA	NA	NA
4-Nitroaniline	NA	NA	NA	NA	NA	NA
4-Nitrophenol	NA	NA	NA	NA	NA	NA
Acenaphthene	NA	NA	NA	NA	NA	NA
Acenaphthylene	NA	NA	NA	NA	NA	NA
Anthracene	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	NA	NA	NA	NA	Yes	J
Benzo(b)fluoranthene	NA	NA	NA	NA	Yes	J
Benzo(g,h,i)perylene	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	NA	NA	NA	NA	Yes	J
bis(2-Chloroethoxy)methane	NA	NA	NA	NA	NA	NA
bis(2-Chloroethyl) ether	NA	NA	NA	NA	NA	NA
bis(2-Chloroisopropyl) ether	NA	NA	NA	NA	NA	NA
bis(2-Ethylhexyl) phthalate	NA	NA	NA	NA	NA	NA
Butyl benzyl phthalate	NA	NA	NA	NA	NA	NA
Carbazole	NA	NA	NA	NA	NA	NA
Chrysene	NA	NA	NA	NA	NA	NA
Di-n-butyl phthalate	NA	NA	NA	NA	NA	NA
Di-n-octyl phthalate	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	NA	NA	NA	NA	Yes	J
Dibenzofuran	NA	NA	NA	NA	NA	NA
Diethyl phthalate	NA	NA	NA	NA	NA	NA
Dimethyl phthalate	NA	NA	NA	NA	NA	NA
Fluoranthene	NA	NA	NA	NA	NA	NA

TABLE 32-7, AUS-0018  
SUMMARY OF ECOLOGICAL COPEC EVALUATION

AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Chemical	Surface Water		Sediment		Soil	
	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale
Fluorene	NA	NA	NA	NA	NA	NA
Hexachlorobenzene	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	NA	NA	NA	NA	NA	NA
Hexachloroethane	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-c,d)pyrene	NA	NA	NA	NA	Yes	J
Isophorone	NA	NA	NA	NA	NA	NA
N-Nitroso-di-n-propylamine	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	NA	NA	NA	NA	NA	NA
Naphthalene	NA	NA	NA	NA	NA	NA
Pentachlorophenol	NA	NA	NA	NA	NA	NA
Phenanthrene	NA	NA	NA	NA	NA	NA
Phenol	NA	NA	NA	NA	NA	NA
Pyrene	NA	NA	NA	NA	NA	NA
<b>Metals and Inorganics</b>						
Aluminum	NA	NA	NA	NA	Uncertainty	I
Antimony	NA	NA	NA	NA	No	A
Arsenic	NA	NA	NA	NA	Yes	J
Barium	NA	NA	NA	NA	No	F
Beryllium	NA	NA	NA	NA	No	F
Boron	NA	NA	NA	NA	Yes	D
Cadmium	NA	NA	NA	NA	No	A
Calcium	NA	NA	NA	NA	Uncertainty	G,H
Chromium	NA	NA	NA	NA	Yes	D
Cobalt	NA	NA	NA	NA	No	F
Copper	NA	NA	NA	NA	Yes	J
Cyanide, Total	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	Yes	E
Lead	NA	NA	NA	NA	Yes	J
Magnesium	NA	NA	NA	NA	Uncertainty	G,H
Manganese	NA	NA	NA	NA	Yes	D
Mercury	NA	NA	NA	NA	Yes	J
Nickel	NA	NA	NA	NA	No	F
Potassium	NA	NA	NA	NA	Uncertainty	G,H
Selenium	NA	NA	NA	NA	Yes	D
Silver	NA	NA	NA	NA	Yes	J
Sodium	NA	NA	NA	NA	Uncertainty	G,H
Thallium	NA	NA	NA	NA	No	F
Vanadium	NA	NA	NA	NA	No	F
Zinc	NA	NA	NA	NA	Yes	J
<b>Explosives</b>						
1,3,5-Trinitrobenzene	NA	NA	NA	NA	No	A
1,3-Dinitrobenzene	NA	NA	NA	NA	No	A

**TABLE 32-7, AUS-0018  
SUMMARY OF ECOLOGICAL COPEC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Sediment		Soil	
	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale
2,4,6-Trinitrotoluene (TNT)	NA	NA	NA	NA	No	A
2,4-Dinitrotoluene	NA	NA	NA	NA	No	A
2,6-Dinitrotoluene	NA	NA	NA	NA	Uncertainty	B
2-Amino-4,6-Dinitrotoluene	NA	NA	NA	NA	No	A
2-Nitrotoluene (ONT)	NA	NA	NA	NA	No	C
3-Nitrotoluene	NA	NA	NA	NA	No	C
4-Amino-2,6-Dinitrotoluene	NA	NA	NA	NA	No	C
4-Nitrotoluene (PNT)	NA	NA	NA	NA	No	C
HMX	NA	NA	NA	NA	No	A
Nitrobenzene	NA	NA	NA	NA	No	A
Nitroglycerin	NA	NA	NA	NA	NA	NA
Pentaerythritol tetranitrate (PETN)	NA	NA	NA	NA	NA	NA
Perchloric Acid	NA	NA	NA	NA	NA	NA
RDX	NA	NA	NA	NA	No	A
Tetryl	NA	NA	NA	NA	No	C

- A - Chemical was not detected and the reporting limit does not exceed the screening concentration.
- B - Chemical was not detected, but reporting limit was equal to or exceeded screening concentration.
- C - Chemical was not detected and there is no screening concentration.
- D - Chemical was detected and was equal to or exceeded screening concentration, but did not exceed background.
- E - Chemical was detected and was equal to or exceeded screening concentration and background, if applicable.
- F - Chemical was detected and did not exceed screening concentration.
- G - Chemical was detected, but no screening value was available.
- H - Chemical was detected, but it is an essential nutrient.
- I - If pH<5.5, Aluminum is a COPEC, otherwise it is not.
- J - Chemical was classified as a COPEC based on USEPA 1998 data but was not a COPEC based on SI data.
- NA - Not Analyzed or not applicable.

**TABLE 32-8**  
**AUS-0018 - IOP RAILROAD CLASSIFICATION YARD**  
**CHEMICALS DETECTED ABOVE SCREENING CRITERIA AND ABOVE REFUGE BACKGROUND**  
**(WHERE APPLICABLE)**

**ADDITIONAL AND UNCHARACTERIZED SITES OU SI**

Chemical	Drum <sup>1</sup>	Soil	Sediment	Ground Water	Surface Water
<b>SVOCs</b>					
Benzo(a)pyrene		H,E	NA	NA	NA
Benzo(b)fluoranthene		H,E	NA	NA	NA
Benzo(k)fluoranthene		E	NA	NA	NA
Dibenz(a,h)anthracene		H,E	NA	NA	NA
Indeno(1,2,3-c,d)pyrene		H,E	NA	NA	NA
<b>Metals</b>					
Arsenic		H,E	NA	NA	NA
Barium		H	NA	NA	NA
Cadmium		H	NA	NA	NA
Copper		E	NA	NA	NA
Iron		E	NA	NA	NA
Lead		H,E	NA	NA	NA
Mercury		H,E	NA	NA	NA
Nickel		H	NA	NA	NA
Silver		H,E	NA	NA	NA
Zinc		H,E	NA	NA	NA

Key:

<sup>1</sup> Drums were not present at this site.

NA = not analyzed

H = human health screening criteria exceeded

E = ecological screening criteria exceeded

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AUS-0018-001	Units	Result:	Reference	Result:	Reference
		0 - 6 In	Code	2 ft	Code
<b>Volatile Organic Compounds</b>					
All VOCs	UG/KG	NA		ND	
<b>Explosives</b>					
All Explosives	UG/KG	ND		NA	
<b>Metals</b>					
All Metals	MG/KG			NA	
Aluminum	MG/KG	16800			
Arsenic	MG/KG	12.6	e1,h1,h5,h7		
Barium	MG/KG	225	b1,h5		
Beryllium	MG/KG	0.79	b1		
Calcium	MG/KG	2880	b1		
Chromium	MG/KG	19.9	e1,h5		
Cobalt	MG/KG	10.2			
Copper	MG/KG	15.4	b1		
Iron	MG/KG	25800	b1,h5		
Lead	MG/KG	31.4	b1		
Magnesium	MG/KG	3380	b1		
Manganese	MG/KG	936	e1		
Mercury	MG/KG	0.01	e5		
Nickel	MG/KG	14.8	h5		
Potassium	MG/KG	701	b1		
Selenium (duplicate)	MG/KG	0.41	e5,h5		
Sodium	MG/KG	81.7			
Thallium (duplicate)	MG/KG	0.69	b1		
Vanadium	MG/KG	40.4			
Zinc	MG/KG	50.6			

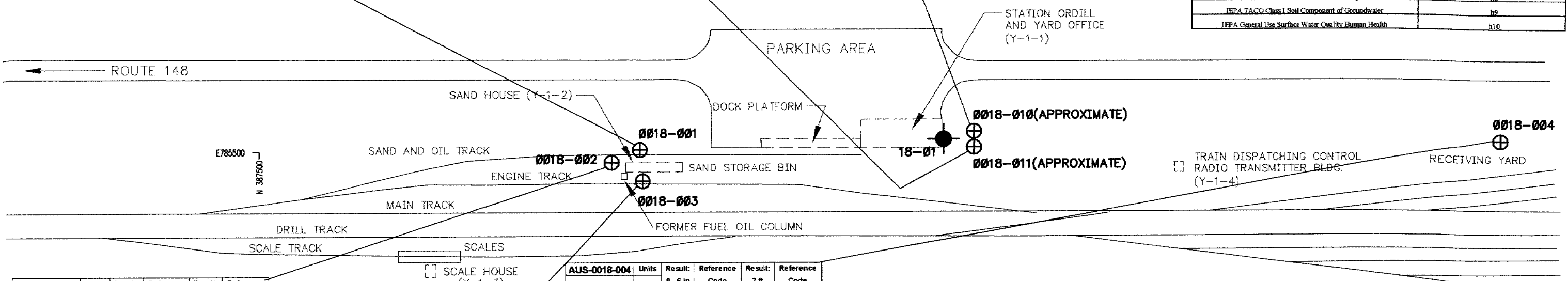
AUS-0018-011	Units	Result:	Reference
		0 - 6 in	Code
<b>Metals</b>			
Aluminum	MG/KG	864	
Antimony	MG/KG	0.59	h5
Arsenic	MG/KG	2.3	h5
Barium	MG/KG	11	
Beryllium	MG/KG	0.05	
Cadmium	MG/KG	0.81	b1,h5
Calcium	MG/KG	18500	b1
Cobalt	MG/KG	1.7	
Copper	MG/KG	14.4	b1
Iron	MG/KG	3120	e1
Lead	MG/KG	34.3	b1
Magnesium	MG/KG	113000	b1
Manganese	MG/KG	143	e1
Mercury	MG/KG	0.09	b1,e5
Nickel	MG/KG	2.8	
Potassium	MG/KG	175	
Vanadium	MG/KG	2.6	
Zinc	MG/KG	43.9	

AUS-0018-010	Units	Result:	Reference
		0 - 6 in	Code
<b>Metals</b>			
Aluminum	MG/KG	731	
Antimony	MG/KG	0.42	h5
Arsenic	MG/KG	2.4	h5
Barium	MG/KG	17.1	
Beryllium	MG/KG	0.05	
Cadmium	MG/KG	0.82	b1,h5
Calcium	MG/KG	19200	b1
Chromium	MG/KG	1.8	
Cobalt	MG/KG	1.5	
Copper	MG/KG	17.3	b1
Iron	MG/KG	2570	e1
Lead	MG/KG	24.7	b1
Magnesium	MG/KG	109000	b1
Manganese	MG/KG	134	e1
Mercury	MG/KG	0.0909	b1,e5
Nickel	MG/KG	1.8	
Potassium	MG/KG	150	
Vanadium	MG/KG	2.2	
Zinc	MG/KG	45.6	

**LEGEND**

- ⊕ MONITORING WELL LOCATION
- ⊕ HAND AUGER LOCATION
- ⊙ APPROXIMATE USEPA 1998 SAMPLE LOCATION

Screening Reference	Reference Code
AUS Background Soil UTL	b1
Little Grassy Background Sediment UTL	b2
Little Grassy Background Surface Water UTL	b3
Ecological Direct Exposure Pathway TRV - Soil	e1
Ecological Direct Exposure Pathway TRV - Sediment	e2
Ecological Direct Exposure Pathway TRV - Surface Water	e3
IEPA General Use Surface Water Quality Aquatic Life Toxicity	e4
Superfund Chemical Data Matrix Kow values (potential bioaccumulators)	e5
USEPA Region IX Industrial Soil PRG - carcinous	h1
USEPA Region IX Industrial Soil PRG - noncarcinous	h2
USEPA Region IX Tap Water PRG - carcinous	h3
USEPA Region IX Tap Water PRG - noncarcinous	h4
USEPA Region IX Migration to Groundwater PRG (DAF=1)	h5
USEPA MCL Drinking Water Standards	h6
IEPA TACO Industrial/Commercial Soil Ingestion	h7
IEPA TACO Construction Worker Soil Ingestion	h8
IEPA TACO Class I Soil Component of Groundwater	h9
IEPA General Use Surface Water Quality Human Health	h10



AUS-0018-002	Units	Result:	Reference	Result:	Reference
		0 - 6 In	Code	2 ft	Code
<b>Volatile Organic Compounds</b>					
All VOCs	UG/KG	NA		ND	
<b>Explosives</b>					
All Explosives	UG/KG	ND		NA	
<b>Metals</b>					
All Metals	MG/KG			NA	
Aluminum	MG/KG	14900			
Arsenic	MG/KG	7.9	h1,h5,h7		
Barium	MG/KG	143	h5		
Beryllium	MG/KG	0.79	b1		
Calcium	MG/KG	2700	b1		
Chromium	MG/KG	20.5	e1,h5		
Cobalt	MG/KG	13.5			
Copper	MG/KG	17	b1		
Iron	MG/KG	21500	b1,h5		
Lead	MG/KG	28.2	b1		
Magnesium	MG/KG	2980	b1		
Manganese	MG/KG	406	e1		
Mercury	MG/KG	0.02	e5		
Nickel	MG/KG	16.2	h5		
Potassium	MG/KG	81.7	b1		
Sodium	MG/KG	75.4			
Vanadium	MG/KG	34.9			
Zinc	MG/KG	100	b1		

AUS-0018-003	Units	Result:	Reference	Result:	Reference
		0 - 6 in	Code	2 ft	Code
<b>Volatile Organic Compounds</b>					
All VOCs	UG/KG	NA		ND	
<b>Explosives</b>					
All Explosives	UG/KG	ND		NA	
<b>Metals</b>					
All Metals	MG/KG			NA	
Aluminum	MG/KG	11100			
Arsenic	MG/KG	7.7	h1,h5,h7		
Barium	MG/KG	104	h5		
Beryllium	MG/KG	0.41	b1		
Boron	MG/KG	0.84	e1		
Calcium	MG/KG	1820	b1		
Chromium	MG/KG	15.9	e1,h5		
Cobalt	MG/KG	5.1			
Copper	MG/KG	7	b1		
Iron	MG/KG	16100	e1		
Lead	MG/KG	15.6	b1		
Magnesium	MG/KG	2020	b1		
Manganese	MG/KG	907	e1		
Mercury	MG/KG	0.017	e5		
Nickel	MG/KG	8.2			
Potassium	MG/KG	419			
Selenium	MG/KG	0.69	e5,h5		
Sodium	MG/KG	65			
Vanadium	MG/KG	35.5			
Zinc	MG/KG	27.8			

AUS-0018-004	Units	Result:	Reference	Result:	Reference
		0 - 6 in	Code	2 ft	Code
<b>Volatile Organic Compounds</b>					
All VOCs	UG/KG	NA		ND	
Acetone	UG/KG			40	
<b>Explosives</b>					
All Explosives	UG/KG	ND		NA	
<b>Metals</b>					
All Metals	MG/KG			NA	
Aluminum	MG/KG	13600			
Arsenic	MG/KG	8.3	h1,h5,h7		
Barium	MG/KG	190	h5		
Beryllium	MG/KG	0.59			
Calcium	MG/KG	1830	b1		
Chromium	MG/KG	15.5	e1,h5		
Cobalt	MG/KG	7.9			
Copper	MG/KG	10.3			
Iron	MG/KG	17900	e1		
Lead	MG/KG	23.8	b1		
Magnesium	MG/KG	1890	b1		
Manganese	MG/KG	1210	e1		
Mercury	MG/KG	0.033	e5		
Nickel	MG/KG	10.3	h5		
Potassium	MG/KG	632	b1		
Selenium	MG/KG	0.62	e5,h5		
Sodium	MG/KG	51.4			
Vanadium	MG/KG	31.9			
Zinc	MG/KG	110	b1		

AUS-0018-005	Units	Result:	Reference	Result:	Reference
		0 - 6 in	Code	2 ft	Code
<b>Volatile Organic Compounds</b>					
All VOCs	UG/KG	NA		ND	
<b>Explosives</b>					
All Explosives	UG/KG	ND		NA	
<b>Metals</b>					
All Metals	MG/KG			NA	
Aluminum	MG/KG	11100			
Arsenic	MG/KG	7.7	h1,h5,h7		
Barium	MG/KG	79.2			
Beryllium	MG/KG	0.45			
Calcium	MG/KG	1250	b1		
Chromium	MG/KG	14.9	e1,h5		
Cobalt	MG/KG	4.6			
Copper	MG/KG	8.4			
Iron	MG/KG	15800	e1		
Lead	MG/KG	13.6			
Magnesium	MG/KG	1630	b1		
Manganese	MG/KG	362	e1		
Mercury	MG/KG	0.018	e5		
Nickel	MG/KG	7.1	h5		
Potassium	MG/KG	488			
Selenium	MG/KG	0.39	e5,h5		
Sodium	MG/KG	56			
Vanadium	MG/KG	30.3			
Zinc	MG/KG	29.7			

**NOTES:**

- BASE MAP IS FROM IOP DRAWING: LOCATION LAYOUT, CLASSIFICATION YARD AND STATION ORDLL, PLAN NO. 6544-101.18, REVISION DATED 6-30-42.
  - DATA QUALIFIERS FOR ANALYTICAL RESULTS ARE NOT INDICATED. REFER TO QCSR FOR DATA QUALIFIERS.
  - THE FOLLOWING COMPOUNDS ARE INCLUDED IN THE ANALYTE LIST FOR BOTH SVOCs AND EXPLOSIVES: 2,4-DINITROTOLUENE, 2,6-DINITROTOLUENE, AND NITROBENZENE. THESE COMPOUNDS MAY BE REPORTED AS EITHER SVOCs OR EXPLOSIVES.
- APPROXIMATE SCALE 1"=100'

**AUS-0018-IOP RAILROAD CLASSIFICATION YARD**

PA/SI REPORT-AUS OU CRAB ORCHARD NWR MARION, ILLINOIS	PROJECT NO. 2320000026.00
<b>URS</b>	
DRN. BY: djd 10/24/00 DSGN. BY: mjh CHKD. BY: mch/cmw	FIG. NO. 32-1



## **SECTION THIRTY-THREE Former Railroad Spur North of Area 4 East**

AUS-0019 is identified as a former railroad spur. The general location of AUS-0019, along with other sites in this volume, is shown in Figure 30-1. Figure 33-1 shows the site in more detail.

### **AUS Original Site Designations**

AUS-0019 is one of the original sites in the Additional and Uncharacterized Sites Operable Unit (AUS OU) designated in 1997-1999 by the United States Fish & Wildlife Service (USFWS).

### **33.1 HISTORIC SEARCH INFORMATION**

#### **33.1.1 Site Description**

No evidence was found that this spur was part of Illinois Ordnance Plant (IOP) operations. Based on aerial photographs, it appears that this site pre-dated the IOP and previously contained a building that was served by the former railroad spur.

#### **33.1.2 Operational History and Waste Characteristics**

AUS-0019 was identified by the USFWS as a possible disposal area (dump) based on their review of historical aerial photographs.<sup>1</sup> The aerial photograph interpretation done by Entech identified a railroad spur and a building foundation at this location, in the 1943 aerial photograph.<sup>2</sup> There was also an area of surficial discoloration identified between the building foundation and the railroad spur, and there appeared to be truckloads of earthen material dumped in this area.<sup>3</sup> By 1951, the area of surficial discoloration was gone.<sup>4</sup> This area remained scarred in subsequent aerial photographs.

It does not appear that this area was used for any IOP operations, since the site appears to have pre-dated the IOP. This assumption was made based on the aerial photograph review, since in 1943 this building had already been razed and this building was not identified in IOP records. No information was found regarding activities that may have taken place in this former building or who may have used this railroad spur prior to the United States Government taking possession of the property.

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<sup>1</sup> Entech, Inc., 1999, Historical Aerial Photographic Analysis -- Inventory of Potential Disposal Sites: Additional and Uncharacterized Sites (AUS) Operable Unit, Crab Orchard National Wildlife Refuge, Marion, Illinois, Volume I (Text) Page 3-15, and Volume II (Maps) Page G. The photos were obtained from the National Archives and Records Administration (NARA) and the U.S. Department of Agriculture Agricultural Stabilization and Conservation Service (ASCS).

<sup>2</sup> Entech, Inc., 2000, Historical Aerial Photographic Analysis of Area 4, Crab Orchard National Wildlife Refuge (CONWR), Figure 1.

<sup>3</sup> Entech, Inc., 2000, Historical Aerial Photographic Analysis of Area 4, Crab Orchard National Wildlife Refuge (CONWR), Figure 1 and Page 3.

<sup>4</sup> Entech, Inc., 2000, Historical Aerial Photographic Analysis of Area 4, Crab Orchard National Wildlife Refuge (CONWR), Figure 2.

## **SECTION THIRTY-THREE Former Railroad Spur North of Area 4 East**

This site was not identified during the site reconnaissance. It was later identified using coordinates obtained from aerial photographs<sup>5</sup>.

There were no known industrial lessees of this property.

### **33.1.3 AUS-0019 Previous Sampling Results**

There has been no previous sampling at this site.

### **33.1.4 Observations During Site Visit**

There are no buildings remaining at this site. This site is located within a wooded area and there is a drainageway near the sample location (Figure 33-1).

### **33.1.5 Recommendations Based on Preliminary Assessment**

AUS-0019 was retained in the Site Investigation (SI) because the aerial photograph interpretation identified an area of surficial discoloration (a potential spill) located between the former building foundation and the former railroad spur at this location.

## **33.2 SITE INVESTIGATION INFORMATION**

URS conducted a Site Investigation at AUS-0019 on May 11, 2000. The rationale for sample locations, media, and analytes was not included in the FSP for the AUS OU PA/SI, since sample locations at this site were added after the FSP had been completed. AUS OU SI sample locations are shown on Figure 33-1. Survey coordinates for all sample locations in AUS-0019 are listed in Table 33-1. Table 33-2 lists the sample locations and the matrix sampled at that location. One soil sample was obtained.

### **33.2.1 Field Investigation**

Sample 0019-001 was collected from a soil depth of 1 to 2 feet (ft). The sample was located using coordinates obtained from historic aerial photographs since there was no remaining evidence at the surface of the previous soil discoloration. The sample location was from near the ditch, not inside of the ditch that appears on Figure 33-1.

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<sup>5</sup> At the beginning of the project, a test was conducted to estimate the accuracy of locating features from historic aerial photos. Using conventional methods, survey coordinates were obtained of a number of existing features at the Refuge that also appeared on a series of historic photos (for example, the corners of IOP buildings that are still existing). Entech independently obtained coordinates from the aerial photos. The coordinates obtained from the aerial photos were found to be in agreement with the coordinates obtained by conventional methods, within a few ft; acceptable for locating site features such as spills.

**SECTION THIRTY-THREE Former Railroad Spur North of Area 4 East****33.2.2 Field Results****33.2.2.1 Site Conditions****33.2.2.1.1 *Geologic Conditions***

There were no test pits or monitoring wells installed at AUS-0019. The soil from the hand auger boring, which extended to a depth of 2 ft, was described as silty clay fill.

**33.2.2.1.2 *Hydrogeologic Conditions***

No hydrogeological information is available for this site.

**33.2.2.1.3 *Hydrologic Conditions***

There is one drainageway at the site, close to the sampled location.

**33.2.2.2 Chemical Results**

Table 33-3 lists the chemicals detected in AUS-0019 during this investigation, along with the frequency and range of detections. Tabulated results of all analyses are included in the Quality Control Summary Report (QCSR). All results are shown in Figure 33-1.

**33.3 SCREENING RISK ASSESSMENT**

Results of the screening are presented in Tables 33-4 and 33-5 as follows:

- Table 33-4--human health risk screening for soils, and
- Table 33-5--ecological risk screening for soils.

Each table lists the maximum detected concentration for each constituent analyzed at AUS-0019. The screening results are presented in the tables in terms of hazard quotients (HQs). The HQ for any chemical detected, for any particular screening criterion is simply the ratio of the maximum detected concentration to the screening concentration. For human health for carcinogens, a screening level "cancer risk" is calculated instead of an HQ.

Chemicals that are shaded in the tables are those that exceeded the screening criteria, and are identified as chemicals of potential concern (COPCs) for human health risk, and chemicals of potential ecological concern (COPECs) for ecological risk. The only COPCs/COPECs not shaded in the table are those inorganic constituents that exceeded the screening criteria but were detected at levels below Refuge background.

In cases where the chemical was analyzed but not detected, the HQ is the ratio between the maximum reporting limit and the screening concentration. Chemicals not detected are identified with a "U" qualifier in the qualifier column. When these HQ values exceed one, they are not shaded. These constituents are not identified as COPCs/COPECs, but rather as uncertainties.

## SECTION THIRTY-THREE Former Railroad Spur North of Area 4 East

In Figure 33-1, the shading convention used is the same as for the tables discussed above. The particular screening criteria exceeded are indicated by the code in the analytical results labels. Duplicate results are shown only if the duplicate result for an analyte exceeded the screening criteria and the result from the original sample did not; or, if the analyte was detected in the duplicate and not in the original sample. Since in the screening process results which are qualified as estimated (coded with "J") are treated the same as unqualified results, data qualifiers are not included in the results shown in the figures. Refer to the QCSR for data qualifiers.

Tables 33-6 (human health risk) and 33-7 (ecological risk) list all the analytes and corresponding media sampled and indicate whether each is a COPC (or COPEC), not a COPC (or COPEC), or an uncertainty. The codes in the tables indicate the rationale for each classification. All COPCs (Table 33-6) and COPECs (Table 33-7) are shaded in the tables.

### 33.3.1 Human Health Risk

#### 33.3.1.1 Soil

Human health screening results for soil samples are presented in Table 33-4. For carcinogens, a cancer risk was calculated using the United States Environmental Protection Agency (USEPA) Region 9 Industrial Soil Preliminary Remediation Goals (PRGs) as screening values. The cancer risk was derived by calculating a ratio of the maximum detected concentrations, or the maximum reporting limits, to their appropriate screening values. These ratios were then multiplied by  $1 \times 10^{-6}$ . In addition, ratios were calculated using the USEPA Region 9 Industrial Soil PRG for Toxins, the USEPA Region 9 Migration to Groundwater Criteria (Dilution Attenuation Factor (DAF)=1), the Illinois Tiered Approach to Corrective Action Objectives (TACO) Industrial/Commercial Soil Ingestion Criteria, the Illinois TACO Construction Worker Soil Ingestion Criteria, and the Illinois TACO Class I Soil Component of Groundwater Criteria.

### 33.3.2 Ecological Risk

#### 33.3.2.1 Soil

Ecological screening results for soil samples are presented in Table 33-5. Soil screening concentrations for direct exposures were developed using toxicity reference values (TRVs) derived from several sources, including the following:

- USEPA (2000)<sup>6</sup>
- Environment Canada (1995)<sup>7</sup>
- Talmage *et al.* (1999)<sup>8</sup>
- Efroymsen *et al.* (1997a, 1997b)<sup>9</sup>

<sup>6</sup> USEPA. 2000. Ecological Soil Screening Level Guidance (Draft). USEPA Office of Emergency and Remedial Response, Washington, DC.

<sup>7</sup> Environment Canada. 1995. Toxicity Testing of NCSR Priority Substances for Development of Soil Quality Guidelines for Contaminated Sites. Guidelines Division, Evaluation and Interpretation Branch, Environmental Conservation Directorate, Environment Canada. Hull, Quebec.

<sup>8</sup> Talmage, S.S., D.M. Opresko, C.J. Maxwell, C.J.E. Welsh, F. M. Cretella, P.H. Reno, and F. B. Daniel. 1999. Nitroaromatic Munition Compounds: Environmental Effects and Screening Values. *Rev Environ. Contam. Toxicol* 161:1-156.

**SECTION THIRTY-THREE Former Railroad Spur North of Area 4 East**

- CCME (1999)<sup>10</sup>
- MHSPE (1994)<sup>11</sup>
- Other sources

A detailed discussion of the screening concentration selection is presented in Appendix G.

The screening approach for ingestion pathway exposures was based on the potential for a chemical to bioaccumulate. The potential for a chemical to bioaccumulate was based on the organic chemical-specific octanol-to-water partitioning coefficient ( $K_{ow}$ ), which provides an indication of the lipophilicity of an organic chemical, and its potential for sequestration in biological tissue. The document *Assessment and Control of Bioconcentratable Contaminants in Surface Waters* (USEPA 1991)<sup>12</sup> used a log  $K_{ow}$  of 3.5 as a target threshold value indicative of bioaccumulative chemicals to target organic chemicals of greatest concern. Using this as a guideline, organic chemicals with a log  $K_{ow}$  greater than 3.5 were considered potentially bioaccumulative chemicals. Among inorganics, mercury and selenium were considered as potentially bioaccumulative chemicals. Any potentially bioaccumulative chemical that is detected was retained as a COPEC.

### 33.4 SCIENTIFIC MANAGEMENT DECISION POINT

#### 33.4.1 Human Health Risk Evaluation

This report recommends that inorganic constituents that exceeded project screening criteria but were within Refuge background levels not be retained as COPCs for further evaluation. These are the constituents coded with "D" on Table 33-6, and include arsenic, chromium, nickel and selenium.

Except for the inorganic constituents that exceeded screening criteria but not background, there were no exceedances of human health screening criteria.

Several chemicals represent uncertainties for AUS-0019 because, while they were not detected, the reporting limit was equal to or exceeded the screening criteria. These are indicated as uncertainties on Table 33-6, and coded with a "B." The uncertainty associated with these chemicals is not considered to be significant.

<sup>9</sup> Efrogmson, R.A., M.E. Will, G.W. Suter II, and A.C. Wooten. 1997a. *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision*. Oak Ridge National Laboratory, Oak Ridge, Tennessee. ES/ER/TM-85/R3.

Efrogmson, R.A., M.E. Will, and G.W. Suter II. 1997b. *Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision*. Oak Ridge National Laboratory, Oak Ridge, Tennessee. ES/ER/TM-126/R2.

<sup>10</sup> Canadian Council of Ministers of the Environment. 1999. *Canadian Environmental Quality Guidelines*.

<sup>11</sup> Ministry of Housing, Spatial Planning, and the Environment (MHSPE). 1994. *Intervention Values and Target Values – Soil Quality Standards*. Directorate General for Environmental Protection, Department of Soil Protection, The Hague, The Netherlands.

<sup>12</sup> USEPA 1991. *Assessment and Control of Bioconcentratable Contaminants in Surface Waters (Draft)*. US Environmental Protection Agency Office of Research and Development, Washington, D.C.

## **SECTION THIRTY-THREE** Former Railroad Spur North of Area 4 East

In summary, results of the soil analyses at AUS-0019 indicate there are no chemicals present at levels of potential human health concern warranting further evaluation. It is recommended that none of the chemicals be retained as COPECs for this site.

### **33.4.2 Ecological Risk Evaluation**

There were no COPECs identified among the organic constituents analyzed at AUS-0019. However, several were identified as uncertainties because the reporting limit was higher than the screening concentration. In fact, there were no volatile organic compounds, semivolatile organic compounds or explosives detected, lending weight of evidence that organic chemicals are not of ecological concern at AUS-0019.

Among the inorganic compounds, chromium, iron, manganese, mercury and selenium were identified as COPECs. This report recommends that inorganic constituents that exceeded project screening criteria but were within Refuge background levels not be retained as COPECs for further evaluation. These are the constituents coded with "D" on Table 33-7, and include chromium, manganese, mercury, and selenium. Iron was the only COPEC detected above background. The maximum concentration of iron (23,800 milligrams per kilogram (mg/kg)) was about 23 percent above the background concentration (19,306 mg/kg -- Table 33-5). Though the maximum detection exceeded the screening value, iron is not considered a significant ecological concern since it is generally considered to have low toxicity and is also an essential nutrient.

Aluminum and boron were also identified as uncertainties at AUS-0019 (Table 33-7). The screening criterion for aluminum is based on soil pH, and there are no site-specific pH data available for AUS-0019. However, the maximum concentration is below background, and thus aluminum is not considered a significant ecological concern. Boron was not detected, but the screening value for boron was below the reporting limit. Because it was not detected, boron is not considered a significant concern. Other inorganics were identified as uncertainties because they were detected but no screening values were identified. These include calcium, magnesium, potassium, and sodium. All of these are essential nutrients, and calcium and magnesium were also below background concentrations. Therefore, none of these constituents is considered a significant concern.

In summary, results of the soil analyses at AUS-0019 indicate there are no chemicals present at levels of potential ecological concern warranting further evaluation. It is recommended that none of the chemicals be retained as COPECs for this site.

### **33.4.3 Summary of Recommendations**

Based on the above discussions, it is recommended that none of the constituents detected at Site AUS-0019 be retained for further evaluation. Site AUS-0019 is judged to require no further action.

**SECTION THIRTY-THREE Former Railroad Spur North of Area 4 East**

**TABLE 33-1  
SURVEY COORDINATES FOR SAMPLE LOCATIONS IN AUS-0019**

<b>Sample Location</b>	<b>Northing</b>	<b>Easting</b>	<b>Ground Surface Elevation</b>	<b>Top of Casing Elevation</b>	<b>Comments</b>
0019-001	386913.0	785721.6	444.80	NA	

Sheet 1 of 1

NA = Not Applicable

**SECTION THIRTY-THREE Former Railroad Spur North of Area 4 East**

TABLE 33-2  
MATRICES SAMPLED AT EACH SAMPLE LOCATION AT AUS-0019

Soil
AUS-0019-001

Sheet 1 of 1



**SECTION THIRTY-THREE Former Railroad Spur North of Area 4 East**

**TABLE 33-3  
SOIL SAMPLE ANALYTICAL RESULTS SUMMARY**

<b>Constituents</b>	<b>Number of Detections</b>	<b>Range of Detections</b>
<b>Metals</b>		
Aluminum	1/1	16,000 mg/kg
Arsenic	1/1	6.5 mg/kg
Barium	1/1	60.6 mg/kg
Beryllium	1/1	0.28 mg/kg
Calcium	1/1	3,070 mg/kg
Chromium, Total	1/1	18.9 mg/kg
Cobalt	1/1	3.6 mg/kg
Copper	1/1	13.7 mg/kg
Iron	1/1	21,500 mg/kg
Lead	1/1	12.7 mg/kg
Magnesium	1/1	2,670 mg/kg
Manganese	1/1	109 mg/kg
Mercury	1/1	0.0094 mg/kg
Nickel	1/1	8.2 mg/kg
Potassium	1/1	528 mg/kg
Selenium	1/1	0.58 mg/kg
Sodium	1/1	145 mg/kg
Thallium	1/1	0.64 mg/kg
Vanadium	1/1	24.1 mg/kg
Zinc	1/1	50.1 mg/kg

Sheet 1 of 1

mg/kg = milligrams per kilogram

Notes: This table was derived from the figures that show the analytical results. As a result, duplicates are shown only if the duplicate result for an analyte exceeded the screening criteria and the result from the original sample did not; or, if the analyte was detected in the duplicate and not in the original sample. There may be some duplicate results, not shown in the table, that are outside the range shown. In addition, the frequency and range of detections is based on the number of sample locations, not the total number of samples (the total number of samples includes originals plus duplicates).

Checked by: MMF 7/20/01

**TABLE 33-4  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0019**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
<b>Volatile Organic Compounds</b>								
71-55-6	1,1,1-Trichloroethane	6	U	UG/KG			1.80E-06	6.00E-02
79-34-5	1,1,2,2-Tetrachloroethane	6	U	UG/KG		6.68E-09	1.54E-06	3.00E+01
79-00-5	1,1,2-Trichloroethane	6	U	UG/KG		3.16E-09	3.94E-05	6.67E+00
75-34-3	1,1-Dichloroethane	6	U	UG/KG			2.91E-06	6.00E-03
75-35-4	1,1-Dichloroethene	6	U	UG/KG		5.05E-08	8.91E-05	2.00E+00
107-06-2	1,2-Dichloroethane (EDC)	6	U	UG/KG		7.85E-09	1.70E-04	6.00E+00
540-59-0	1,2-Dichloroethene (total)	6	U	UG/KG			4.07E-05	3.00E-01
78-87-5	1,2-Dichloropropane	6	UJ	UG/KG		7.81E-09	2.82E-04	6.00E+00
78-93-3	2-Butanone (MEK)	12	U	UG/KG			4.33E-07	
591-78-6	2-Hexanone	12	U	UG/KG				
108-10-1	4-Methyl-2-pentanone (MIBK)	12	U	UG/KG			4.16E-06	
67-64-1	Acetone	12	U	UG/KG			1.93E-06	1.50E-02
71-43-2	Benzene	6	U	UG/KG		4.10E-09	2.48E-04	3.00E+00
75-27-4	Bromodichloromethane	6	U	UG/KG		2.55E-09	5.75E-06	2.00E-01
75-25-2	Bromoform	6	U	UG/KG		1.92E-11	3.41E-07	1.50E-01
74-83-9	Bromomethane	6	U	UG/KG			4.57E-04	6.00E-01
75-15-0	Carbon disulfide	6	U	UG/KG			4.96E-06	3.00E-03
56-23-5	Carbon tetrachloride	6	U	UG/KG		1.13E-08	8.58E-04	2.00E+00
108-90-7	Chlorobenzene	6	U	UG/KG			1.11E-05	8.57E-02
75-00-3	Chloroethane	6	U	UG/KG		9.22E-10	3.18E-07	
67-66-3	Chloroform	6	U	UG/KG		1.15E-08	4.66E-03	2.00E-01
74-87-3	Chloromethane	6	U	UG/KG		2.25E-09		
156-59-2	cis-1,2-Dichloroethene	6	U	UG/KG			4.07E-05	3.00E-01

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 33-4  
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10061-01-5	cis-1,3-Dichloropropene	6	U	UG/KG		3.37E-08	1.36E-04	
124-48-1	Dibromochloromethane	6	U	UG/KG		2.26E-09	3.77E-06	3.00E-01
100-41-4	Ethylbenzene	6	U	UG/KG			1.00E-06	8.57E-03
75-09-2	Methylene chloride	6	U	UG/KG		2.92E-10	6.14E-07	6.00E+00
110-54-3	N-Hexane	6	U	UG/KG			1.49E-05	
100-42-5	Styrene	6	U	UG/KG			2.94E-07	3.00E-02
127-18-4	Tetrachloroethylene (PCE)	6	U	UG/KG		3.21E-10	3.52E-06	2.00E+00
108-88-3	Toluene	6	U	UG/KG			3.02E-06	1.00E-02
1330-20-7	total Xylenes	6	U	UG/KG			1.35E-06	6.00E-04
156-60-5	trans-1,2-Dichloroethene	6	U	UG/KG			2.80E-05	2.00E-01
10061-02-6	trans-1,3-Dichloropropene	6	U	UG/KG		3.37E-08	1.36E-04	
79-01-6	Trichloroethylene (TCE)	6	U	UG/KG		9.81E-10	7.59E-05	2.00E+00
75-01-4	Vinyl chloride	6	U	UG/KG		1.23E-07		8.57E+00
<b>Semivolatile Organic Compounds</b>								
120-82-1	1,2,4-Trichlorobenzene	420	UJ	UG/KG			5.51E-05	1.40E+00
95-50-1	1,2-Dichlorobenzene	420	U	UG/KG			1.27E-04	4.67E-01
541-73-1	1,3-Dichlorobenzene	420	U	UG/KG			8.12E-03	
106-46-7	1,4-Dichlorobenzene	420	U	UG/KG		5.17E-08	2.19E-04	4.20E+00
95-95-4	2,4,5-Trichlorophenol	2100	U	UG/KG			2.38E-05	2.10E-01
88-06-2	2,4,6-Trichlorophenol	420	U	UG/KG		1.87E-09		5.25E+01
120-83-2	2,4-Dichlorophenol	420	U	UG/KG			1.59E-04	8.40E+00
105-67-9	2,4-Dimethylphenol	420	U	UG/KG			2.38E-05	1.05E+00
51-28-5	2,4-Dinitrophenol	2100	U	UG/KG			1.19E-03	2.10E+02
91-58-7	2-Chloronaphthalene	420	U	UG/KG			1.54E-05	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 33-4  
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95-57-8	2-Chlorophenol	420	U	UG/KG			1.74E-03	2.10E+00
91-57-6	2-Methylnaphthalene	420	U	UG/KG			7.75E-06	2.10E-03
95-48-7	2-Methylphenol	420	U	UG/KG			9.54E-06	5.25E-01
88-74-4	2-Nitroaniline	2100	U	UG/KG			4.17E-02	
88-75-5	2-Nitrophenol	420	U	UG/KG			5.96E-05	
91-94-1	3,3'-Dichlorobenzidine	420	U	UG/KG		7.66E-08		1.40E+03
99-09-2	3-Nitroaniline	2100	U	UG/KG			4.17E-02	
534-52-1	4,6-Dinitro-2-methylphenol	2100	U	UG/KG				
101-55-3	4-Bromophenyl phenyl ether	420	U	UG/KG				
59-50-7	4-Chloro-3-methylphenol	420	U	UG/KG			9.54E-06	
106-47-8	4-Chloroaniline	830	U	UG/KG			2.36E-04	2.77E+01
7005-72-3	4-Chlorophenyl phenyl ether	420	U	UG/KG				
106-44-5	4-Methylphenol	420	U	UG/KG			9.54E-05	
100-01-6	4-Nitroaniline	2100	U	UG/KG			4.17E-02	
100-02-7	4-Nitrophenol	2100	U	UG/KG			2.98E-04	
83-32-9	Acenaphthene	420	U	UG/KG			1.09E-05	1.40E-02
208-96-8	Acenaphthylene	420	U	UG/KG			7.75E-06	2.10E-03
120-12-7	Anthracene	420	U	UG/KG			1.08E-06	7.00E-04
56-55-3	Benzo(a)anthracene	420	U	UG/KG		1.46E-07		5.25E+00
50-32-8	Benzo(a)pyrene	420	U	UG/KG		1.46E-06		1.05E+00
205-99-2	Benzo(b)fluoranthene	420	U	UG/KG		1.46E-07		2.10E+00
191-24-2	Benzo(g,h,i)perylene	420	U	UG/KG			7.75E-06	2.10E-03
207-08-9	Benzo(k)fluoranthene	420	U	UG/KG		1.46E-08		2.10E-01
111-91-1	bis(2-Chloroethoxy)methane	420	U	UG/KG				

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
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111-44-4	bis(2-Chloroethyl) ether	420	U	UG/KG		6.78E-07		2.10E+04
108-60-1	bis(2-Chloroisopropyl) ether	420	U	UG/KG		5.20E-08	9.88E-05	
117-81-7	bis(2-Ethylhexyl) phthalate (DEHP)	420	U	UG/KG		2.38E-09	2.38E-05	
85-68-7	Butyl benzyl phthalate	420	U	UG/KG			2.38E-06	5.25E-04
86-74-8	Carbazole	420	U	UG/KG		3.41E-09		1.40E+01
218-01-9	Chrysene	420	U	UG/KG		1.46E-09		5.25E-02
84-74-2	Di-n-butyl phthalate	420	U	UG/KG			4.77E-06	1.40E-03
117-84-0	Di-n-octyl phthalate	420	U	UG/KG			2.38E-05	4.20E-05
53-70-3	Dibenz(a,h)anthracene	420	U	UG/KG		1.46E-06		5.25E+00
132-64-9	Dibenzofuran	420	U	UG/KG			8.30E-05	
84-66-2	Diethyl phthalate	420	U	UG/KG			5.96E-07	
131-11-3	Dimethyl phthalate	420	U	UG/KG			4.77E-08	
206-44-0	Fluoranthene	420	U	UG/KG			1.40E-05	2.10E-03
86-73-7	Fluorene	420	U	UG/KG			1.27E-05	1.40E-02
118-74-1	Hexachlorobenzene	420	U	UG/KG		2.72E-07	5.96E-04	4.20E+00
87-68-3	Hexachlorobutadiene	420	U	UG/KG		1.33E-08	2.38E-03	4.20E+00
77-47-4	Hexachlorocyclopentadiene	420	U	UG/KG			7.12E-05	2.10E-02
67-72-1	Hexachloroethane	420	U	UG/KG		2.38E-09	4.77E-04	2.10E+01
193-39-5	Indeno(1,2,3-c,d)pyrene	420	U	UG/KG		1.46E-07		6.00E-01
78-59-1	Isophorone	420	U	UG/KG		1.62E-10	2.38E-06	1.40E+01
621-64-7	N-Nitroso-di-n-propylamine	420	UJ	UG/KG		1.19E-06		2.10E+05
86-30-6	N-Nitrosodiphenylamine	420	U	UG/KG		8.34E-10		7.00E+00
91-20-3	Naphthalene	420	U	UG/KG			2.23E-03	1.05E-01
98-95-3	Nitrobenzene	420	U	UG/KG			3.67E-03	

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87-86-5	Pentachlorophenol	2100	U	UG/KG		1.89E-07	1.47E-04	2.10E+03
85-01-8	Phenanthrene	420	U	UG/KG			7.75E-06	2.10E-03
108-95-2	Phenol	420	U	UG/KG			7.95E-07	8.40E-02
129-00-0	Pyrene	420	U	UG/KG			7.75E-06	2.10E-03
<b>Explosives</b>								
99-35-4	1,3,5-Trinitrobenzene	310	U	UG/KG			1.17E-05	
99-65-0	1,3-Dinitrobenzene	310	U	UG/KG			3.52E-03	
118-96-7	2,4,6-Trinitrotoluene (TNT)	620	U	UG/KG		7.54E-09	1.41E-03	
121-14-2	2,4-Dinitrotoluene	420	U	UG/KG			2.38E-04	1.05E+04
606-20-2	2,6-Dinitrotoluene	620	U	UG/KG			7.04E-04	2.07E+04
35572-78-2	2-Amino-4,6-Dinitrotoluene	620	U	UG/KG				
88-72-2	2-Nitrotoluene (ONT)	620	U	UG/KG				
99-08-1	3-Nitrotoluene	620	U	UG/KG			3.05E-04	
19406-51-0	4-Amino-2,6-Dinitrotoluene	620	U	UG/KG				
99-99-0	4-Nitrotoluene (PNT)	620	U	UG/KG			3.05E-04	
2691-41-0	HMX	620	U	UG/KG			1.41E-05	
121-82-4	RDX	620	U	UG/KG		2.76E-08	2.35E-04	
479-45-8	Tetryl	940	U	UG/KG			1.07E-04	
<b>Metals</b>								
7429-90-5	Aluminum	16000		MG/KG	5.56E-01		9.54E-03	
7440-36-0	Antimony	0.75	U	MG/KG	9.04E-01		9.17E-04	2.50E+00
7440-38-2	Arsenic	8.7		MG/KG	6.44E-01	3.19E-06	1.98E-02	8.70E+00
7440-39-3	Barium	63.1		MG/KG	3.24E-01		5.07E-04	7.89E-01
7440-41-7	Beryllium	0.36	J	MG/KG	4.74E-01	1.61E-10	9.74E-05	1.20E-01

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7440-42-8	Boron	12	U	MG/KG	2.26E+00		1.52E-04	
7440-43-9	Cadmium	0.62	U	MG/KG	3.26E+00	2.07E-10	7.65E-04	1.55E+00
7440-70-2	Calcium	3070	J	MG/KG	1.23E+00			
7440-47-3	Chromium	22.9		MG/KG	9.09E-01	5.11E-08		1.15E+01
7440-48-4	Cobalt	4.2	J	MG/KG	1.94E-01		3.43E-05	
7440-50-8	Copper	14.3		MG/KG	1.27E+00		1.88E-04	
7439-89-6	Iron	23800		MG/KG	1.23E+00		3.89E-02	
7439-92-1	Lead	12.7	J	MG/KG	5.43E-01			
7439-95-4	Magnesium	2670		MG/KG	1.72E+00			
7439-96-5	Manganese	164		MG/KG	4.51E-02		5.09E-03	
7439-97-6	Mercury	0.012	J	MG/KG	2.00E-01			
7440-02-0	Nickel	8.2		MG/KG	4.34E-01		2.01E-04	1.17E+00
2023695	Potassium	609	J	MG/KG	9.74E-01			
7782-49-2	Selenium	0.84		MG/KG	3.59E-01		8.22E-05	2.80E+00
7440-22-4	Silver	1.2	U	MG/KG	2.07E+00		1.17E-04	6.00E-01
7440-23-5	Sodium	145		MG/KG	8.53E-01			
7440-28-0	Thallium	0.64	J	MG/KG	1.56E+00		4.47E-06	
7440-62-2	Vanadium	31		MG/KG	6.57E-01		2.17E-03	1.03E-01
7440-66-6	Zinc	52.3		MG/KG	1.02E+00		8.54E-05	8.72E-02

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ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
<b>Volatile Organic Compounds</b>							
71-55-6	1,1,1-Trichloroethane	6	U	UG/KG			3.00E-03
79-34-5	1,1,2,2-Tetrachloroethane	6	U	UG/KG			
79-00-5	1,1,2-Trichloroethane	6	U	UG/KG	7.32E-07	7.32E-07	3.00E-01
75-34-3	1,1-Dichloroethane	6	U	UG/KG	3.00E-08	3.00E-08	2.61E-04
75-35-4	1,1-Dichloroethene	6	U	UG/KG	3.33E-07	3.33E-06	1.00E-01
107-06-2	1,2-Dichloroethane (EDC)	6	U	UG/KG	9.52E-05	4.29E-06	3.00E-01
540-59-0	1,2-Dichloroethene (total)	6	U	UG/KG	3.00E-07	3.00E-07	1.50E-02
78-87-5	1,2-Dichloropropane	6	UJ	UG/KG	7.14E-05	3.33E-06	2.00E-01
78-93-3	2-Butanone (MEK)	12	U	UG/KG			
591-78-6	2-Hexanone	12	U	UG/KG			
108-10-1	4-Methyl-2-pentanone (MIBK)	12	U	UG/KG			
67-64-1	Acetone	12	U	UG/KG	6.00E-08	6.00E-08	7.50E-04
71-43-2	Benzene	6	U	UG/KG	3.00E-05	1.40E-06	2.00E-01
75-27-4	Bromodichloromethane	6	U	UG/KG	6.52E-05	3.00E-06	1.00E-02
75-25-2	Bromoform	6	U	UG/KG	8.33E-06	3.75E-07	7.50E-03
74-83-9	Bromomethane	6	U	UG/KG	2.07E-06	6.00E-06	3.00E-02
75-15-0	Carbon disulfide	6	U	UG/KG	3.00E-08	3.00E-07	1.88E-04
56-23-5	Carbon tetrachloride	6	U	UG/KG	1.36E-04	1.46E-05	8.57E-02
108-90-7	Chlorobenzene	6	U	UG/KG	1.46E-07	1.46E-06	6.00E-03
75-00-3	Chloroethane	6	U	UG/KG			
67-66-3	Chloroform	6	U	UG/KG	6.38E-06	3.00E-06	1.00E-02
74-87-3	Chloromethane	6	U	UG/KG			
156-59-2	cis-1,2-Dichloroethene	6	U	UG/KG	3.00E-07	3.00E-07	1.50E-02

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect



**TABLE 33-4  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0019**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
10061-01-5	cis-1,3-Dichloropropene	6	U	UG/KG			
124-48-1	Dibromochloromethane	6	U	UG/KG	1.46E-07	1.46E-07	1.50E-02
100-41-4	Ethylbenzene	6	U	UG/KG	3.00E-08	3.00E-07	4.62E-04
75-09-2	Methylene chloride	6	U	UG/KG	7.89E-06	5.00E-07	3.00E-01
110-54-3	N-Hexane	6	U	UG/KG			
100-42-5	Styrene	6	U	UG/KG	1.46E-08	1.46E-07	1.50E-03
127-18-4	Tetrachloroethylene (PCE)	6	U	UG/KG	5.45E-05	2.50E-06	1.00E-01
108-88-3	Toluene	6	U	UG/KG	1.46E-08	1.46E-08	5.00E-04
1330-20-7	total Xylenes	6	U	UG/KG	6.00E-09	1.46E-08	4.00E-05
156-60-5	trans-1,2-Dichloroethene	6	U	UG/KG	1.46E-07	1.46E-07	8.57E-03
10061-02-6	trans-1,3-Dichloropropene	6	U	UG/KG			
79-01-6	Trichloroethylene (TCE)	6	U	UG/KG	1.15E-05	5.00E-06	1.00E-01
75-01-4	Vinyl chloride	6	U	UG/KG	2.00E-03	9.23E-05	6.00E-01
<b>Semivolatle Organic Compounds</b>							
120-82-1	1,2,4-Trichlorobenzene	420	UJ	UG/KG	2.10E-05	2.10E-04	8.40E-02
95-50-1	1,2-Dichlorobenzene	420	U	UG/KG	2.33E-06	2.33E-05	2.47E-02
541-73-1	1,3-Dichlorobenzene	420	U	UG/KG			
106-46-7	1,4-Dichlorobenzene	420	U	UG/KG			2.10E-01
95-95-4	2,4,5-Trichlorophenol	2100	U	UG/KG	1.05E-05	1.05E-05	7.78E-03
88-06-2	2,4,6-Trichlorophenol	420	U	UG/KG	8.08E-04	3.82E-05	2.10E+00
120-83-2	2,4-Dichlorophenol	420	U	UG/KG	6.89E-05	6.89E-04	4.20E-01
105-67-9	2,4-Dimethylphenol	420	U	UG/KG	1.02E-05	1.02E-05	4.67E-02
51-28-5	2,4-Dinitrophenol	2100	U	UG/KG	5.12E-04	5.12E-03	1.05E+01
91-58-7	2-Chloronaphthalene	420	U	UG/KG			

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 33-4**  
**HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0019**

**ADDITIONAL AND UNCHARACTERIZED SITES OU**  
**CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
95-57-8	2-Chlorophenol	420	U	UG/KG	4.20E-05	4.20E-05	1.05E-01
91-57-6	2-Methylnaphthalene	420	U	UG/KG	6.89E-06	6.89E-06	1.00E-04
95-48-7	2-Methylphenol	420	U	UG/KG	4.20E-06	4.20E-06	2.80E-02
88-74-4	2-Nitroaniline	2100	U	UG/KG			
88-75-5	2-Nitrophenol	420	U	UG/KG			
91-94-1	3,3'-Dichlorobenzidine	420	U	UG/KG	3.23E-02	1.50E-03	6.00E+01
99-09-2	3-Nitroaniline	2100	U	UG/KG			
534-52-1	4,6-Dinitro-2-methylphenol	2100	U	UG/KG			
101-55-3	4-Bromophenyl phenyl ether	420	U	UG/KG			
59-50-7	4-Chloro-3-methylphenol	420	U	UG/KG			
106-47-8	4-Chloroaniline	830	U	UG/KG	1.01E-04	1.01E-03	1.19E+00
7005-72-3	4-Chlorophenyl phenyl ether	420	U	UG/KG			
106-44-5	4-Methylphenol	420	U	UG/KG			
100-01-6	4-Nitroaniline	2100	U	UG/KG			
100-02-7	4-Nitrophenol	2100	U	UG/KG			
83-32-9	Acenaphthene	420	U	UG/KG	3.50E-06	3.50E-06	7.37E-04
208-96-8	Acenaphthylene	420	U	UG/KG	6.89E-06	6.89E-06	1.00E-04
120-12-7	Anthracene	420	U	UG/KG	6.89E-07	6.89E-07	3.50E-05
56-55-3	Benzo(a)anthracene	420	U	UG/KG	5.25E-02	2.47E-03	2.10E-01
50-32-8	Benzo(a)pyrene	420	U	UG/KG	5.25E-01	2.47E-02	5.25E-02
205-99-2	Benzo(b)fluoranthene	420	U	UG/KG	5.25E-02	2.47E-03	8.40E-02
191-24-2	Benzo(g,h,i)perylene	420	U	UG/KG	6.89E-06	6.89E-06	1.00E-04
207-08-9	Benzo(k)fluoranthene	420	U	UG/KG	5.38E-03	2.47E-04	8.57E-03
111-91-1	bis(2-Chloroethoxy)methane	420	U	UG/KG			

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
 J = Estimated U = Nondetect

**TABLE 33-4  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0019**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
111-44-4	bis(2-Chloroethyl) ether	420	U	UG/KG	8.40E-02	5.60E-03	1.05E+03
108-60-1	bis(2-Chloroisopropyl) ether	420	U	UG/KG			
117-81-7	bis(2-Ethylhexyl) phthalate (DEHP)	420	U	UG/KG	1.02E-03	1.02E-04	1.17E-04
85-68-7	Butyl benzyl phthalate	420	U	UG/KG	1.02E-06	1.02E-06	4.52E-04
86-74-8	Carbazole	420	U	UG/KG	1.45E-03	6.77E-05	7.00E-01
218-01-9	Chrysene	420	U	UG/KG	5.38E-04	2.47E-05	2.63E-03
84-74-2	Di-n-butyl phthalate	420	U	UG/KG	2.10E-06	2.10E-06	1.83E-04
117-84-0	Di-n-octyl phthalate	420	U	UG/KG	1.02E-05	1.02E-04	4.20E-05
53-70-3	Dibenz(a,h)anthracene	420	U	UG/KG	5.25E-01	2.47E-02	2.10E-01
132-64-9	Dibenzofuran	420	U	UG/KG			
84-66-2	Diethyl phthalate	420	U	UG/KG	4.20E-07	4.20E-07	8.94E-04
131-11-3	Dimethyl phthalate	420	U	UG/KG			
206-44-0	Fluoranthene	420	U	UG/KG	5.12E-06	5.12E-06	9.77E-05
86-73-7	Fluorene	420	U	UG/KG	5.12E-06	5.12E-06	7.50E-04
118-74-1	Hexachlorobenzene	420	U	UG/KG	1.05E-01	5.38E-03	2.10E-01
87-68-3	Hexachlorobutadiene	420	U	UG/KG			
77-47-4	Hexachlorocyclopentadiene	420	U	UG/KG	3.00E-05	3.00E-05	1.05E-03
67-72-1	Hexachloroethane	420	U	UG/KG	2.10E-04	2.10E-04	8.40E-01
193-39-5	Indeno(1,2,3-c,d)pyrene	420	U	UG/KG	5.25E-02	2.47E-03	3.00E-02
78-59-1	Isophorone	420	U	UG/KG	1.02E-06	1.02E-06	5.25E-02
621-64-7	N-Nitroso-di-n-propylamine	420	UJ	UG/KG	5.25E-01	2.33E-02	8.40E+03
86-30-6	N-Nitrosodiphenylamine	420	U	UG/KG	3.50E-04	1.68E-05	4.20E-01
91-20-3	Naphthalene	420	U	UG/KG	5.12E-06	5.12E-05	5.00E-03
98-95-3	Nitrobenzene	420	U	UG/KG	4.20E-04	4.20E-04	4.20E+00

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J = Estimated U = Nondetect

**TABLE 33-4  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0019**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
87-86-5	Pentachlorophenol	2100	U	UG/KG	8.75E-02	4.04E-03	7.00E+01
85-01-8	Phenanthrene	420	U	UG/KG	6.89E-06	6.89E-06	1.00E-04
108-95-2	Phenol	420	U	UG/KG	4.20E-07	3.50E-06	4.20E-03
129-00-0	Pyrene	420	U	UG/KG	6.89E-06	6.89E-06	1.00E-04
<b>Explosives</b>							
99-35-4	1,3,5-Trinitrobenzene	310	U	UG/KG			
99-65-0	1,3-Dinitrobenzene	310	U	UG/KG			
118-96-7	2,4,6-Trinitrotoluene (TNT)	620	U	UG/KG			
121-14-2	2,4-Dinitrotoluene	420	U	UG/KG	5.00E-02	2.33E-03	5.25E+02
606-20-2	2,6-Dinitrotoluene	620	U	UG/KG	7.38E-02	3.44E-03	8.86E+02
35572-78-2	2-Amino-4,6-Dinitrotoluene	620	U	UG/KG			
88-72-2	2-Nitrotoluene (ONT)	620	U	UG/KG			
99-08-1	3-Nitrotoluene	620	U	UG/KG			
19406-51-0	4-Amino-2,6-Dinitrotoluene	620	U	UG/KG			
99-99-0	4-Nitrotoluene (PNT)	620	U	UG/KG			
2691-41-0	HMX	620	U	UG/KG			
121-82-4	RDX	620	U	UG/KG			
479-45-8	Tetryl	940	U	UG/KG			
<b>Metals</b>							
7429-90-5	Aluminum	16000		MG/KG			
7440-36-0	Antimony	0.75	U	MG/KG	9.15E-04	9.15E-03	1.50E-01
7440-38-2	Arsenic	8.7		MG/KG	2.90E+00	1.43E-01	3.11E-01
7440-39-3	Barium	63.1		MG/KG	4.51E-04	4.51E-03	5.26E-02
7440-41-7	Beryllium	0.36	J	MG/KG	3.60E-01	1.24E-02	5.45E-02

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 33-4  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0019**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
7440-42-8	Boron	12	U	MG/KG	6.67E-05	6.67E-04	
7440-43-9	Cadmium	0.62	U	MG/KG	3.10E-04	3.10E-03	1.68E-01
7440-70-2	Calcium	3070	J	MG/KG			
7440-47-3	Chromium	22.9		MG/KG	2.29E-03	5.59E-03	8.18E-01
7440-48-4	Cobalt	4.2	J	MG/KG	3.50E-05	3.50E-04	
7440-50-8	Copper	14.3		MG/KG	1.74E-04	1.74E-03	1.30E-03
7439-89-6	Iron	23800		MG/KG			
7439-92-1	Lead	12.7	J	MG/KG	3.18E-02	3.18E-02	
7439-95-4	Magnesium	2670		MG/KG			
7439-96-5	Manganese	164		MG/KG	1.71E-03	1.71E-02	
7439-97-6	Mercury	0.012	J	MG/KG	1.97E-05	1.97E-04	8.00E-02
7440-02-0	Nickel	8.2		MG/KG	2.00E-04	2.00E-03	1.08E-01
2023695	Potassium	609	J	MG/KG			
7782-49-2	Selenium	0.84		MG/KG	8.40E-05	8.40E-04	3.50E-01
7440-22-4	Silver	1.2	U	MG/KG	1.20E-04	1.20E-03	8.00E-01
7440-23-5	Sodium	145		MG/KG			
7440-28-0	Thallium	0.64	J	MG/KG	4.00E-03	4.00E-03	2.67E-01
7440-62-2	Vanadium	31		MG/KG	2.21E-03	2.21E-02	3.16E-02
7440-66-6	Zinc	52.3		MG/KG	8.57E-05	8.57E-04	1.45E-02

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 33-5  
ECOLOGICAL SCREENING OF SOIL RESULTS FROM AUS-0019**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Background (SOIL)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ) (SOIL)	Retained as Potential Bioaccumulator
<b>Volatile Organic Compounds</b>							
71-55-6	1,1,1-Trichloroethane		6	U	UG/KG	2.01E-04	
79-34-5	1,1,2,2-Tetrachloroethane		6	U	UG/KG	4.72E-02	
79-00-5	1,1,2-Trichloroethane		6	U	UG/KG	2.10E-04	
75-34-3	1,1-Dichloroethane		6	U	UG/KG	2.99E-04	
75-35-4	1,1-Dichloroethene		6	U	UG/KG	7.25E-04	
107-06-2	1,2-Dichloroethane (EDC)		6	U	UG/KG	2.83E-04	
540-59-0	1,2-Dichloroethene (total)		6	U	UG/KG	7.62E-03	
78-87-5	1,2-Dichloropropane		6	UJ	UG/KG	8.57E-06	
78-93-3	2-Butanone (MEK)		12	U	UG/KG	1.34E-04	
591-78-6	2-Hexanone		12	U	UG/KG	9.52E-04	
108-10-1	4-Methyl-2-pentanone (MIBK)		12	U	UG/KG	2.71E-05	
67-64-1	Acetone		12	U	UG/KG	4.80E-03	
71-43-2	Benzene		6	U	UG/KG	3.75E-04	
75-27-4	Bromodichloromethane		6	U	UG/KG	1.11E-02	
75-25-2	Bromoform		6	U	UG/KG	3.77E-04	
74-83-9	Bromomethane		6	U	UG/KG	2.55E-02	
75-15-0	Carbon disulfide		6	U	UG/KG	6.37E-02	
56-23-5	Carbon tetrachloride		6	U	UG/KG	6.00E-06	
108-90-7	Chlorobenzene		6	U	UG/KG	1.50E-04	
75-00-3	Chloroethane		6	U	UG/KG		
67-66-3	Chloroform		6	U	UG/KG	5.04E-03	
74-87-3	Chloromethane		6	U	UG/KG	5.77E-04	
156-59-2	cis-1,2-Dichloroethene		6	U	UG/KG	7.62E-03	
10061-01-5	cis-1,3-Dichloropropene		6	U	UG/KG	1.51E-02	
124-48-1	Dibromochloromethane		6	U	UG/KG	2.93E-03	
100-41-4	Ethylbenzene		6	U	UG/KG	1.20E-03	
75-09-2	Methylene chloride		6	U	UG/KG	1.48E-03	
110-54-3	N-Hexane		6	U	UG/KG		
100-42-5	Styrene		6	U	UG/KG	2.00E-05	
127-18-4	Tetrachloroethylene (PCE)		6	U	UG/KG	4.62E-04	
108-88-3	Toluene		6	U	UG/KG	2.00E-03	
1330-20-7	total Xylenes		6	U	UG/KG	1.00E-02	
156-60-5	trans-1,2-Dichloroethene		6	U	UG/KG	7.62E-03	
10061-02-6	trans-1,3-Dichloropropene		6	U	UG/KG	1.51E-02	
79-01-6	Trichloroethylene (TCE)		6	U	UG/KG	6.67E-04	
75-01-4	Vinyl chloride		6	U	UG/KG	9.29E-03	
<b>Semivolatile Organic Compounds</b>							
120-82-1	1,2,4-Trichlorobenzene		420	UJ	UG/KG	2.10E-02	
95-50-1	1,2-Dichlorobenzene		420	U	UG/KG	1.42E-01	
541-73-1	1,3-Dichlorobenzene		420	U	UG/KG	1.11E-02	
106-46-7	1,4-Dichlorobenzene		420	U	UG/KG	2.10E-02	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 33-5  
ECOLOGICAL SCREENING OF SOIL RESULTS FROM AUS-0019**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Background (SOIL)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ) (SOIL)	Retained as Potential Bioaccumulator
95-95-4	2,4,5-Trichlorophenol		2100	U	UG/KG	5.25E-01	
88-06-2	2,4,6-Trichlorophenol		420	U	UG/KG	4.20E-02	
120-83-2	2,4-Dichlorophenol		420	U	UG/KG	4.80E-03	
105-67-9	2,4-Dimethylphenol		420	U	UG/KG	4.20E+01	
51-28-5	2,4-Dinitrophenol		2100	U	UG/KG	1.05E-01	
91-58-7	2-Chloronaphthalene		420	U	UG/KG	3.45E+01	
95-57-8	2-Chlorophenol		420	U	UG/KG	1.73E+00	
91-57-6	2-Methylnaphthalene		420	U	UG/KG	1.30E-01	
95-48-7	2-Methylphenol		420	U	UG/KG	1.04E-02	
88-74-4	2-Nitroaniline		2100	U	UG/KG	2.83E-02	
88-75-5	2-Nitrophenol		420	U	UG/KG	2.63E-01	
91-94-1	3,3'-Dichlorobenzidine		420	U	UG/KG	6.50E-01	
99-09-2	3-Nitroaniline		2100	U	UG/KG	6.65E-01	
534-52-1	4,6-Dinitro-2-methylphenol		2100	U	UG/KG		
101-55-3	4-Bromophenyl phenyl ether		420	U	UG/KG		
59-50-7	4-Chloro-3-methylphenol		420	U	UG/KG	5.28E-02	
106-47-8	4-Chloroaniline		830	U	UG/KG	7.55E-01	
7005-72-3	4-Chlorophenyl phenyl ether		420	U	UG/KG		
106-44-5	4-Methylphenol		420	U	UG/KG	2.58E-03	
100-01-6	4-Nitroaniline		2100	U	UG/KG	9.59E-02	
100-02-7	4-Nitrophenol		2100	U	UG/KG	3.00E-01	
83-32-9	Acenaphthene		420	U	UG/KG	6.15E-04	
208-96-8	Acenaphthylene		420	U	UG/KG	6.15E-04	
120-12-7	Anthracene		420	U	UG/KG	2.84E-04	
56-55-3	Benzo(a)anthracene		420	U	UG/KG	8.06E-02	
50-32-8	Benzo(a)pyrene		420	U	UG/KG	9.55E-05	
205-99-2	Benzo(b)fluoranthene		420	U	UG/KG	7.02E-03	
191-24-2	Benzo(g,h,i)perylene		420	U	UG/KG	3.53E-03	
207-08-9	Benzo(k)fluoranthene		420	U	UG/KG	7.02E-03	
111-91-1	bis(2-Chloroethoxy)methane		420	U	UG/KG	1.39E+00	
111-44-4	bis(2-Chloroethyl) ether		420	U	UG/KG	1.77E-02	
108-60-1	bis(2-Chloroisopropyl) ether		420	U	UG/KG		
117-81-7	bis(2-Ethylhexyl) phthalate (DEHP)		420	U	UG/KG	4.54E-01	
85-68-7	Butyl benzyl phthalate		420	U	UG/KG	1.76E+00	
86-74-8	Carbazole		420	U	UG/KG		
218-01-9	Chrysene		420	U	UG/KG	8.88E-02	
84-74-2	Di-n-butyl phthalate		420	U	UG/KG	2.10E-03	
117-84-0	Di-n-octyl phthalate		420	U	UG/KG	5.92E-04	
53-70-3	Dibenz(a,h)anthracene		420	U	UG/KG	2.28E-02	
132-64-9	Dibenzofuran		420	U	UG/KG		
84-66-2	Diethyl phthalate		420	U	UG/KG	4.20E-03	
131-11-3	Dimethyl phthalate		420	U	UG/KG	2.10E-03	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 33-5  
ECOLOGICAL SCREENING OF SOIL RESULTS FROM AUS-0019**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Background (SOIL)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ) (SOIL)	Retained as Potential Bioaccumulator
206-44-0	Fluoranthene		420	U	UG/KG	3.44E-03	
86-73-7	Fluorene		420	U	UG/KG	1.40E-02	
118-74-1	Hexachlorobenzene		420	U	UG/KG	4.20E-04	
87-68-3	Hexachlorobutadiene		420	U	UG/KG	1.06E+01	
77-47-4	Hexachlorocyclopentadiene		420	U	UG/KG	4.20E-02	
67-72-1	Hexachloroethane		420	U	UG/KG	7.04E-01	
193-39-5	Indeno(1,2,3-c,d)pyrene		420	U	UG/KG	3.85E-03	
78-59-1	Isophorone		420	U	UG/KG	3.02E-03	
621-64-7	N-Nitroso-di-n-propylamine		420	UJ	UG/KG	7.73E-01	
86-30-6	N-Nitrosodiphenylamine		420	U	UG/KG	2.10E-02	
91-20-3	Naphthalene		420	U	UG/KG	1.69E-03	
98-95-3	Nitrobenzene		420	U	UG/KG	1.05E-02	
87-86-5	Pentachlorophenol		2100	U	UG/KG	3.50E-01	
85-01-8	Phenanthrene		420	U	UG/KG	9.19E-03	
108-95-2	Phenol		420	U	UG/KG	1.05E-02	
129-00-0	Pyrene		420	U	UG/KG	5.35E-03	
<b>Explosives</b>							
99-35-4	1,3,5-Trinitrobenzene		310	U	UG/KG	8.24E-01	
99-65-0	1,3-Dinitrobenzene		310	U	UG/KG	4.73E-01	
118-96-7	2,4,6-Trinitrotoluene (TNT)		620	U	UG/KG	2.07E-02	
121-14-2	2,4-Dinitrotoluene		420	U	UG/KG	3.28E-01	
606-20-2	2,6-Dinitrotoluene		620	U	UG/KG	1.89E+01	
35572-78-2	2-Amino-4,6-Dinitrotoluene		620	U	UG/KG	7.75E-03	
88-72-2	2-Nitrotoluene (ONT)		620	U	UG/KG		
99-08-1	3-Nitrotoluene		620	U	UG/KG		
19406-51-0	4-Amino-2,6-Dinitrotoluene		620	U	UG/KG		
99-99-0	4-Nitrotoluene (PNT)		620	U	UG/KG		
2691-41-0	HMX		620	U	UG/KG	2.48E-02	
121-82-4	RDX		620	U	UG/KG	6.20E-03	
479-45-8	Tetryl		940	U	UG/KG		
<b>Metals</b>							
7429-90-5	Aluminum	28800	16000		MG/KG		
7440-36-0	Antimony	0.83	0.75	U	MG/KG	1.50E-01	
7440-38-2	Arsenic	13.5	8.7		MG/KG	9.67E-01	
7440-39-3	Barium	195	63.1		MG/KG	1.26E-01	
7440-41-7	Beryllium	0.76	0.36	J	MG/KG	3.60E-02	
7440-42-8	Boron	5.3	12	U	MG/KG	2.40E+01	
7440-43-9	Cadmium	0.19	0.62	U	MG/KG	2.14E-02	
7440-70-2	Calcium	2497	3070	J	MG/KG		
7440-47-3	Chromium	25.2	22.9		MG/KG	4.58E+00	
7440-48-4	Cobalt	21.7	4.2	J	MG/KG	2.10E-01	
7440-50-8	Copper	11.3	14.3		MG/KG	4.61E-01	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect



**TABLE 33-5  
ECOLOGICAL SCREENING OF SOIL RESULTS FROM AUS-0019**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Background (SOIL)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ) (SOIL)	Retained as Potential Bioaccumulator
7439-89-6	Iron	19306	23800		MG/KG	1.19E+02	
7439-92-1	Lead	23.4	12.7	J	MG/KG	2.93E-02	
7439-95-4	Magnesium	1552	2670		MG/KG		
7439-96-5	Manganese	3640	164		MG/KG	1.64E+00	
7439-97-6	Mercury	0.06	0.012	J	MG/KG	1.71E-03	YES
7440-02-0	Nickel	18.9	8.2		MG/KG	2.73E-01	
2023695	Potassium	625	609	J	MG/KG		
7782-49-2	Selenium	2.34	0.84		MG/KG	8.40E-01	YES
7440-22-4	Silver	0.58	1.2	U	MG/KG	6.00E-01	
7440-23-5	Sodium	170	145		MG/KG		
7440-28-0	Thallium	0.41	0.64	J	MG/KG	6.40E-01	
7440-62-2	Vanadium	47.2	31		MG/KG	6.74E-01	
7440-66-6	Zinc	51.4	52.3		MG/KG	4.36E-01	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 33-6, AUS-0019  
SUMMARY OF HUMAN HEALTH COPC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Groundwater		Sediment		Soil	
	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale
<b>Volatile Organic Compounds</b>								
1,1,1-Trichloroethane	NA	NA	NA	NA	NA	NA	No	A
1,1,2,2-Tetrachloroethane	NA	NA	NA	NA	NA	NA	Uncertainty	B
1,1,2-Trichloroethane	NA	NA	NA	NA	NA	NA	Uncertainty	B
1,1-Dichloroethane	NA	NA	NA	NA	NA	NA	No	A
1,1-Dichloroethene	NA	NA	NA	NA	NA	NA	Uncertainty	B
1,2-Dichloroethane (EDC)	NA	NA	NA	NA	NA	NA	Uncertainty	B
1,2-Dichloroethene (total)	NA	NA	NA	NA	NA	NA	No	A
1,2-Dichloropropane	NA	NA	NA	NA	NA	NA	Uncertainty	B
2-Butanone (MEK)	NA	NA	NA	NA	NA	NA	No	A
2-Hexanone	NA	NA	NA	NA	NA	NA	No	C
4-Methyl-2-pentanone (MIBK)	NA	NA	NA	NA	NA	NA	No	A
Acetone	NA	NA	NA	NA	NA	NA	No	A
Benzene	NA	NA	NA	NA	NA	NA	Uncertainty	B
Bromodichloromethane	NA	NA	NA	NA	NA	NA	No	A
Bromoform	NA	NA	NA	NA	NA	NA	No	A
Bromomethane	NA	NA	NA	NA	NA	NA	No	A
Carbon disulfide	NA	NA	NA	NA	NA	NA	No	A
Carbon tetrachloride	NA	NA	NA	NA	NA	NA	Uncertainty	B
Chlorobenzene	NA	NA	NA	NA	NA	NA	No	A
Chloroethane	NA	NA	NA	NA	NA	NA	No	A
Chloroform	NA	NA	NA	NA	NA	NA	No	A
Chloromethane	NA	NA	NA	NA	NA	NA	No	A
cis-1,2-Dichloroethene	NA	NA	NA	NA	NA	NA	No	A
cis-1,3-Dichloropropene	NA	NA	NA	NA	NA	NA	No	A
Dibromochloromethane	NA	NA	NA	NA	NA	NA	No	A
Ethylbenzene	NA	NA	NA	NA	NA	NA	No	A
Methylene chloride	NA	NA	NA	NA	NA	NA	Uncertainty	B
N-Hexane	NA	NA	NA	NA	NA	NA	No	A
Styrene	NA	NA	NA	NA	NA	NA	No	A
Tetrachloroethylene (PCE)	NA	NA	NA	NA	NA	NA	Uncertainty	B
Toluene	NA	NA	NA	NA	NA	NA	No	A
total Xylenes	NA	NA	NA	NA	NA	NA	No	A
trans-1,2-Dichloroethene	NA	NA	NA	NA	NA	NA	No	A
trans-1,3-Dichloropropene	NA	NA	NA	NA	NA	NA	No	A
Trichloroethylene (TCE)	NA	NA	NA	NA	NA	NA	Uncertainty	B
Vinyl chloride	NA	NA	NA	NA	NA	NA	Uncertainty	B
<b>Semivolatile Organic Compounds</b>								
1,2,4-Trichlorobenzene	NA	NA	NA	NA	NA	NA	Uncertainty	B
1,2-Dichlorobenzene	NA	NA	NA	NA	NA	NA	No	A
1,3-Dichlorobenzene	NA	NA	NA	NA	NA	NA	No	A
1,4-Dichlorobenzene	NA	NA	NA	NA	NA	NA	Uncertainty	B
2,4,5-Trichlorophenol	NA	NA	NA	NA	NA	NA	No	A

**TABLE 33-6, AUS-0019**  
**SUMMARY OF HUMAN HEALTH COPC EVALUATION**

**AUS OU PA/SI**  
**CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Groundwater		Sediment		Soil	
	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale
2,4,6-Trichlorophenol	NA	NA	NA	NA	NA	NA	Uncertainty	B
2,4-Dichlorophenol	NA	NA	NA	NA	NA	NA	Uncertainty	B
2,4-Dimethylphenol	NA	NA	NA	NA	NA	NA	Uncertainty	B
2,4-Dinitrophenol	NA	NA	NA	NA	NA	NA	Uncertainty	B
2-Chloronaphthalene	NA	NA	NA	NA	NA	NA	No	A
2-Chlorophenol	NA	NA	NA	NA	NA	NA	Uncertainty	B
1-Methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	NA	NA	NA	NA	NA	NA	No	A
2-Methylphenol	NA	NA	NA	NA	NA	NA	No	A
2-Nitroaniline	NA	NA	NA	NA	NA	NA	No	A
2-Nitrophenol	NA	NA	NA	NA	NA	NA	No	A
3,3'-Dichlorobenzidine	NA	NA	NA	NA	NA	NA	Uncertainty	B
3-Nitroaniline	NA	NA	NA	NA	NA	NA	No	A
4,6-Dinitro-2-methylphenol	NA	NA	NA	NA	NA	NA	No	C
4-Bromophenyl phenyl ether	NA	NA	NA	NA	NA	NA	No	C
4-Chloro-3-methylphenol	NA	NA	NA	NA	NA	NA	No	A
4-Chloroaniline	NA	NA	NA	NA	NA	NA	Uncertainty	B
4-Chlorophenyl phenyl ether	NA	NA	NA	NA	NA	NA	No	C
4-Methylphenol	NA	NA	NA	NA	NA	NA	No	A
4-Nitroaniline	NA	NA	NA	NA	NA	NA	No	A
4-Nitrophenol	NA	NA	NA	NA	NA	NA	No	A
Acenaphthene	NA	NA	NA	NA	NA	NA	No	A
Acenaphthylene	NA	NA	NA	NA	NA	NA	No	A
Anthracene	NA	NA	NA	NA	NA	NA	No	A
Benzo(a)anthracene	NA	NA	NA	NA	NA	NA	Uncertainty	B
Benzo(a)pyrene	NA	NA	NA	NA	NA	NA	Uncertainty	B
Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA	Uncertainty	B
Benzo(g,h,i)perylene	NA	NA	NA	NA	NA	NA	No	A
Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	No	A
bis(2-Chloroethoxy)methane	NA	NA	NA	NA	NA	NA	No	C
bis(2-Chloroethyl) ether	NA	NA	NA	NA	NA	NA	Uncertainty	B
bis(2-Chloroisopropyl) ether	NA	NA	NA	NA	NA	NA	No	A
bis(2-Ethylhexyl) phthalate	NA	NA	NA	NA	NA	NA	No	A
Butyl benzyl phthalate	NA	NA	NA	NA	NA	NA	No	A
Carbazole	NA	NA	NA	NA	NA	NA	Uncertainty	B
Chrysene	NA	NA	NA	NA	NA	NA	No	A
Di-n-butyl phthalate	NA	NA	NA	NA	NA	NA	No	A
Di-n-octyl phthalate	NA	NA	NA	NA	NA	NA	No	A
Dibenz(a,h)anthracene	NA	NA	NA	NA	NA	NA	Uncertainty	B
Dibenzofuran	NA	NA	NA	NA	NA	NA	No	A
Diethyl phthalate	NA	NA	NA	NA	NA	NA	No	A
Dimethyl phthalate	NA	NA	NA	NA	NA	NA	No	A
Fluoranthene	NA	NA	NA	NA	NA	NA	No	A

**TABLE 33-6, AUS-0019  
SUMMARY OF HUMAN HEALTH COPC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Groundwater		Sediment		Soil	
	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale
Fluorene	NA	NA	NA	NA	NA	NA	No	A
Hexachlorobenzene	NA	NA	NA	NA	NA	NA	Uncertainty	B
Hexachlorobutadiene	NA	NA	NA	NA	NA	NA	Uncertainty	B
Hexachlorocyclopentadiene	NA	NA	NA	NA	NA	NA	No	A
Hexachloroethane	NA	NA	NA	NA	NA	NA	Uncertainty	B
Indeno(1,2,3-c,d)pyrene	NA	NA	NA	NA	NA	NA	No	A
Isophorone	NA	NA	NA	NA	NA	NA	Uncertainty	B
N-Nitroso-di-n-propylamine	NA	NA	NA	NA	NA	NA	Uncertainty	B
N-Nitrosodiphenylamine	NA	NA	NA	NA	NA	NA	Uncertainty	B
Naphthalene	NA	NA	NA	NA	NA	NA	No	A
Pentachlorophenol	NA	NA	NA	NA	NA	NA	Uncertainty	B
Phenanthrene	NA	NA	NA	NA	NA	NA	No	A
Phenol	NA	NA	NA	NA	NA	NA	No	A
Pyrene	NA	NA	NA	NA	NA	NA	No	A
<b>Metals and Inorganics</b>								
Aluminum	NA	NA	NA	NA	NA	NA	No	F
Antimony	NA	NA	NA	NA	NA	NA	Uncertainty	B
Arsenic	NA	NA	NA	NA	NA	NA	Yes	D
Barium	NA	NA	NA	NA	NA	NA	No	F
Beryllium	NA	NA	NA	NA	NA	NA	No	F
Boron	NA	NA	NA	NA	NA	NA	No	A
Cadmium	NA	NA	NA	NA	NA	NA	Uncertainty	B
Calcium	NA	NA	NA	NA	NA	NA	No	H
Chromium	NA	NA	NA	NA	NA	NA	Yes	D
Cobalt	NA	NA	NA	NA	NA	NA	No	F
Copper	NA	NA	NA	NA	NA	NA	No	F
Cyanide, Total	NA	NA	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	NA	NA	No	F
Lead	NA	NA	NA	NA	NA	NA	No	F
Magnesium	NA	NA	NA	NA	NA	NA	No	H
Manganese	NA	NA	NA	NA	NA	NA	No	F
Mercury	NA	NA	NA	NA	NA	NA	No	F
Nickel	NA	NA	NA	NA	NA	NA	Yes	D
Potassium	NA	NA	NA	NA	NA	NA	No	H
Selenium	NA	NA	NA	NA	NA	NA	Yes	D
Silver	NA	NA	NA	NA	NA	NA	No	A
Sodium	NA	NA	NA	NA	NA	NA	No	H
Thallium	NA	NA	NA	NA	NA	NA	No	F
Vanadium	NA	NA	NA	NA	NA	NA	No	F
Zinc	NA	NA	NA	NA	NA	NA	No	F
<b>Explosives</b>								
1,3,5-Trinitrobenzene	NA	NA	NA	NA	NA	NA	No	A
1,3-Dinitrobenzene	NA	NA	NA	NA	NA	NA	No	A

**TABLE 33-6, AUS-0019  
SUMMARY OF HUMAN HEALTH COPC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Groundwater		Sediment		Soil	
	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale
2,4,6-Trinitrotoluene (TNT)	NA	NA	NA	NA	NA	NA	No	A
2,4-Dinitrotoluene	NA	NA	NA	NA	NA	NA	Uncertainty	B
2,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA	Uncertainty	B
2-Amino-4,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA	No	C
2-Nitrotoluene (ONT)	NA	NA	NA	NA	NA	NA	No	C
3-Nitrotoluene	NA	NA	NA	NA	NA	NA	No	A
4-Amino-2,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA	No	C
4-Nitrotoluene (PNT)	NA	NA	NA	NA	NA	NA	No	A
HMX	NA	NA	NA	NA	NA	NA	No	A
Nitrobenzene	NA	NA	NA	NA	NA	NA	Uncertainty	B
Nitroglycerin	NA	NA	NA	NA	NA	NA	NA	NA
Pentaerythritol tetranitrate (PETN)	NA	NA	NA	NA	NA	NA	NA	NA
Perchloric Acid	NA	NA	NA	NA	NA	NA	NA	NA
RDX	NA	NA	NA	NA	NA	NA	No	A
Tetryl	NA	NA	NA	NA	NA	NA	No	A
<b>Other Parameters</b>								
Nitrogen, Nitrate-Nitrite	NA	NA	NA	NA	NA	NA	NA	NA
Phosphorus, Total (as P)	NA	NA	NA	NA	NA	NA	NA	NA

- A - Chemical was not detected and the reporting limit does not exceed the screening concentration.
- B - Chemical was not detected, but reporting limit was equal to or exceeded screening concentration.
- C - Chemical was not detected and there is no screening concentration.
- D - Chemical was detected and was equal to or exceeded screening concentration, but did not exceed background.
- E - Chemical was detected and was equal to or exceeded screening concentration and background, if applicable.
- F - Chemical was detected and did not exceed screening concentration.
- G - Chemical was detected, but no screening value was available.
- H - Chemical was detected, but it is an essential nutrient.
- J - Chemical was classified as a COPC based on USEPA 1998 data but was not a COPC based on SI data.
- NA - Not Analyzed or not applicable.

**TABLE 33-7, AUS-0019**  
**SUMMARY OF ECOLOGICAL COPEC EVALUATION**

**AUS OU PA/SI**  
**CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Sediment		Soil	
	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale
<b>Volatile Organic Compounds</b>						
1,1,1-Trichloroethane	NA	NA	NA	NA	No	A
1,1,2,2-Tetrachloroethane	NA	NA	NA	NA	No	A
1,1,2-Trichloroethane	NA	NA	NA	NA	No	A
1,1-Dichloroethane	NA	NA	NA	NA	No	A
1,1-Dichloroethene	NA	NA	NA	NA	No	A
1,2-Dichloroethane (EDC)	NA	NA	NA	NA	No	A
1,2-Dichloroethene (total)	NA	NA	NA	NA	No	A
1,2-Dichloropropane	NA	NA	NA	NA	No	A
2-Butanone (MEK)	NA	NA	NA	NA	No	A
2-Hexanone	NA	NA	NA	NA	No	A
4-Methyl-2-pentanone (MIBK)	NA	NA	NA	NA	No	A
Acetone	NA	NA	NA	NA	No	A
Benzene	NA	NA	NA	NA	No	A
Bromodichloromethane	NA	NA	NA	NA	No	A
Bromoform	NA	NA	NA	NA	No	A
Bromomethane	NA	NA	NA	NA	No	A
Carbon disulfide	NA	NA	NA	NA	No	A
Carbon tetrachloride	NA	NA	NA	NA	No	A
Chlorobenzene	NA	NA	NA	NA	No	A
Chloroethane	NA	NA	NA	NA	No	C
Chloroform	NA	NA	NA	NA	No	A
Chloromethane	NA	NA	NA	NA	No	A
cis-1,2-Dichloroethene	NA	NA	NA	NA	No	A
cis-1,3-Dichloropropene	NA	NA	NA	NA	No	A
Dibromochloromethane	NA	NA	NA	NA	No	A
Ethylbenzene	NA	NA	NA	NA	No	A
Methylene chloride	NA	NA	NA	NA	No	A
N-Hexane	NA	NA	NA	NA	No	C
Styrene	NA	NA	NA	NA	No	A
Tetrachloroethylene (PCE)	NA	NA	NA	NA	No	A
Toluene	NA	NA	NA	NA	No	A
total Xylenes	NA	NA	NA	NA	No	A
trans-1,2-Dichloroethene	NA	NA	NA	NA	No	A
trans-1,3-Dichloropropene	NA	NA	NA	NA	No	A
Trichloroethylene (TCE)	NA	NA	NA	NA	No	A
Vinyl chloride	NA	NA	NA	NA	No	A
<b>Semivolatile Organic Compounds</b>						
1,2,4-Trichlorobenzene	NA	NA	NA	NA	No	A
1,2-Dichlorobenzene	NA	NA	NA	NA	No	A
1,3-Dichlorobenzene	NA	NA	NA	NA	No	A
1,4-Dichlorobenzene	NA	NA	NA	NA	No	A
2,4,5-Trichlorophenol	NA	NA	NA	NA	No	A

**TABLE 33-7, AUS-0019  
SUMMARY OF ECOLOGICAL COPEC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Sediment		Soil	
	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale
2,4,6-Trichlorophenol	NA	NA	NA	NA	No	A
2,4-Dichlorophenol	NA	NA	NA	NA	No	A
2,4-Dimethylphenol	NA	NA	NA	NA	Uncertainty	B
2,4-Dinitrophenol	NA	NA	NA	NA	No	A
2-Chloronaphthalene	NA	NA	NA	NA	Uncertainty	B
2-Chlorophenol	NA	NA	NA	NA	Uncertainty	B
1-Methylnaphthalene	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	NA	NA	NA	NA	No	A
2-Methylphenol	NA	NA	NA	NA	No	A
2-Nitroaniline	NA	NA	NA	NA	No	A
2-Nitrophenol	NA	NA	NA	NA	No	A
3,3'-Dichlorobenzidine	NA	NA	NA	NA	No	A
3-Nitroaniline	NA	NA	NA	NA	No	A
4,6-Dinitro-2-methylphenol	NA	NA	NA	NA	No	C
4-Bromophenyl phenyl ether	NA	NA	NA	NA	No	C
4-Chloro-3-methylphenol	NA	NA	NA	NA	No	A
4-Chloroaniline	NA	NA	NA	NA	No	A
4-Chlorophenyl phenyl ether	NA	NA	NA	NA	No	C
4-Methylphenol	NA	NA	NA	NA	No	A
4-Nitroaniline	NA	NA	NA	NA	No	A
4-Nitrophenol	NA	NA	NA	NA	No	A
Acenaphthene	NA	NA	NA	NA	No	A
Acenaphthylene	NA	NA	NA	NA	No	A
Anthracene	NA	NA	NA	NA	No	A
Benzo(a)anthracene	NA	NA	NA	NA	No	A
Benzo(a)pyrene	NA	NA	NA	NA	No	A
Benzo(b)fluoranthene	NA	NA	NA	NA	No	A
Benzo(g,h,i)perylene	NA	NA	NA	NA	No	A
Benzo(k)fluoranthene	NA	NA	NA	NA	No	A
bis(2-Chloroethoxy)methane	NA	NA	NA	NA	Uncertainty	B
bis(2-Chloroethyl) ether	NA	NA	NA	NA	No	A
bis(2-Chloroisopropyl) ether	NA	NA	NA	NA	No	C
bis(2-Ethylhexyl) phthalate	NA	NA	NA	NA	No	A
Butyl benzyl phthalate	NA	NA	NA	NA	Uncertainty	B
Carbazole	NA	NA	NA	NA	No	C
Chrysene	NA	NA	NA	NA	No	A
Di-n-butyl phthalate	NA	NA	NA	NA	No	A
Di-n-octyl phthalate	NA	NA	NA	NA	No	A
Dibenz(a,h)anthracene	NA	NA	NA	NA	No	A
Dibenzofuran	NA	NA	NA	NA	No	C
Diethyl phthalate	NA	NA	NA	NA	No	A
Dimethyl phthalate	NA	NA	NA	NA	No	A
Fluoranthene	NA	NA	NA	NA	No	A

TABLE 33-7, AUS-0019  
SUMMARY OF ECOLOGICAL COPEC EVALUATION

AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Chemical	Surface Water		Sediment		Soil	
	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale
Fluorene	NA	NA	NA	NA	No	A
Hexachlorobenzene	NA	NA	NA	NA	No	A
Hexachlorobutadiene	NA	NA	NA	NA	Uncertainty	B
Hexachlorocyclopentadiene	NA	NA	NA	NA	No	A
Hexachloroethane	NA	NA	NA	NA	No	A
Indeno(1,2,3-c,d)pyrene	NA	NA	NA	NA	No	A
Isophorone	NA	NA	NA	NA	No	A
N-Nitroso-di-n-propylamine	NA	NA	NA	NA	No	A
N-Nitrosodiphenylamine	NA	NA	NA	NA	No	A
Naphthalene	NA	NA	NA	NA	No	A
Pentachlorophenol	NA	NA	NA	NA	No	A
Phenanthrene	NA	NA	NA	NA	No	A
Phenol	NA	NA	NA	NA	No	A
Pyrene	NA	NA	NA	NA	No	A
<b>Metals and Inorganics</b>						
Aluminum	NA	NA	NA	NA	Uncertainty	I
Antimony	NA	NA	NA	NA	No	A
Arsenic	NA	NA	NA	NA	No	F
Barium	NA	NA	NA	NA	No	F
Beryllium	NA	NA	NA	NA	No	F
Boron	NA	NA	NA	NA	Uncertainty	B
Cadmium	NA	NA	NA	NA	No	A
Calcium	NA	NA	NA	NA	Uncertainty	G,H
Chromium	NA	NA	NA	NA	Yes	D
Cobalt	NA	NA	NA	NA	No	F
Copper	NA	NA	NA	NA	No	F
Cyanide, Total	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	Yes	E
Lead	NA	NA	NA	NA	No	F
Magnesium	NA	NA	NA	NA	Uncertainty	G,H
Manganese	NA	NA	NA	NA	Yes	D
Mercury	NA	NA	NA	NA	Yes	D
Nickel	NA	NA	NA	NA	No	F
Potassium	NA	NA	NA	NA	Uncertainty	G,H
Selenium	NA	NA	NA	NA	Yes	D
Silver	NA	NA	NA	NA	No	A
Sodium	NA	NA	NA	NA	Uncertainty	G,H
Thallium	NA	NA	NA	NA	No	F
Vanadium	NA	NA	NA	NA	No	F
Zinc	NA	NA	NA	NA	No	F
<b>Explosives</b>						
1,3,5-Trinitrobenzene	NA	NA	NA	NA	No	A
1,3-Dinitrobenzene	NA	NA	NA	NA	No	A



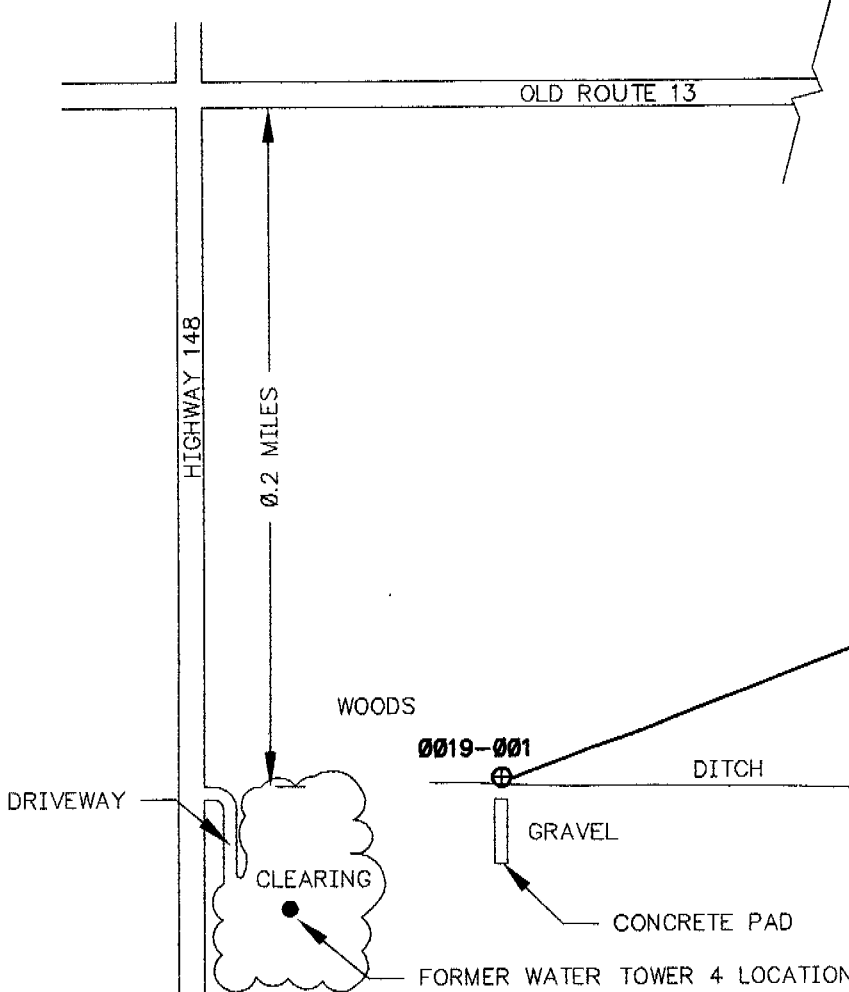
**TABLE 33-7, AUS-0019  
SUMMARY OF ECOLOGICAL COPEC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Sediment		Soil	
	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale
2,4,6-Trinitrotoluene (TNT)	NA	NA	NA	NA	No	A
2,4-Dinitrotoluene	NA	NA	NA	NA	No	A
2,6-Dinitrotoluene	NA	NA	NA	NA	Uncertainty	B
2-Amino-4,6-Dinitrotoluene	NA	NA	NA	NA	No	A
2-Nitrotoluene (ONT)	NA	NA	NA	NA	No	C
3-Nitrotoluene	NA	NA	NA	NA	No	C
4-Amino-2,6-Dinitrotoluene	NA	NA	NA	NA	No	C
4-Nitrotoluene (PNT)	NA	NA	NA	NA	No	C
HMX	NA	NA	NA	NA	No	A
Nitrobenzene	NA	NA	NA	NA	No	A
Nitroglycerin	NA	NA	NA	NA	NA	NA
Pentaerythritol tetranitrate (PETN)	NA	NA	NA	NA	NA	NA
Perchloric Acid	NA	NA	NA	NA	NA	NA
RDX	NA	NA	NA	NA	No	A
Tetryl	NA	NA	NA	NA	No	C

- A - Chemical was not detected and the reporting limit does not exceed the screening concentration.
- B - Chemical was not detected, but reporting limit was equal to or exceeded screening concentration.
- C - Chemical was not detected and there is no screening concentration.
- D - Chemical was detected and was equal to or exceeded screening concentration, but did not exceed background.
- E - Chemical was detected and was equal to or exceeded screening concentration and background, if applicable.
- F - Chemical was detected and did not exceed screening concentration.
- G - Chemical was detected, but no screening value was available.
- H - Chemical was detected, but it is an essential nutrient.
- I - If pH<5.5, Aluminum is a COPEC, otherwise it is not.
- J - Chemical was classified as a COPEC based on USEPA 1998 data but was not a COPEC based on SI data.
- NA - Not Analyzed or not applicable.

# AUS-0019-FORMER RAILROAD SPUR NORTH OF AREA 4 EAST



AUS-0019-001	Units	Result:	Reference
		1 ft	Code
<b>Volatile Organic Compounds</b>			
All VOCs	UG/KG	ND	
<b>Semivolatile Organic Compounds</b>			
All SVOCs	UG/KG	ND	
<b>Metals</b>			
Aluminum	MG/KG	16000	
Arsenic	MG/KG	6.5	h1,h5,h7
Barium	MG/KG	60.6	
Beryllium	MG/KG	0.28	
Calcium	MG/KG	3070	b1
Chromium	MG/KG	18.9	e1,h5
Cobalt	MG/KG	3.6	
Copper	MG/KG	13.7	b1
Iron	MG/KG	21500	b1,e1
Lead	MG/KG	12.7	
Magnesium	MG/KG	2670	b1
Manganese	MG/KG	109	e1
Mercury	MG/KG	0.0084	e5
Nickel	MG/KG	8.2	h5
Potassium	MG/KG	528	
Selenium	MG/KG	0.58	e5,h5
Sodium	MG/KG	145	
Thallium (duplicate)	MG/KG	0.64	b1
Vanadium	MG/KG	24.1	
Zinc	MG/KG	50.1	

**LEGEND**

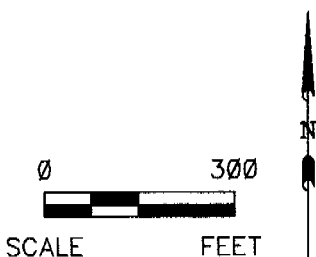
- ⊕ HAND AUGER LOCATION
- FORMER WATER TOWER STANDPIPE

**NOTES:**

1. TAKEN FROM URS FIELD SKETCH DRAWN ON 10/17/00.
2. DATA QUALIFIERS FOR ANALYTICAL RESULTS ARE NOT INDICATED. REFER TO QCSR FOR DATA QUALIFIERS.
3. THE FOLLOWING COMPOUNDS ARE INCLUDED IN THE ANALYTE LIST FOR BOTH SVOCs AND EXPLOSIVES: 2,4-DINITROTOLUENE, 2,6-DIINITROTOLUENE, AND NITROBENZENE. THESE COMPOUNDS MAY BE REPORTED AS EITHER SVOCs OR EXPLOSIVES.

Screening Reference	Reference Code
AUS Background Soil UTL	b1
Little Grassy Background Sediment UTL	b2
Little Grassy Background Surface Water UTL	b3
Ecological Direct Exposure Pathway TRV - Soil	e1
Ecological Direct Exposure Pathway TRV - Sediment	e2
Ecological Direct Exposure Pathway TRV - Surface Water	e3
IEPA General Use Surface Water Quality Aquatic Life Toxicity	e4
Superfund Chemical Data Matrix Kow values (potential bioaccumulotor)	e5
USEPA Region IX Industrial Soil PRG - cancerous	h1
USEPA Region IX Industrial Soil PRG - noncancerous	h2
USEPA Region IX Tap Water PRG - cancerous	h3
USEPA Region IX Tap Water PRG - noncancerous	h4
USEPA Region IX Migration to Groundwater PRG (DAF=1)	h5
USEPA MCL Drinking Water Standards	h6
IEPA TACO Industrial/Commercial Soil Injection	h7
IEPA TACO Construction Worker Soil Ingestion	h8
IEPA TACO Class I Soil Component of Groundwater	h9
IEPA General Use Surface Water Quality Human Health	h10

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PA/SI REPORT-AUS OU CRAB ORCHARD NWR MARION, ILLINOIS		PROJECT NO. 2320000026.00
<b>URS</b>		
DRN. BY: djd 12/2/00 DSGN. BY: are CHKD. BY: mch/cmw	AUS-0019 Sample Locations and Detections in Soils	FIG. NO. 33-1

AUS-0021, the former Illinois Ordnance Plant (IOP) Area 7 Fire Station, is located 0.2 miles north of the intersection of Chamnesstown Road and Ogden Road, on the west side of Chamnesstown Road. The overall location of AUS-0021 is shown in Figure 30-1 and the site is shown in more detail in Figure 34-1.

### **AUS Original Site Designations**

AUS-0021 is one of the original sites in the Additional and Uncharacterized Sites Operable Unit (AUS OU) designated in 1997-1999 by the United States Fish & Wildlife Service (USFWS).

## **34.1 HISTORIC SEARCH INFORMATION**

### **34.1.1 Site Description**

AUS-0021 is the location of former IOP Fire Station No. 3 (Building A-3-3).<sup>1</sup> The site is located south of Area 7 and north of the PCB Operable Unit (PCB OU) Landfill.

### **34.1.2 Operational History and Waste Characteristics**

This fire station was originally constructed and operated by the Sherwin Williams Defense Corporation, under contract with the War Department (SWDC\War Department), as a part of the IOP. It served IOP Area 7 and other nearby IOP facilities. This fire station building contained a coal bin, a boiler room (containing a portable heating boiler)<sup>2</sup>, an office, a toilet (with showers), a locker room, an apparatus room, a work room and a fireman's room (with 16 bunks).<sup>3</sup>

The 1951 aerial photograph revealed a scarred area of unknown origin behind (to the west) Building A-3-3.<sup>4</sup> This scarring was no longer evident in the 1960 aerial photograph.

The Crab Orchard Field Trial Club leased Fire Station No. 3 (along with Area 7 Building IN-5-7) from 1948 through at least 1969.<sup>5,6,7</sup> They used this building as a club house with an office, a reception lounge, a public lounge, a judges room, a trophy room, a conference room, a kitchen, a

<sup>1</sup> U.S. Army Corps of Engineers, 1944, War Department Facilities Inventory of the Illinois Ordnance Plant Carbondale, Illinois, Part I, Section 5, Page 1.

<sup>2</sup> DPRA Document No. 00009327. Illinois Ordnance Plant, Report on Condition for Extended Non-use of Illinois Ordnance Plant, Carbondale, Illinois, for Reconstruction Finance Corporation, Office of Defense Plants, dated January 1, 1946, Page 80.

<sup>3</sup> U.S. Army Corps of Engineers, 1944, War Department Facilities Inventory of the Illinois Ordnance Plant Carbondale, Illinois, Part I, Section 8, Page 7.

<sup>4</sup> Entech, Inc., 1999, Historical Aerial Photographic Analysis – Inventory of Potential Disposal Sites: Additional and Uncharacterized Sites (AUS) Operable Unit, Crab Orchard National Wildlife Refuge, Marion, Illinois, Volume I (Text) Page 3-55, and Volume II (Maps) Page EE. The photos were obtained from the National Archives and Records Administration (NARA) and the U.S. Department of Agriculture Agricultural Stabilization and Conservation Service (ASCS).

<sup>5</sup> DPRA Document No. 00008035. Special Use Permit No. 49-596, dated April 27, 1949.

<sup>6</sup> DPRA Document No. 00008020. Crab Orchard Field Trial Club, Letter to USFWS renewing Special Use Permit No. 49-596 until August 31, 1959, dated July 2, 1949.

<sup>7</sup> DPRA Document No. 00008090. Special Use Permit No. 30739, dated September 11, 1959.

dining room/cafeteria and sleeping quarters.<sup>8</sup> The Crab Orchard Field Trial Club was responsible for hosting, scheduling, handling and conducting all upland or bird dog trials on the Refuge.<sup>9</sup> These trials were to be held in the area to the east of Sneed Road (Route 148) and south of Crab Orchard Lake.<sup>10</sup>

According to USFWS records, the Department of Justice, Bureau of Prisons had a Special Use Permit for Fire Station No. 3, from November 1973 through January 1975.<sup>11</sup> They reportedly used this building for storage.<sup>12</sup>

The USFWS also mentioned a possible fire pit area at this site; however, the location is unknown and evidence of a fire pit was not identified during the site reconnaissance.

### **34.1.3 AUS-0021 Previous Sampling Results**

No previous sampling has been done at this site.

### **34.1.4 Observations During Site Visit**

Former Building A-3-3 has been razed and only pieces of the building foundation are still visible at the site. A sewer manhole and a very small brick structure of unknown use were identified just west of the building foundation.

Just to the north of the remaining foundation, there were several pieces of metal that were not identified during the site visit. Later, during the Site Investigation (SI), these were identified by an ordnance and explosive waste (OEW) expert (Human Factors Applications (HFA)) as possible gas canisters. Pieces of small rockets and smoke grenades were also identified at the site by HFA. A drainageway flows from this area into a north-flowing drainageway on the site (Figure 34-1).

### **34.1.5 Recommendations Based on Preliminary Assessment**

AUS-0021 was included in the SI since there have been no previous investigations done at this site and since the United States Environmental Protection Agency (USEPA) sample results from a similar site (AUS-0043 – Area 11/12 Fire Station) exceeded preliminary screening levels for metals.

## **34.2 SITE INVESTIGATION INFORMATION**

URS conducted a Site Investigation at AUS-0021 on May 3 and May 11, 2000. The rationale for sample locations, media, and analytes is presented in the Field Sampling Plan (FSP)<sup>13</sup> for the

<sup>8</sup> DPRA Document No. 00007754. Special Conditions – Crab Orchard Field Trial Club, Special Use Permit 30738, Page 1.

<sup>9</sup> DPRA Document No. 00008038. Memorandum from the Regional Director in Minneapolis, MN to the Chief, Branch of Wildlife Refuges dated May 4, 1949, regarding Special Use Permit No. 49-596.

<sup>10</sup> DPRA Document No. 00008038. Memorandum from the Regional Director in Minneapolis, MN to the Chief, Branch of Wildlife Refuges dated May 4, 1949, regarding Special Use Permit No. 49-596.

<sup>11</sup> DPRA Document No. 00019083. USFWS, Cancellation of Special Use Permit SUP-22-74 with the Department of Justice-Bureau of Prisons, dated October 25, 1974.

<sup>12</sup> DPRA Document No. 00019046. Special Use Permit No. SUP-22-74, dated November 14, 1973.

AUS OU Preliminary Assessment/Site Investigation (PA/SI). Since the time the FSP was prepared, additional information has become available, and the historic discussion (Section 34.1) has been updated to include that information. The sampling locations discussed below are based on the information that was available at the time the FSP was developed, and may not address all areas of potential releases.

AUS OU SI sample locations are shown on Figure 34-1. Survey coordinates for all sample locations in AUS-0021 are listed in Table 34-1. Table 34-2 lists the sample locations and the matrix sampled at that location. All samples are soil samples.

### **34.2.1 Field Investigation**

Sampling was done in accordance with the FSP, except as noted.

#### **Scarred Area on West Side of Former Building A-3-3**

Sample 0021-004 was collected from a scarred area behind Building A-3-3 that was identified in the 1951 aerial photograph. Sample 0021-005 was collected from the north-flowing drainageway near the former scarred area.

#### **Ordnance Scrap Debris Area**

Sample 0021-003 was collected from the ordnance scrap debris area and sample 0021-002 was collected from the drainageway that flows from this area. Sample 0021-001 was collected from the north flowing drainageway, just west of the ordnance scrap debris area.

### **34.2.2 Field Results**

#### **34.2.2.1 Site Conditions**

##### **34.2.2.1.1 *Geologic Conditions***

Soil from the hand auger locations, which extended to a depth of 6 inches, was described as silty clay fill. There are no other available subsurface data from the site.

##### **34.2.2.1.2 *Hydrogeologic Conditions***

No hydrogeological information is available for this site.

##### **34.2.2.1.3 *Hydrologic Conditions***

Surface water flow is generally toward the north, as shown in Figure 34-1.

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<sup>13</sup> U.S. Fish & Wildlife Service, Department of the Interior, March 2000, Draft Final Field Sampling Plan Site Inspection, Additional and Uncharacterized Sites Operable Unit, Crab Orchard National Wildlife Refuge Superfund Site, Marion, Illinois (Williamson County), prepared by URS Corporation.

**34.2.2.2 Chemical Results**

Table 34-3 lists the chemicals detected at AUS-0021 during this investigation, along with the frequency and range of detections. Tabulated results of all analyses are included in the Quality Control Summary Report (QCSR). All results are shown in Figure 34-1.

**34.3 SCREENING RISK ASSESSMENT**

Results of the screening are presented in Tables 34-4 and 34-5 as follows:

- Table 34-4--human health risk screening for soils, and
- Table 34-5--ecological risk screening for soils.

Each table lists the maximum detected concentration for each constituent analyzed at AUS-0021. The screening results are presented in the tables in terms of hazard quotients (HQs). The HQ for any chemical detected, for any particular screening criterion is simply the ratio of the maximum detected concentration to the screening concentration. For human health for carcinogens, a screening level “cancer risk” is calculated instead of an HQ.

Chemicals that are shaded in the tables are those that exceeded the screening criteria, and are identified as chemicals of potential concern (COPCs) for human health risk, and chemicals of potential ecological concern (COPECs) for ecological risk. The only COPCs/COPECs not shaded in the table are those inorganic constituents that exceeded the screening criteria but were detected at levels below Refuge background.

In cases where the chemical was analyzed but not detected, the HQ is the ratio between the maximum reporting limit and the screening concentration. Chemicals not detected are identified with a “U” qualifier in the qualifier column. When these HQ values exceed one, they are not shaded. These constituents are not identified as COPCs/COPECs, but rather as uncertainties.

In Figure 34-1, the shading convention used is the same as for the tables discussed above. The particular screening criteria exceeded are indicated by the code in the analytical results labels. Duplicate results are shown only if the duplicate result for an analyte exceeded the screening criteria and the result from the original sample did not; or, if the analyte was detected in the duplicate and not in the original sample. Since in the screening process results which are qualified as estimated (coded with “J”) are treated the same as unqualified results, data qualifiers are not included in the results shown in the figures. Refer to the QCSR for data qualifiers.

Tables 34-6 (human health risk) and 34-7 (ecological risk) list all the analytes and corresponding media sampled and indicate whether each is a COPC (or COPEC), not a COPC (or COPEC), or an uncertainty. The codes in the tables indicate the rationale for each classification. All COPCs (Table 34-6) and COPECs (Table 34-7) are shaded in the tables.

**34.3.1 Human Health Risk****34.3.1.1 Soil**

Human health screening results for soil and samples are presented in Table 34-4. For carcinogens, a cancer risk was calculated using the USEPA Region 9 Industrial Soil Preliminary Remediation Goals (PRGs) as screening values. The cancer risk was derived by calculating a ratio of the maximum detected concentrations, or the maximum reporting limits, to their appropriate screening values. These ratios were then multiplied by  $1 \times 10^{-6}$ . In addition, ratios were calculated using the USEPA Region 9 Industrial Soil PRG for Toxins, the USEPA Region 9 Migration to Groundwater Criteria (Dilution Attenuation Factor (DAF)=1), the Illinois Tiered Approach to Corrective Action Objectives (TACO) Industrial/Commercial Soil Ingestion Criteria, the Illinois TACO Construction Worker Soil Ingestion

**34.3.2 Ecological Risk****34.3.2.1 Soil**

Ecological screening results for soil samples are presented in Table 34-5. Soil screening concentrations for direct exposures were developed using toxicity reference values (TRVs) derived from several sources, including the following:

- USEPA (2000)<sup>14</sup>
- Environment Canada (1995)<sup>15</sup>
- Talmage *et al.* (1999)<sup>16</sup>
- Efroymsen *et al.* (1997a, 1997b)<sup>17</sup>
- CCME (1999)<sup>18</sup>
- MHSPE (1994)<sup>19</sup>
- Other sources

A detailed discussion of the screening concentration selection is presented in Appendix G.

<sup>14</sup> USEPA. 2000. Ecological Soil Screening Level Guidance (Draft). USEPA Office of Emergency and Remedial Response, Washington, DC.

<sup>15</sup> Environment Canada. 1995. Toxicity Testing of NCSRP Priority Substances for Development of Soil Quality Guidelines for Contaminated Sites. Guidelines Division, Evaluation and interpretation Branch, Environmental Conservation Directorate, Environment Canada. Hull, Quebec.

<sup>16</sup> Talmage, S.S., D.M. Opresko, C.J. Maxwell, C.J.E. Welsh, F. M. Cretella, P.H. Reno, and F. B. Daniel. 1999. Nitroaromatic Munition Compounds: Environmental Effects and Screening Values. *Rev Environ. Contam. Toxicol* 161:1-156.

<sup>17</sup> Efroymsen, R.A., M.E. Will, G.W. Suter II, and A.C. Wooten. 1997a. *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision*. Oak Ridge National Laboratory, Oak Ridge, Tennessee. ES/ER/TM-85/R3.

Efroymsen, R.A., M.E. Will, and G.W. Suter II. 1997b. *Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision*. Oak Ridge National Laboratory, Oak Ridge, Tennessee. ES/ER/TM-126/R2.

<sup>18</sup> Canadian Council of Ministers of the Environment. 1999. Canadian Environmental Quality Guidelines.

<sup>19</sup> Ministry of Housing, Spatial Planning, and the Environment (MHSPE). 1994. *Intervention Values and Target Values – Soil Quality Standards*. Directorate General for Environmental Protection, Department of Soil Protection, The Hague, The Netherlands.

The screening approach for ingestion pathway exposures was based on the potential for a chemical to bioaccumulate. The potential for a chemical to bioaccumulate was based on the organic chemical-specific octanol-to-water partitioning coefficient ( $K_{ow}$ ), which provides an indication of the lipophilicity of an organic chemical, and its potential for sequestration in biological tissue. The document *Assessment and Control of Bioconcentratable Contaminants in Surface Waters* (USEPA 1991)<sup>20</sup> used a log  $K_{ow}$  of 3.5 as a target threshold value indicative of bioaccumulative chemicals to target organic chemicals of greatest concern. Using this as a guideline, organic chemicals with a log  $K_{ow}$  greater than 3.5 were considered potentially bioaccumulative chemicals. Among inorganics, mercury and selenium were considered as potentially bioaccumulative chemicals. Any potentially bioaccumulative chemical that is detected was retained as a COPEC.

#### 34.4 SCIENTIFIC MANAGEMENT DECISION POINT

##### 34.4.1 Human Health Risk Evaluation

Only one organic constituent was identified as a COPC. Trichloroethylene (TCE) exceeded the Region 9 migration to groundwater screening criteria of 3 micrograms per kilogram (ug/kg) for a DAF of 1. Two samples were analyzed for TCE, with detections of 5 and 9 ug/kg. The DAF 20 screening criterion for TCE is 60 ug/kg. No other screening criteria were exceeded, including the Illinois TACO migration to groundwater criterion, which is 60 ug/kg. Groundwater may occasionally rise to near the surface at this site; however, the DAF 1 value is extremely conservative.

Among the inorganic compounds antimony, arsenic, barium, chromium, nickel and selenium were identified as COPCs. This report recommends that inorganic constituents that exceeded project screening criteria but were within Refuge background levels not be retained as COPCs for further evaluation. These are the constituents coded with “D” on Table 34-6, and include all the COPCs except barium, discussed below.

*Barium.* The maximum barium concentration detected, 245 milligrams per kilogram (mg/kg), exceeded the calculated background value of 195 mg/kg for barium<sup>21</sup>. The Region 9 migration to groundwater criteria for a DAF of 1 for barium is 76 mg/kg. The maximum concentration detected is less than the mean plus three standard deviations, which was calculated at 361 mg/kg for barium<sup>22</sup>. Since the maximum detection is below the mean plus three standard deviations ( $3S_b$ ), it is recommended that barium not be retained as a COPC for further evaluation.

Several chemicals represent uncertainties for AUS-0021 because, while they were not detected, the reporting limit was equal to or exceeded the screening criteria. These are indicated as uncertainties on Table 34-6, and coded with a “B.” The uncertainty associated with these chemicals is not considered to be significant.

<sup>20</sup> USEPA 1991. *Assessment and Control of Bioconcentratable Contaminants in Surface Waters* (Draft). US Environmental Protection Agency Office of Research and Development, Washington, D.C.

<sup>21</sup> This the 95 percent upper tolerance limit (UTL), based on the 95 percent confidence level. See Section 2 for the development of background values.

<sup>22</sup> See discussion and results in Section 2 and Table 2-7.



### 34.4.2 Ecological Risk Evaluation

Only one volatile organic chemical detected at AUS-0021 was trichloroethylene at 9 ug/kg, which is well below its respective ecological screening concentration in soils (Table 34-5. HQ = 0.001). The volatile organics are not considered significant ecological concerns. Several semivolatile organic compounds were identified as uncertainties because the reporting limit was higher than the screening concentration. In fact, there was only one volatile organic compound (trichloroethylene noted previously), one semivolatile organic compound, and no explosives detected, lending weight of evidence that organic chemicals are not of ecological concern at AUS-0021. The single semivolatile organic detected was bis(2-ethylhexyl)phthalate (0.17 J-qualified). The HQ for bis(2-ethylhexyl)phthalate was less than 1, but it was retained as a COPEC because it was detected and is a potential bioaccumulating constituent based on its  $K_{ow}$ . However, bis(2-ethylhexyl)phthalate is also a common laboratory contaminant and is often observed in environmental samples. Though it was selected as a potential bioaccumulator based on its  $K_{ow}$ , the maximum concentration is also below the USEPA Region V Environmental Data Quality Level of 0.926 mg/kg, which takes into consideration ingestion pathway exposures to higher trophic levels (i.e., bioaccumulative concerns). Because of its low concentration, the fact that it was J-qualified, and because it is also below bioaccumulation-based screening levels, bis(2-ethylhexyl)phthalate is not considered a significant ecological concern at AUS-0021.

Among the inorganic compounds arsenic, boron, chromium, manganese, mercury, and selenium were identified as COPECs. This report recommends that inorganic constituents that exceeded project screening criteria but were within Refuge background levels not be retained as COPECs for further evaluation. These are the constituents coded with "D" on Table 34-7, and include arsenic, boron, chromium, manganese, mercury, and selenium. The only remaining inorganic COPECs are cobalt and iron, which are discussed below.

*Cobalt* - Cobalt only slightly exceeded an HQ of 1 (1.16), and the maximum concentration was comparable to background (a difference of only 7 percent). Therefore, cobalt is not considered a significant concern.

*Iron* - The maximum concentration of iron (28,700 mg/kg) was roughly 50 percent above the background concentration (19,306 mg/kg -- Table 34-5). Though the maximum detection exceeded the screening value, iron is not considered a significant ecological concern since it is generally considered to have low toxicity and it is an essential nutrient.

Several inorganic chemicals represent uncertainties for AUS-0021 since they were detected but no screening concentrations were identified. These include calcium, magnesium, potassium, and sodium. Each is considered an essential nutrient, and the uncertainty associated with these constituents is not considered to be significant.

In summary, results of the soil analyses at AUS-0021 indicate there are no chemicals present at levels of potential ecological concern warranting further evaluation. It is recommended that none of the chemicals be retained as COPECs for this site.

**34.4.3 Summary of Recommendations**

Based on the above discussions, TCE is the only constituent that may warrant further investigation, based on potential groundwater impacts. Because this site is very close to Area 7 (AUS-0A07), and TCE was widespread in the soils at Area 7, it is recommended that a well be installed at Site AUS-0021 as part of the AUS-0A07 investigation, and be monitored for volatile organic compounds (VOCs). It is also recommended that the Site 21 designation be dropped, and that this location be incorporated into Site AUS-0A07.

It is recommended that none of the other chemicals be retained as COPCs/COPECs for this site.

**TABLE 34-1  
SURVEY COORDINATES FOR SAMPLE LOCATIONS IN AUS-0021**

<b>Sample Location</b>	<b>Northing</b>	<b>Easting</b>	<b>Ground Surface Elevation</b>	<b>Top of Casing Elevation</b>	<b>Comments</b>
0021-001	369760.6	794415.0	444.34	NA	
0021-002	369764.1	794462.7	444.06	NA	
0021-003	369720.0	794467.4	445.82	NA	
0021-004	369556.1	794447.6	449.93	NA	
0021-005	369573.0	794423.8	447.67	NA	

Sheet 1 of 1

NA = Not Applicable

**TABLE 34-2**  
**MATRICES SAMPLED AT EACH SAMPLE LOCATION AT AUS-0021**

<b>Soil</b>
AUS-0021-001*
AUS-0021-002*
AUS-0021-003
AUS-0021-004
AUS-0021-005

**Sheet 1 of 1**

\* Note that the samples at this location were originally designated as sediment, but are actually soil samples.

TABLE 34-3  
SOIL SAMPLE ANALYTICAL RESULTS SUMMARY

Constituents	Number of Detections	Range of Detections
<b>Volatile Organic Compounds</b>		
Trichloroethylene (TCE)	2/2	5 ug/kg to 9 ug/kg
<b>Semivolatile Organic Compounds</b>		
Bis(2-Ethylhexyl) phthalate	1/5	170 ug/kg
<b>Explosives</b>		
Tetryl	1/3	5,100 ug/kg
<b>Metals</b>		
Aluminum	5/5	11,000 mg/kg to 20,500 mg/kg
Antimony	2/5	0.26 mg/kg to 0.58 mg/kg
Arsenic	5/5	8.1 mg/kg to 12.8 mg/kg
Barium	5/5	101 mg/kg to 245 mg/kg
Beryllium	5/5	0.54 mg/kg to 0.73 mg/kg
Boron	2/5	0.55 mg/kg to 1.1 mg/kg
Calcium	5/5	1,270 mg/kg to 3,060 mg/kg
Chromium, Total	5/5	13.9 mg/kg to 23.1 mg/kg
Cobalt	5/5	6 mg/kg to 23.2 mg/kg
Copper	5/5	10.4 mg/kg to 22.7 mg/kg
Iron	5/5	18,200 mg/kg to 28,700 mg/kg
Lead	5/5	15.5 mg/kg to 57.9 mg/kg
Magnesium	5/5	1,720 mg/kg to 3,720 mg/kg
Manganese	5/5	227 mg/kg to 3,030 mg/kg
Mercury	5/5	0.02 mg/kg to 0.049 mg/kg
Nickel	5/5	11.4 mg/kg to 17.2 mg/kg
Potassium	5/5	732 mg/kg to 1,220 mg/kg
Selenium	2/5	0.39 mg/kg
Sodium	5/5	45.9 mg/kg to 64.8 mg/kg
Thallium	4/5	0.52 mg/kg to 0.78 mg/kg
Vanadium	5/5	32.4 mg/kg to 44 mg/kg
Zinc	5/5	37.1 mg/kg to 102 mg/kg

Sheet 1 of 1

mg/kg = milligrams per kilogram

ug/kg = micrograms per kilogram

Notes: This table was derived from the figures that show the analytical results. As a result, duplicates are included only when the duplicate results are greater than original sample results, or when an analyte was detected in a duplicate and not in the original sample. There may be some duplicate results, not shown in the table, that are lower than the low end of the range shown. In addition, the frequency and range of detections is based on the number of sample locations, not the total number of samples (the total number of samples includes originals plus duplicates).

Checked by: MMF 7/20/01

**TABLE 34-4  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0021**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
<b>Volatile Organic Compounds</b>								
71-55-6	1,1,1-Trichloroethane	5	U	UG/KG			1.50E-06	5.00E-02
79-34-5	1,1,2,2-Tetrachloroethane	5	U	UG/KG		5.57E-09	1.28E-06	2.50E+01
79-00-5	1,1,2-Trichloroethane	5	U	UG/KG		2.63E-09	3.29E-05	5.56E+00
75-34-3	1,1-Dichloroethane	5	U	UG/KG			2.43E-06	5.00E-03
75-35-4	1,1-Dichloroethene	5	U	UG/KG		4.21E-08	7.42E-05	1.67E+00
107-06-2	1,2-Dichloroethane (EDC)	5	U	UG/KG		6.54E-09	1.42E-04	5.00E+00
540-59-0	1,2-Dichloroethene (total)	5	U	UG/KG			3.39E-05	2.50E-01
78-87-5	1,2-Dichloropropane	5	U	UG/KG		6.51E-09	2.35E-04	5.00E+00
78-93-3	2-Butanone (MEK)	11	U	UG/KG			3.97E-07	
591-78-6	2-Hexanone	11	U	UG/KG				
108-10-1	4-Methyl-2-pentanone (MIBK)	11	U	UG/KG			3.81E-06	
67-64-1	Acetone	11	U	UG/KG			1.77E-06	1.38E-02
71-43-2	Benzene	5	U	UG/KG		3.41E-09	2.06E-04	2.50E+00
75-27-4	Bromodichloromethane	5	U	UG/KG		2.12E-09	4.79E-06	1.67E-01
75-25-2	Bromoform	5	U	UG/KG		1.60E-11	2.84E-07	1.25E-01
74-83-9	Bromomethane	5	U	UG/KG			3.81E-04	5.00E-01
75-15-0	Carbon disulfide	5	U	UG/KG			4.14E-06	2.50E-03
56-23-5	Carbon tetrachloride	5	U	UG/KG		9.45E-09	7.15E-04	1.67E+00
108-90-7	Chlorobenzene	5	U	UG/KG			9.21E-06	7.14E-02
75-00-3	Chloroethane	5	U	UG/KG		7.68E-10	2.65E-07	
67-66-3	Chloroform	5	U	UG/KG		9.60E-09	3.88E-03	1.67E-01
74-87-3	Chloromethane	5	U	UG/KG		1.88E-09		
156-59-2	cis-1,2-Dichloroethene	5	U	UG/KG			3.39E-05	2.50E-01

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
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10061-01-5	cis-1,3-Dichloropropene	5	U	UG/KG		2.81E-08	1.14E-04	
124-48-1	Dibromochloromethane	5	U	UG/KG		1.88E-09	3.14E-06	2.50E-01
100-41-4	Ethylbenzene	5	U	UG/KG			8.37E-07	7.14E-03
75-09-2	Methylene chloride	5	U	UG/KG		2.44E-10	5.11E-07	5.00E+00
110-54-3	N-Hexane	5	U	UG/KG			1.24E-05	
100-42-5	Styrene	5	U	UG/KG			2.45E-07	2.50E-02
127-18-4	Tetrachloroethylene (PCE)	5	U	UG/KG		2.68E-10	2.94E-06	1.67E+00
108-88-3	Toluene	5	U	UG/KG			2.52E-06	8.33E-03
1330-20-7	total Xylenes	5	U	UG/KG			1.12E-06	5.00E-04
156-60-5	trans-1,2-Dichloroethene	5	U	UG/KG			2.33E-05	1.67E-01
10061-02-6	trans-1,3-Dichloropropene	5	U	UG/KG		2.81E-08	1.14E-04	
79-01-6	Trichloroethylene (TCE)	9		UG/KG		1.47E-09	1.14E-04	3.00E+00
75-01-4	Vinyl chloride	5	U	UG/KG		1.03E-07		7.14E+00
<b>Semivolatile Organic Compounds</b>								
120-82-1	1,2,4-Trichlorobenzene	450	U	UG/KG			5.91E-05	1.50E+00
95-50-1	1,2-Dichlorobenzene	450	U	UG/KG			1.36E-04	5.00E-01
541-73-1	1,3-Dichlorobenzene	450	U	UG/KG			8.69E-03	
106-46-7	1,4-Dichlorobenzene	450	U	UG/KG		5.54E-08	2.34E-04	4.50E+00
95-95-4	2,4,5-Trichlorophenol	2300	U	UG/KG			2.61E-05	2.30E-01
88-06-2	2,4,6-Trichlorophenol	450	U	UG/KG		2.01E-09		5.63E+01
120-83-2	2,4-Dichlorophenol	450	U	UG/KG			1.70E-04	9.00E+00
105-67-9	2,4-Dimethylphenol	450	U	UG/KG			2.55E-05	1.13E+00
51-28-5	2,4-Dinitrophenol	2300	U	UG/KG			1.31E-03	2.30E+02
91-58-7	2-Chloronaphthalene	450	U	UG/KG			1.65E-05	

ND = Not Detected E = Outside of Range UJ= Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 34-4  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0021**

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95-57-8	2-Chlorophenol	450	U	UG/KG			1.86E-03	2.25E+00
91-57-6	2-Methylnaphthalene	450	U	UG/KG			8.30E-06	2.25E-03
95-48-7	2-Methylphenol	450	U	UG/KG			1.02E-05	5.63E-01
88-74-4	2-Nitroaniline	2300	U	UG/KG			4.57E-02	
88-75-5	2-Nitrophenol	450	U	UG/KG			6.39E-05	
91-94-1	3,3'-Dichlorobenzidine	450	U	UG/KG		8.21E-08		1.50E+03
99-09-2	3-Nitroaniline	2300	U	UG/KG			4.57E-02	
534-52-1	4,6-Dinitro-2-methylphenol	2300	U	UG/KG				
101-55-3	4-Bromophenyl phenyl ether	450	U	UG/KG				
59-50-7	4-Chloro-3-methylphenol	450	U	UG/KG			1.02E-05	
106-47-8	4-Chloroaniline	900	U	UG/KG			2.55E-04	3.00E+01
7005-72-3	4-Chlorophenyl phenyl ether	450	U	UG/KG				
106-44-5	4-Methylphenol	450	U	UG/KG			1.02E-04	
100-01-6	4-Nitroaniline	2300	U	UG/KG			4.57E-02	
100-02-7	4-Nitrophenol	2300	U	UG/KG			3.26E-04	
83-32-9	Acenaphthene	450	U	UG/KG			1.17E-05	1.50E-02
208-96-8	Acenaphthylene	450	U	UG/KG			8.30E-06	2.25E-03
120-12-7	Anthracene	450	U	UG/KG			1.15E-06	7.50E-04
56-55-3	Benzo(a)anthracene	450	U	UG/KG		1.56E-07		5.63E+00
50-32-8	Benzo(a)pyrene	450	U	UG/KG		1.56E-06		1.13E+00
205-99-2	Benzo(b)fluoranthene	450	U	UG/KG		1.56E-07		2.25E+00
191-24-2	Benzo(g,h,i)perylene	450	U	UG/KG			8.30E-06	2.25E-03
207-08-9	Benzo(k)fluoranthene	450	U	UG/KG		1.56E-08		2.25E-01
111-91-1	bis(2-Chloroethoxy)methane	450	U	UG/KG				

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
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HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0021**

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111-44-4	bis(2-Chloroethyl) ether	450	U	UG/KG		7.26E-07		2.25E+04
108-60-1	bis(2-Chloroisopropyl) ether	450	U	UG/KG		5.57E-08	1.06E-04	
117-81-7	bis(2-Ethylhexyl) phthalate (DEHP)	170	J	UG/KG		9.65E-10	9.65E-06	
85-68-7	Butyl benzyl phthalate	450	U	UG/KG			2.55E-06	5.63E-04
86-74-8	Carbazole	450	U	UG/KG		3.65E-09		1.50E+01
218-01-9	Chrysene	450	U	UG/KG		1.56E-09		5.63E-02
84-74-2	Di-n-butyl phthalate	450	U	UG/KG			5.11E-06	1.50E-03
117-84-0	Di-n-octyl phthalate	450	U	UG/KG			2.55E-05	4.50E-05
53-70-3	Dibenz(a,h)anthracene	450	U	UG/KG		1.56E-06		5.63E+00
132-64-9	Dibenzofuran	450	U	UG/KG			8.89E-05	
84-66-2	Diethyl phthalate	450	U	UG/KG			6.39E-07	
131-11-3	Dimethyl phthalate	450	U	UG/KG			5.11E-08	
206-44-0	Fluoranthene	450	U	UG/KG			1.50E-05	2.25E-03
86-73-7	Fluorene	450	U	UG/KG			1.36E-05	1.50E-02
118-74-1	Hexachlorobenzene	450	U	UG/KG		2.92E-07	6.39E-04	4.50E+00
87-68-3	Hexachlorobutadiene	450	U	UG/KG		1.42E-08	2.55E-03	4.50E+00
77-47-4	Hexachlorocyclopentadiene	450	U	UG/KG			7.63E-05	2.25E-02
67-72-1	Hexachloroethane	450	U	UG/KG		2.55E-09	5.11E-04	2.25E+01
193-39-5	Indeno(1,2,3-c,d)pyrene	450	U	UG/KG		1.56E-07		6.43E-01
78-59-1	Isophorone	450	U	UG/KG		1.73E-10	2.55E-06	1.50E+01
621-64-7	N-Nitroso-di-n-propylamine	450	U	UG/KG		1.28E-06		2.25E+05
86-30-6	N-Nitrosodiphenylamine	450	U	UG/KG		8.94E-10		7.50E+00
91-20-3	Naphthalene	450	U	UG/KG			2.39E-03	1.13E-01
98-95-3	Nitrobenzene	430	U	UG/KG			3.76E-03	

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87-86-5	Pentachlorophenol	2300	U	UG/KG		2.07E-07	1.61E-04	2.30E+03
85-01-8	Phenanthrene	450	U	UG/KG			8.30E-06	2.25E-03
108-95-2	Phenol	450	U	UG/KG			8.51E-07	9.00E-02
129-00-0	Pyrene	450	U	UG/KG			8.30E-06	2.25E-03
<b>Explosives</b>								
99-35-4	1,3,5-Trinitrobenzene	340	U	UG/KG			1.29E-05	
99-65-0	1,3-Dinitrobenzene	340	U	UG/KG			3.86E-03	
118-96-7	2,4,6-Trinitrotoluene (TNT)	680	U	UG/KG		8.27E-09	1.54E-03	
121-14-2	2,4-Dinitrotoluene	430	U	UG/KG			2.44E-04	1.08E+04
606-20-2	2,6-Dinitrotoluene	450	U	UG/KG			5.11E-04	1.50E+04
35572-78-2	2-Amino-4,6-Dinitrotoluene	680	U	UG/KG				
88-72-2	2-Nitrotoluene (ONT)	680	U	UG/KG				
99-08-1	3-Nitrotoluene	680	U	UG/KG			3.35E-04	
19406-51-0	4-Amino-2,6-Dinitrotoluene	680	U	UG/KG				
99-99-0	4-Nitrotoluene (PNT)	680	U	UG/KG			3.35E-04	
2691-41-0	HMX	680	U	UG/KG			1.54E-05	
121-82-4	RDX	680	U	UG/KG		3.03E-08	2.57E-04	
479-45-8	Tetryl	5100		UG/KG			5.79E-04	
<b>Metals</b>								
7429-90-5	Aluminum	20500		MG/KG	7.12E-01		1.22E-02	
7440-36-0	Antimony	0.58	J	MG/KG	6.99E-01		7.09E-04	1.93E+00
7440-38-2	Arsenic	12.8		MG/KG	9.48E-01	4.69E-06	2.91E-02	1.28E+01
7440-39-3	Barium	245		MG/KG	1.26E+00		1.97E-03	3.06E+00
7440-41-7	Beryllium	0.73		MG/KG	9.61E-01	3.26E-10	1.98E-04	2.43E-01

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HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0021**

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CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
7440-42-8	Boron	1.1	J	MG/KG	2.08E-01		1.39E-05	
7440-43-9	Cadmium	0.68	U	MG/KG	3.58E+00	2.28E-10	8.40E-04	1.70E+00
7440-70-2	Calcium	3060		MG/KG	1.23E+00			
7440-47-3	Chromium	23.1		MG/KG	9.17E-01	5.15E-08		1.16E+01
7440-48-4	Cobalt	23.2		MG/KG	1.07E+00		1.89E-04	
7440-50-8	Copper	22.7		MG/KG	2.01E+00		2.99E-04	
7439-89-6	Iron	28700		MG/KG	1.49E+00		4.69E-02	
7439-92-1	Lead	57.9	J	MG/KG	2.47E+00			
7439-95-4	Magnesium	3720		MG/KG	2.40E+00			
7439-96-5	Manganese	3030		MG/KG	8.32E-01		9.40E-02	
7439-97-6	Mercury	0.049	J	MG/KG	8.17E-01			
7440-02-0	Nickel	17.2		MG/KG	9.10E-01		4.21E-04	2.46E+00
2023695	Potassium	1220		MG/KG	1.95E+00			
7782-49-2	Selenium	0.39	J	MG/KG	1.67E-01		3.82E-05	1.30E+00
7440-22-4	Silver	1.4	U	MG/KG	2.41E+00		1.37E-04	7.00E-01
7440-23-5	Sodium	64.8	J	MG/KG	3.81E-01			
7440-28-0	Thallium	0.78	J	MG/KG	1.90E+00		5.45E-06	
7440-62-2	Vanadium	44		MG/KG	9.32E-01		3.08E-03	1.47E-01
7440-66-6	Zinc	102		MG/KG	1.98E+00		1.67E-04	1.70E-01

ND = Not Detected E = Outside of Range UJ= Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 34-4**  
**HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0021**

**ADDITIONAL AND UNCHARACTERIZED SITES OU**  
**CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
<b>Volatile Organic Compounds</b>							
71-55-6	1,1,1-Trichloroethane	5	U	UG/KG			2.50E-03
79-34-5	1,1,2,2-Tetrachloroethane	5	U	UG/KG			
79-00-5	1,1,2-Trichloroethane	5	U	UG/KG	6.10E-07	6.10E-07	2.50E-01
75-34-3	1,1-Dichloroethane	5	U	UG/KG	2.50E-08	2.50E-08	2.17E-04
75-35-4	1,1-Dichloroethene	5	U	UG/KG	2.78E-07	2.78E-06	8.33E-02
107-06-2	1,2-Dichloroethane (EDC)	5	U	UG/KG	7.94E-05	3.57E-06	2.50E-01
540-59-0	1,2-Dichloroethene (total)	5	U	UG/KG	2.50E-07	2.50E-07	1.25E-02
78-87-5	1,2-Dichloropropane	5	U	UG/KG	5.95E-05	2.78E-06	1.67E-01
78-93-3	2-Butanone (MEK)	11	U	UG/KG			
591-78-6	2-Hexanone	11	U	UG/KG			
108-10-1	4-Methyl-2-pentanone (MIBK)	11	U	UG/KG			
67-64-1	Acetone	11	U	UG/KG	5.50E-08	5.50E-08	6.88E-04
71-43-2	Benzene	5	U	UG/KG	2.50E-05	1.16E-06	1.67E-01
75-27-4	Bromodichloromethane	5	U	UG/KG	5.43E-05	2.50E-06	8.33E-03
75-25-2	Bromoform	5	U	UG/KG	6.94E-06	3.13E-07	6.25E-03
74-83-9	Bromomethane	5	U	UG/KG	1.72E-06	5.00E-06	2.50E-02
75-15-0	Carbon disulfide	5	U	UG/KG	2.50E-08	2.50E-07	1.56E-04
56-23-5	Carbon tetrachloride	5	U	UG/KG	1.14E-04	1.22E-05	7.14E-02
108-90-7	Chlorobenzene	5	U	UG/KG	1.22E-07	1.22E-06	5.00E-03
75-00-3	Chloroethane	5	U	UG/KG			
67-66-3	Chloroform	5	U	UG/KG	5.32E-06	2.50E-06	8.33E-03
74-87-3	Chloromethane	5	U	UG/KG			
156-59-2	cis-1,2-Dichloroethene	5	U	UG/KG	2.50E-07	2.50E-07	1.25E-02

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
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**TABLE 34-4  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0021**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
10061-01-5	cis-1,3-Dichloropropene	5	U	UG/KG			
124-48-1	Dibromochloromethane	5	U	UG/KG	1.22E-07	1.22E-07	1.25E-02
100-41-4	Ethylbenzene	5	U	UG/KG	2.50E-08	2.50E-07	3.85E-04
75-09-2	Methylene chloride	5	U	UG/KG	6.58E-06	4.17E-07	2.50E-01
110-54-3	N-Hexane	5	U	UG/KG			
100-42-5	Styrene	5	U	UG/KG	1.22E-08	1.22E-07	1.25E-03
127-18-4	Tetrachloroethylene (PCE)	5	U	UG/KG	4.55E-05	2.08E-06	8.33E-02
108-88-3	Toluene	5	U	UG/KG	1.22E-08	1.22E-08	4.17E-04
1330-20-7	total Xylenes	5	U	UG/KG	5.00E-09	1.22E-08	3.33E-05
156-60-5	trans-1,2-Dichloroethene	5	U	UG/KG	1.22E-07	1.22E-07	7.14E-03
10061-02-6	trans-1,3-Dichloropropene	5	U	UG/KG			
79-01-6	Trichloroethylene (TCE)	9	U	UG/KG	1.73E-05	7.50E-06	1.50E-01
75-01-4	Vinyl chloride	5	U	UG/KG	1.67E-03	7.69E-05	5.00E-01
<b>Semivolatile Organic Compounds</b>							
120-82-1	1,2,4-Trichlorobenzene	450	U	UG/KG	2.25E-05	2.25E-04	9.00E-02
95-50-1	1,2-Dichlorobenzene	450	U	UG/KG	2.50E-06	2.50E-05	2.65E-02
541-73-1	1,3-Dichlorobenzene	450	U	UG/KG			
106-46-7	1,4-Dichlorobenzene	450	U	UG/KG			2.25E-01
95-95-4	2,4,5-Trichlorophenol	2300	U	UG/KG	1.15E-05	1.15E-05	8.52E-03
88-06-2	2,4,6-Trichlorophenol	450	U	UG/KG	8.65E-04	4.09E-05	2.25E+00
120-83-2	2,4-Dichlorophenol	450	U	UG/KG	7.38E-05	7.38E-04	4.50E-01
105-67-9	2,4-Dimethylphenol	450	U	UG/KG	1.10E-05	1.10E-05	5.00E-02
51-28-5	2,4-Dinitrophenol	2300	U	UG/KG	5.61E-04	5.61E-03	1.15E+01
91-58-7	2-Chloronaphthalene	450	U	UG/KG			

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**TABLE 34-4  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0021**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
95-57-8	2-Chlorophenol	450	U	UG/KG	4.50E-05	4.50E-05	1.13E-01
91-57-6	2-Methylnaphthalene	450	U	UG/KG	7.38E-06	7.38E-06	1.07E-04
95-48-7	2-Methylphenol	450	U	UG/KG	4.50E-06	4.50E-06	3.00E-02
88-74-4	2-Nitroaniline	2300	U	UG/KG			
88-75-5	2-Nitrophenol	450	U	UG/KG			
91-94-1	3,3'-Dichlorobenzidine	450	U	UG/KG	3.46E-02	1.61E-03	6.43E+01
99-09-2	3-Nitroaniline	2300	U	UG/KG			
534-52-1	4,6-Dinitro-2-methylphenol	2300	U	UG/KG			
101-55-3	4-Bromophenyl phenyl ether	450	U	UG/KG			
59-50-7	4-Chloro-3-methylphenol	450	U	UG/KG			
106-47-8	4-Chloroaniline	900	U	UG/KG	1.10E-04	1.10E-03	1.29E+00
7005-72-3	4-Chlorophenyl phenyl ether	450	U	UG/KG			
106-44-5	4-Methylphenol	450	U	UG/KG			
100-01-6	4-Nitroaniline	2300	U	UG/KG			
100-02-7	4-Nitrophenol	2300	U	UG/KG			
83-32-9	Acenaphthene	450	U	UG/KG	3.75E-06	3.75E-06	7.89E-04
208-96-8	Acenaphthylene	450	U	UG/KG	7.38E-06	7.38E-06	1.07E-04
120-12-7	Anthracene	450	U	UG/KG	7.38E-07	7.38E-07	3.75E-05
56-55-3	Benzo(a)anthracene	450	U	UG/KG	5.63E-02	2.65E-03	2.25E-01
50-32-8	Benzo(a)pyrene	450	U	UG/KG	5.63E-01	2.65E-02	5.63E-02
205-99-2	Benzo(b)fluoranthene	450	U	UG/KG	5.63E-02	2.65E-03	9.00E-02
191-24-2	Benzo(g,h,i)perylene	450	U	UG/KG	7.38E-06	7.38E-06	1.07E-04
207-08-9	Benzo(k)fluoranthene	450	U	UG/KG	5.77E-03	2.65E-04	9.18E-03
111-91-1	bis(2-Chloroethoxy)methane	450	U	UG/KG			

ND = Not Detected E = Outside of Range UJ= Estimated Nondetect  
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**TABLE 34-4  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0021**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
111-44-4	bis(2-Chloroethyl) ether	450	U	UG/KG	9.00E-02	6.00E-03	1.13E+03
108-60-1	bis(2-Chloroisopropyl) ether	450	U	UG/KG			
117-81-7	bis(2-Ethylhexyl) phthalate (DEHP)	170	J	UG/KG	4.15E-04	4.15E-05	4.72E-05
85-68-7	Butyl benzyl phthalate	450	U	UG/KG	1.10E-06	1.10E-06	4.84E-04
86-74-8	Carbazole	450	U	UG/KG	1.55E-03	7.26E-05	7.50E-01
218-01-9	Chrysene	450	U	UG/KG	5.77E-04	2.65E-05	2.81E-03
84-74-2	Di-n-butyl phthalate	450	U	UG/KG	2.25E-06	2.25E-06	1.96E-04
117-84-0	Di-n-octyl phthalate	450	U	UG/KG	1.10E-05	1.10E-04	4.50E-05
53-70-3	Dibenz(a,h)anthracene	450	U	UG/KG	5.63E-01	2.65E-02	2.25E-01
132-64-9	Dibenzofuran	450	U	UG/KG			
84-66-2	Diethyl phthalate	450	U	UG/KG	4.50E-07	4.50E-07	9.57E-04
131-11-3	Dimethyl phthalate	450	U	UG/KG			
206-44-0	Fluoranthene	450	U	UG/KG	5.49E-06	5.49E-06	1.05E-04
86-73-7	Fluorene	450	U	UG/KG	5.49E-06	5.49E-06	8.04E-04
118-74-1	Hexachlorobenzene	450	U	UG/KG	1.13E-01	5.77E-03	2.25E-01
87-68-3	Hexachlorobutadiene	450	U	UG/KG			
77-47-4	Hexachlorocyclopentadiene	450	U	UG/KG	3.21E-05	3.21E-05	1.13E-03
67-72-1	Hexachloroethane	450	U	UG/KG	2.25E-04	2.25E-04	9.00E-01
193-39-5	Indeno(1,2,3-c,d)pyrene	450	U	UG/KG	5.63E-02	2.65E-03	3.21E-02
78-59-1	Isophorone	450	U	UG/KG	1.10E-06	1.10E-06	5.63E-02
621-64-7	N-Nitroso-di-n-propylamine	450	U	UG/KG	5.63E-01	2.50E-02	9.00E+03
86-30-6	N-Nitrosodiphenylamine	450	U	UG/KG	3.75E-04	1.80E-05	4.50E-01
91-20-3	Naphthalene	450	U	UG/KG	5.49E-06	5.49E-05	5.36E-03
98-95-3	Nitrobenzene	430	U	UG/KG	4.30E-04	4.30E-04	4.30E+00

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**TABLE 34-4  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0021**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
87-86-5	Pentachlorophenol	2300	U	UG/KG	9.58E-02	4.42E-03	7.67E+01
85-01-8	Phenanthrene	450	U	UG/KG	7.38E-06	7.38E-06	1.07E-04
108-95-2	Phenol	450	U	UG/KG	4.50E-07	3.75E-06	4.50E-03
129-00-0	Pyrene	450	U	UG/KG	7.38E-06	7.38E-06	1.07E-04
<b>Explosives</b>							
99-35-4	1,3,5-Trinitrobenzene	340	U	UG/KG			
99-65-0	1,3-Dinitrobenzene	340	U	UG/KG			
118-96-7	2,4,6-Trinitrotoluene (TNT)	680	U	UG/KG			
121-14-2	2,4-Dinitrotoluene	430	U	UG/KG	5.12E-02	2.39E-03	5.38E+02
606-20-2	2,6-Dinitrotoluene	450	U	UG/KG	5.36E-02	2.50E-03	6.43E+02
35572-78-2	2-Amino-4,6-Dinitrotoluene	680	U	UG/KG			
88-72-2	2-Nitrotoluene (ONT)	680	U	UG/KG			
99-08-1	3-Nitrotoluene	680	U	UG/KG			
19406-51-0	4-Amino-2,6-Dinitrotoluene	680	U	UG/KG			
99-99-0	4-Nitrotoluene (PNT)	680	U	UG/KG			
2691-41-0	HMX	680	U	UG/KG			
121-82-4	RDX	680	U	UG/KG			
479-45-8	Tetryl	5100		UG/KG			
<b>Metals</b>							
7429-90-5	Aluminum	20500		MG/KG			
7440-36-0	Antimony	0.58	J	MG/KG	7.07E-04	7.07E-03	1.16E-01
7440-38-2	Arsenic	12.8		MG/KG	4.27E+00	2.10E-01	4.57E-01
7440-39-3	Barium	245		MG/KG	1.75E-03	1.75E-02	2.04E-01
7440-41-7	Beryllium	0.73		MG/KG	7.30E-01	2.52E-02	1.11E-01

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**TABLE 34-4  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0021**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
7440-42-8	Boron	1.1	J	MG/KG	6.11E-06	6.11E-05	
7440-43-9	Cadmium	0.68	U	MG/KG	3.40E-04	3.40E-03	1.84E-01
7440-70-2	Calcium	3060		MG/KG			
7440-47-3	Chromium	23.1		MG/KG	2.31E-03	5.63E-03	8.25E-01
7440-48-4	Cobalt	23.2		MG/KG	1.93E-04	1.93E-03	
7440-50-8	Copper	22.7		MG/KG	2.77E-04	2.77E-03	2.06E-03
7439-89-6	Iron	28700		MG/KG			
7439-92-1	Lead	57.9	J	MG/KG	1.45E-01	1.45E-01	
7439-95-4	Magnesium	3720		MG/KG			
7439-96-5	Manganese	3030		MG/KG	3.16E-02	3.16E-01	
7439-97-6	Mercury	0.049	J	MG/KG	8.03E-05	8.03E-04	3.27E-01
7440-02-0	Nickel	17.2		MG/KG	4.20E-04	4.20E-03	2.26E-01
2023695	Potassium	1220		MG/KG			
7782-49-2	Selenium	0.39	J	MG/KG	3.90E-05	3.90E-04	1.63E-01
7440-22-4	Silver	1.4	U	MG/KG	1.40E-04	1.40E-03	9.33E-01
7440-23-5	Sodium	64.8	J	MG/KG			
7440-28-0	Thallium	0.78	J	MG/KG	4.88E-03	4.88E-03	3.25E-01
7440-62-2	Vanadium	44		MG/KG	3.14E-03	3.14E-02	4.49E-02
7440-66-6	Zinc	102		MG/KG	1.67E-04	1.67E-03	2.83E-02

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J = Estimated U = Nondetect

**TABLE 34-5  
ECOLOGICAL SCREENING OF SOIL RESULTS FROM AUS-0021**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Background (SOIL)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ) (SOIL)	Retained as Potential Bioaccumulator
<b>Volatile Organic Compounds</b>							
71-55-6	1,1,1-Trichloroethane		5	U	UG/KG	1.68E-04	
79-34-5	1,1,2,2-Tetrachloroethane		5	U	UG/KG	3.93E-02	
79-00-5	1,1,2-Trichloroethane		5	U	UG/KG	1.75E-04	
75-34-3	1,1-Dichloroethane		5	U	UG/KG	2.49E-04	
75-35-4	1,1-Dichloroethene		5	U	UG/KG	6.04E-04	
107-06-2	1,2-Dichloroethane (EDC)		5	U	UG/KG	2.36E-04	
540-59-0	1,2-Dichloroethene (total)		5	U	UG/KG	6.35E-03	
78-87-5	1,2-Dichloropropane		5	U	UG/KG	7.14E-06	
78-93-3	2-Butanone (MEK)		11	U	UG/KG	1.23E-04	
591-78-6	2-Hexanone		11	U	UG/KG	8.73E-04	
108-10-1	4-Methyl-2-pentanone (MIBK)		11	U	UG/KG	2.48E-05	
67-64-1	Acetone		11	U	UG/KG	4.40E-03	
71-43-2	Benzene		5	U	UG/KG	3.13E-04	
75-27-4	Bromodichloromethane		5	U	UG/KG	9.26E-03	
75-25-2	Bromoform		5	U	UG/KG	3.14E-04	
74-83-9	Bromomethane		5	U	UG/KG	2.13E-02	
75-15-0	Carbon disulfide		5	U	UG/KG	5.31E-02	
56-23-5	Carbon tetrachloride		5	U	UG/KG	5.00E-06	
108-90-7	Chlorobenzene		5	U	UG/KG	1.25E-04	
75-00-3	Chloroethane		5	U	UG/KG		
67-66-3	Chloroform		5	U	UG/KG	4.20E-03	
74-87-3	Chloromethane		5	U	UG/KG	4.81E-04	
156-59-2	cis-1,2-Dichloroethene		5	U	UG/KG	6.35E-03	
10061-01-5	cis-1,3-Dichloropropene		5	U	UG/KG	1.26E-02	
124-48-1	Dibromochloromethane		5	U	UG/KG	2.44E-03	
100-41-4	Ethylbenzene		5	U	UG/KG	1.00E-03	
75-09-2	Methylene chloride		5	U	UG/KG	1.23E-03	
110-54-3	N-Hexane		5	U	UG/KG		
100-42-5	Styrene		5	U	UG/KG	1.67E-05	
127-18-4	Tetrachloroethylene (PCE)		5	U	UG/KG	3.85E-04	
108-88-3	Toluene		5	U	UG/KG	1.67E-03	
1330-20-7	total Xylenes		5	U	UG/KG	8.33E-03	
156-60-5	trans-1,2-Dichloroethene		5	U	UG/KG	6.35E-03	
10061-02-6	trans-1,3-Dichloropropene		5	U	UG/KG	1.26E-02	
79-01-6	Trichloroethylene (TCE)		9		UG/KG	1.00E-03	
75-01-4	Vinyl chloride		5	U	UG/KG	7.74E-03	
<b>Semivolatile Organic Compounds</b>							
120-82-1	1,2,4-Trichlorobenzene		450	U	UG/KG	2.25E-02	
95-50-1	1,2-Dichlorobenzene		450	U	UG/KG	1.52E-01	
541-73-1	1,3-Dichlorobenzene		450	U	UG/KG	1.19E-02	
106-46-7	1,4-Dichlorobenzene		450	U	UG/KG	2.25E-02	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 34-5  
ECOLOGICAL SCREENING OF SOIL RESULTS FROM AUS-0021**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Background (SOIL)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ) (SOIL)	Retained as Potential Bioaccumulator
95-95-4	2,4,5-Trichlorophenol		2300	U	UG/KG	5.75E-01	
88-06-2	2,4,6-Trichlorophenol		450	U	UG/KG	4.50E-02	
120-83-2	2,4-Dichlorophenol		450	U	UG/KG	5.14E-03	
105-67-9	2,4-Dimethylphenol		450	U	UG/KG	4.50E+01	
51-28-5	2,4-Dinitrophenol		2300	U	UG/KG	1.15E-01	
91-58-7	2-Chloronaphthalene		450	U	UG/KG	3.69E+01	
95-57-8	2-Chlorophenol		450	U	UG/KG	1.85E+00	
91-57-6	2-Methylnaphthalene		450	U	UG/KG	1.39E-01	
95-48-7	2-Methylphenol		450	U	UG/KG	1.11E-02	
88-74-4	2-Nitroaniline		2300	U	UG/KG	3.10E-02	
88-75-5	2-Nitrophenol		450	U	UG/KG	2.81E-01	
91-94-1	3,3'-Dichlorobenzidine		450	U	UG/KG	6.96E-01	
99-09-2	3-Nitroaniline		2300	U	UG/KG	7.28E-01	
534-52-1	4,6-Dinitro-2-methylphenol		2300	U	UG/KG		
101-55-3	4-Bromophenyl phenyl ether		450	U	UG/KG		
59-50-7	4-Chloro-3-methylphenol		450	U	UG/KG	5.66E-02	
106-47-8	4-Chloroaniline		900	U	UG/KG	8.18E-01	
7005-72-3	4-Chlorophenyl phenyl ether		450	U	UG/KG		
106-44-5	4-Methylphenol		450	U	UG/KG	2.76E-03	
100-01-6	4-Nitroaniline		2300	U	UG/KG	1.05E-01	
100-02-7	4-Nitrophenol		2300	U	UG/KG	3.29E-01	
83-32-9	Acenaphthene		450	U	UG/KG	6.59E-04	
208-96-8	Acenaphthylene		450	U	UG/KG	6.59E-04	
120-12-7	Anthracene		450	U	UG/KG	3.04E-04	
56-55-3	Benzo(a)anthracene		450	U	UG/KG	8.64E-02	
50-32-8	Benzo(a)pyrene		450	U	UG/KG	1.02E-04	
205-99-2	Benzo(b)fluoranthene		450	U	UG/KG	7.53E-03	
191-24-2	Benzo(g,h,i)perylene		450	U	UG/KG	3.78E-03	
207-08-9	Benzo(k)fluoranthene		450	U	UG/KG	7.53E-03	
111-91-1	bis(2-Chloroethoxy)methane		450	U	UG/KG	1.49E+00	
111-44-4	bis(2-Chloroethyl) ether		450	U	UG/KG	1.90E-02	
108-60-1	bis(2-Chloroisopropyl) ether		450	U	UG/KG		
117-81-7	bis(2-Ethylhexyl) phthalate (DEHP)		170	J	UG/KG	1.84E-01	YES
85-68-7	Butyl benzyl phthalate		450	U	UG/KG	1.88E+00	
86-74-8	Carbazole		450	U	UG/KG		
218-01-9	Chrysene		450	U	UG/KG	9.51E-02	
84-74-2	Di-n-butyl phthalate		450	U	UG/KG	2.25E-03	
117-84-0	Di-n-octyl phthalate		450	U	UG/KG	6.35E-04	
53-70-3	Dibenz(a,h)anthracene		450	U	UG/KG	2.45E-02	
132-64-9	Dibenzofuran		450	U	UG/KG		
84-66-2	Diethyl phthalate		450	U	UG/KG	4.50E-03	
131-11-3	Dimethyl phthalate		450	U	UG/KG	2.25E-03	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 34-6, AUS-0021**  
**SUMMARY OF HUMAN HEALTH COPC EVALUATION**

**AUS OU PA/SI**  
**CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Groundwater		Sediment		Soil	
	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale
<b>Volatile Organic Compounds</b>								
1,1,1-Trichloroethane	NA	NA	NA	NA	NA	NA	No	A
1,1,2,2-Tetrachloroethane	NA	NA	NA	NA	NA	NA	Uncertainty	B
1,1,2-Trichloroethane	NA	NA	NA	NA	NA	NA	Uncertainty	B
1,1-Dichloroethane	NA	NA	NA	NA	NA	NA	No	A
1,1-Dichloroethene	NA	NA	NA	NA	NA	NA	Uncertainty	B
1,2-Dichloroethane (EDC)	NA	NA	NA	NA	NA	NA	Uncertainty	B
1,2-Dichloroethene (total)	NA	NA	NA	NA	NA	NA	No	A
1,2-Dichloropropane	NA	NA	NA	NA	NA	NA	Uncertainty	B
2-Butanone (MEK)	NA	NA	NA	NA	NA	NA	No	A
2-Hexanone	NA	NA	NA	NA	NA	NA	No	C
4-Methyl-2-pentanone (MIBK)	NA	NA	NA	NA	NA	NA	No	A
Acetone	NA	NA	NA	NA	NA	NA	No	A
Benzene	NA	NA	NA	NA	NA	NA	Uncertainty	B
Bromodichloromethane	NA	NA	NA	NA	NA	NA	No	A
Bromoform	NA	NA	NA	NA	NA	NA	No	A
Bromomethane	NA	NA	NA	NA	NA	NA	No	A
Carbon disulfide	NA	NA	NA	NA	NA	NA	No	A
Carbon tetrachloride	NA	NA	NA	NA	NA	NA	Uncertainty	B
Chlorobenzene	NA	NA	NA	NA	NA	NA	No	A
Chloroethane	NA	NA	NA	NA	NA	NA	No	A
Chloroform	NA	NA	NA	NA	NA	NA	No	A
Chloromethane	NA	NA	NA	NA	NA	NA	No	A
cis-1,2-Dichloroethene	NA	NA	NA	NA	NA	NA	No	A
cis-1,3-Dichloropropene	NA	NA	NA	NA	NA	NA	No	A
Dibromochloromethane	NA	NA	NA	NA	NA	NA	No	A
Ethylbenzene	NA	NA	NA	NA	NA	NA	No	A
Methylene chloride	NA	NA	NA	NA	NA	NA	Uncertainty	B
N-Hexane	NA	NA	NA	NA	NA	NA	No	A
Styrene	NA	NA	NA	NA	NA	NA	No	A
Tetrachloroethylene (PCE)	NA	NA	NA	NA	NA	NA	Uncertainty	B
Toluene	NA	NA	NA	NA	NA	NA	No	A
total Xylenes	NA	NA	NA	NA	NA	NA	No	A
trans-1,2-Dichloroethene	NA	NA	NA	NA	NA	NA	No	A
trans-1,3-Dichloropropene	NA	NA	NA	NA	NA	NA	No	A
Trichloroethylene (TCE)	NA	NA	NA	NA	NA	NA	Yes	E
Vinyl chloride	NA	NA	NA	NA	NA	NA	Uncertainty	B
<b>Semivolatile Organic Compounds</b>								
1,2,4-Trichlorobenzene	NA	NA	NA	NA	NA	NA	Uncertainty	B
1,2-Dichlorobenzene	NA	NA	NA	NA	NA	NA	No	A
1,3-Dichlorobenzene	NA	NA	NA	NA	NA	NA	No	A
1,4-Dichlorobenzene	NA	NA	NA	NA	NA	NA	Uncertainty	B
2,4,5-Trichlorophenol	NA	NA	NA	NA	NA	NA	No	A

**TABLE 34-6, AUS-0021  
SUMMARY OF HUMAN HEALTH COPC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Groundwater		Sediment		Soil	
	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale
2,4,6-Trichlorophenol	NA	NA	NA	NA	NA	NA	Uncertainty	B
2,4-Dichlorophenol	NA	NA	NA	NA	NA	NA	Uncertainty	B
2,4-Dimethylphenol	NA	NA	NA	NA	NA	NA	Uncertainty	B
2,4-Dinitrophenol	NA	NA	NA	NA	NA	NA	Uncertainty	B
2-Chloronaphthalene	NA	NA	NA	NA	NA	NA	No	A
2-Chlorophenol	NA	NA	NA	NA	NA	NA	Uncertainty	B
1-Methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	NA	NA	NA	NA	NA	NA	No	A
2-Methylphenol	NA	NA	NA	NA	NA	NA	No	A
2-Nitroaniline	NA	NA	NA	NA	NA	NA	No	A
2-Nitrophenol	NA	NA	NA	NA	NA	NA	No	A
3,3'-Dichlorobenzidine	NA	NA	NA	NA	NA	NA	Uncertainty	B
3-Nitroaniline	NA	NA	NA	NA	NA	NA	No	A
4,6-Dinitro-2-methylphenol	NA	NA	NA	NA	NA	NA	No	C
4-Bromophenyl phenyl ether	NA	NA	NA	NA	NA	NA	No	C
4-Chloro-3-methylphenol	NA	NA	NA	NA	NA	NA	No	A
4-Chloroaniline	NA	NA	NA	NA	NA	NA	Uncertainty	B
4-Chlorophenyl phenyl ether	NA	NA	NA	NA	NA	NA	No	C
4-Methylphenol	NA	NA	NA	NA	NA	NA	No	A
4-Nitroaniline	NA	NA	NA	NA	NA	NA	No	A
4-Nitrophenol	NA	NA	NA	NA	NA	NA	No	A
Acenaphthene	NA	NA	NA	NA	NA	NA	No	A
Acenaphthylene	NA	NA	NA	NA	NA	NA	No	A
Anthracene	NA	NA	NA	NA	NA	NA	No	A
Benzo(a)anthracene	NA	NA	NA	NA	NA	NA	Uncertainty	B
Benzo(a)pyrene	NA	NA	NA	NA	NA	NA	Uncertainty	B
Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA	Uncertainty	B
Benzo(g,h,i)perylene	NA	NA	NA	NA	NA	NA	No	A
Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	No	A
bis(2-Chloroethoxy)methane	NA	NA	NA	NA	NA	NA	No	C
bis(2-Chloroethyl) ether	NA	NA	NA	NA	NA	NA	Uncertainty	B
bis(2-Chloroisopropyl) ether	NA	NA	NA	NA	NA	NA	No	A
bis(2-Ethylhexyl) phthalate	NA	NA	NA	NA	NA	NA	No	F
Butyl benzyl phthalate	NA	NA	NA	NA	NA	NA	No	A
Carbazole	NA	NA	NA	NA	NA	NA	Uncertainty	B
Chrysene	NA	NA	NA	NA	NA	NA	No	A
Di-n-butyl phthalate	NA	NA	NA	NA	NA	NA	No	A
Di-n-octyl phthalate	NA	NA	NA	NA	NA	NA	No	A
Dibenz(a,h)anthracene	NA	NA	NA	NA	NA	NA	Uncertainty	B
Dibenzofuran	NA	NA	NA	NA	NA	NA	No	A
Diethyl phthalate	NA	NA	NA	NA	NA	NA	No	A
Dimethyl phthalate	NA	NA	NA	NA	NA	NA	No	A
Fluoranthene	NA	NA	NA	NA	NA	NA	No	A

**TABLE 34-5  
ECOLOGICAL SCREENING OF SOIL RESULTS FROM AUS-0021**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Background (SOIL)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ) (SOIL)	Retained as Potential Bioaccumulator
206-44-0	Fluoranthene		450	U	UG/KG	3.69E-03	
86-73-7	Fluorene		450	U	UG/KG	1.50E-02	
118-74-1	Hexachlorobenzene		450	U	UG/KG	4.50E-04	
87-68-3	Hexachlorobutadiene		450	U	UG/KG	1.13E+01	
77-47-4	Hexachlorocyclopentadiene		450	U	UG/KG	4.50E-02	
67-72-1	Hexachloroethane		450	U	UG/KG	7.55E-01	
193-39-5	Indeno(1,2,3-c,d)pyrene		450	U	UG/KG	4.13E-03	
78-59-1	Isophorone		450	U	UG/KG	3.24E-03	
621-64-7	N-Nitroso-di-n-propylamine		450	U	UG/KG	8.28E-01	
86-30-6	N-Nitrosodiphenylamine		450	U	UG/KG	2.25E-02	
91-20-3	Naphthalene		450	U	UG/KG	1.81E-03	
98-95-3	Nitrobenzene		430	U	UG/KG	1.08E-02	
87-86-5	Pentachlorophenol		2300	U	UG/KG	3.83E-01	
85-01-8	Phenanthrene		450	U	UG/KG	9.85E-03	
108-95-2	Phenol		450	U	UG/KG	1.13E-02	
129-00-0	Pyrene		450	U	UG/KG	5.73E-03	
<b>Explosives</b>							
99-35-4	1,3,5-Trinitrobenzene		340	U	UG/KG	9.04E-01	
99-65-0	1,3-Dinitrobenzene		340	U	UG/KG	5.19E-01	
118-96-7	2,4,6-Trinitrotoluene (TNT)		680	U	UG/KG	2.27E-02	
121-14-2	2,4-Dinitrotoluene		430	U	UG/KG	3.36E-01	
606-20-2	2,6-Dinitrotoluene		450	U	UG/KG	1.37E+01	
35572-78-2	2-Amino-4,6-Dinitrotoluene		680	U	UG/KG	8.50E-03	
88-72-2	2-Nitrotoluene (ONT)		680	U	UG/KG		
99-08-1	3-Nitrotoluene		680	U	UG/KG		
19406-51-0	4-Amino-2,6-Dinitrotoluene		680	U	UG/KG		
99-99-0	4-Nitrotoluene (PNT)		680	U	UG/KG		
2691-41-0	HMX		680	U	UG/KG	2.72E-02	
121-82-4	RDX		680	U	UG/KG	6.80E-03	
479-45-8	Tetryl		5100		UG/KG		
<b>Metals</b>							
7429-90-5	Aluminum	28800	20500		MG/KG		
7440-36-0	Antimony	0.83	0.58	J	MG/KG	1.16E-01	
7440-38-2	Arsenic	13.5	12.8		MG/KG	1.42E+00	
7440-39-3	Barium	195	245		MG/KG	4.90E-01	
7440-41-7	Beryllium	0.76	0.73		MG/KG	7.30E-02	
7440-42-8	Boron	5.3	1.1	J	MG/KG	2.20E+00	
7440-43-9	Cadmium	0.19	0.68	U	MG/KG	2.34E-02	
7440-70-2	Calcium	2497	3060		MG/KG		
7440-47-3	Chromium	25.2	23.1		MG/KG	4.62E+00	
7440-48-4	Cobalt	21.7	23.2		MG/KG	1.16E+00	
7440-50-8	Copper	11.3	22.7		MG/KG	7.32E-01	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 34-5  
ECOLOGICAL SCREENING OF SOIL RESULTS FROM AUS-0021**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Background (SOIL)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ) (SOIL)	Retained as Potential Bioaccumulator
7439-89-6	Iron	19306	28700		MG/KG	1.44E+02	
7439-92-1	Lead	23.4	57.9	J	MG/KG	1.34E-01	
7439-95-4	Magnesium	1552	3720		MG/KG		
7439-96-5	Manganese	3640	3030		MG/KG	3.03E+01	
7439-97-6	Mercury	0.06	0.049	J	MG/KG	7.00E-03	YES
7440-02-0	Nickel	18.9	17.2		MG/KG	5.73E-01	
2023695	Potassium	625	1220		MG/KG		
7782-49-2	Selenium	2.34	0.39	J	MG/KG	3.90E-01	YES
7440-22-4	Silver	0.58	1.4	U	MG/KG	7.00E-01	
7440-23-5	Sodium	170	64.8	J	MG/KG		
7440-28-0	Thallium	0.41	0.78	J	MG/KG	7.80E-01	
7440-62-2	Vanadium	47.2	44		MG/KG	9.57E-01	
7440-66-6	Zinc	51.4	102		MG/KG	8.50E-01	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 34-6, AUS-0021  
SUMMARY OF HUMAN HEALTH COPC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Groundwater		Sediment		Soil	
	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale
Fluorene	NA	NA	NA	NA	NA	NA	No	A
Hexachlorobenzene	NA	NA	NA	NA	NA	NA	Uncertainty	B
Hexachlorobutadiene	NA	NA	NA	NA	NA	NA	Uncertainty	B
Hexachlorocyclopentadiene	NA	NA	NA	NA	NA	NA	No	A
Hexachloroethane	NA	NA	NA	NA	NA	NA	Uncertainty	B
Indeno(1,2,3-c,d)pyrene	NA	NA	NA	NA	NA	NA	No	A
Isophorone	NA	NA	NA	NA	NA	NA	Uncertainty	B
N-Nitroso-di-n-propylamine	NA	NA	NA	NA	NA	NA	Uncertainty	B
N-Nitrosodiphenylamine	NA	NA	NA	NA	NA	NA	Uncertainty	B
Naphthalene	NA	NA	NA	NA	NA	NA	No	A
Pentachlorophenol	NA	NA	NA	NA	NA	NA	Uncertainty	B
Phenanthrene	NA	NA	NA	NA	NA	NA	No	A
Phenol	NA	NA	NA	NA	NA	NA	No	A
Pyrene	NA	NA	NA	NA	NA	NA	No	A
<b>Metals and Inorganics</b>								
Aluminum	NA	NA	NA	NA	NA	NA	No	F
Antimony	NA	NA	NA	NA	NA	NA	Yes	D
Arsenic	NA	NA	NA	NA	NA	NA	Yes	D
Barium	NA	NA	NA	NA	NA	NA	Yes	E
Beryllium	NA	NA	NA	NA	NA	NA	No	F
Boron	NA	NA	NA	NA	NA	NA	No	F
Cadmium	NA	NA	NA	NA	NA	NA	Uncertainty	B
Calcium	NA	NA	NA	NA	NA	NA	No	H
Chromium	NA	NA	NA	NA	NA	NA	Yes	D
Cobalt	NA	NA	NA	NA	NA	NA	No	F
Copper	NA	NA	NA	NA	NA	NA	No	F
Cyanide, Total	NA	NA	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	NA	NA	No	F
Lead	NA	NA	NA	NA	NA	NA	No	F
Magnesium	NA	NA	NA	NA	NA	NA	No	H
Manganese	NA	NA	NA	NA	NA	NA	No	F
Mercury	NA	NA	NA	NA	NA	NA	No	F
Nickel	NA	NA	NA	NA	NA	NA	Yes	D
Potassium	NA	NA	NA	NA	NA	NA	No	H
Selenium	NA	NA	NA	NA	NA	NA	Yes	D
Silver	NA	NA	NA	NA	NA	NA	No	A
Sodium	NA	NA	NA	NA	NA	NA	No	H
Thallium	NA	NA	NA	NA	NA	NA	No	F
Vanadium	NA	NA	NA	NA	NA	NA	No	F
Zinc	NA	NA	NA	NA	NA	NA	No	F
<b>Explosives</b>								
1,3,5-Trinitrobenzene	NA	NA	NA	NA	NA	NA	No	A
1,3-Dinitrobenzene	NA	NA	NA	NA	NA	NA	No	A



**TABLE 34-6, AUS-0021  
SUMMARY OF HUMAN HEALTH COPC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Groundwater		Sediment		Soil	
	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale
2,4,6-Trinitrotoluene (TNT)	NA	NA	NA	NA	NA	NA	No	A
2,4-Dinitrotoluene	NA	NA	NA	NA	NA	NA	Uncertainty	B
2,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA	Uncertainty	B
2-Amino-4,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA	No	C
2-Nitrotoluene (ONT)	NA	NA	NA	NA	NA	NA	No	C
3-Nitrotoluene	NA	NA	NA	NA	NA	NA	No	A
4-Amino-2,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA	No	C
4-Nitrotoluene (PNT)	NA	NA	NA	NA	NA	NA	No	A
HMX	NA	NA	NA	NA	NA	NA	No	A
Nitrobenzene	NA	NA	NA	NA	NA	NA	Uncertainty	B
Nitroglycerin	NA	NA	NA	NA	NA	NA	NA	NA
Pentaerythritol tetranitrate (PETN)	NA	NA	NA	NA	NA	NA	NA	NA
Perchloric Acid	NA	NA	NA	NA	NA	NA	NA	NA
RDX	NA	NA	NA	NA	NA	NA	No	A
Tetryl	NA	NA	NA	NA	NA	NA	No	F
<b>Other Parameters</b>								
Nitrogen, Nitrate-Nitrite	NA	NA	NA	NA	NA	NA	NA	NA
Phosphorus, Total (as P)	NA	NA	NA	NA	NA	NA	NA	NA

- A - Chemical was not detected and the reporting limit does not exceed the screening concentration.
- B - Chemical was not detected, but reporting limit was equal to or exceeded screening concentration.
- C - Chemical was not detected and there is no screening concentration.
- D - Chemical was detected and was equal to or exceeded screening concentration, but did not exceed background.
- E - Chemical was detected and was equal to or exceeded screening concentration and background, if applicable.
- F - Chemical was detected and did not exceed screening concentration.
- G - Chemical was detected, but no screening value was available.
- H - Chemical was detected, but it is an essential nutrient.
- J - Chemical was classified as a COPC based on USEPA 1998 data but was not a COPC based on SI data.
- NA - Not Analyzed or not applicable.

**TABLE 34-7, AUS-0021  
SUMMARY OF ECOLOGICAL COPEC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Sediment		Soil	
	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale
<b>Volatile Organic Compounds</b>						
1,1,1-Trichloroethane	NA	NA	NA	NA	No	A
1,1,2,2-Tetrachloroethane	NA	NA	NA	NA	No	A
1,1,2-Trichloroethane	NA	NA	NA	NA	No	A
1,1-Dichloroethane	NA	NA	NA	NA	No	A
1,1-Dichloroethene	NA	NA	NA	NA	No	A
1,2-Dichloroethane (EDC)	NA	NA	NA	NA	No	A
1,2-Dichloroethene (total)	NA	NA	NA	NA	No	A
1,2-Dichloropropane	NA	NA	NA	NA	No	A
2-Butanone (MEK)	NA	NA	NA	NA	No	A
2-Hexanone	NA	NA	NA	NA	No	A
4-Methyl-2-pentanone (MIBK)	NA	NA	NA	NA	No	A
Acetone	NA	NA	NA	NA	No	A
Benzene	NA	NA	NA	NA	No	A
Bromodichloromethane	NA	NA	NA	NA	No	A
Bromoform	NA	NA	NA	NA	No	A
Bromomethane	NA	NA	NA	NA	No	A
Carbon disulfide	NA	NA	NA	NA	No	A
Carbon tetrachloride	NA	NA	NA	NA	No	A
Chlorobenzene	NA	NA	NA	NA	No	A
Chloroethane	NA	NA	NA	NA	No	C
Chloroform	NA	NA	NA	NA	No	A
Chloromethane	NA	NA	NA	NA	No	A
cis-1,2-Dichloroethene	NA	NA	NA	NA	No	A
cis-1,3-Dichloropropene	NA	NA	NA	NA	No	A
Dibromochloromethane	NA	NA	NA	NA	No	A
Ethylbenzene	NA	NA	NA	NA	No	A
Methylene chloride	NA	NA	NA	NA	No	A
N-Hexane	NA	NA	NA	NA	No	C
Styrene	NA	NA	NA	NA	No	A
Tetrachloroethylene (PCE)	NA	NA	NA	NA	No	A
Toluene	NA	NA	NA	NA	No	A
total Xylenes	NA	NA	NA	NA	No	A
trans-1,2-Dichloroethene	NA	NA	NA	NA	No	A
trans-1,3-Dichloropropene	NA	NA	NA	NA	No	A
Trichloroethylene (TCE)	NA	NA	NA	NA	No	F
Vinyl chloride	NA	NA	NA	NA	No	A
<b>Semivolatile Organic Compounds</b>						
1,2,4-Trichlorobenzene	NA	NA	NA	NA	No	A
1,2-Dichlorobenzene	NA	NA	NA	NA	No	A
1,3-Dichlorobenzene	NA	NA	NA	NA	No	A
1,4-Dichlorobenzene	NA	NA	NA	NA	No	A
2,4,5-Trichlorophenol	NA	NA	NA	NA	No	A

TABLE 34-7, AUS-0021  
SUMMARY OF ECOLOGICAL COPEC EVALUATION

AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Chemical	Surface Water		Sediment		Soil	
	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale
2,4,6-Trichlorophenol	NA	NA	NA	NA	No	A
2,4-Dichlorophenol	NA	NA	NA	NA	No	A
2,4-Dimethylphenol	NA	NA	NA	NA	Uncertainty	B
2,4-Dinitrophenol	NA	NA	NA	NA	No	A
2-Chloronaphthalene	NA	NA	NA	NA	Uncertainty	B
2-Chlorophenol	NA	NA	NA	NA	Uncertainty	B
1-Methylnaphthalene	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	NA	NA	NA	NA	No	A
2-Methylphenol	NA	NA	NA	NA	No	A
2-Nitroaniline	NA	NA	NA	NA	No	A
2-Nitrophenol	NA	NA	NA	NA	No	A
3,3'-Dichlorobenzidine	NA	NA	NA	NA	No	A
3-Nitroaniline	NA	NA	NA	NA	No	A
4,6-Dinitro-2-methylphenol	NA	NA	NA	NA	No	C
4-Bromophenyl phenyl ether	NA	NA	NA	NA	No	C
4-Chloro-3-methylphenol	NA	NA	NA	NA	No	A
4-Chloroaniline	NA	NA	NA	NA	No	A
4-Chlorophenyl phenyl ether	NA	NA	NA	NA	No	C
4-Methylphenol	NA	NA	NA	NA	No	A
4-Nitroaniline	NA	NA	NA	NA	No	A
4-Nitrophenol	NA	NA	NA	NA	No	A
Acenaphthene	NA	NA	NA	NA	No	A
Acenaphthylene	NA	NA	NA	NA	No	A
Anthracene	NA	NA	NA	NA	No	A
Benzo(a)anthracene	NA	NA	NA	NA	No	A
Benzo(a)pyrene	NA	NA	NA	NA	No	A
Benzo(b)fluoranthene	NA	NA	NA	NA	No	A
Benzo(g,h,i)perylene	NA	NA	NA	NA	No	A
Benzo(k)fluoranthene	NA	NA	NA	NA	No	A
bis(2-Chloroethoxy)methane	NA	NA	NA	NA	Uncertainty	B
bis(2-Chloroethyl) ether	NA	NA	NA	NA	No	A
bis(2-Chloroisopropyl) ether	NA	NA	NA	NA	No	C
bis(2-Ethylhexyl) phthalate	NA	NA	NA	NA	Yes	E
Butyl benzyl phthalate	NA	NA	NA	NA	Uncertainty	B
Carbazole	NA	NA	NA	NA	No	C
Chrysene	NA	NA	NA	NA	No	A
Di-n-butyl phthalate	NA	NA	NA	NA	No	A
Di-n-octyl phthalate	NA	NA	NA	NA	No	A
Dibenz(a,h)anthracene	NA	NA	NA	NA	No	A
Dibenzofuran	NA	NA	NA	NA	No	C
Diethyl phthalate	NA	NA	NA	NA	No	A
Dimethyl phthalate	NA	NA	NA	NA	No	A
Fluoranthene	NA	NA	NA	NA	No	A

**TABLE 34-7, AUS-0021**  
**SUMMARY OF ECOLOGICAL COPEC EVALUATION**

**AUS OU PA/SI**  
**CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Sediment		Soil	
	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale
Fluorene	NA	NA	NA	NA	No	A
Hexachlorobenzene	NA	NA	NA	NA	No	A
Hexachlorobutadiene	NA	NA	NA	NA	Uncertainty	B
Hexachlorocyclopentadiene	NA	NA	NA	NA	No	A
Hexachloroethane	NA	NA	NA	NA	No	A
Indeno(1,2,3-c,d)pyrene	NA	NA	NA	NA	No	A
Isophorone	NA	NA	NA	NA	No	A
N-Nitroso-di-n-propylamine	NA	NA	NA	NA	No	A
N-Nitrosodiphenylamine	NA	NA	NA	NA	No	A
Naphthalene	NA	NA	NA	NA	No	A
Pentachlorophenol	NA	NA	NA	NA	No	A
Phenanthrene	NA	NA	NA	NA	No	A
Phenol	NA	NA	NA	NA	No	A
Pyrene	NA	NA	NA	NA	No	A
<b>Metals and Inorganics</b>						
Aluminum	NA	NA	NA	NA	Uncertainty	I
Antimony	NA	NA	NA	NA	No	F
Arsenic	NA	NA	NA	NA	Yes	D
Barium	NA	NA	NA	NA	No	F
Beryllium	NA	NA	NA	NA	No	F
Boron	NA	NA	NA	NA	Yes	D
Cadmium	NA	NA	NA	NA	No	A
Calcium	NA	NA	NA	NA	Uncertainty	G,H
Chromium	NA	NA	NA	NA	Yes	D
Cobalt	NA	NA	NA	NA	Yes	E
Copper	NA	NA	NA	NA	No	F
Cyanide, Total	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	Yes	E
Lead	NA	NA	NA	NA	No	F
Magnesium	NA	NA	NA	NA	Uncertainty	G,H
Manganese	NA	NA	NA	NA	Yes	D
Mercury	NA	NA	NA	NA	Yes	D
Nickel	NA	NA	NA	NA	No	F
Potassium	NA	NA	NA	NA	Uncertainty	G,H
Selenium	NA	NA	NA	NA	Yes	D
Silver	NA	NA	NA	NA	No	A
Sodium	NA	NA	NA	NA	Uncertainty	G,H
Thallium	NA	NA	NA	NA	No	F
Vanadium	NA	NA	NA	NA	No	F
Zinc	NA	NA	NA	NA	No	F
<b>Explosives</b>						
1,3,5-Trinitrobenzene	NA	NA	NA	NA	No	A
1,3-Dinitrobenzene	NA	NA	NA	NA	No	A

**TABLE 34-7, AUS-0021  
SUMMARY OF ECOLOGICAL COPEC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Sediment		Soil	
	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale
2,4,6-Trinitrotoluene (TNT)	NA	NA	NA	NA	No	A
2,4-Dinitrotoluene	NA	NA	NA	NA	No	A
2,6-Dinitrotoluene	NA	NA	NA	NA	Uncertainty	B
2-Amino-4,6-Dinitrotoluene	NA	NA	NA	NA	No	A
2-Nitrotoluene (ONT)	NA	NA	NA	NA	No	C
3-Nitrotoluene	NA	NA	NA	NA	No	C
4-Amino-2,6-Dinitrotoluene	NA	NA	NA	NA	No	C
4-Nitrotoluene (PNT)	NA	NA	NA	NA	No	C
HMX	NA	NA	NA	NA	No	A
Nitrobenzene	NA	NA	NA	NA	No	A
Nitroglycerin	NA	NA	NA	NA	NA	NA
Pentaerythritol tetranitrate (PETN)	NA	NA	NA	NA	NA	NA
Perchloric Acid	NA	NA	NA	NA	NA	NA
RDX	NA	NA	NA	NA	No	A
Tetryl	NA	NA	NA	NA	Uncertainty	G

- A - Chemical was not detected and the reporting limit does not exceed the screening concentration.
- B - Chemical was not detected, but reporting limit was equal to or exceeded screening concentration.
- C - Chemical was not detected and there is no screening concentration.
- D - Chemical was detected and was equal to or exceeded screening concentration, but did not exceed background.
- E - Chemical was detected and was equal to or exceeded screening concentration and background, if applicable.
- F - Chemical was detected and did not exceed screening concentration.
- G - Chemical was detected, but no screening value was available.
- H - Chemical was detected, but it is an essential nutrient.
- I - If pH<5.5, Aluminum is a COPEC, otherwise it is not.
- J - Chemical was classified as a COPEC based on USEPA 1998 data but was not a COPEC based on SI data.
- NA - Not Analyzed or not applicable.

File: E:\232000026.00\PA-SI REPORT-AUS OUV-AUS-0021.DWG Last edited: 09/24/01 @ 10:05 a.m. WC-ST.LOUIS, MO

# AUS-0021-IOP AREA 7 FIRE STATION

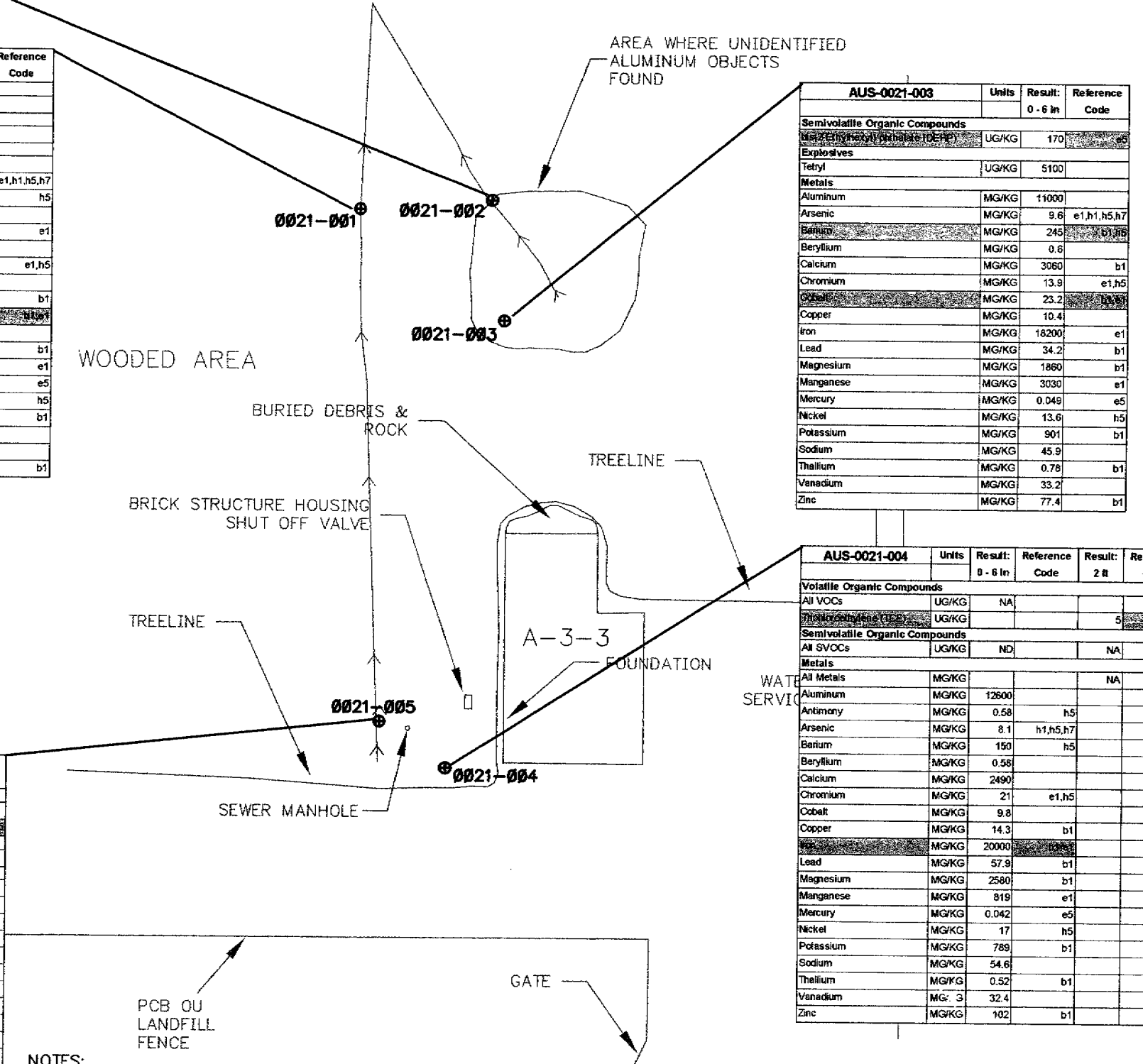
AUS-0021-002	Units	Result:	Reference
0 - 6 in			
<b>Semi-volatile Organic Compounds</b>			
All SVOCs	UG/KG	ND	
<b>Explosives</b>			
All Explosives	UG/KG	ND	
<b>Metals</b>			
Aluminum	MG/KG	11000	
Antimony	MG/KG	0.26	
Arsenic	MG/KG	11.5	e1,h1,h5,h7
Barium	MG/KG	136	h5
Beryllium	MG/KG	0.73	
Calcium	MG/KG	1270	
Chromium	MG/KG	20.2	e1,h5
Cobalt	MG/KG	13.7	
Copper	MG/KG	13.2	b1
Lead	MG/KG	21100	e1,h5
Lead	MG/KG	21.9	
Magnesium	MG/KG	1720	b1
Manganese	MG/KG	1440	e1
Mercury	MG/KG	0.032	e5
Nickel	MG/KG	11.4	h5
Potassium	MG/KG	732	b1
Selenium	MG/KG	0.39	e5,h5
Sodium	MG/KG	52.1	
Thallium	MG/KG	0.55	b1
Vanadium	MG/KG	44	
Zinc	MG/KG	37.1	

AUS-0021-001	Units	Result:	Reference
0 - 6 in			
<b>Semi-volatile Organic Compounds</b>			
All SVOCs	UG/KG	ND	
<b>Explosives</b>			
All Explosives	UG/KG	ND	
<b>Metals</b>			
Aluminum	MG/KG	15700	
Arsenic	MG/KG	10.9	e1,h1,h5,h7
Barium	MG/KG	101	h5
Beryllium	MG/KG	0.54	
Boron	MG/KG	0.55	e1
Calcium	MG/KG	1660	
Chromium	MG/KG	20.9	e1,h5
Cobalt	MG/KG	6.8	
Copper	MG/KG	16	b1
Lead	MG/KG	24100	e1,h5
Lead	MG/KG	17.9	
Magnesium	MG/KG	3140	b1
Manganese	MG/KG	370	e1
Mercury	MG/KG	0.02	e5
Nickel	MG/KG	12.6	h5
Potassium	MG/KG	1160	b1
Sodium	MG/KG	52.9	
Vanadium	MG/KG	38.4	
Zinc	MG/KG	54.8	b1

AUS-0021-003	Units	Result:	Reference
0 - 6 in			
<b>Semi-volatile Organic Compounds</b>			
All SVOCs	UG/KG	170	e5
<b>Explosives</b>			
Tetryl	UG/KG	5100	
<b>Metals</b>			
Aluminum	MG/KG	11000	
Arsenic	MG/KG	9.6	e1,h1,h5,h7
Beryllium	MG/KG	245	b1,h5
Boron	MG/KG	0.6	
Calcium	MG/KG	3060	b1
Chromium	MG/KG	13.9	e1,h5
Cobalt	MG/KG	23.2	
Copper	MG/KG	10.4	
Iron	MG/KG	18200	e1
Lead	MG/KG	34.2	b1
Magnesium	MG/KG	1860	b1
Manganese	MG/KG	3030	e1
Mercury	MG/KG	0.049	e5
Nickel	MG/KG	13.6	h5
Potassium	MG/KG	901	b1
Sodium	MG/KG	45.9	
Thallium	MG/KG	0.78	b1
Vanadium	MG/KG	33.2	
Zinc	MG/KG	77.4	b1

AUS-0021-005	Units	Result:	Reference	Result:	Reference
0 - 6 in					
<b>Volatile Organic Compounds</b>					
All VOCs	UG/KG	NA			
Trichloroethylene (TCE)	UG/KG			9	h5
<b>Semi-volatile Organic Compounds</b>					
All SVOCs	UG/KG	ND		NA	
<b>Metals</b>					
All Metals	MG/KG			NA	
Aluminum	MG/KG	20500			
Arsenic	MG/KG	12.8	e1,h1,h5,h7		
Barium	MG/KG	112	h5		
Beryllium	MG/KG	0.54			
Boron	MG/KG	1.1	e1		
Calcium	MG/KG	1380			
Chromium	MG/KG	23.1	e1,h5		
Cobalt	MG/KG	6			
Copper	MG/KG	22.7	b1		
Lead	MG/KG	28700	e1,h5		
Lead	MG/KG	15.5			
Magnesium	MG/KG	3720	b1		
Manganese	MG/KG	227	e1		
Mercury	MG/KG	0.034	e5		
Nickel	MG/KG	17.2	h5		
Potassium	MG/KG	1220	b1		
Selenium	MG/KG	0.39	e5,h5		
Sodium	MG/KG	64.8			
Thallium	MG/KG	0.58	b1		
Vanadium	MG/KG	39.7			
Zinc	MG/KG	86.4	b1		

Screening Reference	Reference Code
AUS Background Soil UTL	b1
Little Grassy Background Sediment UTL	b2
Little Grassy Background Surface Water UTL	b3
Ecological Direct Exposure Pathway TRV - Soil	e1
Ecological Direct Exposure Pathway TRV - Sediment	e2
Ecological Direct Exposure Pathway TRV - Surface Water	e3
IEPA General Use Surface Water Quality Aquatic Life Toxicity	e4
Superfund Chemical Data Matrix Kow values (potential bioaccumulator)	e5
USEPA Region IX Industrial Soil PRG - cancerous	h1
USEPA Region IX Industrial Soil PRG - noncancerous	h2
USEPA Region IX Tap Water PRG - cancerous	h3
USEPA Region IX Tap Water PRG - noncancerous	h4
USEPA Region IX Migration to Groundwater PRG (DAF=1)	h5
USEPA MCL Drinking Water Standards	h6
IEPA TACO Industrial/Commercial Soil Ingestion	h7
IEPA TACO Construction Worker Soil Ingestion	h8
IEPA TACO Class I Soil Component of Groundwater	h9
IEPA General Use Surface Water Quality Human Health	h10



- NOTES:
1. BASE MAP IS FROM SKETCH PREPARED DURING SITE RECONNAISSANCE, MARCH 30, 1999. DRAWING IS NOT TO SCALE. THE BUILDING FOUNDATION IS APPROXIMATELY 8 FT. BY 52 FT. MAXIMUM DIMENSIONS. SAMPLE LOCATIONS ARE APPROXIMATE. FOR SAMPLE LOCATION COORDINATES SEE TABLE 34-1.
  2. DATA QUALIFIERS FOR ANALYTICAL RESULTS ARE NOT INDICATED. REFER TO THE QCSR FOR DATA QUALIFIERS.
  3. THE FOLLOWING COMPOUNDS ARE INCLUDED IN THE ANALYTE LIST FOR BOTH SVOCs AND EXPLOSIVES: 2,4-DINITROTOLUENE, 2,6-DINITROTOLUENE, AND NITROBENZENE. THESE COMPOUNDS MAY BE REPORTED AS EITHER SVOCs OR EXPLOSIVES.

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DRN. BY:djd 10/24/00 DSGN. BY:mjh CHKD. BY:mch/cmw	AUS-0021 Sample Locations and Detections in Soils
FIG. NO. 34-1	

**SECTION THIRTY-FIVE****Probable IOP Small Arms Training Range**

AUS-0022 is located about 300 feet (ft) south of Ogden Road and 2,000 ft east of the intersection of Ogden and Charnesstown Roads. The location of AUS-0022 is shown in Figure 30-1, along with other sites addressed in this volume.

**AUS Original Site Designations**

AUS-0022 is one of the original sites in the Additional and Uncharacterized Sites Operable Unit (AUS OU) designated in 1997-1999 by the United States Fish & Wildlife Service (USFWS). It was originally described as "Refuge Border by the Prison Landfill."<sup>1</sup>

**35.1 HISTORIC SEARCH INFORMATION****35.1.1 Site Description**

AUS-0022 was identified in the aerial photograph interpretation as a probable Illinois Ordnance Plant (IOP) small arms training range.<sup>2</sup> It appears that a natural ridge may have been used as a backstop for the training range. There were no buildings identified in this area and it appears that this facility was originally constructed and operated by the Sherwin Williams Defense Corporation, under contract with the War Department (SWDC/War Department), as a part of the IOP. Mr. Virgil Hollis (a former SWDC/War Department employee), confirmed that there was an IOP firing range used for small arms firing by security guards at the Plant.<sup>3</sup>

**35.1.2 Operational History and Waste Characteristics**

Entech identified a probable small arms training range and an associated access road in the 1943 aerial photograph.<sup>4</sup> See Site 01 on Figure 43-32 of this report for Entech's location of the site. By 1951, the training range appears to have been abandoned.<sup>5</sup> It appears as if the backstop for the firing range is a natural ridge<sup>6</sup> and as seen in aerial photographs, this ridge runs in a northwest to southeast direction. There appears to have been twenty targets (ten closer and ten farther back that are offset from the closer targets) located along the easternmost side of this

<sup>1</sup> The site was designated as such because it is located just north of the federal penitentiary property boundary, near the penitentiary landfill, which was also identified by Entech in the aerial photo interpretation.

<sup>2</sup> Entech, Inc., 1999, Historical Aerial Photographic Analysis – Inventory of Potential Disposal Sites: Additional and Uncharacterized Sites (AUS) Operable Unit, Crab Orchard National Wildlife Refuge, Marion, Illinois, Volume I (Text) Page 3-60, and Volume II (Maps) Page FF. The Entech reports analyze historic aerial overflight photographs of industrial areas at the Refuge, from 1943 to 1993. The photos were obtained from the National Archives and Records Administration (NARA) and the U.S. Department of Agriculture Agricultural Stabilization and Conservation Service (ASCS).

<sup>3</sup> ACO 000128. Interview with Mr. Virgil Hollis as found in Appendix H, Page H-7, of an unknown report.

<sup>4</sup> Entech, Inc., 1999, Historical Aerial Photographic Analysis – Inventory of Potential Disposal Sites: Additional and Uncharacterized Sites (AUS) Operable Unit, Crab Orchard National Wildlife Refuge, Marion, Illinois, Volume I (Text) Page 3-60, and Volume II (Maps) Page FF.

<sup>5</sup> Entech, Inc., 1999, Historical Aerial Photographic Analysis – Inventory of Potential Disposal Sites: Additional and Uncharacterized Sites (AUS) Operable Unit, Crab Orchard National Wildlife Refuge, Marion, Illinois, Volume I (Text) Page 3-60.

<sup>6</sup> Entech, Inc., 1999, Historical Aerial Photographic Analysis – Inventory of Potential Disposal Sites: Additional and Uncharacterized Sites (AUS) Operable Unit, Crab Orchard National Wildlife Refuge, Marion, Illinois, Volume I (Text) Page 3-60.

**SECTION THIRTY-FIVE****Probable IOP Small Arms Training Range**

ridge, as seen in the 1943 aerial photographs. This site does not appear to have been used again according to subsequent aerial photographs.

There were no known industrial lessees of this property.

**35.1.3 AUS-0022 Previous Sampling Results**

There has been no previous sampling at this site.

**35.1.4 Observations During Site Visit**

This site was not identified during the initial site reconnaissance.

**35.1.5 Recommendations Based on Preliminary Assessment**

AUS-0022 was included in the Site Investigation (SI) since the aerial photograph interpretation identified this site as a probable small arms training facility. There is the potential for metals contamination in this area based on its past use.

**35.2 SITE INVESTIGATION INFORMATION**

URS conducted a Site Investigation at AUS-0022 on May 8, 2000. The rationale for sample locations, media, and analytes was not included in the Field Sampling Plan (FSP) for the AUS OU Preliminary Assessment Assessment/Site Investigation (PA/SI), since sample locations at this site were added after the FSP had been completed. Since the time the FSP was prepared, additional information has become available, and the historic discussion (Section 35.1) includes that information.

AUS OU SI sample locations are shown on Figure 35-1. Survey coordinates for all sample locations in AUS-0022 are listed in Table 35-1. Table 35-2 lists the sample locations and the matrix sampled at that location. All samples are soil samples.

**35.2.1 Field Investigation**

Two samples were collected from the east side of the berm (0022-001 and 0022-002), assumed to be the side that was being fired at during target practice.

**35.2.2 Field Results****35.2.2.1 Site Conditions****35.2.2.1.1 *Geologic Conditions***

The only subsurface information from this site was from hand auger borings. The soil was described as fill.



**SECTION THIRTY-FIVE****Probable IOP Small Arms Training Range****35.2.2.1.2 Hydrogeologic Conditions**

No hydrogeological information is available for this site.

**35.2.2.1.3 Hydrologic Conditions**

There is a drainageway, which passes under Ogden Road, on the east side of the site.

**35.2.2.2 Chemical Results**

Table 35-3 lists the chemicals detected at AUS-0022 during this investigation, along with the frequency and range of detections. Tabulated results of all analyses are included in the Quality Control Summary Report (QCSR). All results are shown in Figure 35-1.

**35.3 SCREENING RISK ASSESSMENT**

Results of the screening are presented in Tables 35-4 and 35-5 as follows:

- Table 35-4--human health risk screening for soils, and
- Table 35-5--ecological risk screening for soils.

Each table lists the maximum detected concentration for each constituent analyzed at AUS-0022. The screening results are presented in the tables in terms of hazard quotients (HQs). The HQ for any chemical detected, for any particular screening criterion is simply the ratio of the maximum detected concentration to the screening concentration. For human health for carcinogens, a screening level "cancer risk" is calculated instead of an HQ.

Chemicals that are shaded in the tables are those that exceeded the screening criteria, and are identified as chemicals of potential concern (COPCs) for human health risk, and chemicals of potential ecological concern (COPECs) for ecological risk. The only COPCs/COPECs not shaded in the table are those inorganic constituents that exceeded the screening criteria but were detected at levels below Refuge background.

In cases where the chemical was analyzed but not detected, the HQ is the ratio between the maximum reporting limit and the screening concentration. Chemicals not detected are identified with a "U" qualifier in the qualifier column. When these HQ values exceed one, they are not shaded. These constituents are not identified as COPCs/COPECs, but rather as uncertainties.

In Figure 35-1 the shading convention used is the same as for the tables discussed above. The particular screening criteria exceeded are indicated by the code in the analytical results labels. Duplicate results are shown only if the duplicate result for an analyte exceeded the screening criteria and the result from the original sample did not; or, if the analyte was detected in the duplicate and not in the original sample. Since in the screening process results which are qualified as estimated (coded with "J") are treated the same as unqualified results, data qualifiers are not included in the results shown in the figures. Refer to the QCSR for data qualifiers.

**SECTION THIRTY-FIVE****Probable IOP Small Arms Training Range**

Tables 35-6 (human health risk) and 35-7 (ecological risk) list all the analytes and corresponding media sampled and indicate whether each is a COPC (or COPEC), not a COPC (or COPEC), or an uncertainty. The codes in the tables indicate the rationale for each classification. All COPCs (Table 35-6) and COPECs (Table 35-7) are shaded in the tables.

**35.3.1 Human Health Risk****35.3.1.1 Soil**

Human health screening results for soil and samples are presented in Table 35-4. For carcinogens, a cancer risk was calculated using the United States Environmental Protection Agency (USEPA) Region 9 Industrial Soil Preliminary Remediation Goals (PRGs) as screening values. The cancer risk was derived by calculating a ratio of the maximum detected concentrations, or the maximum reporting limits, to their appropriate screening values. These ratios were then multiplied by  $1 \times 10^{-6}$ . In addition, ratios were calculated using the USEPA Region 9 Industrial Soil PRG for Toxins, the USEPA Region 9 Migration to Groundwater Criteria (Dilution Attenuation Factor (DAF)=1), the Illinois Tiered Approach to Corrective Action Objectives (TACO) Industrial/Commercial Soil Ingestion Criteria, the Illinois TACO Construction Worker Soil Ingestion Criteria, and the Illinois TACO Class I Soil Component of Groundwater Criteria.

**35.3.2 Ecological Risk****35.3.2.1 Soil**

Ecological screening results for soil samples are presented in Table 35-5. Soil screening concentrations for direct exposures were developed using toxicity reference values (TRVs) derived from several sources, including the following:

- USEPA (2000)<sup>7</sup>
- Environment Canada (1995)<sup>8</sup>
- Talmage *et al.* (1999)<sup>9</sup>
- Efroymsen *et al.* (1997a, 1997b)<sup>10</sup>
- CCME (1999)<sup>11</sup>

<sup>7</sup> USEPA. 2000. Ecological Soil Screening Level Guidance (Draft). USEPA Office of Emergency and Remedial Response, Washington, DC.

<sup>8</sup> Environment Canada. 1995. Toxicity Testing of NCSRP Priority Substances for Development of Soil Quality Guidelines for Contaminated Sites. Guidelines Division, Evaluation and Interpretation Branch, Environmental Conservation Directorate, Environment Canada. Hull, Quebec.

<sup>9</sup> Talmage, S.S., D.M. Opresko, C.J. Maxwell, C.J.E. Welsh, F. M. Cretella, P.H. Reno, and F. B. Daniel. 1999. Nitroaromatic Munition Compounds: Environmental Effects and Screening Values. *Rev Environ. Contam. Toxicol* 161:1-156.

<sup>10</sup> Efroymsen, R.A., M.E. Will, G.W. Suter II, and A.C. Wooten. 1997a. *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision*. Oak Ridge National Laboratory, Oak Ridge, Tennessee. ES/ER/TM-85/R3.

Efroymsen, R.A., M.E. Will, and G.W. Suter II. 1997b. *Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision*. Oak Ridge National Laboratory, Oak Ridge, Tennessee. ES/ER/TM-126/R2.

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- MHSPE (1994)<sup>12</sup>
- Other sources

A detailed discussion of the screening concentration selection is presented in Appendix G.

The screening approach for ingestion pathway exposures was based on the potential for a chemical to bioaccumulate. The potential for a chemical to bioaccumulate was based on the organic chemical-specific octanol-to-water partitioning coefficient ( $K_{ow}$ ), which provides an indication of the lipophilicity of an organic chemical, and its potential for sequestration in biological tissue. The document *Assessment and Control of Bioconcentratable Contaminants in Surface Waters* (USEPA 1991)<sup>13</sup> used a log  $K_{ow}$  of 3.5 as a target threshold value indicative of bioaccumulative chemicals to target organic chemicals of greatest concern. Using this as a guideline, organic chemicals with a log  $K_{ow}$  greater than 3.5 were considered potentially bioaccumulative chemicals. Among inorganics, mercury and selenium were considered as potentially bioaccumulative chemicals. Any potentially bioaccumulative chemical that is detected was retained as a COPEC.

### 35.4 SCIENTIFIC MANAGEMENT DECISION POINT

#### 35.4.1 Human Health Risk Evaluation

All constituents which exceeded screening criteria were detected below Refuge background level (Table 35-6). This report recommends that inorganic constituents that exceeded project screening criteria but were within Refuge background levels not be retained as COPCs for further evaluation. These are the constituents coded with "D" on Table 35-6, and include antimony, arsenic, barium chromium, nickel, and selenium.

Cadmium was identified as an uncertainty because the maximum reporting limit, 0.68 milligrams per kilogram (mg/kg), exceeded the screening criteria (note cadmium is coded with a "B" in Table 35-6). The uncertainty associated with cadmium is not considered to be significant.

In summary, results of the soil analyses at AUS-0022 indicate there are no chemicals present at levels of potential human health concern warranting further evaluation. It is recommended that none of the chemicals be retained as COPCs for this site.

#### 35.4.2 Ecological Risk Evaluation

Inorganic compounds identified as COPECs include boron, chromium, iron, manganese, mercury, and selenium (Table 35-7). This report recommends that inorganic constituents that exceeded project screening criteria but were within Refuge background levels not be retained as COPECs for further evaluation. These are the constituents coded with "D" on Table 35-7, and

<sup>11</sup> Canadian Council of Ministers of the Environment. 1999. Canadian Environmental Quality Guidelines.

<sup>12</sup> Ministry of Housing, Spatial Planning, and the Environment (MHSPE). 1994. *Intervention Values and Target Values – Soil Quality Standards*. Directorate General for Environmental Protection, Department of Soil Protection, The Hague, The Netherlands.

<sup>13</sup> USEPA 1991. *Assessment and Control of Bioconcentratable Contaminants in Surface Waters (Draft)*. US Environmental Protection Agency Office of Research and Development, Washington, D.C.

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include chromium, iron, manganese, mercury, and selenium (Table 35-5). Though boron was detected and exceeded the screening concentration, the detection was qualified as estimated (indicated by the "J" code), and was only 7 percent above background. Therefore, boron is not considered a significant concern.

Several inorganic chemicals represent uncertainties for AUS-0022 since they were detected but no screening concentrations were identified. These include calcium, magnesium, potassium, and sodium. Each of these constituents is an essential nutrient. Therefore, the uncertainty associated with these chemicals is not considered to be significant. Aluminum was also characterized as an uncertainty. The screening criterion for aluminum is based on soil pH, and there are no site-specific pH data available for AUS-0022. However, the maximum concentration is below background, and thus aluminum is not considered a significant ecological concern. The last uncertainty identified is thallium. For thallium, the reporting limit was 40% higher than the screening concentration. However, thallium was not detected and is not considered a significant concern.

In summary, results of the soil analyses at AUS-0022 indicate there are no chemicals present at levels of potential ecological concern warranting further evaluation. It is recommended that none of the chemicals be retained as COPECs for this site.

**35.4.3 Summary of Recommendations**

Based on the above discussions, it is recommended that none of the constituents detected at Site AUS-0022 be retained for further evaluation. Site AUS-0022 is judged to require no further action.

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**TABLE 35-1  
SURVEY COORDINATES FOR SAMPLE LOCATIONS IN AUS-0022**

<b>Sample Location</b>	<b>Northing</b>	<b>Easting</b>	<b>Ground Surface Elevation</b>	<b>Top of Casing Elevation</b>	<b>Comments</b>
0022-001	368308.9	796482.3	441.36	NA	
0022-002	368284.1	796500.6	440.84	NA	

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NA = Not Applicable

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**TABLE 35-2**  
**MATRICES SAMPLED AT EACH SAMPLE LOCATION AT AUS-0022**

<b>Soil</b>
AUS-0022-001
AUS-0022-002

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**TABLE 35-3  
SOIL SAMPLE ANALYTICAL RESULTS SUMMARY**

Constituents	Number of Detections	Range of Detections
<b>Metals</b>		
Aluminum	2/2	4,670 mg/kg to 8,980 mg/kg
Antimony	2/2	0.23 mg/kg to 0.45 mg/kg
Arsenic	2/2	2.3 mg/kg to 5.7 mg/kg
Barium	2/2	74.9 mg/kg to 169 mg/kg
Beryllium	2/2	0.19 mg/kg to 0.48 mg/kg
Boron	2/2	1.3 mg/kg to 5.6 mg/kg
Calcium	2/2	2,240 mg/kg to 6,440 mg/kg
Chromium, Total	2/2	6.9 mg/kg to 18.4 mg/kg
Cobalt	2/2	3 mg/kg to 7.9 mg/kg
Copper	2/2	6.9 mg/kg to 8.9 mg/kg
Iron	2/2	6,020 mg/kg to 16,200 mg/kg
Lead	2/2	15.3 mg/kg to 24.6 mg/kg
Magnesium	2/2	1,060 mg/kg to 1,450 mg/kg
Manganese	2/2	653 mg/kg to 1,810 mg/kg
Mercury	2/2	0.038 mg/kg to 0.061 mg/kg
Nickel	2/2	5.8 mg/kg to 12.6 mg/kg
Potassium	2/2	613 mg/kg to 790 mg/kg
Selenium	1/2	0.45 mg/kg
Sodium	2/2	38.8 mg/kg to 40.2 mg/kg
Vanadium	2/2	12.2 mg/kg to 23.3 mg/kg
Zinc	2/2	28.9 mg/kg to 35.2 mg/kg

Sheet 1 of 1

mg/kg = milligrams per kilogram

Notes: This table was derived from the figures that show the analytical results. As a result, duplicates are shown only if the duplicate result for an analyte exceeded the screening criteria and the result from the original sample did not; or, if the analyte was detected in the duplicate and not in the original sample. There may be some duplicate results, not shown in the table, that are outside the range shown. In addition, the frequency and range of detections is based on the number of sample locations, not the total number of samples (the total number of samples includes originals plus duplicates).

Checked by: MMF 7/20/01

**TABLE 35-4  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0022**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria
<b>Metals</b>									
7429-90-5	Aluminum	8980		MG/KG	3.12E-01		5.36E-03		
7440-36-0	Antimony	0.45	J	MG/KG	5.42E-01		5.50E-04	1.50E+00	5.49E-04
7440-38-2	Arsenic	5.7		MG/KG	4.22E-01	2.09E-06	1.30E-02	5.70E+00	1.90E+00
7440-39-3	Barium	169		MG/KG	8.67E-01		1.36E-03	2.11E+00	1.21E-03
7440-41-7	Beryllium	0.48	J	MG/KG	6.32E-01	2.14E-10	1.30E-04	1.60E-01	4.80E-01
7440-42-8	Boron	5.6	J	MG/KG	1.06E+00		7.08E-05		3.11E-05
7440-43-9	Cadmium	0.68	U	MG/KG	3.58E+00	2.28E-10	8.40E-04	1.70E+00	3.40E-04
7440-70-2	Calcium	6440		MG/KG	2.58E+00				
7440-47-3	Chromium	18.4		MG/KG	7.30E-01	4.10E-08		9.20E+00	1.84E-03
7440-48-4	Cobalt	7.9		MG/KG	3.64E-01		6.44E-05		6.58E-05
7440-50-8	Copper	8.9		MG/KG	7.88E-01		1.17E-04		1.09E-04
7439-89-6	Iron	16200		MG/KG	8.39E-01		2.65E-02		
7439-92-1	Lead	24.6	J	MG/KG	1.05E+00				6.15E-02
7439-95-4	Magnesium	1450		MG/KG	9.34E-01				
7439-96-5	Manganese	1810		MG/KG	4.97E-01		5.61E-02		1.89E-02
7439-97-6	Mercury	0.06	J	MG/KG	1.00E+00				1.00E-04
7440-02-0	Nickel	12.6		MG/KG	6.67E-01		3.08E-04	1.80E+00	3.07E-04
2023695	Potassium	790		MG/KG	1.26E+00				
7782-49-2	Selenium	0.45	J	MG/KG	1.92E-01		4.40E-05	1.50E+00	4.50E-05
7440-22-4	Silver	1.4	U	MG/KG	2.41E+00		1.37E-04	7.00E-01	1.40E-04
7440-23-5	Sodium	40.2	J	MG/KG	2.36E-01				
7440-28-0	Thallium	1.4	U	MG/KG	3.41E+00		9.78E-06		8.75E-03
7440-62-2	Vanadium	23.3		MG/KG	4.94E-01		1.63E-03	7.77E-02	1.66E-03
7440-66-6	Zinc	35.2		MG/KG	6.85E-01		5.75E-05	5.87E-02	5.77E-05

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect



**TABLE 35-4  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0022**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
<b>Metals</b>						
7429-90-5	Aluminum	8980		MG/KG		
7440-36-0	Antimony	0.45	J	MG/KG	5.49E-03	9.00E-02
7440-38-2	Arsenic	5.7		MG/KG	9.34E-02	2.04E-01
7440-39-3	Barium	169		MG/KG	1.21E-02	1.41E-01
7440-41-7	Beryllium	0.48	J	MG/KG	1.66E-02	7.27E-02
7440-42-8	Boron	5.6	J	MG/KG	3.11E-04	
7440-43-9	Cadmium	0.68	U	MG/KG	3.40E-03	1.84E-01
7440-70-2	Calcium	6440		MG/KG		
7440-47-3	Chromium	18.4		MG/KG	4.49E-03	6.57E-01
7440-48-4	Cobalt	7.9		MG/KG	6.58E-04	
7440-50-8	Copper	8.9		MG/KG	1.09E-03	8.09E-04
7439-89-6	Iron	16200		MG/KG		
7439-92-1	Lead	24.6	J	MG/KG	6.15E-02	
7439-95-4	Magnesium	1450		MG/KG		
7439-96-5	Manganese	1810		MG/KG	1.89E-01	
7439-97-6	Mercury	0.06	J	MG/KG	1.00E-03	4.07E-01
7440-02-0	Nickel	12.6		MG/KG	3.07E-03	1.66E-01
2023695	Potassium	790		MG/KG		
7782-49-2	Selenium	0.45	J	MG/KG	4.50E-04	1.88E-01
7440-22-4	Silver	1.4	U	MG/KG	1.40E-03	9.33E-01
7440-23-5	Sodium	40.2	J	MG/KG		
7440-28-0	Thallium	1.4	U	MG/KG	8.75E-03	5.83E-01
7440-62-2	Vanadium	23.3		MG/KG	1.66E-02	2.38E-02
7440-66-6	Zinc	35.2		MG/KG	5.77E-04	9.78E-03

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 35-5  
ECOLOGICAL SCREENING OF SOIL RESULTS FROM AUS-0022**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Background (SOIL)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ) (SOIL)	Retained as Potential Bioaccumulator
<b>Metals</b>							
7429-90-5	Aluminum	28800	8980		MG/KG		
7440-36-0	Antimony	0.83	0.45	J	MG/KG	9.00E-02	
7440-38-2	Arsenic	13.5	5.7		MG/KG	6.33E-01	
7440-39-3	Barium	195	169		MG/KG	3.38E-01	
7440-41-7	Beryllium	0.76	0.48	J	MG/KG	4.80E-02	
7440-42-8	Boron	5.3	5.6	J	MG/KG	1.12E+01	
7440-43-9	Cadmium	0.19	0.68	U	MG/KG	2.34E-02	
7440-70-2	Calcium	2497	6440		MG/KG		
7440-47-3	Chromium	25.2	18.4		MG/KG	3.68E+00	
7440-48-4	Cobalt	21.7	7.9		MG/KG	3.95E-01	
7440-50-8	Copper	11.3	8.9		MG/KG	2.87E-01	
7439-89-6	Iron	19306	16200		MG/KG	8.10E+01	
7439-92-1	Lead	23.4	24.6	J	MG/KG	5.68E-02	
7439-95-4	Magnesium	1552	1450		MG/KG		
7439-96-5	Manganese	3640	1810		MG/KG	1.81E+01	
7439-97-6	Mercury	0.06	0.06	J	MG/KG	8.71E-03	YES
7440-02-0	Nickel	18.9	12.6		MG/KG	4.20E-01	
2023695	Potassium	625	790		MG/KG		
7782-49-2	Selenium	2.34	0.45	J	MG/KG	4.50E-01	YES
7440-22-4	Silver	0.58	1.4	U	MG/KG	7.00E-01	
7440-23-5	Sodium	170	40.2	J	MG/KG		
7440-28-0	Thallium	0.41	1.4	U	MG/KG	1.40E+00	
7440-62-2	Vanadium	47.2	23.3		MG/KG	5.07E-01	
7440-66-6	Zinc	51.4	35.2		MG/KG	2.93E-01	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 35-6, AUS-0022  
SUMMARY OF HUMAN HEALTH COPC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Groundwater		Sediment		Soil	
	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale
<b>Volatile Organic Compounds</b>								
1,1,1-Trichloroethane	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	NA	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloroethane	NA	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloroethene	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane (EDC)	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloroethene (total)	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloropropane	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone (MEK)	NA	NA	NA	NA	NA	NA	NA	NA
2-Hexanone	NA	NA	NA	NA	NA	NA	NA	NA
4-Methyl-2-pentanone (MIBK)	NA	NA	NA	NA	NA	NA	NA	NA
Acetone	NA	NA	NA	NA	NA	NA	NA	NA
Benzene	NA	NA	NA	NA	NA	NA	NA	NA
Bromodichloromethane	NA	NA	NA	NA	NA	NA	NA	NA
Bromoform	NA	NA	NA	NA	NA	NA	NA	NA
Bromomethane	NA	NA	NA	NA	NA	NA	NA	NA
Carbon disulfide	NA	NA	NA	NA	NA	NA	NA	NA
Carbon tetrachloride	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
Chloroethane	NA	NA	NA	NA	NA	NA	NA	NA
Chloroform	NA	NA	NA	NA	NA	NA	NA	NA
Chloromethane	NA	NA	NA	NA	NA	NA	NA	NA
cis-1,2-Dichloroethene	NA	NA	NA	NA	NA	NA	NA	NA
cis-1,3-Dichloropropene	NA	NA	NA	NA	NA	NA	NA	NA
Dibromochloromethane	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	NA	NA	NA	NA	NA	NA	NA	NA
Methylene chloride	NA	NA	NA	NA	NA	NA	NA	NA
N-Hexane	NA	NA	NA	NA	NA	NA	NA	NA
Styrene	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethylene (PCE)	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	NA	NA	NA	NA	NA	NA	NA	NA
total Xylenes	NA	NA	NA	NA	NA	NA	NA	NA
trans-1,2-Dichloroethene	NA	NA	NA	NA	NA	NA	NA	NA
trans-1,3-Dichloropropene	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethylene (TCE)	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl chloride	NA	NA	NA	NA	NA	NA	NA	NA
<b>Semivolatile Organic Compounds</b>								
1,2,4-Trichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA

**TABLE 35-6, AUS-0022  
SUMMARY OF HUMAN HEALTH COPC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Groundwater		Sediment		Soil	
	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale
2,4,6-Trichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrophenol	NA	NA	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	NA	NA	NA	NA	NA	NA	NA	NA
2-Chlorophenol	NA	NA	NA	NA	NA	NA	NA	NA
1-Methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylphenol	NA	NA	NA	NA	NA	NA	NA	NA
2-Nitroaniline	NA	NA	NA	NA	NA	NA	NA	NA
2-Nitrophenol	NA	NA	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	NA	NA	NA	NA	NA	NA	NA	NA
3-Nitroaniline	NA	NA	NA	NA	NA	NA	NA	NA
4,6-Dinitro-2-methylphenol	NA	NA	NA	NA	NA	NA	NA	NA
4-Bromophenyl phenyl ether	NA	NA	NA	NA	NA	NA	NA	NA
4-Chloro-3-methylphenol	NA	NA	NA	NA	NA	NA	NA	NA
4-Chloroaniline	NA	NA	NA	NA	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	NA	NA	NA	NA	NA	NA	NA	NA
4-Methylphenol	NA	NA	NA	NA	NA	NA	NA	NA
4-Nitroaniline	NA	NA	NA	NA	NA	NA	NA	NA
4-Nitrophenol	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Chloroethoxy)methane	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Chloroethyl) ether	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Chloroisopropyl) ether	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Ethylhexyl) phthalate	NA	NA	NA	NA	NA	NA	NA	NA
Butyl benzyl phthalate	NA	NA	NA	NA	NA	NA	NA	NA
Carbazole	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-butyl phthalate	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-octyl phthalate	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA
Diethyl phthalate	NA	NA	NA	NA	NA	NA	NA	NA
Dimethyl phthalate	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA

**TABLE 35-6, AUS-0022  
SUMMARY OF HUMAN HEALTH COPC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Groundwater		Sediment		Soil	
	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale
Fluorene	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	NA	NA	NA	NA	NA	NA	NA	NA
Hexachloroethane	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-c,d)pyrene	NA	NA	NA	NA	NA	NA	NA	NA
Isophorone	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitroso-di-n-propylamine	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorophenol	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	NA	NA	NA	NA	NA	NA	NA	NA
Phenol	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	NA	NA	NA	NA	NA	NA	NA	NA
<b>Metals and Inorganics</b>								
Aluminum	NA	NA	NA	NA	NA	NA	No	F
Antimony	NA	NA	NA	NA	NA	NA	Yes	D
Arsenic	NA	NA	NA	NA	NA	NA	Yes	D
Barium	NA	NA	NA	NA	NA	NA	Yes	D
Beryllium	NA	NA	NA	NA	NA	NA	No	F
Boron	NA	NA	NA	NA	NA	NA	No	F
Cadmium	NA	NA	NA	NA	NA	NA	Uncertainty	B
Calcium	NA	NA	NA	NA	NA	NA	No	H
Chromium	NA	NA	NA	NA	NA	NA	Yes	D
Cobalt	NA	NA	NA	NA	NA	NA	No	F
Copper	NA	NA	NA	NA	NA	NA	No	F
Cyanide, Total	NA	NA	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	NA	NA	No	F
Lead	NA	NA	NA	NA	NA	NA	No	F
Magnesium	NA	NA	NA	NA	NA	NA	No	H
Manganese	NA	NA	NA	NA	NA	NA	No	F
Mercury	NA	NA	NA	NA	NA	NA	No	F
Nickel	NA	NA	NA	NA	NA	NA	Yes	D
Potassium	NA	NA	NA	NA	NA	NA	No	H
Selenium	NA	NA	NA	NA	NA	NA	Yes	D
Silver	NA	NA	NA	NA	NA	NA	No	A
Sodium	NA	NA	NA	NA	NA	NA	No	H
Thallium	NA	NA	NA	NA	NA	NA	No	A
Vanadium	NA	NA	NA	NA	NA	NA	No	F
Zinc	NA	NA	NA	NA	NA	NA	No	F
<b>Explosives</b>								
1,3,5-Trinitrobenzene	NA	NA	NA	NA	NA	NA	NA	NA
1,3-Dinitrobenzene	NA	NA	NA	NA	NA	NA	NA	NA

**TABLE 35-6, AUS-0022**  
**SUMMARY OF HUMAN HEALTH COPC EVALUATION**

**AUS OU PA/SI**  
**CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Groundwater		Sediment		Soil	
	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale
2,4,6-Trinitrotoluene (TNT)	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	NA	NA	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA	NA	NA
2-Amino-4,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA	NA	NA
2-Nitrotoluene (ONT)	NA	NA	NA	NA	NA	NA	NA	NA
3-Nitrotoluene	NA	NA	NA	NA	NA	NA	NA	NA
4-Amino-2,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA	NA	NA
4-Nitrotoluene (PNT)	NA	NA	NA	NA	NA	NA	NA	NA
HMX	NA	NA	NA	NA	NA	NA	NA	NA
Nitrobenzene	NA	NA	NA	NA	NA	NA	NA	NA
Nitroglycerin	NA	NA	NA	NA	NA	NA	NA	NA
Pentaerythritol tetranitrate (PETN)	NA	NA	NA	NA	NA	NA	NA	NA
Perchloric Acid	NA	NA	NA	NA	NA	NA	NA	NA
RDX	NA	NA	NA	NA	NA	NA	NA	NA
Tetryl	NA	NA	NA	NA	NA	NA	NA	NA
<b>Other Parameters</b>								
Nitrogen, Nitrate-Nitrite	NA	NA	NA	NA	NA	NA	NA	NA
Phosphorus, Total (as P)	NA	NA	NA	NA	NA	NA	NA	NA

- A - Chemical was not detected and the reporting limit does not exceed the screening concentration.
- B - Chemical was not detected, but reporting limit was equal to or exceeded screening concentration.
- C - Chemical was not detected and there is no screening concentration.
- D - Chemical was detected and was equal to or exceeded screening concentration, but did not exceed background.
- E - Chemical was detected and was equal to or exceeded screening concentration and background, if applicable.
- F - Chemical was detected and did not exceed screening concentration.
- G - Chemical was detected, but no screening value was available.
- H - Chemical was detected, but it is an essential nutrient.
- J - Chemical was classified as a COPC based on USEPA 1998 data but was not a COPC based on SI data.
- NA - Not Analyzed or not applicable.

**TABLE 35-7, AUS-0022  
SUMMARY OF ECOLOGICAL COPEC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Sediment		Soil	
	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale
<b>Volatile Organic Compounds</b>						
1,1,1-Trichloroethane	NA	NA	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	NA	NA	NA	NA	NA	NA
1,1-Dichloroethane	NA	NA	NA	NA	NA	NA
1,1-Dichloroethene	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane (EDC)	NA	NA	NA	NA	NA	NA
1,2-Dichloroethene (total)	NA	NA	NA	NA	NA	NA
1,2-Dichloropropane	NA	NA	NA	NA	NA	NA
2-Butanone (MEK)	NA	NA	NA	NA	NA	NA
2-Hexanone	NA	NA	NA	NA	NA	NA
4-Methyl-2-pentanone (MIBK)	NA	NA	NA	NA	NA	NA
Acetone	NA	NA	NA	NA	NA	NA
Benzene	NA	NA	NA	NA	NA	NA
Bromodichloromethane	NA	NA	NA	NA	NA	NA
Bromoform	NA	NA	NA	NA	NA	NA
Bromomethane	NA	NA	NA	NA	NA	NA
Carbon disulfide	NA	NA	NA	NA	NA	NA
Carbon tetrachloride	NA	NA	NA	NA	NA	NA
Chlorobenzene	NA	NA	NA	NA	NA	NA
Chloroethane	NA	NA	NA	NA	NA	NA
Chloroform	NA	NA	NA	NA	NA	NA
Chloromethane	NA	NA	NA	NA	NA	NA
cis-1,2-Dichloroethene	NA	NA	NA	NA	NA	NA
cis-1,3-Dichloropropene	NA	NA	NA	NA	NA	NA
Dibromochloromethane	NA	NA	NA	NA	NA	NA
Ethylbenzene	NA	NA	NA	NA	NA	NA
Methylene chloride	NA	NA	NA	NA	NA	NA
N-Hexane	NA	NA	NA	NA	NA	NA
Styrene	NA	NA	NA	NA	NA	NA
Tetrachloroethylene (PCE)	NA	NA	NA	NA	NA	NA
Toluene	NA	NA	NA	NA	NA	NA
total Xylenes	NA	NA	NA	NA	NA	NA
trans-1,2-Dichloroethene	NA	NA	NA	NA	NA	NA
trans-1,3-Dichloropropene	NA	NA	NA	NA	NA	NA
Trichloroethylene (TCE)	NA	NA	NA	NA	NA	NA
Vinyl chloride	NA	NA	NA	NA	NA	NA
<b>Semivolatile Organic Compounds</b>						
1,2,4-Trichlorobenzene	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	NA	NA	NA	NA	NA	NA

**TABLE 35-7, AUS-0022  
SUMMARY OF ECOLOGICAL COPEC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Sediment		Soil	
	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale
2,4,6-Trichlorophenol	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol	NA	NA	NA	NA	NA	NA
2,4-Dinitrophenol	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	NA	NA	NA	NA	NA	NA
2-Chlorophenol	NA	NA	NA	NA	NA	NA
1-Methylnaphthalene	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	NA	NA	NA	NA	NA	NA
2-Methylphenol	NA	NA	NA	NA	NA	NA
2-Nitroaniline	NA	NA	NA	NA	NA	NA
2-Nitrophenol	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	NA	NA	NA	NA	NA	NA
3-Nitroaniline	NA	NA	NA	NA	NA	NA
4,6-Dinitro-2-methylphenol	NA	NA	NA	NA	NA	NA
4-Bromophenyl phenyl ether	NA	NA	NA	NA	NA	NA
4-Chloro-3-methylphenol	NA	NA	NA	NA	NA	NA
4-Chloroaniline	NA	NA	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	NA	NA	NA	NA	NA	NA
4-Methylphenol	NA	NA	NA	NA	NA	NA
4-Nitroaniline	NA	NA	NA	NA	NA	NA
4-Nitrophenol	NA	NA	NA	NA	NA	NA
Acenaphthene	NA	NA	NA	NA	NA	NA
Acenaphthylene	NA	NA	NA	NA	NA	NA
Anthracene	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA
bis(2-Chloroethoxy)methane	NA	NA	NA	NA	NA	NA
bis(2-Chloroethyl) ether	NA	NA	NA	NA	NA	NA
bis(2-Chloroisopropyl) ether	NA	NA	NA	NA	NA	NA
bis(2-Ethylhexyl) phthalate	NA	NA	NA	NA	NA	NA
Butyl benzyl phthalate	NA	NA	NA	NA	NA	NA
Carbazole	NA	NA	NA	NA	NA	NA
Chrysene	NA	NA	NA	NA	NA	NA
Di-n-butyl phthalate	NA	NA	NA	NA	NA	NA
Di-n-octyl phthalate	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	NA	NA	NA	NA	NA	NA
Dibenzofuran	NA	NA	NA	NA	NA	NA
Diethyl phthalate	NA	NA	NA	NA	NA	NA
Dimethyl phthalate	NA	NA	NA	NA	NA	NA
Fluoranthene	NA	NA	NA	NA	NA	NA



**TABLE 35-7, AUS-0022**  
**SUMMARY OF ECOLOGICAL COPEC EVALUATION**

**AUS OU PA/SI**  
**CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Sediment		Soil	
	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale
Fluorene	NA	NA	NA	NA	NA	NA
Hexachlorobenzene	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	NA	NA	NA	NA	NA	NA
Hexachloroethane	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-c,d)pyrene	NA	NA	NA	NA	NA	NA
Isophorone	NA	NA	NA	NA	NA	NA
N-Nitroso-di-n-propylamine	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	NA	NA	NA	NA	NA	NA
Naphthalene	NA	NA	NA	NA	NA	NA
Pentachlorophenol	NA	NA	NA	NA	NA	NA
Phenanthrene	NA	NA	NA	NA	NA	NA
Phenol	NA	NA	NA	NA	NA	NA
Pyrene	NA	NA	NA	NA	NA	NA
<b>Metals and Inorganics</b>						
Aluminum	NA	NA	NA	NA	Uncertainty	I
Antimony	NA	NA	NA	NA	No	F
Arsenic	NA	NA	NA	NA	No	F
Barium	NA	NA	NA	NA	No	F
Beryllium	NA	NA	NA	NA	No	F
Boron	NA	NA	NA	NA	Yes	E
Cadmium	NA	NA	NA	NA	No	A
Calcium	NA	NA	NA	NA	Uncertainty	G,H
Chromium	NA	NA	NA	NA	Yes	D
Cobalt	NA	NA	NA	NA	No	F
Copper	NA	NA	NA	NA	No	F
Cyanide, Total	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	Yes	D
Lead	NA	NA	NA	NA	No	F
Magnesium	NA	NA	NA	NA	Uncertainty	G,H
Manganese	NA	NA	NA	NA	Yes	D
Mercury	NA	NA	NA	NA	Yes	D
Nickel	NA	NA	NA	NA	No	F
Potassium	NA	NA	NA	NA	Uncertainty	G,H
Selenium	NA	NA	NA	NA	Yes	D
Silver	NA	NA	NA	NA	No	A
Sodium	NA	NA	NA	NA	Uncertainty	G,H
Thallium	NA	NA	NA	NA	Uncertainty	B
Vanadium	NA	NA	NA	NA	No	F
Zinc	NA	NA	NA	NA	No	F
<b>Explosives</b>						
1,3,5-Trinitrobenzene	NA	NA	NA	NA	NA	NA
1,3-Dinitrobenzene	NA	NA	NA	NA	NA	NA

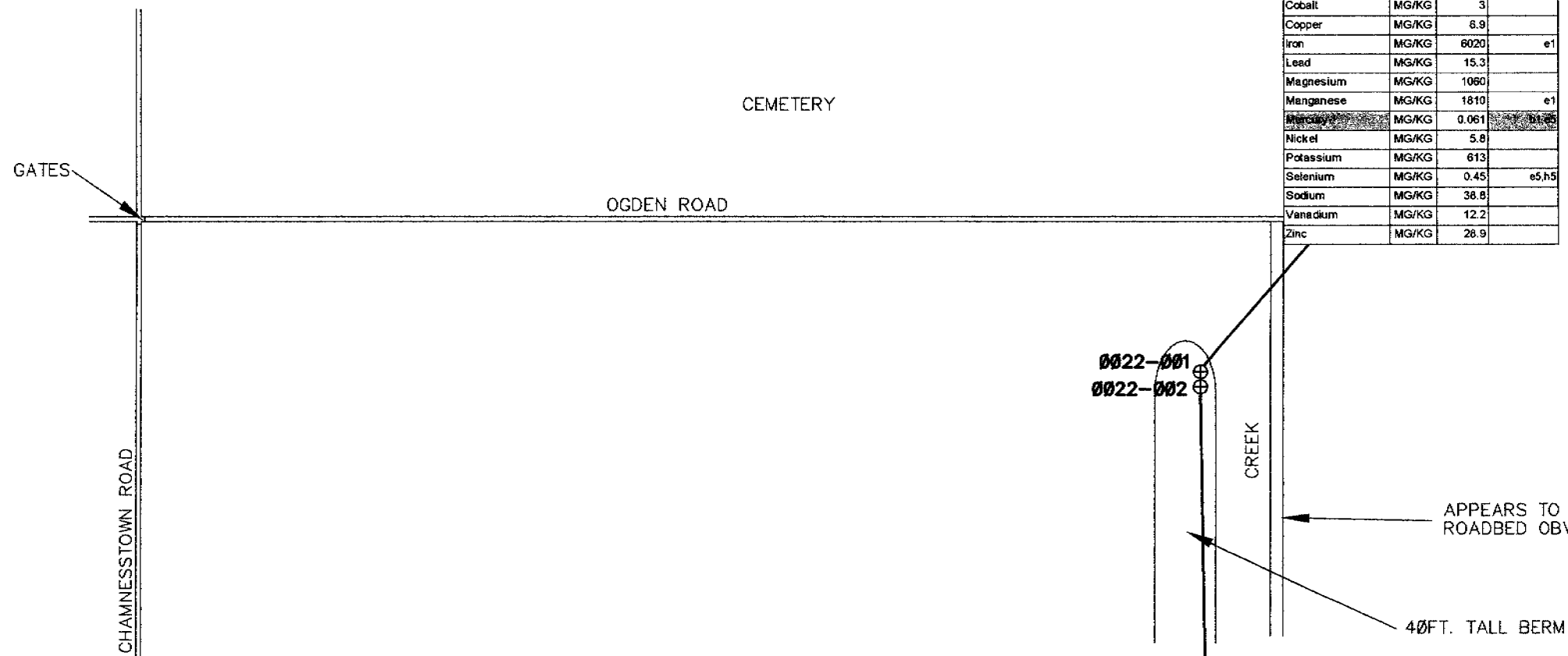
**TABLE 35-7, AUS-0022  
SUMMARY OF ECOLOGICAL COPEC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Sediment		Soil	
	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale
2,4,6-Trinitrotoluene (TNT)	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA
2-Amino-4,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA
2-Nitrotoluene (ONT)	NA	NA	NA	NA	NA	NA
3-Nitrotoluene	NA	NA	NA	NA	NA	NA
4-Amino-2,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA
4-Nitrotoluene (PNT)	NA	NA	NA	NA	NA	NA
HMX	NA	NA	NA	NA	NA	NA
Nitrobenzene	NA	NA	NA	NA	NA	NA
Nitroglycerin	NA	NA	NA	NA	NA	NA
Pentaerythritol tetranitrate (PETN)	NA	NA	NA	NA	NA	NA
Perchloric Acid	NA	NA	NA	NA	NA	NA
RDX	NA	NA	NA	NA	NA	NA
Tetryl	NA	NA	NA	NA	NA	NA

- A - Chemical was not detected and the reporting limit does not exceed the screening concentration.
- B - Chemical was not detected, but reporting limit was equal to or exceeded screening concentration.
- C - Chemical was not detected and there is no screening concentration.
- D - Chemical was detected and was equal to or exceeded screening concentration, but did not exceed background.
- E - Chemical was detected and was equal to or exceeded screening concentration and background, if applicable.
- F - Chemical was detected and did not exceed screening concentration.
- G - Chemical was detected, but no screening value was available.
- H - Chemical was detected, but it is an essential nutrient.
- I - If pH<5.5, Aluminum is a COPEC, otherwise it is not.
- J - Chemical was classified as a COPEC based on USEPA 1998 data but was not a COPEC based on SI data.
- NA - Not Analyzed or not applicable.

# AUS-0022-PROBABLE IOP SMALL ARMS TRAINING RANGE



AUS-0022-001	Units	Result: 0 - 6 In	Reference Code
<b>Metals</b>			
Aluminum	MG/KG	4670	
Antimony	MG/KG	0.45	h5
Arsenic	MG/KG	2.3	h5
Barium	MG/KG	169	h5
Beryllium	MG/KG	0.19	
Boron	MG/KG	5.6	
Calcium	MG/KG	6440	b1
Chromium	MG/KG	6.9	e1,h5
Cobalt	MG/KG	3	
Copper	MG/KG	8.9	
Iron	MG/KG	6020	e1
Lead	MG/KG	15.3	
Magnesium	MG/KG	1060	
Manganese	MG/KG	1610	e1
Mercury	MG/KG	0.061	h1,h5
Nickel	MG/KG	5.8	
Potassium	MG/KG	613	
Selenium	MG/KG	0.45	e5,h5
Sodium	MG/KG	38.8	
Vanadium	MG/KG	12.2	
Zinc	MG/KG	26.9	

## LEGEND

⊕ HAND AUGER LOCATION

## NOTES:

- DRAWING TAKEN FROM FIELD SKETCH DRAWN ON 10/17/00.
- DATA QUALIFIERS FOR ANALYTICAL RESULTS ARE NOT INDICATED. REFER TO THE QCSR FOR DATA QUALIFIERS.

Screening Reference	Reference Code
AUS Background Soil UTL	b1
Little Grass Background Sediment UTL	b2
Little Grass Background Surface Water UTL	b3
Ecological Direct Exposure Pathway TRV - Soil	e1
Ecological Direct Exposure Pathway TRV - Sediments	e2
Ecological Direct Exposure Pathway TRV - Surface Water	e3
IEPA General Use Surface Water Quality Aquatic Life Toxicity	e4
Superfund Chemical Data Matrix Kow values (potential bioaccumulator)	e5
USEPA Region IX Industrial Soil PRG - cancerous	h1
USEPA Region IX Industrial Soil PRG - noncancerous	h2
USEPA Region IX Tap Water PRG - cancerous	h3
USEPA Region IX Tap Water PRG - noncancerous	h4
USEPA Region IX Migration to Groundwater PRG (DAF=1)	h5
USEPA MCL Drinking Water Standards	h6
IEPA TACO Industrial/Commercial Soil Ingestion	h7
IEPA TACO Construction Worker Soil Ingestion	h8
IEPA TACO Class I Soil Component of Groundwater	h9
IEPA General Use Surface Water Quality Human Health	h10

AUS-0022-002	Units	Result: 0 - 6 In	Reference Code
<b>Metals</b>			
Aluminum	MG/KG	8960	
Antimony	MG/KG	0.23	
Arsenic	MG/KG	5.7	h1,h5,h7
Barium	MG/KG	74.9	
Beryllium	MG/KG	0.48	
Boron	MG/KG	1.3	e1
Calcium	MG/KG	2240	
Chromium	MG/KG	16.4	e1,h5
Cobalt	MG/KG	7.9	
Copper	MG/KG	8.9	
Iron	MG/KG	16200	e1
Lead	MG/KG	24.6	b1
Magnesium	MG/KG	1450	
Manganese	MG/KG	653	e1
Mercury	MG/KG	0.038	e5
Nickel	MG/KG	12.6	h5
Potassium	MG/KG	790	b1
Sodium	MG/KG	40.2	
Vanadium	MG/KG	23.3	
Zinc	MG/KG	35.2	

APPEARS TO BE OLD ROADBED OBVIOUS CLEARING

40FT. TALL BERM

APPROXIMATE

NOT TO SCALE

PA/SI REPORT-AUS OU  
CRAB ORCHARD NWR  
MARION, ILLINOIS

PROJECT NO.  
2320000026.00

**URS**

DRN. BY: djd 10/24/00  
DSGN. BY: are  
CHKD. BY: mch/cmw

AUS-0022 Sample Locations  
and Detections in Soils

FIG. NO.  
35-1

AUS-0043 is located on the north side of Ogden Road, 1.2 miles west Route 148. The location of AUS-0043 is shown in Figure 30-1, along with the other sites addressed in this volume.

### **AUS Original Site Designations**

AUS-0043 is one of the original sites in the Additional and Uncharacterized Sites Operable Unit (AUS OU) designated in 1997-1999 by the United States Fish & Wildlife Service (USFWS).

## **36.1 HISTORIC SEARCH INFORMATION**

### **36.1.1 Site Description**

AUS-0043 is the location of former Illinois Ordnance Plant (IOP) Fire Station No. 4 (Building A-3-4)<sup>1</sup>. This fire station building is no longer present on site.

### **36.1.2 Operational History and Waste Characteristics**

Fire Station No. 4 formerly serviced Areas 11 and 12 as well as other nearby IOP facilities. This fire station was operated by the Sherwin William Defense Corporation, under contract with the War Department (SWDC/War Department), as a part of the IOP. No information was found regarding subsequent industrial lessees for this site.

This fire station building contained a coal bin, a boiler room, an office, a toilet (with showers), a locker room, an apparatus room, a work room, and a fireman's room (with 16 bunks).<sup>2</sup> There were several floor drains identified in the building during the site reconnaissance. At least two appeared to be located in the former Boiler Room and several others appeared to be located in the former toilet room.<sup>3</sup> There also appeared to be another floor drain in the former Apparatus Room.<sup>4</sup>

There was also a steel stack located on the west side of the building foundation that appears to have been used for burning unknown materials. The location of this stack was identified during the site reconnaissance.

Also noted during the site reconnaissance was a large cabinet structure on the north side of the foundation (Figure 36-1). It has a cement-like finish on the interior surface that is suspect asbestos-containing material (ACM). It is possible that this cabinet was a part of the Coal Bin Room.<sup>5</sup>

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<sup>1</sup> U.S. Army Corps of Engineers, 1944, War Department Facilities Inventory of the Illinois Ordnance Plant Carbondale, Illinois, Part I, Section 5, Page 1.

<sup>2</sup> U.S. Army Corps of Engineers, 1944, War Department Facilities Inventory of the Illinois Ordnance Plant Carbondale, Illinois, Part I, Section 8, Page 7.

<sup>3</sup> U.S. Army Corps of Engineers, 1944, War Department Facilities Inventory of the Illinois Ordnance Plant Carbondale, Illinois, Part I, Section 8, Page 7.

<sup>4</sup> U.S. Army Corps of Engineers, 1944, War Department Facilities Inventory of the Illinois Ordnance Plant Carbondale, Illinois, Part I, Section 8, Page 7.

<sup>5</sup> U.S. Army Corps of Engineers, 1944, War Department Facilities Inventory of the Illinois Ordnance Plant Carbondale, Illinois, Part I, Section 8, Page 7.

There were two possible “sumps” identified within the footprint of the building during the site reconnaissance. One, located at the back of the building at the northwest corner, was approximately 4 feet (ft) deep. It is possible that this “sump” was located in the Ejector Pump House Building,<sup>6</sup> which was a structure supposedly added to another fire station (Building A-3-2); it may have also been added to this building. The use of this “sump” is not known.

A second possible “sump” was identified in the former Boiler Room.<sup>7</sup> It was approximately 18 inches deep, and may have been a blow-off basin for the boilers.

### **36.1.3 AUS-0043 Previous Sampling Results**

#### **USEPA Sampling, 1998**

In 1998, the United States Environmental Protection Agency (USEPA) collected a sample (43-01) from this site. The sample location is shown in Figure 36-1. The results for all detected constituents are listed in Table 36-1A. There were no semi-volatile organic compound (SVOC) target analytes detected above screening levels in this sample. Lead (150 milligrams per kilogram (mg/kg)) and zinc (220 mg/kg) exceeded New Dutchlist Soil Optimum Levels (DSOLs) and Refuge background levels.<sup>8</sup>

#### **36.1.4 Observations During Site Visit**

The building has been razed and only the foundation and debris remain at the site. A walkover survey of the site revealed a large cabinet and two sumps that were still present within the footprint of the building. A “burner stack” (steel stack) and abandoned farm equipment were also present.

Two drainageways were observed that appear to receive runoff from the building area. These are shown in Figure 36-1.

#### **36.1.5 Recommendations Based on Preliminary Assessment**

AUS-0043 was included in the Site Investigation (SI) because USEPA sample results from this site exceeded preliminary screening levels.

### **36.2 SITE INVESTIGATION INFORMATION**

URS conducted a Site Investigation at AUS-0043 on May 2, 2000. The rationale for sample locations, media, and analytes is presented in the Field Sampling Plan (FSP)<sup>9</sup> for the AUS OU PA/SI. Since the time the FSP was prepared, additional information has become available, and

<sup>6</sup> U.S. Army Corps of Engineers, 1944, War Department Facilities Inventory of the Illinois Ordnance Plant Carbondale, Illinois, Part I, Section 8, Page 7.

<sup>7</sup> U.S. Army Corps of Engineers, 1944, War Department Facilities Inventory of the Illinois Ordnance Plant Carbondale, Illinois, Part I, Section 8, Page 7.

<sup>8</sup> See Table 1-11 of this report for Refuge background soil values used for the PA.

<sup>9</sup> U.S. Fish & Wildlife Service, Department of the Interior, March 2000, Draft Final Field Sampling Plan Site Inspection, Additional and Uncharacterized Sites Operable Unit, Crab Orchard National Wildlife Refuge Superfund Site, Marion, Illinois (Williamson County), prepared by URS Corporation.

the historic discussion (Section 36.1) has been updated to include that information. The sampling locations discussed below are based on the information that was available at the time the FSP was developed, and may not address all areas of potential releases.

AUS OU SI sample locations are shown on Figure 36-1. Survey coordinates for all sample locations in AUS-0043 are listed in Table 36-1. Table 36-2 lists the sample locations and the matrix sampled at that location. Five soil samples and one surface water sample were obtained. All samples are soil samples unless otherwise noted.

### **36.2.1 Field Investigation**

Sampling was done in accordance with the FSP, except as noted.

#### **Sump Located on Northwest Corner of Building**

Sample 0043-003, the only surface water sample from this site, was collected from the 4-ft deep sump that was located on the northwest corner of the building.

#### **Drainageways on Site**

Two soil samples (0043-002 and 0043-005) were collected from the east-flowing drainageway located on the north side of former Building A-3-4. Sample 0043-002 was located near the 4-ft deep “sump,” and Sample 0043-005 was located approximately 65 ft downstream of the same “sump.” Another soil sample (0043-004) was collected from a south flowing drainageway located east of former Building A-3-4.

#### **Steel Stack Possibly Used for Burning**

One soil sample (0043-001) was located next to the steel stack that may have been used for burning unknown materials.

### **36.2.2 Field Results**

#### **36.2.2.1 Site Conditions**

##### **36.2.2.1.1 *Geologic Conditions***

The only subsurface information from this site was obtained from hand auger borings. Soil collected from hand auger samples, which extended to depths of 2 ft, described the first 2 ft of soil at the site as silty clay. Sample location 0043-001 indicates that the first 6 inches of fill has sandy gravel and location 0043-002 had silty clay fill with slag-like material.

##### **36.2.2.1.2 *Hydrogeologic Conditions***

No hydrogeological information is available for this site.

**36.2.2.1.3 Hydrologic Conditions**

Site drainage is shown in Figure 36-1. There is an east-flowing drainage north of the building area, which empties into a south-flowing drainage just east of the building area.

**36.2.2.2 Chemical Results**

The sample analytical results are summarized in the following tables:

- Table 36-3--soil samples results, and
- Table 36-4--surface water samples results.

These tables list all the chemicals detected in AUS-0043 during this investigation, along with the frequency and range of detections. Tabulated results of all analyses are included in the Quality Control Summary Report. All results are shown in Figure 36-1.

**36.3 SCREENING RISK ASSESSMENT**

Results of the screening are presented in Tables 36-5 through 36-8 as follows:

- Table 36-5--human health risk screening for soils,
- Table 36-6--human health risk screening for surface water,
- Table 36-7--ecological risk screening for soils, and
- Table 36-8--ecological risk screening for surface water.

Each table lists the maximum detected concentration for each constituent analyzed at AUS-0043. The screening results are presented in the tables in terms of hazard quotients (HQs). The HQ for any chemical detected, for any particular screening criterion is simply the ratio of the maximum detected concentration to the screening concentration. For human health for carcinogens, a screening level “cancer risk” is calculated instead of an HQ.

Chemicals that are shaded in the tables are those that exceeded the screening criteria, and are identified as chemicals of potential concern (COPCs) for human health risk, and chemicals of potential ecological concern (COPECs) for ecological risk. The only COPCs/COPECs not shaded in the table are those inorganic constituents that exceeded the screening criteria but were detected at levels below Refuge background.

In cases where the chemical was analyzed but not detected, the HQ is the ratio between the maximum reporting limit and the screening concentration. Chemicals not detected are identified with a “U” qualifier in the qualifier column. When these HQ values exceed one, they are not shaded. These constituents are not identified as COPCs/COPECs, but rather as uncertainties.

In Figure 36-1, the shading convention used is the same as for the tables discussed above. The particular screening criteria exceeded are indicated by the code in the analytical results labels. Duplicate results are shown only if the duplicate result for an analyte exceeded the screening criteria and the result from the original sample did not; or, if the analyte was detected in the duplicate and not in the original sample. Since in the screening process results which are qualified as estimated (coded with “J”) are treated the same as unqualified results, data qualifiers are not included in the results shown in the figures. Refer to the QCSR for data qualifiers.

Tables 36-9 (human health risk) and 36-10 (ecological risk) list all the analytes and corresponding media sampled and indicate whether each is a COPC (or COPEC), not a COPC (or COPEC), or an uncertainty. The codes in the tables indicate the rationale for each classification. All COPCs (Table 36-9) and COPECs (Table 36-10) are shaded in the tables.

### 36.3.1 Human Health Risk

#### 36.3.1.1 Soil

Human health screening results for soil samples are presented in Table 36-5. For carcinogens, a cancer risk was calculated using the USEPA Region 9 Industrial Soil Preliminary Remediation Goals (PRGs) as screening values. The cancer risk was derived by calculating a ratio of the maximum detected concentrations, or the maximum reporting limits, to their appropriate screening values. These ratios were then multiplied by  $1 \times 10^{-6}$ . In addition, ratios were calculated using the USEPA Region 9 Industrial Soil PRG for Toxins, the USEPA Region 9 Migration to Groundwater Criteria (Dilution Attenuation Factor (DAF)=1), the Illinois Tiered Approach to Corrective Action Objectives (TACO) Industrial/Commercial Soil Ingestion Criteria, the Illinois TACO Construction Worker Soil Ingestion Criteria, and the Illinois TACO Class I Soil Component of Groundwater Criteria.

#### 36.3.1.2 Surface Water

Human health risk screening results for chemicals in surface water at AUS-0043 are presented in Table 36-6. The maximum concentrations from AUS-0043 were screened against the State of Illinois General Use Surface Water Quality Criteria – Human Health.

### 36.3.2 Ecological Risk

#### 36.3.2.1 Soil

Ecological screening results for soil samples are presented in Table 36-7. Soil screening concentrations for direct exposures were developed using toxicity reference values (TRVs) derived from several sources, including the following:

- USEPA (2000)<sup>10</sup>
- Environment Canada (1995)<sup>11</sup>
- Talmage *et al.* (1999)<sup>12</sup>
- Efroymsen *et al.* (1997a, 1997b)<sup>13</sup>

<sup>10</sup> USEPA. 2000. Ecological Soil Screening Level Guidance (Draft). USEPA Office of Emergency and Remedial Response, Washington, DC.

<sup>11</sup> Environment Canada. 1995. Toxicity Testing of NCSR Priority Substances for Development of Soil Quality Guidelines for Contaminated Sites. Guidelines Division, Evaluation and Interpretation Branch, Environmental Conservation Directorate, Environment Canada. Hull, Quebec.

<sup>12</sup> Talmage, S.S., D.M. Opresko, C.J. Maxwell, C.J.E. Welsh, F. M. Cretella, P.H. Reno, and F. B. Daniel. 1999. Nitroaromatic Munition Compounds: Environmental Effects and Screening Values. *Rev Environ. Contam. Toxicol* 161:1-156.

<sup>13</sup> Efroymsen, R.A., M.E. Will, G.W. Suter II, and A.C. Wooten. 1997a. *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision*. Oak Ridge National Laboratory, Oak Ridge, Tennessee. ES/ER/TM-85/R3.



- CCME (1999)<sup>14</sup>
- MHSPE (1994)<sup>15</sup>
- Other sources

A detailed discussion of the screening concentration selection is presented in Appendix G.

The screening approach for ingestion pathway exposures was based on the potential for a chemical to bioaccumulate. The potential for a chemical to bioaccumulate was based on the organic chemical-specific octanol-to-water partitioning coefficient ( $K_{ow}$ ), which provides an indication of the lipophilicity of an organic chemical, and its potential for sequestration in biological tissue. The document *Assessment and Control of Bioconcentratable Contaminants in Surface Waters* (USEPA 1991)<sup>16</sup> used a log  $K_{ow}$  of 3.5 as a target threshold value indicative of bioaccumulative chemicals to target organic chemicals of greatest concern. Using this as a guideline, organic chemicals with a log  $K_{ow}$  greater than 3.5 were considered potentially bioaccumulative chemicals. Among inorganics, mercury and selenium were considered as potentially bioaccumulative chemicals. Any potentially bioaccumulative chemical that is detected was retained as a COPEC.

### 36.3.2.2 Surface Water

Ecological screening results for surface water samples are presented in Table 36-8. TRVs for direct exposure by aquatic organisms in surface water were obtained from:

- Illinois water quality standards
- National Recommended Ambient Water Quality Criteria (USEPA 1999a)<sup>17</sup>
- EcoTox (USEPA 1996)<sup>18</sup>
- USEPA Region IV Freshwater Screening Values (1999b)<sup>19</sup>
- Maximum Acceptable Toxicant Concentrations (MATCs) or lowest observed effect concentrations (LOECs) obtained from the USEPA Assessment Tools for the Evaluation of Risk database (ASTER 2000)<sup>20</sup>
- Other sources

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Efroymson, R.A., M.E. Will, and G.W. Suter II. 1997b. *Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision*. Oak Ridge National Laboratory, Oak Ridge, Tennessee. ES/ER/TM-126/R2.

<sup>14</sup> Canadian Council of Ministers of the Environment. 1999. Canadian Environmental Quality Guidelines.

<sup>15</sup> Ministry of Housing, Spatial Planning, and the Environment (MHSPE). 1994. *Intervention Values and Target Values – Soil Quality Standards*. Directorate General for Environmental Protection, Department of Soil Protection, The Hague, The Netherlands.

<sup>16</sup> USEPA 1991. *Assessment and Control of Bioconcentratable Contaminants in Surface Waters* (Draft). US Environmental Protection Agency Office of Research and Development, Washington, D.C.

<sup>17</sup> USEPA. 1999a. National Recommended Water Quality Criteria--Correction. Office of Water. EPA 822-Z-99-001. April.

<sup>18</sup> USEPA. 1996. ECO Update: Ecotox Thresholds. EPA-540/F-95/038. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response. Washington, D.C. 12pp.

<sup>19</sup> USEPA. 1999b. Region IV Ecological Risk Assessment Bulletins – Supplement to RAGS. Available at <http://www.epa.gov/region4/waste/oftecser/ecolbul.htm>.

<sup>20</sup> ASTER. 2000. Assessment Tools for Evaluation of Risk Database. United States Environmental Protection Agency, Office of Research and Development.

The Illinois water quality standards are believed to be the most relevant, followed by national recommended ambient water quality criteria. EcoTox reports values based on ambient water quality criteria, and Tier II water quality criteria have been developed in the absence of sufficient information to support a national recommended water quality criterion using guidelines outlined in the Great Lakes Water Quality Initiative. Remaining sources were prioritized based on relevance to the area and professional judgment. The detailed discussion of the approach for selecting a single ecological screening value (ESV) from among the multiple sources is presented in Appendix G.

The screening approach for ingestion pathway exposures was the same as for soils as presented in Section 36.3.2.1.

#### **36.4 SCIENTIFIC MANAGEMENT DECISION POINT**

A Remedial Investigation (RI) is recommended for Site AUS-0043, based on exceedances of the SI screening criteria.

This report recommends that inorganic constituents that exceeded project screening criteria but were within Refuge background levels not necessarily be retained as COPCs/COPECs for further evaluation. These are the constituents coded with “D” on the COPC list, Table 36-9; and on the COPEC list, Table 36-10. COPCs in this category include arsenic, barium, chromium and nickel in soil. COPECs coded with “D” on Table 36-10 include arsenic, chromium, manganese, and mercury in soil. These chemicals may later be included in the RI for other reasons, but the detections at the locations noted are not considered to be of concern since they are below Refuge background levels. All other COPCs/COPECs listed on these tables should be investigated in the RI. In addition, all analytes listed as uncertainties on these tables should be considered for further evaluation in the RI Work Plan.

Chemicals that exceeded screening criteria and Refuge background (if applicable) are listed in Table 36-11.

Note that a number of the human health COPCs exceed migration to groundwater screening criteria. Groundwater has not been investigated at this site, and based on these data, should be considered in the RI. Other areas of the site and media and contaminants in addition to those addressed in this study may warrant investigation in the RI. These issues will be addressed in the work plan for the RI.

**TABLE 36-1  
SURVEY COORDINATES FOR SAMPLE LOCATIONS IN AUS-0043**

<b>Sample Location</b>	<b>Northing</b>	<b>Easting</b>	<b>Ground Surface Elevation</b>	<b>Top of Casing Elevation</b>	<b>Comments</b>
0043-001	369097.3	778902.1	425.19	NA	
0043-002	369138.0	778911.8	424.37	NA	
0043-003	369128.1	778916.8	424.87	NA	
0043-004	369058.1	779000.4	422.89	NA	
0043-005	369134.2	778983.5	423.81	NA	

Sheet 1 of 1

NA = Not Applicable

TABLE 36-1A  
1998 USEPA SOIL SAMPLE ANALYTICAL RESULTS SUMMARY

Sample ID	Constituent	Result (mg/kg)
43-01	Bis(2-Ethylhexyl)phthalate	0.17JB
	Aluminum	13,000
	Arsenic	10
	Barium	140
	Beryllium	0.7
	Calcium	4,300
	Chromium	18
	Cobalt	8.1
	Copper	11
	Iron	19,000
	Lead	150
	Magnesium	2,700
	Manganese	710
	Nickel	17
	Potassium	1,300
	Vanadium	30
Zinc	220	

Sheet 1 of 1

mg/kg = milligrams per kilogram

J = Estimated

B = No explanation of "B" qualifier in report

**TABLE 36-2  
MATRICES SAMPLED AT EACH  
SAMPLE LOCATION AT AUS-0043**

<b>Soil</b>	<b>Surface Water</b>
AUS-0043-001	AUS-0043-003
AUS-0043-002	
AUS-0043-004*	
AUS-0043-005*	

**Sheet 1 of 1**

\* Note that the sample at this location was originally designated as sediment, but is actually a soil sample.

TABLE 36-3  
SOIL SAMPLE ANALYTICAL RESULTS SUMMARY

Constituents	Number of Detections	Range of Detections
<b>Semivolatile Organic Compounds</b>		
2-Methylnaphthalene	1/4	46 ug/kg
Acenaphthylene	1/4	290 ug/kg
Anthracene	1/4	240 ug/kg
Benzo(a)anthracene	1/4	1,200 ug/kg
Benzo(a)pyrene	1/4	1,200 ug/kg
Benzo(b)fluoranthene	1/4	3,000 ug/kg
Benzo(g,h,i)perylene	1/4	1,300 ug/kg
Benzo(k)fluoranthene	1/4	1,000 ug/kg
Bis(2-ethylhexyl) phthalate	2/4	79 ug/kg to 370 ug/kg
Chrysene	1/4	1,600 ug/kg
Fluoranthene	1/4	900 ug/kg
Indeno(1,2,3-c,d)Pyrene	1/4	1,100 ug/kg
Phenanthrene	1/4	76 ug/kg
Pyrene	2/4	63 ug/kg to 1,900 ug/kg
<b>Explosives</b>		
2,6-Dinitrotoluene	1/1	950 ug/kg
Tetryl	1/1	480 ug/kg
<b>Metals</b>		
Aluminum	4/4	1,610 mg/kg to 13,800 mg/kg
Antimony	4/4	0.3 mg/kg to 0.91 mg/kg
Arsenic	4/4	6.3 mg/kg to 12.2 mg/kg
Barium	4/4	21.6 mg/kg to 123 mg/kg
Beryllium	3/4	0.42 mg/kg to 0.53 mg/kg
Boron	3/4	1.5 mg/kg to 7.7 mg/kg
Cadmium	1/4	0.62 mg/kg
Calcium	4/4	3,250 mg/kg to 160,000 mg/kg
Chromium, Total	4/4	5 mg/kg to 19.4 mg/kg
Cobalt	3/4	6.4 mg/kg to 7.1 mg/kg
Copper	4/4	7.1 mg/kg to 18 mg/kg
Iron	4/4	4,370 mg/kg to 19,400 mg/kg
Lead	4/4	13.4 mg/kg to 1,110 mg/kg
Magnesium	4/4	2,630 mg/kg to 97,300 mg/kg
Manganese	4/4	197 mg/kg to 413 mg/kg
Mercury	4/4	0.023 mg/kg to 0.063 mg/kg
Nickel	4/4	6.7 mg/kg to 17.9 mg/kg
Potassium	3/4	891 mg/kg to 1,070 mg/kg
Sodium	4/4	37 mg/kg to 189 mg/kg

Sheet 1 of 2

**TABLE 36-3**  
**SOIL SAMPLE ANALYTICAL RESULTS SUMMARY**

<b>Constituents</b>	<b>Number of Detections</b>	<b>Range of Detections</b>
Vanadium	4/4	5.3 mg/kg to 28.8 mg/kg
Zinc	4/4	52.2 mg/kg to 211 mg/kg

Sheet 2 of 2

mg/kg = milligrams per kilogram

ug/kg = micrograms per kilogram

Notes: This table was derived from the figures that show the analytical results. As a result, duplicates are shown only if the duplicate result for an analyte exceeded the screening criteria and the result from the original sample did not; or, if the analyte was detected in the duplicate and not in the original sample. There may be some duplicate results, not shown in the table, that are outside the range shown. In addition, the frequency and range of detections is based on the number of sample locations, not the total number of samples (the total number of samples includes originals plus duplicates).

Checked by: MMF 7/20/01

TABLE 36-4  
SURFACE WATER SAMPLE ANALYTICAL RESULTS SUMMARY

Constituents	Number of Detections	Range of Detections
<b>Semivolatile Organic Compounds</b>		
Bis(2-Ethylhexyl) phthalate	1/1	4.4 ug/L
<b>Metals</b>		
Barium	1/1	38.4 ug/L
Boron	1/1	68.6 ug/L
Calcium	1/1	75,500 ug/L
Iron	1/1	5,100 ug/L
Magnesium	1/1	7,990 ug/L
Manganese	1/1	170 ug/L
Potassium	1/1	46,900 ug/L
Sodium	1/1	18,700 ug/L
Zinc	1/1	32.9 ug/L

Sheet 1 of 1

ug/L = micrograms per Liter

Notes: This table was derived from the figures that show the analytical results. As a result, duplicates are included only when the duplicate results are greater than original sample results, or when an analyte was detected in a duplicate and not in the original sample. There may be some duplicate results, not shown in the table, that are lower than the low end of the range shown. In addition, the frequency and range of detections is based on the number of sample locations, not the total number of samples (the total number of samples includes originals plus duplicates).

Checked by: MMF 7/20/01



**TABLE 36-5  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0043**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
<b>Volatile Organic Compounds</b>								
71-55-6	1,1,1-Trichloroethane	6	U	UG/KG			1.80E-06	6.00E-02
79-34-5	1,1,2,2-Tetrachloroethane	6	U	UG/KG		6.68E-09	1.54E-06	3.00E+01
79-00-5	1,1,2-Trichloroethane	6	U	UG/KG		3.16E-09	3.94E-05	6.67E+00
75-34-3	1,1-Dichloroethane	6	U	UG/KG			2.91E-06	6.00E-03
75-35-4	1,1-Dichloroethene	6	U	UG/KG		5.05E-08	8.91E-05	2.00E+00
107-06-2	1,2-Dichloroethane (EDC)	6	U	UG/KG		7.85E-09	1.70E-04	6.00E+00
540-59-0	1,2-Dichloroethene (total)	6	U	UG/KG			4.07E-05	3.00E-01
78-87-5	1,2-Dichloropropane	6	U	UG/KG		7.81E-09	2.82E-04	6.00E+00
78-93-3	2-Butanone (MEK)	12	U	UG/KG			4.33E-07	
591-78-6	2-Hexanone	12	U	UG/KG				
108-10-1	4-Methyl-2-pentanone (MIBK)	12	U	UG/KG			4.16E-06	
67-64-1	Acetone	32	U	UG/KG			5.15E-06	4.00E-02
71-43-2	Benzene	6	U	UG/KG		4.10E-09	2.48E-04	3.00E+00
75-27-4	Bromodichloromethane	6	U	UG/KG		2.55E-09	5.75E-06	2.00E-01
75-25-2	Bromoform	6	U	UG/KG		1.92E-11	3.41E-07	1.50E-01
74-83-9	Bromomethane	6	U	UG/KG			4.57E-04	6.00E-01
75-15-0	Carbon disulfide	6	U	UG/KG			4.96E-06	3.00E-03
56-23-5	Carbon tetrachloride	6	U	UG/KG		1.13E-08	8.58E-04	2.00E+00
108-90-7	Chlorobenzene	6	U	UG/KG			1.11E-05	8.57E-02
75-00-3	Chloroethane	6	U	UG/KG		9.22E-10	3.18E-07	
67-66-3	Chloroform	6	U	UG/KG		1.15E-08	4.66E-03	2.00E-01
74-87-3	Chloromethane	6	U	UG/KG		2.25E-09		
156-59-2	cis-1,2-Dichloroethene	6	U	UG/KG			4.07E-05	3.00E-01

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 36-5  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0043**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
10061-01-5	cis-1,3-Dichloropropene	6	U	UG/KG		3.37E-08	1.36E-04	
124-48-1	Dibromochloromethane	6	U	UG/KG		2.26E-09	3.77E-06	3.00E-01
100-41-4	Ethylbenzene	6	U	UG/KG			1.00E-06	8.57E-03
75-09-2	Methylene chloride	6	U	UG/KG		2.92E-10	6.14E-07	6.00E+00
110-54-3	N-Hexane	6	U	UG/KG			1.49E-05	
100-42-5	Styrene	6	U	UG/KG			2.94E-07	3.00E-02
127-18-4	Tetrachloroethylene (PCE)	6	U	UG/KG		3.21E-10	3.52E-06	2.00E+00
108-88-3	Toluene	6	U	UG/KG			3.02E-06	1.00E-02
1330-20-7	total Xylenes	6	U	UG/KG			1.35E-06	6.00E-04
156-60-5	trans-1,2-Dichloroethene	6	U	UG/KG			2.80E-05	2.00E-01
10061-02-6	trans-1,3-Dichloropropene	6	U	UG/KG		3.37E-08	1.36E-04	
79-01-6	Trichloroethylene (TCE)	6	U	UG/KG		9.81E-10	7.59E-05	2.00E+00
75-01-4	Vinyl chloride	6	U	UG/KG		1.23E-07		8.57E+00
<b>Semivolatile Organic Compounds</b>								
120-82-1	1,2,4-Trichlorobenzene	1900	U	UG/KG			2.49E-04	6.33E+00
95-50-1	1,2-Dichlorobenzene	1900	U	UG/KG			5.72E-04	2.11E+00
541-73-1	1,3-Dichlorobenzene	1900	U	UG/KG			3.67E-02	
106-46-7	1,4-Dichlorobenzene	1900	U	UG/KG		2.34E-07	9.89E-04	1.90E+01
95-95-4	2,4,5-Trichlorophenol	9600	U	UG/KG			1.09E-04	9.60E-01
88-06-2	2,4,6-Trichlorophenol	1900	U	UG/KG		8.47E-09		2.38E+02
120-83-2	2,4-Dichlorophenol	1900	U	UG/KG			7.19E-04	3.80E+01
105-67-9	2,4-Dimethylphenol	1900	U	UG/KG			1.08E-04	4.75E+00
51-28-5	2,4-Dinitrophenol	9600	U	UG/KG			5.45E-03	9.60E+02
91-58-7	2-Chloronaphthalene	1900	U	UG/KG			6.96E-05	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

TABLE 36-5

## HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0043

ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
95-57-8	2-Chlorophenol	1900	U	UG/KG			7.87E-03	9.50E+00
91-57-6	2-Methylnaphthalene	46	J	UG/KG			8.48E-07	2.30E-04
95-48-7	2-Methylphenol	1900	U	UG/KG			4.31E-05	2.38E+00
88-74-4	2-Nitroaniline	9600	U	UG/KG			1.91E-01	
88-75-5	2-Nitrophenol	1900	U	UG/KG			2.70E-04	
91-94-1	3,3'-Dichlorobenzidine	1900	U	UG/KG		3.47E-07		6.33E+03
99-09-2	3-Nitroaniline	9600	U	UG/KG			1.91E-01	
534-52-1	4,6-Dinitro-2-methylphenol	9600	U	UG/KG				
101-55-3	4-Bromophenyl phenyl ether	1900	U	UG/KG				
59-50-7	4-Chloro-3-methylphenol	1900	U	UG/KG			4.31E-05	
106-47-8	4-Chloroaniline	3800	U	UG/KG			1.08E-03	1.27E+02
7005-72-3	4-Chlorophenyl phenyl ether	1900	U	UG/KG				
106-44-5	4-Methylphenol	1900	U	UG/KG			4.31E-04	
100-01-6	4-Nitroaniline	9600	U	UG/KG			1.91E-01	
100-02-7	4-Nitrophenol	9600	U	UG/KG			1.36E-03	
83-32-9	Acenaphthene	1900	U	UG/KG			4.95E-05	6.33E-02
208-96-8	Acenaphthylene	290	J	UG/KG			5.35E-06	1.45E-03
120-12-7	Anthracene	240	J	UG/KG			6.16E-07	4.00E-04
56-55-3	Benzo(a)anthracene	1200	J	UG/KG		4.16E-07		1.50E+01
50-32-8	Benzo(a)pyrene	1200	J	UG/KG		4.16E-06		3.00E+00
205-99-2	Benzo(b)fluoranthene	3000		UG/KG		1.04E-06		1.50E+01
191-24-2	Benzo(g,h,i)perylene	1300	J	UG/KG			2.40E-05	6.50E-03
207-08-9	Benzo(k)fluoranthene	1000	J	UG/KG		3.46E-08		5.00E-01
111-91-1	bis(2-Chloroethoxy)methane	1900	U	UG/KG				

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 36-5  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0043**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
111-44-4	bis(2-Chloroethyl) ether	1900	U	UG/KG		3.07E-06		9.50E+04
108-60-1	bis(2-Chloroisopropyl) ether	1900	U	UG/KG		2.35E-07	4.47E-04	
117-81-7	bis(2-Ethylhexyl) phthalate (DEHP)	370	J	UG/KG		2.10E-09	2.10E-05	
85-68-7	Butyl benzyl phthalate	1900	U	UG/KG			1.08E-05	2.38E-03
86-74-8	Carbazole	1900	U	UG/KG		1.54E-08		6.33E+01
218-01-9	Chrysene	1600	J	UG/KG		5.54E-09		2.00E-01
84-74-2	Di-n-butyl phthalate	1900	U	UG/KG			2.16E-05	6.33E-03
117-84-0	Di-n-octyl phthalate	1900	U	UG/KG			1.08E-04	1.90E-04
53-70-3	Dibenz(a,h)anthracene	1900	U	UG/KG		6.58E-06		2.38E+01
132-64-9	Dibenzofuran	1900	U	UG/KG			3.75E-04	
84-66-2	Diethyl phthalate	1900	U	UG/KG			2.70E-06	
131-11-3	Dimethyl phthalate	1900	U	UG/KG			2.16E-07	
206-44-0	Fluoranthene	900	J	UG/KG			2.99E-05	4.50E-03
86-73-7	Fluorene	1900	U	UG/KG			5.73E-05	6.33E-02
118-74-1	Hexachlorobenzene	1900	U	UG/KG		1.23E-06	2.70E-03	1.90E+01
87-68-3	Hexachlorobutadiene	1900	U	UG/KG		6.01E-08	1.08E-02	1.90E+01
77-47-4	Hexachlorocyclopentadiene	1900	U	UG/KG			3.22E-04	9.50E-02
67-72-1	Hexachloroethane	1900	U	UG/KG		1.08E-08	2.16E-03	9.50E+01
193-39-5	Indeno(1,2,3-c,d)pyrene	1100	J	UG/KG		3.81E-07		1.57E+00
78-59-1	Isophorone	1900	U	UG/KG		7.32E-10	1.08E-05	6.33E+01
621-64-7	N-Nitroso-di-n-propylamine	1900	U	UG/KG		5.39E-06		9.50E+05
86-30-6	N-Nitrosodiphenylamine	1900	U	UG/KG		3.77E-09		3.17E+01
91-20-3	Naphthalene	1900	U	UG/KG			1.01E-02	4.75E-01
98-95-3	Nitrobenzene	1900	U	UG/KG			1.66E-02	

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TABLE 36-5

## HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0043

ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
87-86-5	Pentachlorophenol	9600	U	UG/KG		8.66E-07	6.73E-04	9.60E+03
85-01-8	Phenanthrene	76	J	UG/KG			1.40E-06	3.80E-04
108-95-2	Phenol	1900	U	UG/KG			3.59E-06	3.80E-01
129-00-0	Pyrene	1900	J	UG/KG			3.50E-05	9.50E-03
<b>Explosives</b>								
99-35-4	1,3,5-Trinitrobenzene	310	UJ	UG/KG			1.17E-05	
99-65-0	1,3-Dinitrobenzene	310	UJ	UG/KG			3.52E-03	
118-96-7	2,4,6-Trinitrotoluene (TNT)	620	UJ	UG/KG		7.54E-09	1.41E-03	
121-14-2	2,4-Dinitrotoluene	1900	U	UG/KG			1.08E-03	4.75E+04
606-20-2	2,6-Dinitrotoluene	950	J	UG/KG			1.08E-03	3.17E+04
	Dinitrotoluene Mixture	950	J	UG/KG		2.64E-07		3.17E+04
35572-78-2	2-Amino-4,6-Dinitrotoluene	620	UJ	UG/KG				
88-72-2	2-Nitrotoluene (ONT)	620	UJ	UG/KG				
99-08-1	3-Nitrotoluene	620	UJ	UG/KG			3.05E-04	
19406-51-0	4-Amino-2,6-Dinitrotoluene	620	UJ	UG/KG				
99-99-0	4-Nitrotoluene (PNT)	620	UJ	UG/KG			3.05E-04	
2691-41-0	HMX	620	UJ	UG/KG			1.41E-05	
121-82-4	RDX	620	UJ	UG/KG		2.76E-08	2.35E-04	
479-45-8	Tetryl	480	J	UG/KG			5.45E-05	
<b>Metals</b>								
7429-90-5	Aluminum	13800		MG/KG	4.79E-01		8.23E-03	
7440-36-0	Antimony	0.91	J	MG/KG	1.10E+00		1.11E-03	3.03E+00
7440-38-2	Arsenic	12.2		MG/KG	9.04E-01	4.47E-06	2.78E-02	1.22E+01
7440-39-3	Barium	123		MG/KG	6.31E-01		9.88E-04	1.54E+00

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 36-5  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0043**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
7440-41-7	Beryllium	0.53	J	MG/KG	6.97E-01	2.36E-10	1.43E-04	1.77E-01
7440-42-8	Boron	7.7	J	MG/KG	1.45E+00		9.73E-05	
7440-43-9	Cadmium	0.62		MG/KG	3.26E+00	2.07E-10	7.65E-04	1.55E+00
7440-70-2	Calcium	160000		MG/KG	6.41E+01			
7440-47-3	Chromium	19.4		MG/KG	7.70E-01	4.33E-08		9.70E+00
7440-48-4	Cobalt	7.1		MG/KG	3.27E-01		5.79E-05	
7440-50-8	Copper	18		MG/KG	1.59E+00		2.37E-04	
7439-89-6	Iron	19400		MG/KG	1.00E+00		3.17E-02	
7439-92-1	Lead	1110		MG/KG	4.74E+01			
7439-95-4	Magnesium	97300		MG/KG	6.27E+01			
7439-96-5	Manganese	413		MG/KG	1.13E-01		1.28E-02	
7439-97-6	Mercury	0.06	J	MG/KG	1.00E+00			
7440-02-0	Nickel	17.9		MG/KG	9.47E-01		4.38E-04	2.56E+00
2023695	Potassium	1070		MG/KG	1.71E+00			
7782-49-2	Selenium	2.3	U	MG/KG	9.83E-01		2.25E-04	7.67E+00
7440-22-4	Silver	2.3	U	MG/KG	3.97E+00		2.25E-04	1.15E+00
7440-23-5	Sodium	189	J	MG/KG	1.11E+00			
7440-28-0	Thallium	4.6	U	MG/KG	1.12E+01		3.21E-05	
7440-62-2	Vanadium	28.8		MG/KG	6.10E-01		2.01E-03	9.60E-02
7440-66-6	Zinc	211		MG/KG	4.11E+00		3.45E-04	3.52E-01

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TABLE 36-5

## HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0043

ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
<b>Volatile Organic Compounds</b>							
71-55-6	1,1,1-Trichloroethane	6	U	UG/KG			3.00E-03
79-34-5	1,1,2,2-Tetrachloroethane	6	U	UG/KG			
79-00-5	1,1,2-Trichloroethane	6	U	UG/KG	7.32E-07	7.32E-07	3.00E-01
75-34-3	1,1-Dichloroethane	6	U	UG/KG	3.00E-08	3.00E-08	2.61E-04
75-35-4	1,1-Dichloroethene	6	U	UG/KG	3.33E-07	3.33E-06	1.00E-01
107-06-2	1,2-Dichloroethane (EDC)	6	U	UG/KG	9.52E-05	4.29E-06	3.00E-01
540-59-0	1,2-Dichloroethene (total)	6	U	UG/KG	3.00E-07	3.00E-07	1.50E-02
78-87-5	1,2-Dichloropropane	6	U	UG/KG	7.14E-05	3.33E-06	2.00E-01
78-93-3	2-Butanone (MEK)	12	U	UG/KG			
591-78-6	2-Hexanone	12	U	UG/KG			
108-10-1	4-Methyl-2-pentanone (MIBK)	12	U	UG/KG			
67-64-1	Acetone	32	U	UG/KG	1.60E-07	1.60E-07	2.00E-03
71-43-2	Benzene	6	U	UG/KG	3.00E-05	1.40E-06	2.00E-01
75-27-4	Bromodichloromethane	6	U	UG/KG	6.52E-05	3.00E-06	1.00E-02
75-25-2	Bromoform	6	U	UG/KG	8.33E-06	3.75E-07	7.50E-03
74-83-9	Bromomethane	6	U	UG/KG	2.07E-06	6.00E-06	3.00E-02
75-15-0	Carbon disulfide	6	U	UG/KG	3.00E-08	3.00E-07	1.88E-04
56-23-5	Carbon tetrachloride	6	U	UG/KG	1.36E-04	1.46E-05	8.57E-02
108-90-7	Chlorobenzene	6	U	UG/KG	1.46E-07	1.46E-06	6.00E-03
75-00-3	Chloroethane	6	U	UG/KG			
67-66-3	Chloroform	6	U	UG/KG	6.38E-06	3.00E-06	1.00E-02
74-87-3	Chloromethane	6	U	UG/KG			
156-59-2	cis-1,2-Dichloroethene	6	U	UG/KG	3.00E-07	3.00E-07	1.50E-02

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**TABLE 36-5  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0043**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
10061-01-5	cis-1,3-Dichloropropene	6	U	UG/KG			
124-48-1	Dibromochloromethane	6	U	UG/KG	1.46E-07	1.46E-07	1.50E-02
100-41-4	Ethylbenzene	6	U	UG/KG	3.00E-08	3.00E-07	4.62E-04
75-09-2	Methylene chloride	6	U	UG/KG	7.89E-06	5.00E-07	3.00E-01
110-54-3	N-Hexane	6	U	UG/KG			
100-42-5	Styrene	6	U	UG/KG	1.46E-08	1.46E-07	1.50E-03
127-18-4	Tetrachloroethylene (PCE)	6	U	UG/KG	5.45E-05	2.50E-06	1.00E-01
108-88-3	Toluene	6	U	UG/KG	1.46E-08	1.46E-08	5.00E-04
1330-20-7	total Xylenes	6	U	UG/KG	6.00E-09	1.46E-08	4.00E-05
156-60-5	trans-1,2-Dichloroethene	6	U	UG/KG	1.46E-07	1.46E-07	8.57E-03
10061-02-6	trans-1,3-Dichloropropene	6	U	UG/KG			
79-01-6	Trichloroethylene (TCE)	6	U	UG/KG	1.15E-05	5.00E-06	1.00E-01
75-01-4	Vinyl chloride	6	U	UG/KG	2.00E-03	9.23E-05	6.00E-01
<b>Semivolatile Organic Compounds</b>							
120-82-1	1,2,4-Trichlorobenzene	1900	U	UG/KG	9.50E-05	9.50E-04	3.80E-01
95-50-1	1,2-Dichlorobenzene	1900	U	UG/KG	1.06E-05	1.06E-04	1.12E-01
541-73-1	1,3-Dichlorobenzene	1900	U	UG/KG			
106-46-7	1,4-Dichlorobenzene	1900	U	UG/KG			9.50E-01
95-95-4	2,4,5-Trichlorophenol	9600	U	UG/KG	4.80E-05	4.80E-05	3.56E-02
88-06-2	2,4,6-Trichlorophenol	1900	U	UG/KG	3.65E-03	1.73E-04	9.50E+00
120-83-2	2,4-Dichlorophenol	1900	U	UG/KG	3.11E-04	3.11E-03	1.90E+00
105-67-9	2,4-Dimethylphenol	1900	U	UG/KG	4.63E-05	4.63E-05	2.11E-01
51-28-5	2,4-Dinitrophenol	9600	U	UG/KG	2.34E-03	2.34E-02	4.80E+01
91-58-7	2-Chloronaphthalene	1900	U	UG/KG			

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect



TABLE 36-5  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0043

ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
95-57-8	2-Chlorophenol	1900	U	UG/KG	1.90E-04	1.90E-04	4.75E-01
91-57-6	2-Methylnaphthalene	46	J	UG/KG	7.54E-07	7.54E-07	1.10E-05
95-48-7	2-Methylphenol	1900	U	UG/KG	1.90E-05	1.90E-05	1.27E-01
88-74-4	2-Nitroaniline	9600	U	UG/KG			
88-75-5	2-Nitrophenol	1900	U	UG/KG			
91-94-1	3,3'-Dichlorobenzidine	1900	U	UG/KG	1.46E-01	6.79E-03	2.71E+02
99-09-2	3-Nitroaniline	9600	U	UG/KG			
534-52-1	4,6-Dinitro-2-methylphenol	9600	U	UG/KG			
101-55-3	4-Bromophenyl phenyl ether	1900	U	UG/KG			
59-50-7	4-Chloro-3-methylphenol	1900	U	UG/KG			
106-47-8	4-Chloroaniline	3800	U	UG/KG	4.63E-04	4.63E-03	5.43E+00
7005-72-3	4-Chlorophenyl phenyl ether	1900	U	UG/KG			
106-44-5	4-Methylphenol	1900	U	UG/KG			
100-01-6	4-Nitroaniline	9600	U	UG/KG			
100-02-7	4-Nitrophenol	9600	U	UG/KG			
83-32-9	Acenaphthene	1900	U	UG/KG	1.58E-05	1.58E-05	3.33E-03
208-96-8	Acenaphthylene	290	J	UG/KG	4.75E-06	4.75E-06	6.90E-05
120-12-7	Anthracene	240	J	UG/KG	3.93E-07	3.93E-07	2.00E-05
56-55-3	Benzo(a)anthracene	1200	J	UG/KG	1.50E-01	7.06E-03	6.00E-01
50-32-8	Benzo(a)pyrene	1200	J	UG/KG	1.50E+00	7.06E-02	1.50E-01
205-99-2	Benzo(b)fluoranthene	3000	J	UG/KG	3.75E-01	1.76E-02	6.00E-01
191-24-2	Benzo(g,h,i)perylene	1300	J	UG/KG	2.13E-05	2.13E-05	3.10E-04
207-08-9	Benzo(k)fluoranthene	1000	J	UG/KG	1.28E-02	5.88E-04	2.04E-02
111-91-1	bis(2-Chloroethoxy)methane	1900	U	UG/KG			

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 36-5  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0043**

**ADDITIONAL AND UNCHARACTERIZED SITES ON  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
111-44-4	bis(2-Chloroethyl) ether	1900	U	UG/KG	3.80E-01	2.53E-02	4.75E+03
108-60-1	bis(2-Chloroisopropyl) ether	1900	U	UG/KG			
117-81-7	bis(2-Ethylhexyl) phthalate (DEHP)	370	J	UG/KG	9.02E-04	9.02E-05	1.03E-04
85-68-7	Butyl benzyl phthalate	1900	U	UG/KG	4.63E-06	4.63E-06	2.04E-03
86-74-8	Carbazole	1900	U	UG/KG	6.55E-03	3.06E-04	3.17E+00
218-01-9	Chrysene	1600	J	UG/KG	2.05E-03	9.41E-05	1.00E-02
84-74-2	Di-n-butyl phthalate	1900	U	UG/KG	9.50E-06	9.50E-06	8.26E-04
117-84-0	Di-n-octyl phthalate	1900	U	UG/KG	4.63E-05	4.63E-04	1.90E-04
53-70-3	Dibenz(a,h)anthracene	1900	U	UG/KG	2.38E+00	1.12E-01	9.50E-01
132-64-9	Dibenzofuran	1900	U	UG/KG			
84-66-2	Diethyl phthalate	1900	U	UG/KG	1.90E-06	1.90E-06	4.04E-03
131-11-3	Dimethyl phthalate	1900	U	UG/KG			
206-44-0	Fluoranthene	900	J	UG/KG	1.10E-05	1.10E-05	2.09E-04
86-73-7	Fluorene	1900	U	UG/KG	2.32E-05	2.32E-05	3.39E-03
118-74-1	Hexachlorobenzene	1900	U	UG/KG	4.75E-01	2.44E-02	9.50E-01
87-68-3	Hexachlorobutadiene	1900	U	UG/KG			
77-47-4	Hexachlorocyclopentadiene	1900	U	UG/KG	1.36E-04	1.36E-04	4.75E-03
67-72-1	Hexachloroethane	1900	U	UG/KG	9.50E-04	9.50E-04	3.80E+00
193-39-5	Indeno(1,2,3-c,d)pyrene	1100	J	UG/KG	1.38E-01	6.47E-03	7.86E-02
78-59-1	Isophorone	1900	U	UG/KG	4.63E-06	4.63E-06	2.38E-01
621-64-7	N-Nitroso-di-n-propylamine	1900	U	UG/KG	2.38E+00	1.06E-01	3.80E+04
86-30-6	N-Nitrosodiphenylamine	1900	U	UG/KG	1.58E-03	7.60E-05	1.90E+00
91-20-3	Naphthalene	1900	U	UG/KG	2.32E-05	2.32E-04	2.26E-02
98-95-3	Nitrobenzene	1900	U	UG/KG	1.90E-03	1.90E-03	1.90E+01

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

TABLE 36-5

## HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0043

ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
87-86-5	Pentachlorophenol	9600	U	UG/KG	4.00E-01	1.85E-02	3.20E+02
85-01-8	Phenanthrene	76	J	UG/KG	1.25E-06	1.25E-06	1.81E-05
108-95-2	Phenol	1900	U	UG/KG	1.90E-06	1.58E-05	1.90E-02
129-00-0	Pyrene	1900	J	UG/KG	3.11E-05	3.11E-05	4.52E-04
<b>Explosives</b>							
99-35-4	1,3,5-Trinitrobenzene	310	UJ	UG/KG			
99-65-0	1,3-Dinitrobenzene	310	UJ	UG/KG			
118-96-7	2,4,6-Trinitrotoluene (TNT)	620	UJ	UG/KG			
121-14-2	2,4-Dinitrotoluene	1900	U	UG/KG	2.26E-01	1.06E-02	2.38E+03
606-20-2	2,6-Dinitrotoluene	950	J	UG/KG	1.13E-01	5.28E-03	1.36E+03
	Dinitrotoluene Mixture	950	J	UG/KG			
35572-78-2	2-Amino-4,6-Dinitrotoluene	620	UJ	UG/KG			
88-72-2	2-Nitrotoluene (ONT)	620	UJ	UG/KG			
99-08-1	3-Nitrotoluene	620	UJ	UG/KG			
19406-51-0	4-Amino-2,6-Dinitrotoluene	620	UJ	UG/KG			
99-99-0	4-Nitrotoluene (PNT)	620	UJ	UG/KG			
2691-41-0	HMX	620	UJ	UG/KG			
121-82-4	RDX	620	UJ	UG/KG			
479-45-8	Tetryl	480	J	UG/KG			
<b>Metals</b>							
7429-90-5	Aluminum	13800		MG/KG			
7440-36-0	Antimony	0.91	J	MG/KG	1.11E-03	1.11E-02	1.82E-01
7440-38-2	Arsenic	12.2		MG/KG	4.07E+00	2.00E-01	4.36E-01
7440-39-3	Barium	123		MG/KG	8.79E-04	8.79E-03	1.03E-01

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 36-5  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0043**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
7440-41-7	Beryllium	0.53	J	MG/KG	5.30E-01	1.83E-02	8.03E-02
7440-42-8	Boron	7.7	J	MG/KG	4.28E-05	4.28E-04	
7440-43-9	Cadmium	0.62		MG/KG	3.10E-04	3.10E-03	1.68E-01
7440-70-2	Calcium	160000		MG/KG			
7440-47-3	Chromium	19.4		MG/KG	1.94E-03	4.73E-03	6.93E-01
7440-48-4	Cobalt	7.1		MG/KG	5.92E-05	5.92E-04	
7440-50-8	Copper	18		MG/KG	2.20E-04	2.20E-03	1.64E-03
7439-89-6	Iron	19400		MG/KG			
7439-92-1	Lead	1110		MG/KG	2.78E+00	2.78E+00	
7439-95-4	Magnesium	97300		MG/KG			
7439-96-5	Manganese	413		MG/KG	4.30E-03	4.30E-02	
7439-97-6	Mercury	0.06	J	MG/KG	1.03E-04	1.03E-03	4.20E-01
7440-02-0	Nickel	17.9		MG/KG	4.37E-04	4.37E-03	2.36E-01
2023695	Potassium	1070		MG/KG			
7782-49-2	Selenium	2.3	U	MG/KG	2.30E-04	2.30E-03	9.58E-01
7440-22-4	Silver	2.3	U	MG/KG	2.30E-04	2.30E-03	1.53E+00
7440-23-5	Sodium	189	J	MG/KG			
7440-28-0	Thallium	4.6	U	MG/KG	2.88E-02	2.88E-02	1.92E+00
7440-62-2	Vanadium	28.8		MG/KG	2.06E-03	2.06E-02	2.94E-02
7440-66-6	Zinc	211		MG/KG	3.46E-04	3.46E-03	5.86E-02

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 36-6  
HUMAN HEALTH SCREENING OF SURFACE WATER RESULTS FROM AUS-0043**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (Surface Water)	Ratio of Max Concentration (or Max RL) to IEPA General Use Surface Water Quality Criteria - Human Health
<b>Volatile Organic Compounds</b>						
71-55-6	1,1,1-Trichloroethane	1	U	UG/L		
79-34-5	1,1,2,2-Tetrachloroethane	1	U	UG/L		
79-00-5	1,1,2-Trichloroethane	1	U	UG/L		
75-34-3	1,1-Dichloroethane	1	U	UG/L		
75-35-4	1,1-Dichloroethene	1	U	UG/L		
107-06-2	1,2-Dichloroethane (EDC)	1	U	UG/L		
78-87-5	1,2-Dichloropropane	1	U	UG/L		
78-93-3	2-Butanone (MEK)	5	U	UG/L		
591-78-6	2-Hexanone	5	U	UG/L		
108-10-1	4-Methyl-2-pentanone (MIBK)	5	U	UG/L		
67-64-1	Acetone	15	U	UG/L		
71-43-2	Benzene	1	U	UG/L		4.76E-02
75-27-4	Bromodichloromethane	1	U	UG/L		
75-25-2	Bromoform	1	U	UG/L		
74-83-9	Bromomethane	1	U	UG/L		
75-15-0	Carbon disulfide	1	U	UG/L		
56-23-5	Carbon tetrachloride	1	U	UG/L		
108-90-7	Chlorobenzene	1	U	UG/L		
75-00-3	Chloroethane	1	U	UG/L		
67-66-3	Chloroform	1	U	UG/L		
74-87-3	Chloromethane	1	U	UG/L		
156-59-2	cis-1,2-Dichloroethene	1	U	UG/L		
10061-01-5	cis-1,3-Dichloropropene	1	U	UG/L		
124-48-1	Dibromochloromethane	1	U	UG/L		
100-41-4	Ethylbenzene	1	U	UG/L		1.08E-04
75-09-2	Methylene chloride	1	U	UG/L		2.94E-03
110-54-3	N-Hexane	1	U	UG/L		
100-42-5	Styrene	1	U	UG/L		
127-18-4	Tetrachloroethylene (PCE)	1	U	UG/L		
108-88-3	Toluene	1	U	UG/L		1.61E-05
1330-20-7	total Xylenes	1	U	UG/L		1.61E-05
156-60-5	trans-1,2-Dichloroethene	1	U	UG/L		
10061-02-6	trans-1,3-Dichloropropene	1	U	UG/L		
79-01-6	Trichloroethylene (TCE)	1	U	UG/L		
75-01-4	Vinyl chloride	1	U	UG/L		
<b>Semivolatile Organic Compounds</b>						
120-82-1	1,2,4-Trichlorobenzene	10	U	UG/L		
95-50-1	1,2-Dichlorobenzene	10	U	UG/L		
541-73-1	1,3-Dichlorobenzene	10	U	UG/L		

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 36-6  
HUMAN HEALTH SCREENING OF SURFACE WATER RESULTS FROM AUS-0043**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (Surface Water)	Ratio of Max Concentration (or Max RL) to IEPA General Use Surface Water Quality Criteria - Human Health
106-46-7	1,4-Dichlorobenzene	10	U	UG/L		
95-95-4	2,4,5-Trichlorophenol	50	U	UG/L		
88-06-2	2,4,6-Trichlorophenol	10	U	UG/L		
120-83-2	2,4-Dichlorophenol	10	U	UG/L		
105-67-9	2,4-Dimethylphenol	10	U	UG/L		
51-28-5	2,4-Dinitrophenol	50	U	UG/L		
91-58-7	2-Chloronaphthalene	10	U	UG/L		
95-57-8	2-Chlorophenol	10	U	UG/L		
91-57-6	2-Methylnaphthalene	10	U	UG/L		2.86E-03
95-48-7	2-Methylphenol	10	U	UG/L		
88-74-4	2-Nitroaniline	50	U	UG/L		
88-75-5	2-Nitrophenol	10	U	UG/L		
91-94-1	3,3'-Dichlorobenzidine	20	U	UG/L		
99-09-2	3-Nitroaniline	50	U	UG/L		
534-52-1	4,6-Dinitro-2-methylphenol	50	U	UG/L		
101-55-3	4-Bromophenyl phenyl ether	10	U	UG/L		
59-50-7	4-Chloro-3-methylphenol	10	U	UG/L		
106-47-8	4-Chloroaniline	20	U	UG/L		
7005-72-3	4-Chlorophenyl phenyl ether	10	U	UG/L		
106-44-5	4-Methylphenol	10	U	UG/L		
100-01-6	4-Nitroaniline	50	U	UG/L		
100-02-7	4-Nitrophenol	50	U	UG/L		
83-32-9	Acenaphthene	10	U	UG/L		
208-96-8	Acenaphthylene	10	U	UG/L		2.86E-03
120-12-7	Anthracene	10	U	UG/L		2.86E-04
56-55-3	Benzo(a)anthracene	10	U	UG/L		1.00E+02
50-32-8	Benzo(a)pyrene	10	U	UG/L		1.00E+03
205-99-2	Benzo(b)fluoranthene	10	U	UG/L		1.00E+02
191-24-2	Benzo(g,h,i)perylene	10	U	UG/L		2.86E-03
207-08-9	Benzo(k)fluoranthene	10	U	UG/L		
111-91-1	bis(2-Chloroethoxy)methane	10	U	UG/L		
111-44-4	bis(2-Chloroethyl) ether	10	U	UG/L		
108-60-1	bis(2-Chloroisopropyl) ether	10	U	UG/L		
117-81-7	bis(2-Ethylhexyl) phthalate (DEHP)	4.4	J	UG/L		
85-68-7	Butyl benzyl phthalate	10	U	UG/L		
86-74-8	Carbazole	10	U	UG/L		
218-01-9	Chrysene	10	U	UG/L		1.00E+00
84-74-2	Di-n-butyl phthalate	10	U	UG/L		
117-84-0	Di-n-octyl phthalate	10	U	UG/L		
53-70-3	Dibenz(a,h)anthracene	10	U	UG/L		

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 36-6  
HUMAN HEALTH SCREENING OF SURFACE WATER RESULTS FROM AUS-0043**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (Surface Water)	Ratio of Max Concentration (or Max RL) to IEPA General Use Surface Water Quality Criteria - Human Health
132-64-9	Dibenzofuran	10	U	UG/L		
84-66-2	Diethyl phthalate	10	U	UG/L		
131-11-3	Dimethyl phthalate	10	U	UG/L		
206-44-0	Fluoranthene	10	U	UG/L		8.33E-02
86-73-7	Fluorene	10	U	UG/L		2.22E-03
118-74-1	Hexachlorobenzene	10	U	UG/L		
87-68-3	Hexachlorobutadiene	10	U	UG/L		
77-47-4	Hexachlorocyclopentadiene	10	U	UG/L		
67-72-1	Hexachloroethane	10	U	UG/L		
193-39-5	Indeno(1,2,3-c,d)pyrene	10	U	UG/L		1.00E+02
78-59-1	Isophorone	10	U	UG/L		
621-64-7	N-Nitroso-di-n-propylamine	10	U	UG/L		
86-30-6	N-Nitrosodiphenylamine	10	U	UG/L		
91-20-3	Naphthalene	10	U	UG/L		
87-86-5	Pentachlorophenol	50	U	UG/L		
85-01-8	Phenanthrene	10	U	UG/L		2.86E-03
108-95-2	Phenol	10	U	UG/L	1.00E+00	1.00E-01
129-00-0	Pyrene	10	U	UG/L		2.86E-03
<b>Explosives</b>						
99-35-4	1,3,5-Trinitrobenzene	0.25	UJ	UG/L		
99-65-0	1,3-Dinitrobenzene	0.25	UJ	UG/L		
118-96-7	2,4,6-Trinitrotoluene (TNT)	0.5	UJ	UG/L		
121-14-2	2,4-Dinitrotoluene	0.25	UJ	UG/L		
606-20-2	2,6-Dinitrotoluene	0.5	UJ	UG/L		
35572-78-2	2-Amino-4,6-Dinitrotoluene	0.5	UJ	UG/L		
88-72-2	2-Nitrotoluene (ONT)	0.5	UJ	UG/L		
99-08-1	3-Nitrotoluene	0.5	UJ	UG/L		
19406-51-0	4-Amino-2,6-Dinitrotoluene	0.5	UJ	UG/L		
99-99-0	4-Nitrotoluene (PNT)	0.5	UJ	UG/L		
2691-41-0	HMX	0.5	UJ	UG/L		
98-95-3	Nitrobenzene	0.25	UJ	UG/L		
121-82-4	RDX	0.5	UJ	UG/L		
479-45-8	Tetryl	0.75	UJ	UG/L		
<b>Metals</b>						
7429-90-5	Aluminum	200	U	UG/L	1.00E+00	
7440-36-0	Antimony	6	U	UG/L	1.00E+00	
7440-38-2	Arsenic	10	U	UG/L	1.00E+00	
7440-39-3	Barium	38.4	J	UG/L	1.69E+00	7.68E-03
7440-41-7	Beryllium	5	U	UG/L	1.00E+00	
7440-42-8	Boron	68.6	J	UG/L		6.86E-02

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 36-6  
HUMAN HEALTH SCREENING OF SURFACE WATER RESULTS FROM AUS-0043**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (Surface Water)	Ratio of Max Concentration (or Max RL) to IEPA General Use Surface Water Quality Criteria - Human Health
7440-43-9	Cadmium	5	U	UG/L	1.00E+00	
7440-70-2	Calcium	75500		UG/L	1.05E+01	
7440-47-3	Chromium	10	U	UG/L	1.00E+00	
7440-48-4	Cobalt	50	U	UG/L	1.00E+00	
7440-50-8	Copper	10	U	UG/L	1.00E+00	
7439-89-6	Iron	5100		UG/L	5.10E+01	5.10E+00
7439-92-1	Lead	3	U	UG/L	1.50E+00	
7439-95-4	Magnesium	7990		UG/L	3.15E+00	
7439-96-5	Manganese	170		UG/L	2.92E-01	1.70E-01
7439-97-6	Mercury	0.2	U	UG/L	1.00E+00	1.67E+01
7440-02-0	Nickel	10	U	UG/L	1.00E+00	1.00E-02
2023695	Potassium	46900		UG/L	2.91E+01	
7782-49-2	Selenium	5	U	UG/L	1.85E+00	5.00E-03
7440-22-4	Silver	10	U	UG/L	1.00E+00	2.00E+00
7440-23-5	Sodium	18700		UG/L	5.90E+00	
7440-28-0	Thallium	10	U	UG/L	1.00E+00	
7440-62-2	Vanadium	50	U	UG/L	1.00E+00	
7440-66-6	Zinc	32.9		UG/L	1.65E+00	3.29E-02

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect



**TABLE 36-7  
ECOLOGICAL SCREENING OF SOIL RESULTS FROM AUS-0043**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Background (SOIL)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ) (SOIL)	Retained as Potential Bioaccumulator
<b>Volatile Organic Compounds</b>							
71-55-6	1,1,1-Trichloroethane		6	U	UG/KG	2.01E-04	
79-34-5	1,1,2,2-Tetrachloroethane		6	U	UG/KG	4.72E-02	
79-00-5	1,1,2-Trichloroethane		6	U	UG/KG	2.10E-04	
75-34-3	1,1-Dichloroethane		6	U	UG/KG	2.99E-04	
75-35-4	1,1-Dichloroethene		6	U	UG/KG	7.25E-04	
107-06-2	1,2-Dichloroethane (EDC)		6	U	UG/KG	2.83E-04	
540-59-0	1,2-Dichloroethene (total)		6	U	UG/KG	7.62E-03	
78-87-5	1,2-Dichloropropane		6	U	UG/KG	8.57E-06	
78-93-3	2-Butanone (MEK)		12	U	UG/KG	1.34E-04	
591-78-6	2-Hexanone		12	U	UG/KG	9.52E-04	
108-10-1	4-Methyl-2-pentanone (MIBK)		12	U	UG/KG	2.71E-05	
67-64-1	Acetone		32	U	UG/KG	1.28E-02	
71-43-2	Benzene		6	U	UG/KG	3.75E-04	
75-27-4	Bromodichloromethane		6	U	UG/KG	1.11E-02	
75-25-2	Bromoform		6	U	UG/KG	3.77E-04	
74-83-9	Bromomethane		6	U	UG/KG	2.55E-02	
75-15-0	Carbon disulfide		6	U	UG/KG	6.37E-02	
56-23-5	Carbon tetrachloride		6	U	UG/KG	6.00E-06	
108-90-7	Chlorobenzene		6	U	UG/KG	1.50E-04	
75-00-3	Chloroethane		6	U	UG/KG		
67-66-3	Chloroform		6	U	UG/KG	5.04E-03	
74-87-3	Chloromethane		6	U	UG/KG	5.77E-04	
156-59-2	cis-1,2-Dichloroethene		6	U	UG/KG	7.62E-03	
10061-01-5	cis-1,3-Dichloropropene		6	U	UG/KG	1.51E-02	
124-48-1	Dibromochloromethane		6	U	UG/KG	2.93E-03	
100-41-4	Ethylbenzene		6	U	UG/KG	1.20E-03	
75-09-2	Methylene chloride		6	U	UG/KG	1.48E-03	
110-54-3	N-Hexane		6	U	UG/KG		
100-42-5	Styrene		6	U	UG/KG	2.00E-05	
127-18-4	Tetrachloroethylene (PCE)		6	U	UG/KG	4.62E-04	
108-88-3	Toluene		6	U	UG/KG	2.00E-03	
1330-20-7	total Xylenes		6	U	UG/KG	1.00E-02	
156-60-5	trans-1,2-Dichloroethene		6	U	UG/KG	7.62E-03	
10061-02-6	trans-1,3-Dichloropropene		6	U	UG/KG	1.51E-02	
79-01-6	Trichloroethylene (TCE)		6	U	UG/KG	6.67E-04	
75-01-4	Vinyl chloride		6	U	UG/KG	9.29E-03	
<b>Semivolatile Organic Compounds</b>							
120-82-1	1,2,4-Trichlorobenzene		1900	U	UG/KG	9.50E-02	
95-50-1	1,2-Dichlorobenzene		1900	U	UG/KG	6.42E-01	
541-73-1	1,3-Dichlorobenzene		1900	U	UG/KG	5.04E-02	
106-46-7	1,4-Dichlorobenzene		1900	U	UG/KG	9.50E-02	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 36-7  
ECOLOGICAL SCREENING OF SOIL RESULTS FROM AUS-0043**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Background (SOIL)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ) (SOIL)	Retained as Potential Bioaccumulator
95-95-4	2,4,5-Trichlorophenol		9600	U	UG/KG	2.40E+00	
88-06-2	2,4,6-Trichlorophenol		1900	U	UG/KG	1.90E-01	
120-83-2	2,4-Dichlorophenol		1900	U	UG/KG	2.17E-02	
105-67-9	2,4-Dimethylphenol		1900	U	UG/KG	1.90E+02	
51-28-5	2,4-Dinitrophenol		9600	U	UG/KG	4.80E-01	
91-58-7	2-Chloronaphthalene		1900	U	UG/KG	1.56E+02	
95-57-8	2-Chlorophenol		1900	U	UG/KG	7.83E+00	
91-57-6	2-Methylnaphthalene		46	J	UG/KG	1.42E-02	YES
95-48-7	2-Methylphenol		1900	U	UG/KG	4.70E-02	
88-74-4	2-Nitroaniline		9600	U	UG/KG	1.30E-01	
88-75-5	2-Nitrophenol		1900	U	UG/KG	1.19E+00	
91-94-1	3,3'-Dichlorobenzidine		1900	U	UG/KG	2.94E+00	
99-09-2	3-Nitroaniline		9600	U	UG/KG	3.04E+00	
534-52-1	4,6-Dinitro-2-methylphenol		9600	U	UG/KG		
101-55-3	4-Bromophenyl phenyl ether		1900	U	UG/KG		
59-50-7	4-Chloro-3-methylphenol		1900	U	UG/KG	2.39E-01	
106-47-8	4-Chloroaniline		3800	U	UG/KG	3.45E+00	
7005-72-3	4-Chlorophenyl phenyl ether		1900	U	UG/KG		
106-44-5	4-Methylphenol		1900	U	UG/KG	1.17E-02	
100-01-6	4-Nitroaniline		9600	U	UG/KG	4.38E-01	
100-02-7	4-Nitrophenol		9600	U	UG/KG	1.37E+00	
83-32-9	Acenaphthene		1900	U	UG/KG	2.78E-03	
208-96-8	Acenaphthylene		290	J	UG/KG	4.25E-04	
120-12-7	Anthracene		240	J	UG/KG	1.62E-04	YES
56-55-3	Benzo(a)anthracene		1200	J	UG/KG	2.30E-01	YES
50-32-8	Benzo(a)pyrene		1200	J	UG/KG	2.73E-04	YES
205-99-2	Benzo(b)fluoranthene		3000		UG/KG	5.02E-02	YES
191-24-2	Benzo(g,h,i)perylene		1300	J	UG/KG	1.09E-02	YES
207-08-9	Benzo(k)fluoranthene		1000	J	UG/KG	1.67E-02	YES
111-91-1	bis(2-Chloroethoxy)methane		1900	U	UG/KG	6.27E+00	
111-44-4	bis(2-Chloroethyl) ether		1900	U	UG/KG	8.02E-02	
108-60-1	bis(2-Chloroisopropyl) ether		1900	U	UG/KG		
117-81-7	bis(2-Ethylhexyl) phthalate (DEHP)		370	J	UG/KG	4.00E-01	YES
85-68-7	Butyl benzyl phthalate		1900	U	UG/KG	7.95E+00	
86-74-8	Carbazole		1900	U	UG/KG		
218-01-9	Chrysene		1600	J	UG/KG	3.38E-01	YES
84-74-2	Di-n-butyl phthalate		1900	U	UG/KG	9.50E-03	
117-84-0	Di-n-octyl phthalate		1900	U	UG/KG	2.68E-03	
53-70-3	Dibenz(a,h)anthracene		1900	U	UG/KG	1.03E-01	
132-64-9	Dibenzofuran		1900	U	UG/KG		
84-66-2	Diethyl phthalate		1900	U	UG/KG	1.90E-02	
131-11-3	Dimethyl phthalate		1900	U	UG/KG	9.50E-03	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 36-7  
ECOLOGICAL SCREENING OF SOIL RESULTS FROM AUS-0043**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Background (SOIL)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ) (SOIL)	Retained as Potential Bioaccumulator
206-44-0	Fluoranthene		900	J	UG/KG	7.38E-03	YES
86-73-7	Fluorene		1900	U	UG/KG	6.33E-02	
118-74-1	Hexachlorobenzene		1900	U	UG/KG	1.90E-03	
87-68-3	Hexachlorobutadiene		1900	U	UG/KG	4.78E+01	
77-47-4	Hexachlorocyclopentadiene		1900	U	UG/KG	1.90E-01	
67-72-1	Hexachloroethane		1900	U	UG/KG	3.19E+00	
193-39-5	Indeno(1,2,3-c,d)pyrene		1100	J	UG/KG	1.01E-02	YES
78-59-1	Isophorone		1900	U	UG/KG	1.37E-02	
621-64-7	N-Nitroso-di-n-propylamine		1900	U	UG/KG	3.49E+00	
86-30-6	N-Nitrosodiphenylamine		1900	U	UG/KG	9.50E-02	
91-20-3	Naphthalene		1900	U	UG/KG	7.63E-03	
98-95-3	Nitrobenzene		1900	U	UG/KG	4.75E-02	
87-86-5	Pentachlorophenol		9600	U	UG/KG	1.60E+00	
85-01-8	Phenanthrene		76	J	UG/KG	1.66E-03	YES
108-95-2	Phenol		1900	U	UG/KG	4.75E-02	
129-00-0	Pyrene		1900	J	UG/KG	2.42E-02	YES
<b>Explosives</b>							
99-35-4	1,3,5-Trinitrobenzene		310	UJ	UG/KG	8.24E-01	
99-65-0	1,3-Dinitrobenzene		310	UJ	UG/KG	4.73E-01	
118-96-7	2,4,6-Trinitrotoluene (TNT)		620	UJ	UG/KG	2.07E-02	
121-14-2	2,4-Dinitrotoluene		1900	U	UG/KG	1.48E+00	
606-20-2	2,6-Dinitrotoluene		950	J	UG/KG	2.89E+01	
35572-78-2	2-Amino-4,6-Dinitrotoluene		620	UJ	UG/KG	7.75E-03	
88-72-2	2-Nitrotoluene (ONT)		620	UJ	UG/KG		
99-08-1	3-Nitrotoluene		620	UJ	UG/KG		
19406-51-0	4-Amino-2,6-Dinitrotoluene		620	UJ	UG/KG		
99-99-0	4-Nitrotoluene (PNT)		620	UJ	UG/KG		
2691-41-0	HMX		620	UJ	UG/KG	2.48E-02	
121-82-4	RDX		620	UJ	UG/KG	6.20E-03	
479-45-8	Tetryl		480	J	UG/KG		
<b>Metals</b>							
7429-90-5	Aluminum	28800	13800		MG/KG		
7440-36-0	Antimony	0.83	0.91	J	MG/KG	1.82E-01	
7440-38-2	Arsenic	13.5	12.2		MG/KG	1.36E+00	
7440-39-3	Barium	195	123		MG/KG	2.46E-01	
7440-41-7	Beryllium	0.76	0.53	J	MG/KG	5.30E-02	
7440-42-8	Boron	5.3	7.7	J	MG/KG	1.54E+01	
7440-43-9	Cadmium	0.19	0.62		MG/KG	2.14E-02	
7440-70-2	Calcium	2497	160000		MG/KG		
7440-47-3	Chromium	25.2	19.4		MG/KG	3.88E+00	
7440-48-4	Cobalt	21.7	7.1		MG/KG	3.55E-01	
7440-50-8	Copper	11.3	18		MG/KG	5.81E-01	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 36-7  
ECOLOGICAL SCREENING OF SOIL RESULTS FROM AUS-0043**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Background (SOIL)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ) (SOIL)	Retained as Potential Bioaccumulator
7439-89-6	Iron	19306	19400		MG/KG	9.70E+01	
7439-92-1	Lead	23.4	1110		MG/KG	2.56E+00	
7439-95-4	Magnesium	1552	97300		MG/KG		
7439-96-5	Manganese	3640	413		MG/KG	4.13E+00	
7439-97-6	Mercury	0.06	0.06	J	MG/KG	9.00E-03	YES
7440-02-0	Nickel	18.9	17.9		MG/KG	5.97E-01	
2023695	Potassium	625	1070		MG/KG		
7782-49-2	Selenium	2.34	2.3	U	MG/KG	2.30E+00	
7440-22-4	Silver	0.58	2.3	U	MG/KG	1.15E+00	
7440-23-5	Sodium	170	189	J	MG/KG		
7440-28-0	Thallium	0.41	4.6	U	MG/KG	4.60E+00	
7440-62-2	Vanadium	47.2	28.8		MG/KG	6.26E-01	
7440-66-6	Zinc	51.4	211		MG/KG	1.76E+00	

**TABLE 36-8  
ECOLOGICAL SCREENING OF SURFACE WATER RESULTS FROM AUS-0043**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Background (Surface Water)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ)	Retained as Potential Bioaccumulator
<b>Volatile Organic Compounds</b>							
71-55-6	1,1,1-Trichloroethane		1	U	UG/L	9.09E-02	
79-34-5	1,1,2,2-Tetrachloroethane		1	U	UG/L	4.17E-03	
79-00-5	1,1,2-Trichloroethane		1	U	UG/L	1.06E-03	
75-34-3	1,1-Dichloroethane		1	U	UG/L	2.13E-02	
75-35-4	1,1-Dichloroethene		1	U	UG/L	4.00E-02	
107-06-2	1,2-Dichloroethane (EDC)		1	U	UG/L	1.10E-03	
78-87-5	1,2-Dichloropropane		1	U	UG/L	1.90E-03	
78-93-3	2-Butanone (MEK)		5	U	UG/L	3.57E-04	
591-78-6	2-Hexanone		5	U	UG/L	5.05E-02	
108-10-1	4-Methyl-2-pentanone (MIBK)		5	U	UG/L	2.94E-02	
67-64-1	Acetone		15	U	UG/L	2.96E-02	
71-43-2	Benzene		1	U	UG/L	2.17E-02	
75-27-4	Bromodichloromethane		1	U	UG/L	6.57E-05	
75-25-2	Bromoform		1	U	UG/L	3.41E-03	
74-83-9	Bromomethane		1	U	UG/L	1.48E-05	
75-15-0	Carbon disulfide		1	U	UG/L	1.09E+00	
56-23-5	Carbon tetrachloride		1	U	UG/L	1.02E-01	
108-90-7	Chlorobenzene		1	U	UG/L	1.56E-02	
75-00-3	Chloroethane		1	U	UG/L	4.75E-05	
67-66-3	Chloroform		1	U	UG/L	3.57E-02	
74-87-3	Chloromethane		1	U	UG/L	1.48E-05	
156-59-2	cis-1,2-Dichloroethene		1	U	UG/L	1.69E-03	
10061-01-5	cis-1,3-Dichloropropene		1	U	UG/L	1.82E+01	
124-48-1	Dibromochloromethane		1	U	UG/L	6.85E-05	
100-41-4	Ethylbenzene		1	U	UG/L	1.37E-01	
75-09-2	Methylene chloride		1	U	UG/L	5.18E-04	
110-54-3	N-Hexane		1	U	UG/L		
100-42-5	Styrene		1	U	UG/L	2.49E-04	
127-18-4	Tetrachloroethylene (PCE)		1	U	UG/L	1.19E-02	
108-88-3	Toluene		1	U	UG/L	1.02E-01	
1330-20-7	total Xylenes		1	U	UG/L	5.56E-01	
156-60-5	trans-1,2-Dichloroethene		1	U	UG/L	1.69E-03	
10061-02-6	trans-1,3-Dichloropropene		1	U	UG/L	4.10E-02	
79-01-6	Trichloroethylene (TCE)		1	U	UG/L	2.13E-02	
75-01-4	Vinyl chloride		1	U	UG/L	5.48E-05	
<b>Semivolatile Organic Compounds</b>							
120-82-1	1,2,4-Trichlorobenzene		10	U	UG/L	2.23E-01	
95-50-1	1,2-Dichlorobenzene		10	U	UG/L	7.14E-01	
541-73-1	1,3-Dichlorobenzene		10	U	UG/L	1.99E-01	
106-46-7	1,4-Dichlorobenzene		10	U	UG/L	8.93E-01	
95-95-4	2,4,5-Trichlorophenol		50	U	UG/L	7.94E-01	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 36-8  
ECOLOGICAL SCREENING OF SURFACE WATER RESULTS FROM AUS-0043**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Background (Surface Water)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ)	Retained as Potential Bioaccumulator
88-06-2	2,4,6-Trichlorophenol		10	U	UG/L	3.13E+00	
120-83-2	2,4-Dichlorophenol		10	U	UG/L	2.74E-01	
105-67-9	2,4-Dimethylphenol		10	U	UG/L	4.72E-01	
51-28-5	2,4-Dinitrophenol		50	U	UG/L	8.06E+00	
91-58-7	2-Chloronaphthalene		10	U	UG/L	3.23E-02	
95-57-8	2-Chlorophenol		10	U	UG/L	2.28E-01	
91-57-6	2-Methylnaphthalene		10	U	UG/L	2.40E-02	
95-48-7	2-Methylphenol		10	U	UG/L	7.69E-01	
88-74-4	2-Nitroaniline		50	U	UG/L	2.16E-03	
88-75-5	2-Nitrophenol		10	U	UG/L	2.90E-03	
91-94-1	3,3'-Dichlorobenzidine		20	U	UG/L	1.90E-01	
99-09-2	3-Nitroaniline		50	U	UG/L	7.32E-04	
534-52-1	4,6-Dinitro-2-methylphenol		50	U	UG/L	2.17E+01	
101-55-3	4-Bromophenyl phenyl ether		10	U	UG/L	6.67E+00	
59-50-7	4-Chloro-3-methylphenol		10	U	UG/L	3.33E+01	
106-47-8	4-Chloroaniline		20	U	UG/L	8.89E-03	
7005-72-3	4-Chlorophenyl phenyl ether		10	U	UG/L	2.17E-01	
106-44-5	4-Methylphenol		10	U	UG/L	4.44E-03	
100-01-6	4-Nitroaniline		50	U	UG/L	1.08E-03	
100-02-7	4-Nitrophenol		50	U	UG/L	6.04E-01	
83-32-9	Acenaphthene		10	U	UG/L	5.88E-01	
208-96-8	Acenaphthylene		10	U	UG/L	1.50E-02	
120-12-7	Anthracene		10	U	UG/L	1.67E+00	
56-55-3	Benzo(a)anthracene		10	U	UG/L	3.70E+02	
50-32-8	Benzo(a)pyrene		10	U	UG/L	7.14E+02	
205-99-2	Benzo(b)fluoranthene		10	U	UG/L	1.79E+03	
191-24-2	Benzo(g,h,i)perylene		10	U	UG/L	1.31E+00	
207-08-9	Benzo(k)fluoranthene		10	U	UG/L	1.79E+03	
111-91-1	bis(2-Chloroethoxy)methane		10	U	UG/L	1.56E-03	
111-44-4	bis(2-Chloroethyl) ether		10	U	UG/L	4.20E-03	
108-60-1	bis(2-Chloroisopropyl) ether		10	U	UG/L		
117-81-7	bis(2-Ethylhexyl) phthalate (DEHP)		4.4	J	UG/L	1.47E+00	YES
85-68-7	Butyl benzyl phthalate		10	U	UG/L	5.26E-01	
86-74-8	Carbazole		10	U	UG/L	1.12E-02	
218-01-9	Chrysene		10	U	UG/L	6.25E-01	
84-74-2	Di-n-butyl phthalate		10	U	UG/L	1.06E+00	
117-84-0	Di-n-octyl phthalate		10	U	UG/L	1.41E-02	
53-70-3	Dibenz(a,h)anthracene		10	U	UG/L	6.25E+03	
132-64-9	Dibenzofuran		10	U	UG/L	2.70E+00	
84-66-2	Diethyl phthalate		10	U	UG/L	4.76E-02	
131-11-3	Dimethyl phthalate		10	U	UG/L	3.03E-02	
206-44-0	Fluoranthene		10	U	UG/L	1.23E+00	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 36-8  
ECOLOGICAL SCREENING OF SURFACE WATER RESULTS FROM AUS-0043**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Background (Surface Water)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ)	Retained as Potential Bioaccumulator
86-73-7	Fluorene		10	U	UG/L	2.56E+00	
118-74-1	Hexachlorobenzene		10	U	UG/L	2.72E+00	
87-68-3	Hexachlorobutadiene		10	U	UG/L	1.08E+01	
77-47-4	Hexachlorocyclopentadiene		10	U	UG/L	1.43E+02	
67-72-1	Hexachloroethane		10	U	UG/L	1.02E+00	
193-39-5	Indeno(1,2,3-c,d)pyrene		10	U	UG/L	2.32E+00	
78-59-1	Isophorone		10	U	UG/L	8.55E-03	
621-64-7	N-Nitroso-di-n-propylamine		10	U	UG/L		
86-30-6	N-Nitrosodiphenylamine		10	U	UG/L	1.71E-01	
91-20-3	Naphthalene		10	U	UG/L	8.33E-01	
87-86-5	Pentachlorophenol		50	U	UG/L	3.33E+00	
85-01-8	Phenanthrene		10	U	UG/L	1.59E+00	
108-95-2	Phenol	10	10	U	UG/L	1.00E-01	
129-00-0	Pyrene		10	U	UG/L	1.64E-01	
<b>Explosives</b>							
99-35-4	1,3,5-Trinitrobenzene		0.25	UJ	UG/L	8.33E-03	
99-65-0	1,3-Dinitrobenzene		0.25	UJ	UG/L	1.25E-02	
118-96-7	2,4,6-Trinitrotoluene (TNT)		0.5	UJ	UG/L	1.25E-02	
121-14-2	2,4-Dinitrotoluene		0.25	UJ	UG/L	1.09E-03	
606-20-2	2,6-Dinitrotoluene		0.5	UJ	UG/L	1.19E-02	
35572-78-2	2-Amino-4,6-Dinitrotoluene		0.5	UJ	UG/L	2.50E-02	
88-72-2	2-Nitrotoluene (ONT)		0.5	UJ	UG/L	6.85E-05	
99-08-1	3-Nitrotoluene		0.5	UJ	UG/L	6.02E-05	
19406-51-0	4-Amino-2,6-Dinitrotoluene		0.5	UJ	UG/L	9.26E-04	
99-99-0	4-Nitrotoluene (PNT)		0.5	UJ	UG/L	7.14E-05	
2691-41-0	HMX		0.5	UJ	UG/L	1.52E-03	
98-95-3	Nitrobenzene		0.25	UJ	UG/L	9.26E-04	
121-82-4	RDX		0.5	UJ	UG/L	2.63E-03	
479-45-8	Tetryl		0.75	UJ	UG/L		
<b>Metals</b>							
7429-90-5	Aluminum	200	200	U	UG/L	2.30E+00	
7440-36-0	Antimony	6	6	U	UG/L	2.00E-01	
7440-38-2	Arsenic	10	10	U	UG/L	5.26E-02	
7440-39-3	Barium	22.7	38.4	J	UG/L	7.68E-03	
7440-41-7	Beryllium	5	5	U	UG/L	9.43E+00	
7440-42-8	Boron		68.6	J	UG/L	6.86E-02	
7440-43-9	Cadmium	5	5	U	UG/L	4.55E+00	
7440-70-2	Calcium	7197	75500		UG/L	6.51E-01	
7440-47-3	Chromium	10	10	U	UG/L	4.83E-02	
7440-48-4	Cobalt	50	50	U	UG/L	2.17E+01	
7440-50-8	Copper	10	10	U	UG/L	8.47E-01	
7439-89-6	Iron	100	5100		UG/L	5.10E+00	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 36-8  
ECOLOGICAL SCREENING OF SURFACE WATER RESULTS FROM AUS-0043**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Background (Surface Water)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ)	Retained as Potential Bioaccumulator
7439-92-1	Lead	2	3	U	UG/L	1.49E-01	
7439-95-4	Magnesium	2534	7990		UG/L	9.74E-02	
7439-96-5	Manganese	582	170		UG/L	1.70E-01	
7439-97-6	Mercury	0.2	0.2	U	UG/L	1.54E-01	
7440-02-0	Nickel	10	10	U	UG/L	1.00E-02	
2023695	Potassium	1613	46900		UG/L	8.85E-01	
7782-49-2	Selenium	2.7	5	U	UG/L	5.00E-03	
7440-22-4	Silver	10	10	U	UG/L	2.00E+00	
7440-23-5	Sodium	3169	18700		UG/L	2.75E-02	
7440-28-0	Thallium	10	10	U	UG/L	2.50E+00	
7440-62-2	Vanadium	50	50	U	UG/L	2.63E+00	
7440-66-6	Zinc	20	32.9		UG/L	3.29E-02	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect



TABLE 36-9, AUS-0043  
SUMMARY OF HUMAN HEALTH COPC EVALUATION

AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Chemical	Surface Water		Groundwater		Sediment		Soil	
	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale
<b>Volatile Organic Compounds</b>								
1,1,1-Trichloroethane	No	C	NA	NA	NA	NA	No	A
1,1,2,2-Tetrachloroethane	No	C	NA	NA	NA	NA	Uncertainty	B
1,1,2-Trichloroethane	No	C	NA	NA	NA	NA	Uncertainty	B
1,1-Dichloroethane	No	C	NA	NA	NA	NA	No	A
1,1-Dichloroethene	No	C	NA	NA	NA	NA	Uncertainty	B
1,2-Dichloroethane (EDC)	No	C	NA	NA	NA	NA	Uncertainty	B
1,2-Dichloroethene (total)	NA	NA	NA	NA	NA	NA	No	A
1,2-Dichloropropane	No	C	NA	NA	NA	NA	Uncertainty	B
2-Butanone (MEK)	No	C	NA	NA	NA	NA	No	A
2-Hexanone	No	C	NA	NA	NA	NA	No	C
4-Methyl-2-pentanone (MIBK)	No	C	NA	NA	NA	NA	No	A
Acetone	No	C	NA	NA	NA	NA	No	A
Benzene	No	A	NA	NA	NA	NA	Uncertainty	B
Bromodichloromethane	No	C	NA	NA	NA	NA	No	A
Bromoform	No	C	NA	NA	NA	NA	No	A
Bromomethane	No	C	NA	NA	NA	NA	No	A
Carbon disulfide	No	C	NA	NA	NA	NA	No	A
Carbon tetrachloride	No	C	NA	NA	NA	NA	Uncertainty	B
Chlorobenzene	No	C	NA	NA	NA	NA	No	A
Chloroethane	No	C	NA	NA	NA	NA	No	A
Chloroform	No	C	NA	NA	NA	NA	No	A
Chloromethane	No	C	NA	NA	NA	NA	No	A
cis-1,2-Dichloroethene	No	C	NA	NA	NA	NA	No	A
cis-1,3-Dichloropropene	No	C	NA	NA	NA	NA	No	A
Dibromochloromethane	No	C	NA	NA	NA	NA	No	A
Ethylbenzene	No	A	NA	NA	NA	NA	No	A
Methylene chloride	No	A	NA	NA	NA	NA	Uncertainty	B
N-Hexane	No	C	NA	NA	NA	NA	No	A
Styrene	No	C	NA	NA	NA	NA	No	A
Tetrachloroethylene (PCE)	No	C	NA	NA	NA	NA	Uncertainty	B
Toluene	No	A	NA	NA	NA	NA	No	A
total Xylenes	No	A	NA	NA	NA	NA	No	A
trans-1,2-Dichloroethene	No	C	NA	NA	NA	NA	No	A
trans-1,3-Dichloropropene	No	C	NA	NA	NA	NA	No	A
Trichloroethylene (TCE)	No	C	NA	NA	NA	NA	Uncertainty	B
Vinyl chloride	No	C	NA	NA	NA	NA	Uncertainty	B
<b>Semivolatile Organic Compounds</b>								
1,2,4-Trichlorobenzene	No	C	NA	NA	NA	NA	Uncertainty	B
1,2-Dichlorobenzene	No	C	NA	NA	NA	NA	Uncertainty	B
1,3-Dichlorobenzene	No	C	NA	NA	NA	NA	No	A
1,4-Dichlorobenzene	No	C	NA	NA	NA	NA	Uncertainty	B
2,4,5-Trichlorophenol	No	C	NA	NA	NA	NA	No	A

**TABLE 36-9, AUS-0043  
SUMMARY OF HUMAN HEALTH COPC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Groundwater		Sediment		Soil	
	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale
2,4,6-Trichlorophenol	No	C	NA	NA	NA	NA	Uncertainty	B
2,4-Dichlorophenol	No	C	NA	NA	NA	NA	Uncertainty	B
2,4-Dimethylphenol	No	C	NA	NA	NA	NA	Uncertainty	B
2,4-Dinitrophenol	No	C	NA	NA	NA	NA	Uncertainty	B
2-Chloronaphthalene	No	C	NA	NA	NA	NA	No	A
2-Chlorophenol	No	C	NA	NA	NA	NA	Uncertainty	B
1-Methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	No	A	NA	NA	NA	NA	No	F
2-Methylphenol	No	C	NA	NA	NA	NA	Uncertainty	B
2-Nitroaniline	No	C	NA	NA	NA	NA	No	A
2-Nitrophenol	No	C	NA	NA	NA	NA	No	A
3,3'-Dichlorobenzidine	No	C	NA	NA	NA	NA	Uncertainty	B
3-Nitroaniline	No	C	NA	NA	NA	NA	No	A
4,6-Dinitro-2-methylphenol	No	C	NA	NA	NA	NA	No	C
4-Bromophenyl phenyl ether	No	C	NA	NA	NA	NA	No	C
4-Chloro-3-methylphenol	No	C	NA	NA	NA	NA	No	A
4-Chloroaniline	No	C	NA	NA	NA	NA	Uncertainty	B
4-Chlorophenyl phenyl ether	No	C	NA	NA	NA	NA	No	C
4-Methylphenol	No	C	NA	NA	NA	NA	No	A
4-Nitroaniline	No	C	NA	NA	NA	NA	No	A
4-Nitrophenol	No	C	NA	NA	NA	NA	No	A
Acenaphthene	No	C	NA	NA	NA	NA	No	A
Acenaphthylene	No	A	NA	NA	NA	NA	No	F
Anthracene	No	A	NA	NA	NA	NA	No	F
Benzo(a)anthracene	Uncertainty	B	NA	NA	NA	NA	Yes	E
Benzo(a)pyrene	Uncertainty	B	NA	NA	NA	NA	Yes	E
Benzo(b)fluoranthene	Uncertainty	B	NA	NA	NA	NA	Yes	E
Benzo(g,h,i)perylene	No	A	NA	NA	NA	NA	No	F
Benzo(k)fluoranthene	No	C	NA	NA	NA	NA	No	F
bis(2-Chloroethoxy)methane	No	C	NA	NA	NA	NA	No	C
bis(2-Chloroethyl) ether	No	C	NA	NA	NA	NA	Uncertainty	B
bis(2-Chloroisopropyl) ether	No	C	NA	NA	NA	NA	No	A
bis(2-Ethylhexyl) phthalate	Uncertainty	G	NA	NA	NA	NA	No	F
Butyl benzyl phthalate	No	C	NA	NA	NA	NA	No	A
Carbazole	No	C	NA	NA	NA	NA	Uncertainty	B
Chrysene	Uncertainty	B	NA	NA	NA	NA	No	F
Di-n-butyl phthalate	No	C	NA	NA	NA	NA	No	A
Di-n-octyl phthalate	No	C	NA	NA	NA	NA	No	A
Dibenz(a,h)anthracene	No	C	NA	NA	NA	NA	Uncertainty	B
Dibenzofuran	No	C	NA	NA	NA	NA	No	A
Diethyl phthalate	No	C	NA	NA	NA	NA	No	A
Dimethyl phthalate	No	C	NA	NA	NA	NA	No	A
Fluoranthene	No	A	NA	NA	NA	NA	No	F

TABLE 36-9, AUS-0043  
SUMMARY OF HUMAN HEALTH COPC EVALUATION

AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Chemical	Surface Water		Groundwater		Sediment		Soil	
	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale
Fluorene	No	A	NA	NA	NA	NA	No	A
Hexachlorobenzene	No	C	NA	NA	NA	NA	Uncertainty	B
Hexachlorobutadiene	No	C	NA	NA	NA	NA	Uncertainty	B
Hexachlorocyclopentadiene	No	C	NA	NA	NA	NA	No	A
Hexachloroethane	No	C	NA	NA	NA	NA	Uncertainty	B
Indeno(1,2,3-c,d)pyrene	Uncertainty	B	NA	NA	NA	NA	Yes	E
Isophorone	No	C	NA	NA	NA	NA	Uncertainty	B
N-Nitroso-di-n-propylamine	No	C	NA	NA	NA	NA	Uncertainty	B
N-Nitrosodiphenylamine	No	C	NA	NA	NA	NA	Uncertainty	B
Naphthalene	No	C	NA	NA	NA	NA	No	A
Pentachlorophenol	No	C	NA	NA	NA	NA	Uncertainty	B
Phenanthrene	No	A	NA	NA	NA	NA	No	F
Phenol	No	A	NA	NA	NA	NA	No	A
Pyrene	No	A	NA	NA	NA	NA	No	F
<b>Metals and Inorganics</b>								
Aluminum	No	C	NA	NA	NA	NA	No	F
Antimony	No	C	NA	NA	NA	NA	Yes	E
Arsenic	No	C	NA	NA	NA	NA	Yes	D
Barium	No	F	NA	NA	NA	NA	Yes	D
Beryllium	No	C	NA	NA	NA	NA	No	F
Boron	No	F	NA	NA	NA	NA	No	F
Cadmium	No	C	NA	NA	NA	NA	Yes	E
Calcium	No	H	NA	NA	NA	NA	No	H
Chromium	No	C	NA	NA	NA	NA	Yes	D
Cobalt	No	C	NA	NA	NA	NA	No	F
Copper	No	C	NA	NA	NA	NA	No	F
Cyanide, Total	NA	NA	NA	NA	NA	NA	NA	NA
Iron	Yes	E	NA	NA	NA	NA	No	F
Lead	No	C	NA	NA	NA	NA	Yes	E
Magnesium	No	H	NA	NA	NA	NA	No	H
Manganese	No	F	NA	NA	NA	NA	No	F
Mercury	Uncertainty	B	NA	NA	NA	NA	No	F
Nickel	No	A	NA	NA	NA	NA	Yes	D
Potassium	No	H	NA	NA	NA	NA	No	H
Selenium	No	A	NA	NA	NA	NA	Uncertainty	B
Silver	Uncertainty	B	NA	NA	NA	NA	Uncertainty	B
Sodium	No	H	NA	NA	NA	NA	No	H
Thallium	No	C	NA	NA	NA	NA	Uncertainty	B
Vanadium	No	C	NA	NA	NA	NA	No	F
Zinc	No	F	NA	NA	NA	NA	No	F
<b>Explosives</b>								
1,3,5-Trinitrobenzene	No	C	NA	NA	NA	NA	No	A
1,3-Dinitrobenzene	No	C	NA	NA	NA	NA	No	A

**TABLE 36-9, AUS-0043  
SUMMARY OF HUMAN HEALTH COPC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Groundwater		Sediment		Soil	
	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale
2,4,6-Trinitrotoluene (TNT)	No	C	NA	NA	NA	NA	No	A
2,4-Dinitrotoluene	No	C	NA	NA	NA	NA	Uncertainty	B
2,6-Dinitrotoluene	No	C	NA	NA	NA	NA	Yes	E
2-Amino-4,6-Dinitrotoluene	No	C	NA	NA	NA	NA	No	C
2-Nitrotoluene (ONT)	No	C	NA	NA	NA	NA	No	C
3-Nitrotoluene	No	C	NA	NA	NA	NA	No	A
4-Amino-2,6-Dinitrotoluene	No	C	NA	NA	NA	NA	No	C
4-Nitrotoluene (PNT)	No	C	NA	NA	NA	NA	No	A
HMX	No	C	NA	NA	NA	NA	No	A
Nitrobenzene	No	C	NA	NA	NA	NA	Uncertainty	B
Nitroglycerin	NA	NA	NA	NA	NA	NA	NA	NA
Pentaerythritol tetranitrate (PETN)	NA	NA	NA	NA	NA	NA	NA	NA
Perchloric Acid	NA	NA	NA	NA	NA	NA	NA	NA
RDX	No	C	NA	NA	NA	NA	No	A
Tetryl	No	C	NA	NA	NA	NA	No	F
<b>Other Parameters</b>								
Nitrogen, Nitrate-Nitrite	NA	NA	NA	NA	NA	NA	NA	NA
Phosphorus, Total (as P)	NA	NA	NA	NA	NA	NA	NA	NA

- A - Chemical was not detected and the reporting limit does not exceed the screening concentration.
- B - Chemical was not detected, but reporting limit was equal to or exceeded screening concentration.
- C - Chemical was not detected and there is no screening concentration.
- D - Chemical was detected and was equal to or exceeded screening concentration, but did not exceed background.
- E - Chemical was detected and was equal to or exceeded screening concentration and background, if applicable.
- F - Chemical was detected and did not exceed screening concentration.
- G - Chemical was detected, but no screening value was available.
- H - Chemical was detected, but it is an essential nutrient.
- J - Chemical was classified as a COPC based on USEPA 1998 data but was not a COPC based on SI data.
- NA - Not Analyzed or not applicable.

**TABLE 36-10, AUS-0043  
SUMMARY OF ECOLOGICAL COPEC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Sediment		Soil	
	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale
<b>Volatile Organic Compounds</b>						
1,1,1-Trichloroethane	No	A	NA	NA	No	A
1,1,2,2-Tetrachloroethane	No	A	NA	NA	No	A
1,1,2-Trichloroethane	No	A	NA	NA	No	A
1,1-Dichloroethane	No	A	NA	NA	No	A
1,1-Dichloroethene	No	A	NA	NA	No	A
1,2-Dichloroethane (EDC)	No	A	NA	NA	No	A
1,2-Dichloroethene (total)	NA	NA	NA	NA	No	A
1,2-Dichloropropane	No	A	NA	NA	No	A
2-Butanone (MEK)	No	A	NA	NA	No	A
2-Hexanone	No	A	NA	NA	No	A
4-Methyl-2-pentanone (MIBK)	No	A	NA	NA	No	A
Acetone	No	A	NA	NA	No	A
Benzene	No	A	NA	NA	No	A
Bromodichloromethane	No	A	NA	NA	No	A
Bromoform	No	A	NA	NA	No	A
Bromomethane	No	A	NA	NA	No	A
Carbon disulfide	Uncertainty	B	NA	NA	No	A
Carbon tetrachloride	No	A	NA	NA	No	A
Chlorobenzene	No	A	NA	NA	No	A
Chloroethane	No	A	NA	NA	No	C
Chloroform	No	A	NA	NA	No	A
Chloromethane	No	A	NA	NA	No	A
cis-1,2-Dichloroethene	No	A	NA	NA	No	A
cis-1,3-Dichloropropene	Uncertainty	B	NA	NA	No	A
Dibromochloromethane	No	A	NA	NA	No	A
Ethylbenzene	No	A	NA	NA	No	A
Methylene chloride	No	A	NA	NA	No	A
N-Hexane	No	C	NA	NA	No	C
Styrene	No	A	NA	NA	No	A
Tetrachloroethylene (PCE)	No	A	NA	NA	No	A
Toluene	No	A	NA	NA	No	A
total Xylenes	No	A	NA	NA	No	A
trans-1,2-Dichloroethene	No	A	NA	NA	No	A
trans-1,3-Dichloropropene	No	A	NA	NA	No	A
Trichloroethylene (TCE)	No	A	NA	NA	No	A
Vinyl chloride	No	A	NA	NA	No	A
<b>Semivolatile Organic Compounds</b>						
1,2,4-Trichlorobenzene	No	A	NA	NA	No	A
1,2-Dichlorobenzene	No	A	NA	NA	No	A
1,3-Dichlorobenzene	No	A	NA	NA	No	A
1,4-Dichlorobenzene	No	A	NA	NA	No	A
2,4,5-Trichlorophenol	No	A	NA	NA	Uncertainty	B

**TABLE 36-10, AUS-0043**  
**SUMMARY OF ECOLOGICAL COPEC EVALUATION**

**AUS OU PA/SI**  
**CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Sediment		Soil	
	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale
2,4,6-Trichlorophenol	Uncertainty	B	NA	NA	No	A
2,4-Dichlorophenol	No	A	NA	NA	No	A
2,4-Dimethylphenol	No	A	NA	NA	Uncertainty	B
2,4-Dinitrophenol	Uncertainty	B	NA	NA	No	A
2-Chloronaphthalene	No	A	NA	NA	Uncertainty	B
2-Chlorophenol	No	A	NA	NA	Uncertainty	B
1-Methylnaphthalene	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	No	A	NA	NA	Yes	E
2-Methylphenol	No	A	NA	NA	No	A
2-Nitroaniline	No	A	NA	NA	No	A
2-Nitrophenol	No	A	NA	NA	Uncertainty	B
3,3'-Dichlorobenzidine	No	A	NA	NA	Uncertainty	B
3-Nitroaniline	No	A	NA	NA	Uncertainty	B
4,6-Dinitro-2-methylphenol	Uncertainty	B	NA	NA	No	C
4-Bromophenyl phenyl ether	Uncertainty	B	NA	NA	No	C
4-Chloro-3-methylphenol	Uncertainty	B	NA	NA	No	A
4-Chloroaniline	No	A	NA	NA	Uncertainty	B
4-Chlorophenyl phenyl ether	No	A	NA	NA	No	C
4-Methylphenol	No	A	NA	NA	No	A
4-Nitroaniline	No	A	NA	NA	No	A
4-Nitrophenol	No	A	NA	NA	Uncertainty	B
Acenaphthene	No	A	NA	NA	No	A
Acenaphthylene	No	A	NA	NA	No	F
Anthracene	Uncertainty	B	NA	NA	Yes	E
Benzo(a)anthracene	Uncertainty	B	NA	NA	Yes	E
Benzo(a)pyrene	Uncertainty	B	NA	NA	Yes	E
Benzo(b)fluoranthene	Uncertainty	B	NA	NA	Yes	E
Benzo(g,h,i)perylene	Uncertainty	B	NA	NA	Yes	E
Benzo(k)fluoranthene	Uncertainty	B	NA	NA	Yes	E
bis(2-Chloroethoxy)methane	No	A	NA	NA	Uncertainty	B
bis(2-Chloroethyl) ether	No	A	NA	NA	No	A
bis(2-Chloroisopropyl) ether	No	C	NA	NA	No	C
bis(2-Ethylhexyl) phthalate	Yes	E	NA	NA	Yes	E
Butyl benzyl phthalate	No	A	NA	NA	Uncertainty	B
Carbazole	No	A	NA	NA	No	C
Chrysene	No	A	NA	NA	Yes	E
Di-n-butyl phthalate	Uncertainty	B	NA	NA	No	A
Di-n-octyl phthalate	No	A	NA	NA	No	A
Dibenz(a,h)anthracene	Uncertainty	B	NA	NA	No	A
Dibenzofuran	Uncertainty	B	NA	NA	No	C
Diethyl phthalate	No	A	NA	NA	No	A
Dimethyl phthalate	No	A	NA	NA	No	A
Fluoranthene	Uncertainty	B	NA	NA	Yes	E

**TABLE 36-10, AUS-0043  
SUMMARY OF ECOLOGICAL COPEC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Sediment		Soil	
	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale
Fluorene	Uncertainty	B	NA	NA	No	A
Hexachlorobenzene	Uncertainty	B	NA	NA	No	A
Hexachlorobutadiene	Uncertainty	B	NA	NA	Uncertainty	B
Hexachlorocyclopentadiene	Uncertainty	B	NA	NA	No	A
Hexachloroethane	Uncertainty	B	NA	NA	Uncertainty	B
Indeno(1,2,3-c,d)pyrene	Uncertainty	B	NA	NA	Yes	E
Isophorone	No	A	NA	NA	No	A
N-Nitroso-di-n-propylamine	No	C	NA	NA	Uncertainty	B
N-Nitrosodiphenylamine	No	A	NA	NA	No	A
Naphthalene	No	A	NA	NA	No	A
Pentachlorophenol	Uncertainty	B	NA	NA	Uncertainty	B
Phenanthrene	Uncertainty	B	NA	NA	Yes	E
Phenol	No	A	NA	NA	No	A
Pyrene	No	A	NA	NA	Yes	E
<b>Metals and Inorganics</b>						
Aluminum	Uncertainty	B	NA	NA	Uncertainty	I
Antimony	No	A	NA	NA	No	F
Arsenic	No	A	NA	NA	Yes	D
Barium	No	F	NA	NA	No	F
Beryllium	Uncertainty	B	NA	NA	No	F
Boron	No	F	NA	NA	Yes	E
Cadmium	Uncertainty	B	NA	NA	No	F
Calcium	No	F,H	NA	NA	Uncertainty	G,H
Chromium	No	A	NA	NA	Yes	D
Cobalt	Uncertainty	B	NA	NA	No	F
Copper	No	A	NA	NA	No	F
Cyanide, Total	NA	NA	NA	NA	NA	NA
Iron	Yes	E	NA	NA	Yes	E
Lead	No	A	NA	NA	Yes	E
Magnesium	No	F,H	NA	NA	Uncertainty	G,H
Manganese	No	F	NA	NA	Yes	D
Mercury	No	A	NA	NA	Yes	D
Nickel	No	A	NA	NA	No	F
Potassium	No	F,H	NA	NA	Uncertainty	G,H
Selenium	No	A	NA	NA	Uncertainty	B
Silver	Uncertainty	B	NA	NA	Uncertainty	B
Sodium	No	F,H	NA	NA	Uncertainty	G,H
Thallium	Uncertainty	B	NA	NA	Uncertainty	B
Vanadium	Uncertainty	B	NA	NA	No	F
Zinc	No	F	NA	NA	Yes	E
<b>Explosives</b>						
1,3,5-Trinitrobenzene	No	A	NA	NA	No	A
1,3-Dinitrobenzene	No	A	NA	NA	No	A

**TABLE 36-10, AUS-0043  
SUMMARY OF ECOLOGICAL COPEC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Sediment		Soil	
	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale
2,4,6-Trinitrotoluene (TNT)	No	A	NA	NA	No	A
2,4-Dinitrotoluene	No	A	NA	NA	Uncertainty	B
2,6-Dinitrotoluene	No	A	NA	NA	Yes	E
2-Amino-4,6-Dinitrotoluene	No	A	NA	NA	No	A
2-Nitrotoluene (ONT)	No	A	NA	NA	No	C
3-Nitrotoluene	No	A	NA	NA	No	C
4-Amino-2,6-Dinitrotoluene	No	A	NA	NA	No	C
4-Nitrotoluene (PNT)	No	A	NA	NA	No	C
HMX	No	A	NA	NA	No	A
Nitrobenzene	No	A	NA	NA	No	A
Nitroglycerin	NA	NA	NA	NA	NA	NA
Pentaerythritol tetranitrate (PETN)	NA	NA	NA	NA	NA	NA
Perchloric Acid	NA	NA	NA	NA	NA	NA
RDX	No	A	NA	NA	No	A
Tetryl	No	C	NA	NA	Uncertainty	G

- A - Chemical was not detected and the reporting limit does not exceed the screening concentration.
- B - Chemical was not detected, but reporting limit was equal to or exceeded screening concentration.
- C - Chemical was not detected and there is no screening concentration.
- D - Chemical was detected and was equal to or exceeded screening concentration, but did not exceed background.
- E - Chemical was detected and was equal to or exceeded screening concentration and background, if applicable.
- F - Chemical was detected and did not exceed screening concentration.
- G - Chemical was detected, but no screening value was available.
- H - Chemical was detected, but it is an essential nutrient.
- I - If pH<5.5, Aluminum is a COPEC, otherwise it is not.
- J - Chemical was classified as a COPEC based on USEPA 1998 data but was not a COPEC based on SI data.
- NA - Not Analyzed or not applicable.



**TABLE 36-11**  
**AUS-0043 - AREAS 11/12 FIRE STATION**  
**CHEMICALS DETECTED ABOVE SCREENING CRITERIA AND ABOVE REFUGE BACKGROUND**  
**(WHERE APPLICABLE)**

**ADDITIONAL AND UNCHARACTERIZED SITES OU SI**

Chemical	Drum <sup>1</sup>	Soil	Sediment	Ground Water	Surface Water
<b>SVOCs</b>					
2-Methylnaphthalene		E	NA	NA	
Anthracene		E	NA	NA	
Benzo(a)anthracene		H,E	NA	NA	
Benzo(a)pyrene		H,E	NA	NA	
Benzo(b)fluoranthene		H,E	NA	NA	
Benzo(g,h,i)perylene		E	NA	NA	
Benzo(k)fluoranthene		E	NA	NA	
bis(2-Ethylhexyl)phthalate		E	NA	NA	E
Chrysene		E	NA	NA	
Fluoranthene		E	NA	NA	
Indeno(1,2,3-c,d)pyrene		H,E	NA	NA	
Phenanthrene		E	NA	NA	
Pyrene		E	NA	NA	
<b>Metals</b>					
Antimony		H	NA	NA	
Boron		E	NA	NA	
Cadmium		H	NA	NA	
Iron		E	NA	NA	H,E
Lead		H,E	NA	NA	
Zinc		E	NA	NA	
<b>Explosives</b>					
2,6-Dinitrotoluene		H,E	NA	NA	

**Key:**

<sup>1</sup> Drums were not present at this site.

NA = not analyzed

H = human health screening criteria exceeded

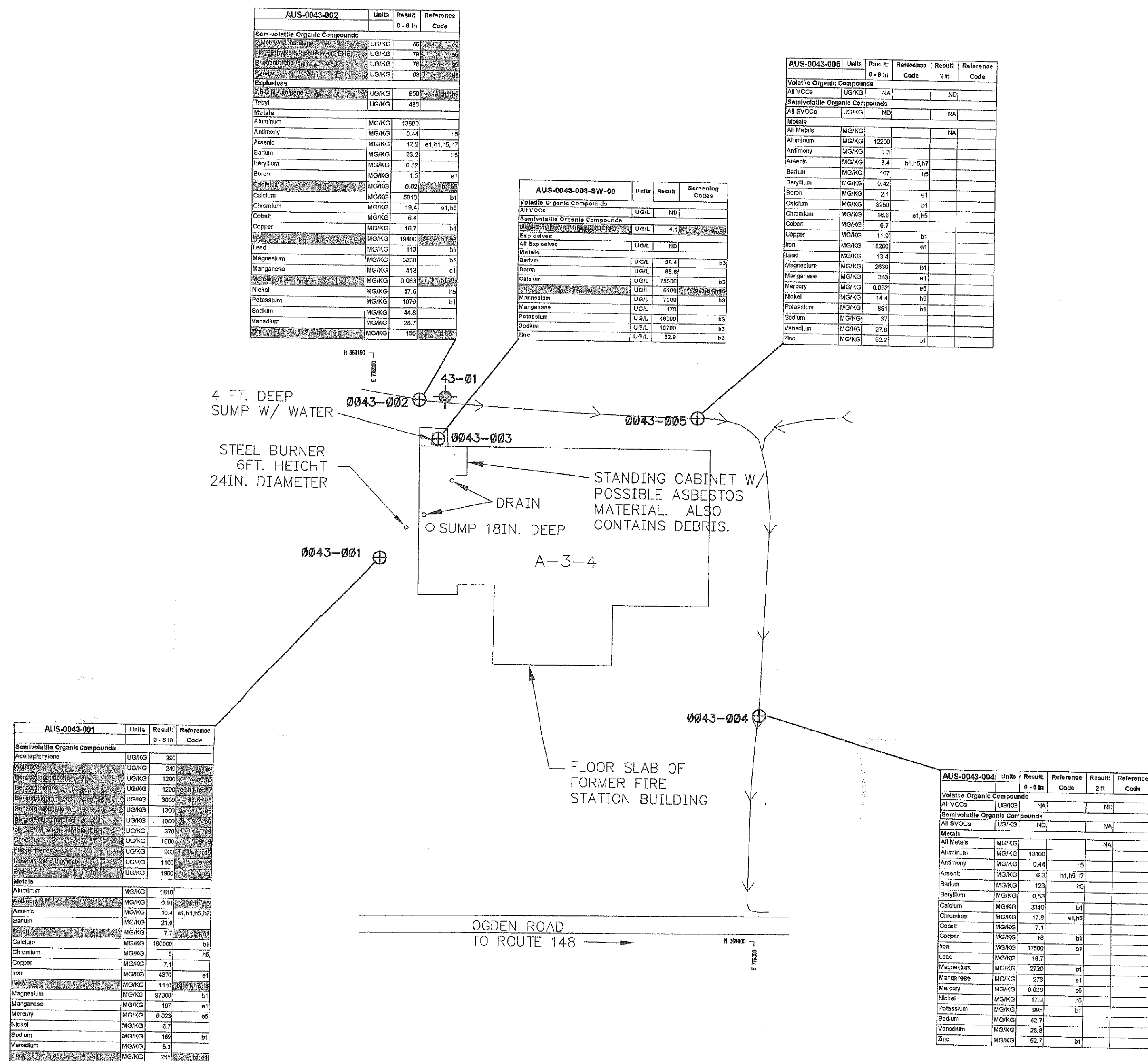
E = ecological screening criteria exceeded

File: E:\3200000026\00\PA-SI REPORT-AUS 0043-AUS-0043(36-1).DWG Last edited: 08/26/01 @ 12:35 p.m. WC-ST.LOUIS, MO

LEGEND

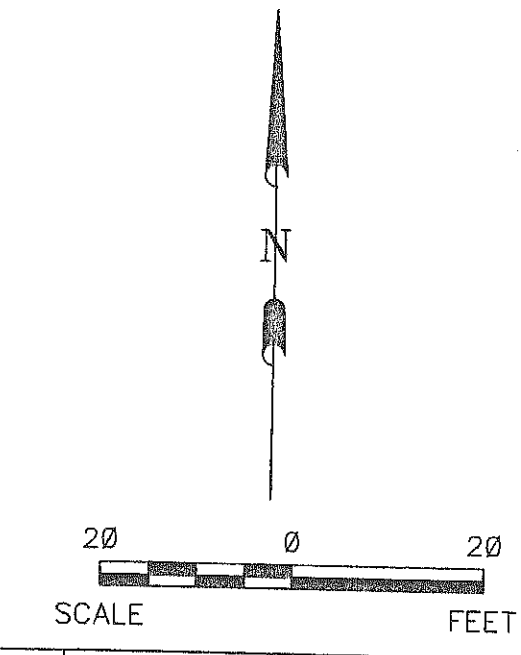
- ⊕ MONITORING WELL LOCATION
- ⊙ HAND AUGER LOCATION
- ⊛ USEPA 1998 SAMPLE LOCATIONS

Screening Reference	Reference Code
AUS Background Soil UTL	b1
1.0µg Grassy Background Surface Water UTL	b2
1.0µg Grassy Background Surface Water UTL	b3
Biological Direct Exposure Pathway TRV - Soil	e1
Ecological Direct Exposure Pathway TRV - Sediment	e2
Recreational Direct Exposure Pathway TRV - Surface Water	e3
Recreational Use Surface Water Quality Aquatic Life Toxicity	e4
Superfund Chemical Data Matrix Key Values (potential bioaccumulater)	e5
USEPA Region IX Industrial Soil FRG - cancerous	b1
USEPA Region IX Industrial Soil FRG - noncancerous	b2
USEPA Region IX Tap Water FRG - cancerous	b3
USEPA Region IX Tap Water FRG - noncancerous	b4
USEPA Region IX Migration to Groundwater FRG (DAF=1)	b5
USEPA MCL Drinking Water Standards	b6
TRPA TACO Industrial/Commercial Soil Injection	b7
TRPA TACO Construction Worker Soil Injection	b8
TRPA TACO Class I Soil Component of Groundwater	b9
TRPA General Use Surface Water Quality Human Health	b10



- NOTES:
- BASE MAP IS FROM SKETCH PREPARED DURING SITE RECONNAISSANCE, MARCH 26, 1999. THE BUILDING FOUNDATION MEASURES APPROXIMATELY 75 FT. BY 55 FT. IN MAXIMUM DIMENSIONS.
  - DATA QUALIFIERS FOR ANALYTICAL RESULTS ARE NOT INDICATED. REFER TO THE QCSR FOR DATA QUALIFIERS.
  - THE FOLLOWING COMPOUNDS ARE INCLUDED IN THE ANALYTE LIST FOR BOTH SVOCs AND EXPLOSIVES: 2,4-DINITROTOLUENE, 2,6-DINITROTOLUENE, AND NITROBENZENE. THESE COMPOUNDS MAY BE REPORTED AS EITHER SVOCs OR EXPLOSIVES.

AUS-0043-AREA 11/12 FIRE STATION



Revision No.	Description	Date	By	App.
REVISIONS				

PA/SI REPORT-AUS OU  
CRAB ORCHARD NWR  
MARION, ILLINOIS

AUS-0043 Sample Locations  
and Detections in Soils  
and Surface Water

Date: 11/14/00	Project Number: 232000026.00	Figure Number: 36-1
Drawn by: DJD	Design by: MAM	Checked by: MCH/CMW

**URS**

AUS-0060 is the Illinois Ordnance Plant (IOP) Fulminate Storage Igloos, Area 14. Later industrial tenants at the Refuge also used the igloos for storage.

The access road to AUS-0060 is on the west side of Wolf Creek Road, about 1.4 miles south of Old Highway 13. The edge of the site is approximately 0.1 mile west of Wolf Creek Road, at an 8-foot (ft) tall gate in the road. The location of AUS-0060 is shown in Figure 30-1, along with the other Additional and Uncharacterized Sites Operable Unit (AUS OU) sites addressed in this volume.

### **AUS Original Site Designations**

AUS-0060 is one of the original AUS OU sites designated in 1997-1999 by the United States Fish & Wildlife Service (USFWS).

## **37.1 HISTORIC SEARCH INFORMATION**

### **37.1.1 Site Description**

AUS-0060 is IOP Area 14 – Lead Azide/Mercury Fulminate Storage Igloos. There are four storage igloos on site, each of which likely has a lead-lined floor (Figure 37-1). There is a 6- by 8-ft concrete pad located just outside each igloo where loading and unloading would occur. An 8-ft chain-link fence surrounds the site.

### **37.1.2 Operational History and Waste Characteristics**

#### **37.1.2.1 IOP Usage and Decontamination**

This site was originally designed, built, and used by Sherwin Williams Defense Corporation, under contract with the War Department (SWDC/War Department) for the storage of lead azide and mercury fulminate for use in detonators. Five structures were located in Area 14:<sup>1</sup>

- FS-1-1 – Azide Storage Vault
- FS-1-2 – Azide Storage Vault
- FS-1-3 – Guard House
- FS-2-1 – Fulminate Storage Vault
- FS-2-2 – Fulminate Storage Vault

#### **IOP Decontamination**

After the IOP operations ended at CONWR, the IOP was to be decontaminated in accordance with a manual developed by the Ordnance Field Director of Ammunition Plants (OFDAP), called "*Shut-Down and Decontamination Procedures for F.D.A.P. Facilities.*"<sup>2</sup> This manual was to be used as a guide to develop a facility-specific plan for the decontamination of buildings, grounds

<sup>1</sup> DPRA Document No. CO02236. IOP, Numerical Lists of Layout Plans & Maps and Standard & Typical Drawings, for Railroads, Road, Sewers, drainage, Water & Miscellaneous Drawings, Pages 48 & 83; and DPRA Document No. CO01132. IOP Drawing, Location Layout Fulminate Storage Area, Area - FS, Plan No. 6544-101.48, dated February 23, 1942.

<sup>2</sup> ACO 005047 - ACO 005109. Office of Field Director of Ammunition Plants, Shut-Down and Decontamination Procedures for F.D.A.P. Facilities.

and equipment.<sup>3</sup> According to this document, there were several cleaning compounds used for desensitizing various explosives (for a list of and brief discussion of the compounds, see section 3.1.2.3.).

Because these igloos were used by the IOP for storage, they may not have required decontamination, unlike load lines and other production areas. Post-World War II military records are inadequate to determine if this area was decontaminated and, if so, if it was adequately decontaminated, and if decontamination instructions were followed.

### 37.1.2.2 Post-World War II Usage and Decontamination

After World War II, the storage igloos may have been used to store other compounds including trinitrotoluene (TNT), tetryl, and nitrocellulose. Universal Match Corporation (UMC) (later Crane/Unidynamics-Phoenix (now Crane Co.)) reported that they leased space at the Refuge from 1952 through 1963.<sup>4</sup> Lease documents indicate UMC occupied Area 14 from 1956 to 1964.<sup>5,6</sup> It is assumed that they leased the entire area. According to Mr. Harvey Pitt, a former UMC employee, one of the materials stored in this area was mercury fulminate, along with other high explosives and propellants.<sup>7,8,9</sup> They may have also stored lead azide and/or lead styphnate in these igloos, since UMC conducted testing of these explosives. Mr. Pitt stated that a common practice for the removal of the lead azide from the shipping containers was to remove the sacks of lead azide from the barrels that contained an alcohol solution in a field to the north. They would allow the sacks to drain/dry and then place the sacks in the storage igloos.<sup>10</sup>

Mr. John Miller, a former Olin chemist and manager, reported that Olin used the four magazines (or igloos) in AUS-0060 (Area 14) for materials storage;<sup>11</sup> however, Special Use Permits for these igloos indicate that Olin occupied only igloos FS-1-1, FS-1-2 and FS-2-1<sup>12</sup> (Wildlife Material Inc. occupied FS-2-2 as discussed below). Olin used these igloos for general storage. Special Use Permits showed that Olin occupied these igloos from 1970 through at least 1985.<sup>13,14,15</sup>

<sup>3</sup> ACO 004979 – ACO 004980. CONWR Former IOP Uncharacterized Sites Report, Pages 5 and 6.

<sup>4</sup> DOI 007947. Unidymanics' (UMC) response to Section 104(e) request for information, Page 2.

<sup>5</sup> FWM 001316. Lands Designation M-20, Lease Contract No. 14-19-003-1631 by and between Universal Match Corporation and the U. S. Department of the Interior, Fish and Wildlife Service, dated February 14, 1956, Page 1.

<sup>6</sup> FWM 001325. Lease Contract No. 14-16-0003-3592, Universal Match Corporation, dated April 3, 1961, Page 1.

<sup>7</sup> According to TechLaw (referenced here (#11)), during his interview, Mr. Pitt stated that UMC stored mercury fulminate in these igloos. However, in Mr. Pitt's deposition (also referenced here (#12)), it appears he stated that UMC did not store mercury fulminate in this area. Note, Mr. Pitt's statement in the deposition is unclear, thus making it difficult to clearly define whether or not he is confirming that UMC stored mercury fulminate in these igloos.

<sup>8</sup> Interview with Mr. Mr. Harvey Pitt as found in TechLaw, Inc., 1997, Draft Investigation Report, The Sherwin Williams Company, Illinois Ordnance Plant, Page B-20.

<sup>9</sup> Deposition of Harvey Pitt on November 19, 1997, Pages 32-33 & 117-118 & Exhibit 14.

<sup>10</sup> Deposition of Harvey Pitt on November 19, 1997, Pages 112, 116, & 117 & Exhibit 14.

<sup>11</sup> Deposition of John Miller on April 9, 1998, Pages 45-46.

<sup>12</sup> CRO 001487 through CRO 001494. Special Use Permits for Area 14 igloos, dated March 1970 through February 1978.

<sup>13</sup> CRO 001487 through CRO 001494. Special Use Permits for Area 14 igloos, dated March 1970 through February 1978.

According to the CERCLA Section 104e response from Wildlife Materials, Inc., they leased Igloo FS-2-2 from at least 1970<sup>16</sup> through 1985<sup>17</sup> for storage of “2FG, 3FG and 4FG black powder, in powder form; M6 propellant (240 mm Howitzer) in solid pellet form; and electric squibs (matches) in solid form with lead wires attached.”<sup>18</sup>

In 1997, under contract with the Department of the Army, Parsons Engineering (1997) investigated this site (referred to in their report as the Mercury Fulminate Storage Area in Area 2) to determine if ordnance or explosives (OE) remained in the bunkers.<sup>19</sup> The only bunker with potential OE residues was FS-2-2, which contained two boxes with small quantities of propellant powder.<sup>20</sup> The propellant powder was removed from the boxes and was disposed of by detonation.<sup>21</sup> The clean boxes were then returned to the bunker.<sup>22</sup> According to the Parsons Engineering report, no further action in regard to OE concerns was recommended at this site.<sup>23</sup>

### 37.1.3 AUS-0060 Previous Sampling Results

#### Parsons Engineering, 1997

As discussed above, Parsons investigated the insides of the bunkers for OE, and addressed what was found.

#### USEPA Sampling, 1998

The United States Environmental Protection Agency (USEPA) previously collected one sample (AUS 60-1) at this site in 1998, for semi-volatile organic compounds (SVOC) and metals analyses. The USEPA sample location is shown in Figure 37-1. The results for all detected constituents are listed in Table 37-1A. There were no SVOC target analytes detected above screening levels in this sample. Arsenic (180 milligrams per kilogram (mg/kg)) exceeded USEPA Soil Screening Levels (SSLs) and Refuge background level.<sup>24</sup> Lead (470 mg/kg) exceeded New Dutchlist Soil Optimum Level (DSOL) and Refuge background level.

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<sup>14</sup> DOI 001538 – DOI 001539. Igloo Lease Contract No. 14-16-0003-81-506 by and between U. S. Fish and Wildlife Service and Olin Corporation, dated October 1, 1980, Page 1 and Page 1 of Page 1A.

<sup>15</sup> DOI 001549. Amendment No. 2 to Igloo Lease Contract No. 14-16-0003-81-506, Olin Corporation, dated March 12, 1985.

<sup>16</sup> DOI 008068. Wildlife Materials, Inc.’s response to 104e request, dated June 28, 1989, Page 2.

<sup>17</sup> DPRA Document No. 00003204. Amendment No. 1 to Igloo Lease Contract No. 14-16-0003-81-509, Wildlife Material, Inc., dated March 1, 1985.

<sup>18</sup> DOI 008069. Wildlife Materials, Inc.’s response to 104e request, dated June 28, 1989, Page 3.

<sup>19</sup> Parsons Engineering Science, Inc., 1997, Engineering Evaluation and Cost Analysis – Final Report. Former Illinois Ordnance Plant - Marion, Illinois, Page 2-44.

<sup>20</sup> Parsons Engineering Science, Inc., 1997, Engineering Evaluation and Cost Analysis – Final Report. Former Illinois Ordnance Plant - Marion, Illinois, Page 2-46.

<sup>21</sup> Parsons Engineering Science, Inc., 1997, Engineering Evaluation and Cost Analysis – Final Report. Former Illinois Ordnance Plant - Marion, Illinois, Pages 2-46 through 2-47.

<sup>22</sup> Parsons Engineering Science, Inc., 1997, Engineering Evaluation and Cost Analysis – Final Report. Former Illinois Ordnance Plant - Marion, Illinois, Pages 2-46 through 2-47.

<sup>23</sup> Parsons Engineering Science, Inc., 1997, Engineering Evaluation and Cost Analysis – Final Report. Former Illinois Ordnance Plant - Marion, Illinois, Page 2-47.

<sup>24</sup> See Table 1-11 of this report for Refuge background soil values used for the PA.

**37.1.4 Observations During Site Visit**

All four of the igloos were intact and accessible but a gate limits access to this area. Crab Orchard Lake is west and south AUS-0060, and open fields surround it on all sides.. The area is generally flat with ditches directing drainage to a low-lying area just west of the internal road structure at the site.

Several abandoned drums were noted: five located west of FS-2-2, one located west of FS-1-2 and one located west of FS-1-1. All drums were rusted and the previous contents are unknown.

**37.1.5 Recommendations Based on Preliminary Assessment**

AUS-0060 was included in the Site Investigation (SI) because of the nature of past usage, the presence of abandoned drums, and because USEPA metals sample results exceeded Preliminary Assessment (PA) screening levels.

**37.2 SITE INVESTIGATION INFORMATION**

URS conducted a Site Investigation at AUS-0060 on May 3, 2000. The rationale for sample locations, media, and analytes is presented in the Field Sampling Plan (FSP)<sup>25</sup> for the AUS OU PA/SI. Since the time the FSP was prepared, additional information has become available, and the historic discussion (Section 37.1) has been updated to include that information. The sampling locations discussed below are based on the information that was available at the time the FSP was developed, and may not address all areas of potential releases.

AUS OU SI sample locations are shown on Figure 37-1. Survey coordinates for all sample locations in AUS-0060 are listed in Table 37-1. Table 37-2 lists the sample locations and the matrix sampled at that location. All samples are soil samples.

**37.2.1 Field Investigation**

Sampling was done in accordance with the FSP, except as noted.

**Drainageways/Ponded Areas**

Sample locations 0060-001 through 0060-004 were from drainageways that receive runoff from the igloo areas. Sample location 0060-006 was from an area of ponded water. When this sample location was selected, it was thought to be hydraulically connected with, and downstream of, the drainageways in the vicinity of the igloos. Note that the interpreted topography shown in Figure 37-1 suggests that this area is actually upstream of the drainage ditches.

All samples were collected in accordance with the tables in the Field Sampling Plan, except for surface water sample AUS-0060-006-SW-00 which was not taken because there was no surface water present at that location.

<sup>25</sup> U.S. Fish & Wildlife Service, Department of the Interior, March 2000, Draft Final Field Sampling Plan Site Inspection, Additional and Uncharacterized Sites Operable Unit, Crab Orchard National Wildlife Refuge Superfund Site, Marion, Illinois (Williamson County), prepared by URS Corporation.

**Abandoned Drums**

Sample location 0060-005 was collected from an area northwest of igloo FS-2-2, where five drums lay abandoned.

**37.2.2 Field Results****37.2.2.1 Site Conditions****37.2.2.1.1 *Geologic Conditions***

There were no test pits or monitoring wells installed at AUS-0060. Soil from hand auger borings, which extended to a depth of one ft, was described as silty clay fill.

**37.2.2.1.2 *Hydrogeologic Conditions***

No hydrogeological information is available for this site.

**37.2.2.1.3 *Hydrologic Conditions***

Site drainage is toward the west, as shown in Figure 37-1. There is a low-lying area where site runoff collects, west of the roadway loop. There is a ponded area near sample location 0060-006, which does not appear on the topographic map prepared for the site. Apparently, the dense vegetation obscured the topography, even though the aerial photography upon which it is based was done in January.

**37.2.2.2 Chemical Results**

Table 37-3 lists the chemicals detected at AUS-0060 during this investigation, along with the frequency and range of detections. Tabulated results of all analyses are included in the Quality Control Summary Report (QCSR). All results are shown in Figure 37-1.

**37.3 SCREENING RISK ASSESSMENT**

Results of the screening are presented in Tables 37-4 and 37-5 as follows:

- Table 37-4--human health risk screening for soils, and
- Table 37-5--ecological risk screening for soils.

Each table lists the maximum detected concentration for each constituent analyzed at AUS-0060. The screening results are presented in the tables in terms of hazard quotients (HQs). The HQ for any chemical detected, for any particular screening criterion is simply the ratio of the maximum detected concentration to the screening concentration. For human health for carcinogens, a screening level "cancer risk" is calculated instead of an HQ.

Chemicals that are shaded in the tables are those that exceeded the screening criteria, and are identified as chemicals of potential concern (COPCs) for human health risk, and chemicals of potential ecological concern (COPECs) for ecological risk. The only COPCs/COPECs not

shaded in the table are those inorganic constituents that exceeded the screening criteria but were detected at levels below Refuge background.

In cases where the chemical was analyzed but not detected, the HQ is the ratio between the maximum reporting limit and the screening concentration. Chemicals not detected are identified with a “U” qualifier in the qualifier column. When these HQ values exceed one, they are not shaded. These constituents are not identified as COPCs/COPECs, but rather as uncertainties.

In Figure 37-1 the shading convention used is the same as for the tables discussed above. The particular screening criteria exceeded are indicated by the code in the analytical results labels. Duplicate results are shown only if the duplicate result for an analyte exceeded the screening criteria and the result from the original sample did not; or, if the analyte was detected in the duplicate and not in the original sample. Since in the screening process results which are qualified as estimated (coded with “J”) are treated the same as unqualified results, data qualifiers are not included in the results shown in the figures. Refer to the QCSR for data qualifiers.

Tables 37-6 (human health risk) and 37-7 (ecological risk) list all the analytes and corresponding media sampled and indicate whether each is a COPC (or COPEC), not a COPC (or COPEC), or an uncertainty. The codes in the tables indicate the rationale for each classification. All COPCs (Table 37-6) and COPECs (Table 37-7) are shaded in the tables.

### **37.3.1 Human Health Risk**

#### **37.3.1.1 Soil**

Human health screening results for soil samples are presented in Table 37-4. For carcinogens, a cancer risk was calculated using the USEPA Region 9 Industrial Soil Preliminary Remediation Goals (PRGs) as screening values. The cancer risk was derived by calculating a ratio of the maximum detected concentrations, or the maximum reporting limits, to their appropriate screening values. These ratios were then multiplied by  $1 \times 10^{-6}$ . In addition, ratios were calculated using the USEPA Region 9 Industrial Soil PRG for Toxins, the USEPA Region 9 Migration to Groundwater Criteria (Dilution Attenuation Factor (DAF)=1), the Illinois TACO Industrial/Commercial Soil Ingestion Criteria, the Illinois TACO Construction Worker Soil Ingestion Criteria, and the Illinois Tiered Approach to Corrective Action Objectives (TACO) Class I Soil Component of Groundwater Criteria.

### **37.3.2 Ecological Risk**

#### **37.3.2.1 Soil**

Ecological screening results for soil samples are presented in Table 37-5. Soil screening concentrations for direct exposures were developed using toxicity reference values (TRVs) derived from several sources, including the following:

- USEPA (2000)<sup>26</sup>
- Environment Canada (1995)<sup>27</sup>

<sup>26</sup> USEPA. 2000. Ecological Soil Screening Level Guidance (Draft). USEPA Office of Emergency and Remedial Response, Washington, DC.



- Talmage *et al.* (1999)<sup>28</sup>
- Efroymsen *et al.* (1997a, 1997b)<sup>29</sup>
- CCME (1999)<sup>30</sup>
- MHSPE (1994)<sup>31</sup>
- Other sources

A detailed discussion of the screening concentration selection is presented in Appendix G.

The screening approach for ingestion pathway exposures was based on the potential for a chemical to bioaccumulate. The potential for a chemical to bioaccumulate was based on the organic chemical-specific octanol-to-water partitioning coefficient ( $K_{ow}$ ), which provides an indication of the lipophilicity of an organic chemical, and its potential for sequestration in biological tissue. The document *Assessment and Control of Bioconcentratable Contaminants in Surface Waters* (USEPA 1991)<sup>32</sup> used a log  $K_{ow}$  of 3.5 as a target threshold value indicative of bioaccumulative chemicals to target organic chemicals of greatest concern. Using this as a guideline, organic chemicals with a log  $K_{ow}$  greater than 3.5 were considered potentially bioaccumulative chemicals. Among inorganics, mercury and selenium were considered as potentially bioaccumulative chemicals. Any potentially bioaccumulative chemical that is detected was retained as a COPEC.

#### 37.4 SCIENTIFIC MANAGEMENT DECISION POINT

A Remedial Investigation (RI) is recommended for Site AUS-0060, based on exceedances of the SI screening criteria, and on the USEPA 1998 sample results, as discussed below.

This report recommends that inorganic constituents that exceeded project screening criteria but were within Refuge background levels not necessarily be retained as COPCs/COPECs for further evaluation. These are the constituents coded with “D” on the COPC list, Table 37-6; and on the COPEC list, Table 37-7. COPCs in this category include antimony, chromium, nickel, and selenium in soil. COPECs coded with “D” on Table 37-7 include boron, chromium, manganese, and selenium in soil. These chemicals may be included in the RI for other reasons, but the

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<sup>27</sup> Environment Canada. 1995. Toxicity Testing of NCSRP Priority Substances for Development of Soil Quality Guidelines for Contaminated Sites. Guidelines Division, Evaluation and Interpretation Branch, Environmental Conservation Directorate, Environment Canada. Hull, Quebec.

<sup>28</sup> Talmage, S.S., D.M. Opresko, C.J. Maxwell, C.J.E. Welsh, F. M. Cretella, P.H. Reno, and F. B. Daniel. 1999. Nitroaromatic Munition Compounds: Environmental Effects and Screening Values. *Rev Environ. Contam. Toxicol* 161:1-156.

<sup>29</sup> Efroymsen, R.A., M.E. Will, G.W. Suter II, and A.C. Wooten. 1997a. *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision*. Oak Ridge National Laboratory, Oak Ridge, Tennessee. ES/ER/TM-85/R3.

Efroymsen, R.A., M.E. Will, and G.W. Suter II. 1997b. *Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision*. Oak Ridge National Laboratory, Oak Ridge, Tennessee. ES/ER/TM-126/R2.

<sup>30</sup> Canadian Council of Ministers of the Environment. 1999. Canadian Environmental Quality Guidelines.

<sup>31</sup> Ministry of Housing, Spatial Planning, and the Environment (MHSPE). 1994. *Intervention Values and Target Values – Soil Quality Standards*. Directorate General for Environmental Protection, Department of Soil Protection, The Hague, The Netherlands.

<sup>32</sup> USEPA 1991. *Assessment and Control of Bioconcentratable Contaminants in Surface Waters (Draft)*. US Environmental Protection Agency Office of Research and Development, Washington, D.C.

detections at the locations noted are not considered to be of concern since they are below Refuge background levels. All other COPCs/COPECs listed on these tables should be investigated in the RI. In addition, all analytes listed as uncertainties on these tables should be considered for further evaluation in the RI Work Plan.

Risk screening results in Tables 37-4 and 37-5 do not suggest significant concerns at Site AUS-0060. However, the USEPA 1998 soil sample results (not reflected in Tables 37-4 and 37-5) had detections of two metals at the site that substantially exceeded human health and ecological screening criteria and Refuge background (arsenic at 180 mg/kg and lead at 470 mg/kg). The Refuge background 95 percent upper tolerance limit (UTL) was calculated at 13.5 mg/kg for arsenic and 23.4 mg/kg for lead. The USEPA sample was taken near the concrete pad in front of the southernmost igloo (Figure 37-1).

As discussed above in Subsection 37.2.1, none of the SI samples were taken from the igloo pad areas. Four of the SI samples (0060-001 through 0060-004) were taken from drainageways that receive runoff from the igloo areas and two were taken at other locations farther from the igloo areas (0060-005 and 0060-006). Interestingly, all the samples from the drainageways near the igloos (0060-001 through 0060-004) had arsenic concentrations (13.5, 12.2, 11.2, and 12.2, mg/kg, respectively) at or near the upper end of the Refuge background range, and above the average Refuge background concentration for arsenic of 7.2 mg/kg.<sup>33</sup> The two samples that were not located in the drainageways (0060-005 and 0060-006) had arsenic concentrations close to the average for Refuge background (8 and 5.9 mg/kg, respectively). A similar relationship was noted for lead. The average lead concentration in Refuge background samples is 15.5 mg/kg. Lead concentrations in Samples 0060-001 through 0060-004 were 22.5, 17.8, 17.3, and 26.1 mg/kg, respectively. Lead concentrations at the other two locations were 12.2 mg/kg (0060-005) and 13.2 mg/kg (0060-006). Similar trends were noted with other inorganic results. The following inorganic constituents were all detected at higher concentrations in all of the drainageway samples compared to the other two samples: antimony (detected in all drainageway samples and non-detect in the other two samples), barium, beryllium, boron, chromium, cobalt, iron, magnesium, nickel, vanadium, and zinc. In addition, mercury was detected at or above background at three of the four drainageway sample locations, but was below background at the other two locations.

These data suggest that the igloo pad areas may represent localized sources of metals contamination that have not migrated far from the pads. Based on these data, this report recommends that a RI be done at Site AUS-0060. The report recommends that the RI focus, at least initially, on the entrance pads to the igloos. Sample analysis should include, at a minimum, the Target Analyte List (TAL) list of inorganic constituents, plus explosive compounds, since the igloos were used for explosives storage.

Chemicals that exceeded screening criteria and Refuge background (if applicable) are listed in Table 37-8.

Other areas of the site and media and contaminants in addition to those addressed in this study may warrant investigation in the RI. These issues will be addressed in the work plan for the RI.

<sup>33</sup> Arsenic and lead were both found to be normally distributed.

In addition, all analytes listed as uncertainties on these tables should be considered for further evaluation in the RI Work Plan.

**TABLE 37-1  
SURVEY COORDINATES FOR SAMPLE LOCATIONS IN AUS-0060**

<b>Sample Location</b>	<b>Northing</b>	<b>Easting</b>	<b>Ground Surface Elevation</b>	<b>Top of Casing Elevation</b>	<b>Comments</b>
0060-001	384644.3	773182.3	413.25	NA	
0060-002	384637.0	773320.2	415.71	NA	
0060-003	384691.5	773218.5	414.66	NA	
0060-004	384834.1	773312.6	418.55	NA	
0060-005	384894.4	773232.8	419.10	NA	
0060-006	384574.9	773127.6	411.01	NA	

Sheet 1 of 1

NA = Not Applicable

TABLE 37-1A  
1998 USEPA SOIL SAMPLE ANALYTICAL RESULTS SUMMARY

Sample ID	Constituent	Result (mg/kg)
60-1	Di-n-butylphthalate	0.43
	Aluminum	12,000
	Arsenic	180
	Barium	99
	Beryllium	0.4
	Calcium	61,000
	Chromium	17
	Cobalt	7.3
	Copper	10
	Iron	17,000
	Lead	470
	Magnesium	23,000
	Manganese	580
	Nickel	12
	Potassium	1,200
	Vanadium	29
Zinc	66	

Sheet 1 of 1

mg/kg = milligrams per kilogram

**TABLE 37-2  
MATRICES SAMPLED AT EACH  
SAMPLE LOCATION AT AUS-0060**

Soil
AUS-0060-001*
AUS-0060-002*
AUS-0060-003*
AUS-0060-004*
AUS-0060-005*
AUS-0060-006*

Sheet 1 of 1

- \* Note that the samples at this location were originally designated as sediment, but are actually soil samples.

TABLE 37-3  
SOIL SAMPLE ANALYTICAL RESULTS SUMMARY

Constituent	Number of Detections	Range of Detections
<b>Metals</b>		
Aluminum	6/6	10,700 mg/kg to 15,100 mg/kg
Antimony	4/6	0.27 mg/kg to 0.52 mg/kg
Arsenic	6/6	5.9 mg/kg to 13.5 mg/kg
Barium	6/6	72.4 mg/kg to 383 mg/kg
Beryllium	6/6	0.42 mg/kg to 0.75 mg/kg
Boron	5/6	0.69 mg/kg to 3.1 mg/kg
Calcium	6/6	201 mg/kg to 7,200 mg/kg
Chromium, Total	6/6	12.8 mg/kg to 22 mg/kg
Cobalt	6/6	4.9 mg/kg to 14.3 mg/kg
Copper	6/6	7.8 mg/kg to 14 mg/kg
Iron	6/6	14,300 mg/kg to 24,400 mg/kg
Lead	6/6	12.2 mg/kg to 26.1 mg/kg
Magnesium	6/6	1,450 mg/kg to 5,510 mg/kg
Manganese	6/6	345 mg/kg to 3,170 mg/kg
Mercury	6/6	0.022 mg/kg to 0.14 mg/kg
Nickel	6/6	8.9 mg/kg to 18.8 mg/kg
Potassium	6/6	587 mg/kg to 986 mg/kg
Selenium	6/6	0.99 mg/kg to 2 mg/kg
Sodium	6/6	35.9 mg/kg to 46.9 mg/kg
Thallium	1/6	0.54 mg/kg
Vanadium	6/6	27.4 mg/kg to 43.6 mg/kg
Zinc	6/6	32.4 mg/kg to 149 mg/kg

Sheet 1 of 1

mg/kg = milligrams per kilogram

Notes: This table was derived from the figures that show the analytical results. As a result, duplicates are shown only if the duplicate result for an analyte exceeded the screening criteria and the result from the original sample did not; or, if the analyte was detected in the duplicate and not in the original sample. There may be some duplicate results, not shown in the table, that are outside the range shown. In addition, the frequency and range of detections is based on the number of sample locations, not the total number of samples (the total number of samples includes originals plus duplicates).

Checked by: MMF 7/20/01

**TABLE 37-4  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0060**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
<b>Volatile Organic Compounds</b>								
71-55-6	1,1,1-Trichloroethane	6	U	UG/KG			1.80E-06	6.00E-02
79-34-5	1,1,2,2-Tetrachloroethane	6	U	UG/KG		6.68E-09	1.54E-06	3.00E+01
79-00-5	1,1,2-Trichloroethane	6	U	UG/KG		3.16E-09	3.94E-05	6.67E+00
75-34-3	1,1-Dichloroethane	6	U	UG/KG			2.91E-06	6.00E-03
75-35-4	1,1-Dichloroethene	6	U	UG/KG		5.05E-08	8.91E-05	2.00E+00
107-06-2	1,2-Dichloroethane (EDC)	6	U	UG/KG		7.85E-09	1.70E-04	6.00E+00
540-59-0	1,2-Dichloroethene (total)	6	U	UG/KG			4.07E-05	3.00E-01
78-87-5	1,2-Dichloropropane	6	U	UG/KG		7.81E-09	2.82E-04	6.00E+00
78-93-3	2-Butanone (MEK)	12	U	UG/KG			4.33E-07	
591-78-6	2-Hexanone	12	U	UG/KG				
108-10-1	4-Methyl-2-pentanone (MIBK)	12	U	UG/KG			4.16E-06	
67-64-1	Acetone	12	U	UG/KG			1.93E-06	1.50E-02
71-43-2	Benzene	6	U	UG/KG		4.10E-09	2.48E-04	3.00E+00
75-27-4	Bromodichloromethane	6	U	UG/KG		2.55E-09	5.75E-06	2.00E-01
75-25-2	Bromoform	6	U	UG/KG		1.92E-11	3.41E-07	1.50E-01
74-83-9	Bromomethane	6	U	UG/KG			4.57E-04	6.00E-01
75-15-0	Carbon disulfide	6	U	UG/KG			4.96E-06	3.00E-03
56-23-5	Carbon tetrachloride	6	U	UG/KG		1.13E-08	8.58E-04	2.00E+00
108-90-7	Chlorobenzene	6	U	UG/KG			1.11E-05	8.57E-02
75-00-3	Chloroethane	6	U	UG/KG		9.22E-10	3.18E-07	
67-66-3	Chloroform	6	U	UG/KG		1.15E-08	4.66E-03	2.00E-01
74-87-3	Chloromethane	6	U	UG/KG		2.25E-09		
156-59-2	cis-1,2-Dichloroethene	6	U	UG/KG			4.07E-05	3.00E-01

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect



**TABLE 37-4  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0060**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
10061-01-5	cis-1,3-Dichloropropene	6	U	UG/KG		3.37E-08	1.36E-04	
124-48-1	Dibromochloromethane	6	U	UG/KG		2.26E-09	3.77E-06	3.00E-01
100-41-4	Ethylbenzene	6	U	UG/KG			1.00E-06	8.57E-03
75-09-2	Methylene chloride	6	U	UG/KG		2.92E-10	6.14E-07	6.00E+00
110-54-3	N-Hexane	6	U	UG/KG			1.49E-05	
100-42-5	Styrene	6	U	UG/KG			2.94E-07	3.00E-02
127-18-4	Tetrachloroethylene (PCE)	6	U	UG/KG		3.21E-10	3.52E-06	2.00E+00
108-88-3	Toluene	6	U	UG/KG			3.02E-06	1.00E-02
1330-20-7	total Xylenes	6	U	UG/KG			1.35E-06	6.00E-04
156-60-5	trans-1,2-Dichloroethene	6	U	UG/KG			2.80E-05	2.00E-01
10061-02-6	trans-1,3-Dichloropropene	6	U	UG/KG		3.37E-08	1.36E-04	
79-01-6	Trichloroethylene (TCE)	6	U	UG/KG		9.81E-10	7.59E-05	2.00E+00
75-01-4	Vinyl chloride	6	U	UG/KG		1.23E-07		8.57E+00
<b>Explosives</b>								
99-35-4	1,3,5-Trinitrobenzene	340	UJ	UG/KG			1.29E-05	
99-65-0	1,3-Dinitrobenzene	340	UJ	UG/KG			3.86E-03	
118-96-7	2,4,6-Trinitrotoluene (TNT)	680	UJ	UG/KG		8.27E-09	1.54E-03	
121-14-2	2,4-Dinitrotoluene	340	UJ	UG/KG			1.93E-04	8.50E+03
606-20-2	2,6-Dinitrotoluene	680	UJ	UG/KG			7.72E-04	2.27E+04
35572-78-2	2-Amino-4,6-Dinitrotoluene	680	UJ	UG/KG				
88-72-2	2-Nitrotoluene (ONT)	680	UJ	UG/KG				
99-08-1	3-Nitrotoluene	680	UJ	UG/KG			3.35E-04	
19406-51-0	4-Amino-2,6-Dinitrotoluene	680	UJ	UG/KG				
99-99-0	4-Nitrotoluene (PNT)	680	UJ	UG/KG			3.35E-04	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

TABLE 37-4

## HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0060

ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
2691-41-0	HMX	680	UJ	UG/KG			1.54E-05	
98-95-3	Nitrobenzene	340	UJ	UG/KG			2.97E-03	
121-82-4	RDX	680	UJ	UG/KG		3.03E-08	2.57E-04	
479-45-8	Tetryl	1000	UJ	UG/KG			1.14E-04	
<b>Metals</b>								
7429-90-5	Aluminum	15100		MG/KG	5.24E-01		9.01E-03	
7440-36-0	Antimony	0.52	J	MG/KG	6.27E-01		6.36E-04	1.73E+00
7440-38-2	Arsenic	13.5		MG/KG	1.00E+00	4.95E-06	3.07E-02	1.35E+01
7440-39-3	Barium	383		MG/KG	1.96E+00		3.08E-03	4.79E+00
7440-41-7	Beryllium	0.75		MG/KG	9.87E-01	3.35E-10	2.03E-04	2.50E-01
7440-42-8	Boron	3.1	J	MG/KG	5.85E-01		3.92E-05	
7440-43-9	Cadmium	0.68	U	MG/KG	3.58E+00	2.28E-10	8.40E-04	1.70E+00
7440-70-2	Calcium	7200		MG/KG	2.88E+00			
7440-47-3	Chromium	22		MG/KG	8.73E-01	4.91E-08		1.10E+01
7440-48-4	Cobalt	14.3		MG/KG	6.59E-01		1.17E-04	
7440-50-8	Copper	14		MG/KG	1.24E+00		1.84E-04	
7439-89-6	Iron	24400		MG/KG	1.26E+00		3.98E-02	
7439-92-1	Lead	26.1	J	MG/KG	1.12E+00			
7439-95-4	Magnesium	5510		MG/KG	3.55E+00			
7439-96-5	Manganese	3170		MG/KG	8.71E-01		9.83E-02	
7439-97-6	Mercury	0.14		MG/KG	2.33E+00			
7440-02-0	Nickel	18.8		MG/KG	9.95E-01		4.60E-04	2.69E+00
2023695	Potassium	986		MG/KG	1.58E+00			
7782-49-2	Selenium	2		MG/KG	8.55E-01		1.96E-04	6.67E+00

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 37-4  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0060**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
7440-22-4	Silver	1.4	U	MG/KG	2.41E+00		1.37E-04	7.00E-01
7440-23-5	Sodium	46.9	J	MG/KG	2.76E-01			
7440-28-0	Thallium	0.54	J	MG/KG	1.32E+00		3.77E-06	
7440-62-2	Vanadium	43.6		MG/KG	9.24E-01		3.05E-03	1.45E-01
7440-66-6	Zinc	149		MG/KG	2.90E+00		2.43E-04	2.48E-01

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TABLE 37-4

## HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0060

ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
<b>Volatile Organic Compounds</b>							
71-55-6	1,1,1-Trichloroethane	6	U	UG/KG			3.00E-03
79-34-5	1,1,2,2-Tetrachloroethane	6	U	UG/KG			
79-00-5	1,1,2-Trichloroethane	6	U	UG/KG	7.32E-07	7.32E-07	3.00E-01
75-34-3	1,1-Dichloroethane	6	U	UG/KG	3.00E-08	3.00E-08	2.61E-04
75-35-4	1,1-Dichloroethene	6	U	UG/KG	3.33E-07	3.33E-06	1.00E-01
107-06-2	1,2-Dichloroethane (EDC)	6	U	UG/KG	9.52E-05	4.29E-06	3.00E-01
540-59-0	1,2-Dichloroethene (total)	6	U	UG/KG	3.00E-07	3.00E-07	1.50E-02
78-87-5	1,2-Dichloropropane	6	U	UG/KG	7.14E-05	3.33E-06	2.00E-01
78-93-3	2-Butanone (MEK)	12	U	UG/KG			
591-78-6	2-Hexanone	12	U	UG/KG			
108-10-1	4-Methyl-2-pentanone (MIBK)	12	U	UG/KG			
67-64-1	Acetone	12	U	UG/KG	6.00E-08	6.00E-08	7.50E-04
71-43-2	Benzene	6	U	UG/KG	3.00E-05	1.40E-06	2.00E-01
75-27-4	Bromodichloromethane	6	U	UG/KG	6.52E-05	3.00E-06	1.00E-02
75-25-2	Bromoform	6	U	UG/KG	8.33E-06	3.75E-07	7.50E-03
74-83-9	Bromomethane	6	U	UG/KG	2.07E-06	6.00E-06	3.00E-02
75-15-0	Carbon disulfide	6	U	UG/KG	3.00E-08	3.00E-07	1.88E-04
56-23-5	Carbon tetrachloride	6	U	UG/KG	1.36E-04	1.46E-05	8.57E-02
108-90-7	Chlorobenzene	6	U	UG/KG	1.46E-07	1.46E-06	6.00E-03
75-00-3	Chloroethane	6	U	UG/KG			
67-66-3	Chloroform	6	U	UG/KG	6.38E-06	3.00E-06	1.00E-02
74-87-3	Chloromethane	6	U	UG/KG			
156-59-2	cis-1,2-Dichloroethene	6	U	UG/KG	3.00E-07	3.00E-07	1.50E-02

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**TABLE 37-4  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0060**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
10061-01-5	cis-1,3-Dichloropropene	6	U	UG/KG			
124-48-1	Dibromochloromethane	6	U	UG/KG	1.46E-07	1.46E-07	1.50E-02
100-41-4	Ethylbenzene	6	U	UG/KG	3.00E-08	3.00E-07	4.62E-04
75-09-2	Methylene chloride	6	U	UG/KG	7.89E-06	5.00E-07	3.00E-01
110-54-3	N-Hexane	6	U	UG/KG			
100-42-5	Styrene	6	U	UG/KG	1.46E-08	1.46E-07	1.50E-03
127-18-4	Tetrachloroethylene (PCE)	6	U	UG/KG	5.45E-05	2.50E-06	1.00E-01
108-88-3	Toluene	6	U	UG/KG	1.46E-08	1.46E-08	5.00E-04
1330-20-7	total Xylenes	6	U	UG/KG	6.00E-09	1.46E-08	4.00E-05
156-60-5	trans-1,2-Dichloroethene	6	U	UG/KG	1.46E-07	1.46E-07	8.57E-03
10061-02-6	trans-1,3-Dichloropropene	6	U	UG/KG			
79-01-6	Trichloroethylene (TCE)	6	U	UG/KG	1.15E-05	5.00E-06	1.00E-01
75-01-4	Vinyl chloride	6	U	UG/KG	2.00E-03	9.23E-05	6.00E-01
<b>Explosives</b>							
99-35-4	1,3,5-Trinitrobenzene	340	UJ	UG/KG			
99-65-0	1,3-Dinitrobenzene	340	UJ	UG/KG			
118-96-7	2,4,6-Trinitrotoluene (TNT)	680	UJ	UG/KG			
121-14-2	2,4-Dinitrotoluene	340	UJ	UG/KG	4.05E-02	1.89E-03	4.25E+02
606-20-2	2,6-Dinitrotoluene	680	UJ	UG/KG	8.10E-02	3.78E-03	9.71E+02
35572-78-2	2-Amino-4,6-Dinitrotoluene	680	UJ	UG/KG			
88-72-2	2-Nitrotoluene (ONT)	680	UJ	UG/KG			
99-08-1	3-Nitrotoluene	680	UJ	UG/KG			
19406-51-0	4-Amino-2,6-Dinitrotoluene	680	UJ	UG/KG			
99-99-0	4-Nitrotoluene (PNT)	680	UJ	UG/KG			

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J = Estimated U = Nondetect

**TABLE 37-4**  
**HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0060**

**ADDITIONAL AND UNCHARACTERIZED SITES OU**  
**CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
2691-41-0	HMX	680	UJ	UG/KG			
98-95-3	Nitrobenzene	340	UJ	UG/KG	3.40E-04	3.40E-04	3.40E+00
121-82-4	RDX	680	UJ	UG/KG			
479-45-8	Tetryl	1000	UJ	UG/KG			
<b>Metals</b>							
7429-90-5	Aluminum	15100		MG/KG			
7440-36-0	Antimony	0.52	J	MG/KG	6.34E-04	6.34E-03	1.04E-01
7440-38-2	Arsenic	13.5		MG/KG	4.50E+00	2.21E-01	4.82E-01
7440-39-3	Barium	383		MG/KG	2.74E-03	2.74E-02	3.19E-01
7440-41-7	Beryllium	0.75		MG/KG	7.50E-01	2.59E-02	1.14E-01
7440-42-8	Boron	3.1	J	MG/KG	1.72E-05	1.72E-04	
7440-43-9	Cadmium	0.68	U	MG/KG	3.40E-04	3.40E-03	1.84E-01
7440-70-2	Calcium	7200		MG/KG			
7440-47-3	Chromium	22		MG/KG	2.20E-03	5.37E-03	7.86E-01
7440-48-4	Cobalt	14.3		MG/KG	1.19E-04	1.19E-03	
7440-50-8	Copper	14		MG/KG	1.71E-04	1.71E-03	1.27E-03
7439-89-6	Iron	24400		MG/KG			
7439-92-1	Lead	26.1	J	MG/KG	6.53E-02	6.53E-02	
7439-95-4	Magnesium	5510		MG/KG			
7439-96-5	Manganese	3170		MG/KG	3.30E-02	3.30E-01	
7439-97-6	Mercury	0.14		MG/KG	2.30E-04	2.30E-03	9.33E-01
7440-02-0	Nickel	18.8		MG/KG	4.59E-04	4.59E-03	2.47E-01
2023695	Potassium	986		MG/KG			
7782-49-2	Selenium	2		MG/KG	2.00E-04	2.00E-03	8.33E-01

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 37-4  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0060**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
7440-22-4	Silver	1.4	U	MG/KG	1.40E-04	1.40E-03	9.33E-01
7440-23-5	Sodium	46.9	J	MG/KG			
7440-28-0	Thallium	0.54	J	MG/KG	3.38E-03	3.38E-03	2.25E-01
7440-62-2	Vanadium	43.6		MG/KG	3.11E-03	3.11E-02	4.45E-02
7440-66-6	Zinc	149		MG/KG	2.44E-04	2.44E-03	4.14E-02

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 37-5  
ECOLOGICAL SCREENING OF SOIL RESULTS FROM AUS-0060**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Background (SOIL)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ) (SOIL)	Retained as Potential Bioaccumulator
<b>Volatile Organic Compounds</b>							
71-55-6	1,1,1-Trichloroethane		6	U	UG/KG	2.01E-04	
79-34-5	1,1,2,2-Tetrachloroethane		6	U	UG/KG	4.72E-02	
79-00-5	1,1,2-Trichloroethane		6	U	UG/KG	2.10E-04	
75-34-3	1,1-Dichloroethane		6	U	UG/KG	2.99E-04	
75-35-4	1,1-Dichloroethene		6	U	UG/KG	7.25E-04	
107-06-2	1,2-Dichloroethane (EDC)		6	U	UG/KG	2.83E-04	
540-59-0	1,2-Dichloroethene (total)		6	U	UG/KG	7.62E-03	
78-87-5	1,2-Dichloropropane		6	U	UG/KG	8.57E-06	
78-93-3	2-Butanone (MEK)		12	U	UG/KG	1.34E-04	
591-78-6	2-Hexanone		12	U	UG/KG	9.52E-04	
108-10-1	4-Methyl-2-pentanone (MIBK)		12	U	UG/KG	2.71E-05	
67-64-1	Acetone		12	U	UG/KG	4.80E-03	
71-43-2	Benzene		6	U	UG/KG	3.75E-04	
75-27-4	Bromodichloromethane		6	U	UG/KG	1.11E-02	
75-25-2	Bromoform		6	U	UG/KG	3.77E-04	
74-83-9	Bromomethane		6	U	UG/KG	2.55E-02	
75-15-0	Carbon disulfide		6	U	UG/KG	6.37E-02	
56-23-5	Carbon tetrachloride		6	U	UG/KG	6.00E-06	
108-90-7	Chlorobenzene		6	U	UG/KG	1.50E-04	
75-00-3	Chloroethane		6	U	UG/KG		
67-66-3	Chloroform		6	U	UG/KG	5.04E-03	
74-87-3	Chloromethane		6	U	UG/KG	5.77E-04	
156-59-2	cis-1,2-Dichloroethene		6	U	UG/KG	7.62E-03	
10061-01-5	cis-1,3-Dichloropropene		6	U	UG/KG	1.51E-02	
124-48-1	Dibromochloromethane		6	U	UG/KG	2.93E-03	
100-41-4	Ethylbenzene		6	U	UG/KG	1.20E-03	
75-09-2	Methylene chloride		6	U	UG/KG	1.48E-03	
110-54-3	N-Hexane		6	U	UG/KG		
100-42-5	Styrene		6	U	UG/KG	2.00E-05	
127-18-4	Tetrachloroethylene (PCE)		6	U	UG/KG	4.62E-04	
108-88-3	Toluene		6	U	UG/KG	2.00E-03	
1330-20-7	total Xylenes		6	U	UG/KG	1.00E-02	
156-60-5	trans-1,2-Dichloroethene		6	U	UG/KG	7.62E-03	
10061-02-6	trans-1,3-Dichloropropene		6	U	UG/KG	1.51E-02	
79-01-6	Trichloroethylene (TCE)		6	U	UG/KG	6.67E-04	
75-01-4	Vinyl chloride		6	U	UG/KG	9.29E-03	
<b>Explosives</b>							
99-35-4	1,3,5-Trinitrobenzene		340	UJ	UG/KG	9.04E-01	
99-65-0	1,3-Dinitrobenzene		340	UJ	UG/KG	5.19E-01	
118-96-7	2,4,6-Trinitrotoluene (TNT)		680	UJ	UG/KG	2.27E-02	
121-14-2	2,4-Dinitrotoluene		340	UJ	UG/KG	2.66E-01	

ND = Not Detected E = Outside of Range UJ - Estimated Nondetect  
J = Estimated U = Nondetect



**TABLE 37-5  
ECOLOGICAL SCREENING OF SOIL RESULTS FROM AUS-0060**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Background (SOIL)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ) (SOIL)	Retained as Potential Bioaccumulator
606-20-2	2,6-Dinitrotoluene		680	UJ	UG/KG	2.07E+01	
35572-78-2	2-Amino-4,6-Dinitrotoluene		680	UJ	UG/KG	8.50E-03	
88-72-2	2-Nitrotoluene (ONT)		680	UJ	UG/KG		
99-08-1	3-Nitrotoluene		680	UJ	UG/KG		
19406-51-0	4-Amino-2,6-Dinitrotoluene		680	UJ	UG/KG		
99-99-0	4-Nitrotoluene (PNT)		680	UJ	UG/KG		
2691-41-0	HMX		680	UJ	UG/KG	2.72E-02	
98-95-3	Nitrobenzene		340	UJ	UG/KG	8.50E-03	
121-82-4	RDX		680	UJ	UG/KG	6.80E-03	
479-45-8	Tetryl		1000	UJ	UG/KG		
<b>Metals</b>							
7429-90-5	Aluminum	28800	15100		MG/KG		
7440-36-0	Antimony	0.83	0.52	J	MG/KG	1.04E-01	
7440-38-2	Arsenic	13.5	13.5		MG/KG	1.50E+00	
7440-39-3	Barium	195	383		MG/KG	7.66E-01	
7440-41-7	Beryllium	0.76	0.75		MG/KG	7.50E-02	
7440-42-8	Boron	5.3	3.1	J	MG/KG	6.20E+00	
7440-43-9	Cadmium	0.19	0.68	U	MG/KG	2.34E-02	
7440-70-2	Calcium	2497	7200		MG/KG		
7440-47-3	Chromium	25.2	22		MG/KG	4.40E+00	
7440-48-4	Cobalt	21.7	14.3		MG/KG	7.15E-01	
7440-50-8	Copper	11.3	14		MG/KG	4.52E-01	
7439-89-6	Iron	19306	24400		MG/KG	1.22E+02	
7439-92-1	Lead	23.4	26.1	J	MG/KG	6.03E-02	
7439-95-4	Magnesium	1552	5510		MG/KG		
7439-96-5	Manganese	3640	3170		MG/KG	3.17E+01	
7439-97-6	Mercury	0.06	0.14		MG/KG	2.00E-02	YES
7440-02-0	Nickel	18.9	18.8		MG/KG	6.27E-01	
2023695	Potassium	625	986		MG/KG		
7782-49-2	Selenium	2.34	2		MG/KG	2.00E+00	YES
7440-22-4	Silver	0.58	1.4	U	MG/KG	7.00E-01	
7440-23-5	Sodium	170	46.9	J	MG/KG		
7440-28-0	Thallium	0.41	0.54	J	MG/KG	5.40E-01	
7440-62-2	Vanadium	47.2	43.6		MG/KG	9.48E-01	
7440-66-6	Zinc	51.4	149		MG/KG	1.24E+00	

ND = Not Detected E = Outside of Range UJ - Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 37-6, AUS-0060  
SUMMARY OF HUMAN HEALTH COPC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Groundwater		Sediment		Soil	
	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale
<b>Volatile Organic Compounds</b>								
1,1,1-Trichloroethane	NA	NA	NA	NA	NA	NA	No	A
1,1,2,2-Tetrachloroethane	NA	NA	NA	NA	NA	NA	Uncertainty	B
1,1,2-Trichloroethane	NA	NA	NA	NA	NA	NA	Uncertainty	B
1,1-Dichloroethane	NA	NA	NA	NA	NA	NA	No	A
1,1-Dichloroethene	NA	NA	NA	NA	NA	NA	Uncertainty	B
1,2-Dichloroethane (EDC)	NA	NA	NA	NA	NA	NA	Uncertainty	B
1,2-Dichloroethene (total)	NA	NA	NA	NA	NA	NA	No	A
1,2-Dichloropropane	NA	NA	NA	NA	NA	NA	Uncertainty	B
2-Butanone (MEK)	NA	NA	NA	NA	NA	NA	No	A
2-Hexanone	NA	NA	NA	NA	NA	NA	No	C
4-Methyl-2-pentanone (MIBK)	NA	NA	NA	NA	NA	NA	No	A
Acetone	NA	NA	NA	NA	NA	NA	No	A
Benzene	NA	NA	NA	NA	NA	NA	Uncertainty	B
Bromodichloromethane	NA	NA	NA	NA	NA	NA	No	A
Bromoform	NA	NA	NA	NA	NA	NA	No	A
Bromomethane	NA	NA	NA	NA	NA	NA	No	A
Carbon disulfide	NA	NA	NA	NA	NA	NA	No	A
Carbon tetrachloride	NA	NA	NA	NA	NA	NA	Uncertainty	B
Chlorobenzene	NA	NA	NA	NA	NA	NA	No	A
Chloroethane	NA	NA	NA	NA	NA	NA	No	A
Chloroform	NA	NA	NA	NA	NA	NA	No	A
Chloromethane	NA	NA	NA	NA	NA	NA	No	A
cis-1,2-Dichloroethene	NA	NA	NA	NA	NA	NA	No	A
cis-1,3-Dichloropropene	NA	NA	NA	NA	NA	NA	No	A
Dibromochloromethane	NA	NA	NA	NA	NA	NA	No	A
Ethylbenzene	NA	NA	NA	NA	NA	NA	No	A
Methylene chloride	NA	NA	NA	NA	NA	NA	Uncertainty	B
N-Hexane	NA	NA	NA	NA	NA	NA	No	A
Styrene	NA	NA	NA	NA	NA	NA	No	A
Tetrachloroethylene (PCE)	NA	NA	NA	NA	NA	NA	Uncertainty	B
Toluene	NA	NA	NA	NA	NA	NA	No	A
total Xylenes	NA	NA	NA	NA	NA	NA	No	A
trans-1,2-Dichloroethene	NA	NA	NA	NA	NA	NA	No	A
trans-1,3-Dichloropropene	NA	NA	NA	NA	NA	NA	No	A
Trichloroethylene (TCE)	NA	NA	NA	NA	NA	NA	Uncertainty	B
Vinyl chloride	NA	NA	NA	NA	NA	NA	Uncertainty	B
<b>Semivolatile Organic Compounds</b>								
1,2,4-Trichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 37-6, AUS-0060  
SUMMARY OF HUMAN HEALTH COPC EVALUATION

AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Chemical	Surface Water		Groundwater		Sediment		Soil	
	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale
2,4,6-Trichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrophenol	NA	NA	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	NA	NA	NA	NA	NA	NA	NA	NA
2-Chlorophenol	NA	NA	NA	NA	NA	NA	NA	NA
1-Methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylphenol	NA	NA	NA	NA	NA	NA	NA	NA
2-Nitroaniline	NA	NA	NA	NA	NA	NA	NA	NA
2-Nitrophenol	NA	NA	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	NA	NA	NA	NA	NA	NA	NA	NA
3-Nitroaniline	NA	NA	NA	NA	NA	NA	NA	NA
4,6-Dinitro-2-methylphenol	NA	NA	NA	NA	NA	NA	NA	NA
4-Bromophenyl phenyl ether	NA	NA	NA	NA	NA	NA	NA	NA
4-Chloro-3-methylphenol	NA	NA	NA	NA	NA	NA	NA	NA
4-Chloroaniline	NA	NA	NA	NA	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	NA	NA	NA	NA	NA	NA	NA	NA
4-Methylphenol	NA	NA	NA	NA	NA	NA	NA	NA
4-Nitroaniline	NA	NA	NA	NA	NA	NA	NA	NA
4-Nitrophenol	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Chloroethoxy)methane	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Chloroethyl) ether	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Chloroisopropyl) ether	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Ethylhexyl) phthalate	NA	NA	NA	NA	NA	NA	NA	NA
Butyl benzyl phthalate	NA	NA	NA	NA	NA	NA	NA	NA
Carbazole	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-butyl phthalate	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-octyl phthalate	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA
Diethyl phthalate	NA	NA	NA	NA	NA	NA	NA	NA
Dimethyl phthalate	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA

**TABLE 37-6, AUS-0060  
SUMMARY OF HUMAN HEALTH COPC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Groundwater		Sediment		Soil	
	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale
Fluorene	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	NA	NA	NA	NA	NA	NA	NA	NA
Hexachloroethane	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-c,d)pyrene	NA	NA	NA	NA	NA	NA	NA	NA
Isophorone	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitroso-di-n-propylamine	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorophenol	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	NA	NA	NA	NA	NA	NA	NA	NA
Phenol	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	NA	NA	NA	NA	NA	NA	NA	NA
<b>Metals and Inorganics</b>								
Aluminum	NA	NA	NA	NA	NA	NA	No	F
Antimony	NA	NA	NA	NA	NA	NA	Yes	D
Arsenic	NA	NA	NA	NA	NA	NA	Yes	J
Barium	NA	NA	NA	NA	NA	NA	Yes	E
Beryllium	NA	NA	NA	NA	NA	NA	No	F
Boron	NA	NA	NA	NA	NA	NA	No	F
Cadmium	NA	NA	NA	NA	NA	NA	Uncertainty	B
Calcium	NA	NA	NA	NA	NA	NA	No	H
Chromium	NA	NA	NA	NA	NA	NA	Yes	D
Cobalt	NA	NA	NA	NA	NA	NA	No	F
Copper	NA	NA	NA	NA	NA	NA	No	F
Cyanide, Total	NA	NA	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	NA	NA	No	F
Lead	NA	NA	NA	NA	NA	NA	Yes	J
Magnesium	NA	NA	NA	NA	NA	NA	No	H
Manganese	NA	NA	NA	NA	NA	NA	No	F
Mercury	NA	NA	NA	NA	NA	NA	No	F
Nickel	NA	NA	NA	NA	NA	NA	Yes	D
Potassium	NA	NA	NA	NA	NA	NA	No	H
Selenium	NA	NA	NA	NA	NA	NA	Yes	D
Silver	NA	NA	NA	NA	NA	NA	No	A
Sodium	NA	NA	NA	NA	NA	NA	No	H
Thallium	NA	NA	NA	NA	NA	NA	No	F
Vanadium	NA	NA	NA	NA	NA	NA	No	F
Zinc	NA	NA	NA	NA	NA	NA	No	F
<b>Explosives</b>								
1,3,5-Trinitrobenzene	NA	NA	NA	NA	NA	NA	No	A
1,3-Dinitrobenzene	NA	NA	NA	NA	NA	NA	No	A

**TABLE 37-6, AUS-0060  
SUMMARY OF HUMAN HEALTH COPC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Groundwater		Sediment		Soil	
	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale
2,4,6-Trinitrotoluene (TNT)	NA	NA	NA	NA	NA	NA	No	A
2,4-Dinitrotoluene	NA	NA	NA	NA	NA	NA	Uncertainty	B
2,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA	Uncertainty	B
2-Amino-4,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA	No	C
2-Nitrotoluene (ONT)	NA	NA	NA	NA	NA	NA	No	C
3-Nitrotoluene	NA	NA	NA	NA	NA	NA	No	A
4-Amino-2,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA	No	C
4-Nitrotoluene (PNT)	NA	NA	NA	NA	NA	NA	No	A
HMX	NA	NA	NA	NA	NA	NA	No	A
Nitrobenzene	NA	NA	NA	NA	NA	NA	Uncertainty	B
Nitroglycerin	NA	NA	NA	NA	NA	NA	NA	NA
Pentaerythritol tetranitrate (PETN)	NA	NA	NA	NA	NA	NA	NA	NA
Perchloric Acid	NA	NA	NA	NA	NA	NA	NA	NA
RDX	NA	NA	NA	NA	NA	NA	No	A
Tetryl	NA	NA	NA	NA	NA	NA	No	A
<b>Other Parameters</b>								
Nitrogen, Nitrate-Nitrite	NA	NA	NA	NA	NA	NA	NA	NA
Phosphorus, Total (as P)	NA	NA	NA	NA	NA	NA	NA	NA

- A - Chemical was not detected and the reporting limit does not exceed the screening concentration.
- B - Chemical was not detected, but reporting limit was equal to or exceeded screening concentration.
- C - Chemical was not detected and there is no screening concentration.
- D - Chemical was detected and was equal to or exceeded screening concentration, but did not exceed background.
- E - Chemical was detected and was equal to or exceeded screening concentration and background, if applicable.
- F - Chemical was detected and did not exceed screening concentration.
- G - Chemical was detected, but no screening value was available.
- H - Chemical was detected, but it is an essential nutrient.
- J - Chemical was classified as a COPC based on USEPA 1998 data but was not a COPC based on SI data.
- NA - Not Analyzed or not applicable.

**TABLE 37-7, AUS-0060**  
**SUMMARY OF ECOLOGICAL COPEC EVALUATION**

**AUS OU PA/SI**  
**CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Sediment		Soil	
	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale
<b>Volatile Organic Compounds</b>						
1,1,1-Trichloroethane	NA	NA	NA	NA	No	A
1,1,2,2-Tetrachloroethane	NA	NA	NA	NA	No	A
1,1,2-Trichloroethane	NA	NA	NA	NA	No	A
1,1-Dichloroethane	NA	NA	NA	NA	No	A
1,1-Dichloroethene	NA	NA	NA	NA	No	A
1,2-Dichloroethane (EDC)	NA	NA	NA	NA	No	A
1,2-Dichloroethene (total)	NA	NA	NA	NA	No	A
1,2-Dichloropropane	NA	NA	NA	NA	No	A
2-Butanone (MEK)	NA	NA	NA	NA	No	A
2-Hexanone	NA	NA	NA	NA	No	A
4-Methyl-2-pentanone (MIBK)	NA	NA	NA	NA	No	A
Acetone	NA	NA	NA	NA	No	A
Benzene	NA	NA	NA	NA	No	A
Bromodichloromethane	NA	NA	NA	NA	No	A
Bromoform	NA	NA	NA	NA	No	A
Bromomethane	NA	NA	NA	NA	No	A
Carbon disulfide	NA	NA	NA	NA	No	A
Carbon tetrachloride	NA	NA	NA	NA	No	A
Chlorobenzene	NA	NA	NA	NA	No	A
Chloroethane	NA	NA	NA	NA	No	C
Chloroform	NA	NA	NA	NA	No	A
Chloromethane	NA	NA	NA	NA	No	A
cis-1,2-Dichloroethene	NA	NA	NA	NA	No	A
cis-1,3-Dichloropropene	NA	NA	NA	NA	No	A
Dibromochloromethane	NA	NA	NA	NA	No	A
Ethylbenzene	NA	NA	NA	NA	No	A
Methylene chloride	NA	NA	NA	NA	No	A
N-Hexane	NA	NA	NA	NA	No	C
Styrene	NA	NA	NA	NA	No	A
Tetrachloroethylene (PCE)	NA	NA	NA	NA	No	A
Toluene	NA	NA	NA	NA	No	A
total Xylenes	NA	NA	NA	NA	No	A
trans-1,2-Dichloroethene	NA	NA	NA	NA	No	A
trans-1,3-Dichloropropene	NA	NA	NA	NA	No	A
Trichloroethylene (TCE)	NA	NA	NA	NA	No	A
Vinyl chloride	NA	NA	NA	NA	No	A
<b>Semivolatile Organic Compounds</b>						
1,2,4-Trichlorobenzene	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	NA	NA	NA	NA	NA	NA

TABLE 37-7, AUS-0060  
SUMMARY OF ECOLOGICAL COPEC EVALUATION

AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Chemical	Surface Water		Sediment		Soil	
	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale
2,4,6-Trichlorophenol	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol	NA	NA	NA	NA	NA	NA
2,4-Dinitrophenol	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	NA	NA	NA	NA	NA	NA
2-Chlorophenol	NA	NA	NA	NA	NA	NA
1-Methylnaphthalene	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	NA	NA	NA	NA	NA	NA
2-Methylphenol	NA	NA	NA	NA	NA	NA
2-Nitroaniline	NA	NA	NA	NA	NA	NA
2-Nitrophenol	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	NA	NA	NA	NA	NA	NA
3-Nitroaniline	NA	NA	NA	NA	NA	NA
4,6-Dinitro-2-methylphenol	NA	NA	NA	NA	NA	NA
4-Bromophenyl phenyl ether	NA	NA	NA	NA	NA	NA
4-Chloro-3-methylphenol	NA	NA	NA	NA	NA	NA
4-Chloroaniline	NA	NA	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	NA	NA	NA	NA	NA	NA
4-Methylphenol	NA	NA	NA	NA	NA	NA
4-Nitroaniline	NA	NA	NA	NA	NA	NA
4-Nitrophenol	NA	NA	NA	NA	NA	NA
Acenaphthene	NA	NA	NA	NA	NA	NA
Acenaphthylene	NA	NA	NA	NA	NA	NA
Anthracene	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA
bis(2-Chloroethoxy)methane	NA	NA	NA	NA	NA	NA
bis(2-Chloroethyl) ether	NA	NA	NA	NA	NA	NA
bis(2-Chloroisopropyl) ether	NA	NA	NA	NA	NA	NA
bis(2-Ethylhexyl) phthalate	NA	NA	NA	NA	NA	NA
Butyl benzyl phthalate	NA	NA	NA	NA	NA	NA
Carbazole	NA	NA	NA	NA	NA	NA
Chrysene	NA	NA	NA	NA	NA	NA
Di-n-butyl phthalate	NA	NA	NA	NA	NA	NA
Di-n-octyl phthalate	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	NA	NA	NA	NA	NA	NA
Dibenzofuran	NA	NA	NA	NA	NA	NA
Diethyl phthalate	NA	NA	NA	NA	NA	NA
Dimethyl phthalate	NA	NA	NA	NA	NA	NA
Fluoranthene	NA	NA	NA	NA	NA	NA

**TABLE 37-7, AUS-0060  
SUMMARY OF ECOLOGICAL COPEC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Sediment		Soil	
	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale
Fluorene	NA	NA	NA	NA	NA	NA
Hexachlorobenzene	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	NA	NA	NA	NA	NA	NA
Hexachloroethane	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-c,d)pyrene	NA	NA	NA	NA	NA	NA
Isophorone	NA	NA	NA	NA	NA	NA
N-Nitroso-di-n-propylamine	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine	NA	NA	NA	NA	NA	NA
Naphthalene	NA	NA	NA	NA	NA	NA
Pentachlorophenol	NA	NA	NA	NA	NA	NA
Phenanthrene	NA	NA	NA	NA	NA	NA
Phenol	NA	NA	NA	NA	NA	NA
Pyrene	NA	NA	NA	NA	NA	NA
<b>Metals and Inorganics</b>						
Aluminum	NA	NA	NA	NA	Uncertainty	I
Antimony	NA	NA	NA	NA	No	F
Arsenic	NA	NA	NA	NA	Yes	E
Barium	NA	NA	NA	NA	No	F
Beryllium	NA	NA	NA	NA	No	F
Boron	NA	NA	NA	NA	Yes	D
Cadmium	NA	NA	NA	NA	No	A
Calcium	NA	NA	NA	NA	Uncertainty	G,H
Chromium	NA	NA	NA	NA	Yes	D
Cobalt	NA	NA	NA	NA	No	F
Copper	NA	NA	NA	NA	No	F
Cyanide, Total	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	Yes	E
Lead	NA	NA	NA	NA	Yes	J
Magnesium	NA	NA	NA	NA	Uncertainty	G,H
Manganese	NA	NA	NA	NA	Yes	D
Mercury	NA	NA	NA	NA	Yes	E
Nickel	NA	NA	NA	NA	No	F
Potassium	NA	NA	NA	NA	Uncertainty	G,H
Selenium	NA	NA	NA	NA	Yes	D
Silver	NA	NA	NA	NA	No	A
Sodium	NA	NA	NA	NA	Uncertainty	G,H
Thallium	NA	NA	NA	NA	No	F
Vanadium	NA	NA	NA	NA	No	F
Zinc	NA	NA	NA	NA	Yes	E
<b>Explosives</b>						
1,3,5-Trinitrobenzene	NA	NA	NA	NA	No	A
1,3-Dinitrobenzene	NA	NA	NA	NA	No	A



**TABLE 37-7, AUS-0060  
SUMMARY OF ECOLOGICAL COPEC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Sediment		Soil	
	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale
2,4,6-Trinitrotoluene (TNT)	NA	NA	NA	NA	No	A
2,4-Dinitrotoluene	NA	NA	NA	NA	No	A
2,6-Dinitrotoluene	NA	NA	NA	NA	Uncertainty	B
2-Amino-4,6-Dinitrotoluene	NA	NA	NA	NA	No	A
2-Nitrotoluene (ONT)	NA	NA	NA	NA	No	C
3-Nitrotoluene	NA	NA	NA	NA	No	C
4-Amino-2,6-Dinitrotoluene	NA	NA	NA	NA	No	C
4-Nitrotoluene (PNT)	NA	NA	NA	NA	No	C
HMX	NA	NA	NA	NA	No	A
Nitrobenzene	NA	NA	NA	NA	No	A
Nitroglycerin	NA	NA	NA	NA	NA	NA
Pentaerythritol tetranitrate (PETN)	NA	NA	NA	NA	NA	NA
Perchloric Acid	NA	NA	NA	NA	NA	NA
RDX	NA	NA	NA	NA	No	A
Tetryl	NA	NA	NA	NA	No	C

- A - Chemical was not detected and the reporting limit does not exceed the screening concentration.
- B - Chemical was not detected, but reporting limit was equal to or exceeded screening concentration.
- C - Chemical was not detected and there is no screening concentration.
- D - Chemical was detected and was equal to or exceeded screening concentration, but did not exceed background.
- E - Chemical was detected and was equal to or exceeded screening concentration and background, if applicable.
- F - Chemical was detected and did not exceed screening concentration.
- G - Chemical was detected, but no screening value was available.
- H - Chemical was detected, but it is an essential nutrient.
- I - If pH<5.5, Aluminum is a COPEC, otherwise it is not.
- J - Chemical was classified as a COPEC based on USEPA 1998 data but was not a COPEC based on SI data.
- NA - Not Analyzed or not applicable.

**TABLE 37-8**  
**AUS-0060 - LEAD AZIDE/MERCURY FULMINATE STORAGE IGLOOS**  
**CHEMICALS DETECTED ABOVE SCREENING CRITERIA AND ABOVE REFUGE BACKGROUND**  
**(WHERE APPLICABLE)**

**ADDITIONAL AND UNCHARACTERIZED SITES OU SI**

Chemical	Drum <sup>1</sup>	Soil	Sediment	Ground Water	Surface Water
<b>Metals</b>					
Arsenic		H,E	NA	NA	NA
Barium		H	NA	NA	NA
Iron		E	NA	NA	NA
Lead		H,E	NA	NA	NA
Mercury		E	NA	NA	NA
Zinc		E	NA	NA	NA

**Key:**

<sup>1</sup> Drums were not present at this site.

NA = not analyzed

H = human health screening criteria exceeded

E = ecological screening criteria exceeded

LEGEND

- ⊕ MONITORING WELL LOCATION
- ⊙ HAND AUGER LOCATION
- ⊛ USEPA 1998 SAMPLE LOCATIONS

Screening Reference	Reference Code
AUS Background Soil UTL	b1
Little Grand Background Sediment UTL	b2
Little Grand Background Surface Water UTL	b3
Ecological Direct Exposure Pathway TR.V - Soil	e1
Ecological Direct Exposure Pathway TR.V - Sediment	e2
Ecological Direct Exposure Pathway TR.V - Surface Water	e3
IRPA General Use Surface Water Quality Aquatic Life Toxicity	a4
Superfund Chemical Data Matrix Key values (potential bioaccumulation)	s5
USEPA Region IX Industrial Soil PFG - nonresidential	n1
USEPA Region IX Industrial Soil PFG - residential	r1
USEPA Region IX Tap Water PFG - nonresidential	n3
USEPA Region IX Tap Water PFG - residential	r3
USEPA MCL Drinking Water Standards	d1
USEPA TACO Industrial/Commercial Soil Inspection	i1
USEPA TACO Construction Worker Soil Inspection	c1
USEPA TACO Class 1 Soil Component of Groundwater	g1
USEPA General Use Surface Water Quality Human Health	h10

ANUS-0060-006	Units	Result	Reference Code	Result	Reference Code
Volatile Organic Compounds					
All VOCs	UGRKG	NA	ND		
Semi-Volatiles					
All Explosives	UGRKG	ND	ND		
Benzene	MG/KG	ND	NA		
Aluminum	MG/KG	19100			
Antimony	MG/KG	0.52	ND		
Arsenic	MG/KG	11.2	e1,h1,h5,h7		
Barium	MG/KG	72.4			
Beryllium	MG/KG	0.42			
Boron	MG/KG	0.80	e1		
Calcium	MG/KG	201			
Chromium	MG/KG	17.5	e1,h5		
Cobalt	MG/KG	4.8			
Copper	MG/KG	12.1	h1		
Iron	MG/KG	16000	e1		
Lead	MG/KG	12.2			
Magnesium	MG/KG	2000	h1		
Manganese	MG/KG	340	e1		
Mercury	MG/KG	0.004	e5		
Nickel	MG/KG	13.0	h5		
Potassium	MG/KG	706	h1		
Selenium	MG/KG	1.8	e1,h5,h7		
Sodium	MG/KG	35.5			
Sulfur	MG/KG	33.2			
Zinc	MG/KG	42.3			

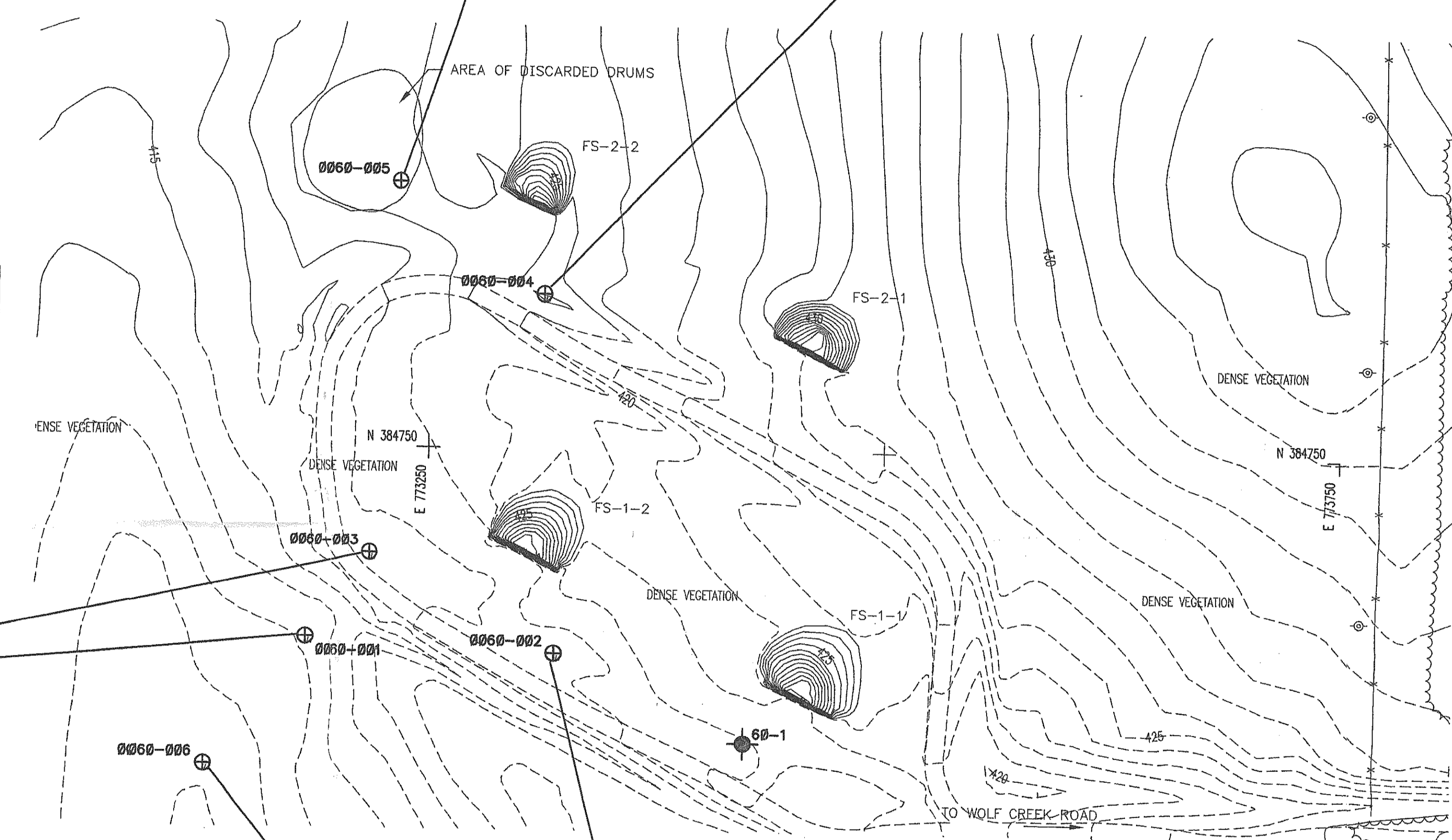
AUS-0060-004	Units	Result	Reference Code	Result	Reference Code
Volatile Organic Compounds					
All VOCs	UGRKG	NA	ND		
Semi-Volatiles					
All Explosives	UGRKG	ND	ND		
Benzene	MG/KG	ND	NA		
Aluminum	MG/KG	19100			
Antimony	MG/KG	0.52	ND		
Arsenic	MG/KG	11.2	e1,h1,h5,h7		
Barium	MG/KG	72.4			
Beryllium	MG/KG	0.42			
Boron	MG/KG	0.80	e1		
Calcium	MG/KG	201			
Chromium	MG/KG	17.5	e1,h5		
Cobalt	MG/KG	4.8			
Copper	MG/KG	12.1	h1		
Iron	MG/KG	16000	e1		
Lead	MG/KG	12.2			
Magnesium	MG/KG	2000	h1		
Manganese	MG/KG	340	e1		
Mercury	MG/KG	0.004	e5		
Nickel	MG/KG	13.0	h5		
Potassium	MG/KG	706	h1		
Selenium	MG/KG	1.8	e1,h5,h7		
Sodium	MG/KG	35.5			
Sulfur	MG/KG	33.2			
Zinc	MG/KG	42.3			

AUS-0060-003	Units	Result	Reference Code	Result	Reference Code
Volatile Organic Compounds					
All VOCs	UGRKG	NA	ND		
Semi-Volatiles					
All Explosives	UGRKG	ND	ND		
Benzene	MG/KG	ND	NA		
Aluminum	MG/KG	16200			
Antimony	MG/KG	0.52	ND		
Arsenic	MG/KG	11.2	e1,h1,h5,h7		
Barium	MG/KG	72.4			
Beryllium	MG/KG	0.42			
Boron	MG/KG	0.80	e1		
Calcium	MG/KG	201			
Chromium	MG/KG	17.5	e1,h5		
Cobalt	MG/KG	4.8			
Copper	MG/KG	12.1	h1		
Iron	MG/KG	16000	e1		
Lead	MG/KG	12.2			
Magnesium	MG/KG	2000	h1		
Manganese	MG/KG	340	e1		
Mercury	MG/KG	0.004	e5		
Nickel	MG/KG	13.0	h5		
Potassium	MG/KG	706	h1		
Selenium	MG/KG	1.8	e1,h5,h7		
Sodium	MG/KG	35.5			
Sulfur	MG/KG	33.2			
Zinc	MG/KG	42.3			

AUS-0060-001	Units	Result	Reference Code	Result	Reference Code
Volatile Organic Compounds					
All VOCs	UGRKG	NA	ND		
Semi-Volatiles					
All Explosives	UGRKG	ND	ND		
Benzene	MG/KG	ND	NA		
Aluminum	MG/KG	16200			
Antimony	MG/KG	0.52	ND		
Arsenic	MG/KG	11.2	e1,h1,h5,h7		
Barium	MG/KG	72.4			
Beryllium	MG/KG	0.42			
Boron	MG/KG	0.80	e1		
Calcium	MG/KG	201			
Chromium	MG/KG	17.5	e1,h5		
Cobalt	MG/KG	4.8			
Copper	MG/KG	12.1	h1		
Iron	MG/KG	16000	e1		
Lead	MG/KG	12.2			
Magnesium	MG/KG	2000	h1		
Manganese	MG/KG	340	e1		
Mercury	MG/KG	0.004	e5		
Nickel	MG/KG	13.0	h5		
Potassium	MG/KG	706	h1		
Selenium	MG/KG	1.8	e1,h5,h7		
Sodium	MG/KG	35.5			
Sulfur	MG/KG	33.2			
Zinc	MG/KG	42.3			

AUS-0060-008	Units	Result	Reference Code	Result	Reference Code
Volatile Organic Compounds					
All VOCs	UGRKG	NA	ND		
Semi-Volatiles					
All Explosives	UGRKG	ND	ND		
Benzene	MG/KG	ND	NA		
Aluminum	MG/KG	19100			
Antimony	MG/KG	0.52	ND		
Arsenic	MG/KG	11.2	e1,h1,h5,h7		
Barium	MG/KG	72.4			
Beryllium	MG/KG	0.42			
Boron	MG/KG	0.80	e1		
Calcium	MG/KG	201			
Chromium	MG/KG	17.5	e1,h5		
Cobalt	MG/KG	4.8			
Copper	MG/KG	12.1	h1		
Iron	MG/KG	16000	e1		
Lead	MG/KG	12.2			
Magnesium	MG/KG	2000	h1		
Manganese	MG/KG	340	e1		
Mercury	MG/KG	0.004	e5		
Nickel	MG/KG	13.0	h5		
Potassium	MG/KG	706	h1		
Selenium	MG/KG	1.8	e1,h5,h7		
Sodium	MG/KG	35.5			
Sulfur	MG/KG	33.2			
Zinc	MG/KG	42.3			

AUS-0060-002	Units	Result	Reference Code	Result	Reference Code
Volatile Organic Compounds					
All VOCs	UGRKG	NA	ND		
Semi-Volatiles					
All Explosives	UGRKG	ND	ND		
Benzene	MG/KG	ND	NA		
Aluminum	MG/KG	12700			
Antimony	MG/KG	0.40	ND		
Arsenic	MG/KG	12.2	e1,h1,h5,h7		
Barium	MG/KG	68.2			
Beryllium	MG/KG	0.6			
Boron	MG/KG	1.8	e1		
Calcium	MG/KG	170			
Chromium	MG/KG	17.8	e1,h5		
Cobalt	MG/KG	4.2			
Copper	MG/KG	11.4	h1		
Iron	MG/KG	20100			
Lead	MG/KG	17.8			
Magnesium	MG/KG	2000	h1		
Manganese	MG/KG	384	e1		
Mercury	MG/KG	0.037	e5		
Nickel	MG/KG	15	h5		
Potassium	MG/KG	706	h1		
Selenium	MG/KG	1.8	e1,h5,h7		
Sodium	MG/KG	40.4			
Sulfur	MG/KG	33.2			
Zinc	MG/KG	44.1			



NOTES:

1. BASE TOPOGRAPHIC MAP PREPARED BY WALKER & ASSOCIATES, FROM FLYOVER IN JANUARY 2000. CONTOUR INTERVAL IS ONE FOOT.
2. DATA QUALIFIERS FOR ANALYTICAL RESULTS ARE NOT INDICATED. REFER TO THE QCSR FOR DATA QUALIFIERS.
3. THE FOLLOWING COMPOUNDS ARE INCLUDED IN THE ANALYTE LIST FOR BOTH SVOCs AND EXPLOSIVES: 2,4-DINITROTOLUENE, 2,6-DINITROTOLUENE, AND NITROBENZENE. THESE COMPOUNDS MAY BE REPORTED AS EITHER SVOCs OR EXPLOSIVES.

Revision No.	Description	Date	By	App.
REVISIONS				
PA/SI REPORT-AUS OU CRAB ORCHARD NWR MARION, ILLINOIS				
AUS-0060 Sample Locations and Detections in Soils				
Date: 11/14/00	Project Number: 232000026.00	Figure Number: 37-1		
Drawn by: DJD	Design by: MAM	Checked by: MCH/CMW		
<b>URS</b>				

# AUS-0060-AREA 14 LEAD AZIDE/MERCURY FULMINATE STORAGE IGLOOS

File: E:\232000026\00\PA-SI REPORT-AUS OU\AUS-SAMPLE LOCATION 2\AUS-0060.DWG Last modified: SEP 21 01:35:57 p.m. URS Corp.

**SECTION THIRTY-EIGHT****IOP Detonation and Disposal Area**

This site was apparently used during the Illinois Ordnance Plant (IOP) era for testing explosives and 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 Operable Unit (PCB OU) Site 17, the Job Corps Landfill (JCLF).

The access road to the site is located on the west side of Wolf Creek Road one mile south of Old Highway 13, within a thin line of trees. 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 location of AUS-0061 is shown in Figure 30-1, along with other sites included in this volume.

**AUS Original Site Designations**

AUS-0061 is one of the original Additional and Uncharacterized Sites Operable Unit (AUS OU) sites designated in 1997-1999 by the United States Fish & Wildlife Service (USFWS). The name has been changed from the original designation "North of Area 14, Concrete Structures" and the disposal portion of the site has been added.

**38.1 HISTORIC SEARCH INFORMATION****38.1.1 Site Description**

"IOP Detonation and Disposal Area" is not an official IOP designation. The site name was developed during this investigation as a description of the site. Figure 38-1 shows only the detonation portion of the site, with the concrete structures.

The disposal portion of this site, which covers about one-half acre, is located adjacent to the former JCLF. PCB OU Site 17 is along the north and east portions of the JCLF. This portion of the site was not investigated during the Preliminary Assessment/Site Investigation (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. The location of the disposal area, which covers about 20 acres, is shown in Figure 43-4 of this report. It was included with AUS-0061 because of proximity and because both sites appear to be related to IOP activities.

**38.1.2 Operational History and Waste Characteristics**

According to former Refuge Manager, Wayne Adams, the concrete structures in the "Detonation Area" of the site were used to detonate explosives during World War II.<sup>1</sup> 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, not on IOP records.

There were no known industrial lessees of this property.

<sup>1</sup> Wayne Adams, personal interview, March 23, 2000.

**SECTION THIRTY-EIGHT****IOP Detonation and Disposal Area**

The IOP Disposal Area portion of this site was observed in the 1943 historical aerial photographs.<sup>2</sup> This area appeared to contain 12 to 14 north-south trending trenches and one east-west trending trench (located due west of Area 2D, west of Wolf Creek Road, midway between this road and Crab Orchard Lake).<sup>3</sup> The trenches were filled with unidentifiable materials and were observed in the 1943 aerial photograph only.<sup>4</sup> By 1951, the trenches were filled.<sup>5</sup>

The 1951 and 1960 aerial photographs showed evidence of surface dumping in the western part of the former trench area.<sup>6</sup> 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.

**38.1.3 AUS-0061 Previous Sampling Results****Job Corps Landfill (JCLF)**

A portion of the IOP Disposal Area part of this site coincides with the JCLF (PCB OU Site 17). It is likely that the remediation done at the Job Corps Landfill did not include the trenches identified in the 1943 aerial photograph because this photograph was not reviewed during the initial investigation done at the JCLF. Specific remediation limits have not been identified at the JCLF site; however, a post-remediation contour map shows that several of the trenches were located outside of the boundaries of the contour lines that were surveyed. It also appeared that remediation done in the area of the former trenches did not extend deeper than 3 feet (ft). As a result, even in the area where the remediation boundary overlapped the former trenches, the contents of the former trenches (which, based on the 1951 aerial photo, had been filled in) may not have been uncovered.

Previous analytical results from PCB OU Site 17 have not been included because that site has been remediated.

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<sup>2</sup> Entech, Inc., 1999, Historical Aerial Photographic Analysis – Inventory of Potential Disposal Sites: Additional and Uncharacterized Sites (AUS) Operable Unit, Crab Orchard National Wildlife Refuge, Marion, Illinois, Volume I (Text) Page 3-10, and Volume II (Maps) Page D. The Entech reports analyze historic aerial overflight photographs of industrial areas at the Refuge, from 1943 to 1993. The photos were obtained from the National Archives and Records Administration (NARA) and the U.S. Department of Agriculture Agricultural Stabilization and Conservation Service (ASCS).

<sup>3</sup> Entech, Inc., 1999, Historical Aerial Photographic Analysis – Inventory of Potential Disposal Sites: Additional and Uncharacterized Sites (AUS) Operable Unit, Crab Orchard National Wildlife Refuge, Marion, Illinois, Volume I (Text) Page 3-10.

<sup>4</sup> Entech, Inc., 1999, Historical Aerial Photographic Analysis – Inventory of Potential Disposal Sites: Additional and Uncharacterized Sites (AUS) Operable Unit, Crab Orchard National Wildlife Refuge, Marion, Illinois, Volume I (Text) Page 3-10.

<sup>5</sup> Entech, Inc., 1999, Historical Aerial Photographic Analysis – Inventory of Potential Disposal Sites: Additional and Uncharacterized Sites (AUS) Operable Unit, Crab Orchard National Wildlife Refuge, Marion, Illinois, Volume I (Text) Page 3-10.

<sup>6</sup> Entech, Inc., 1999, Historical Aerial Photographic Analysis – Inventory of Potential Disposal Sites: Additional and Uncharacterized Sites (AUS) Operable Unit, Crab Orchard National Wildlife Refuge, Marion, Illinois, Volume I (Text) Page 3-10.

**SECTION THIRTY-EIGHT****IOP Detonation and Disposal Area****USEPA Sampling, 1998**

The United States Environmental Protection Agency (USEPA) collected seven samples at the IOP Detonation Area portion of this site (AUS 61-1 through AUS 61-7). Survey coordinates were only available for sample 61-1, which is shown in Figures 38-1 and 38-2. The results for all detected constituents are listed in Table 38-1A. SVOC compounds exceeded screening levels in two of the seven samples (AUS 61-1 and AUS 61-4). The following SVOC compounds were detected at the site above either USEPA SSLs and/or CSOQGs: carbazole (0.71 mg/kg), benzo[a]anthracene (6.8 mg/kg), benzo[b]fluoranthene (18 mg/kg), benzo[k]fluoranthene (18 mg/kg), benzo[a]pyrene (5.4 mg/kg), indeno[1,2,3-c,d]pyrene (5.0 mg/kg), dibenz[a,h]anthracene (2.3 mg/kg), and phenanthrene (5.7 mg/kg). Total PAHs also exceeded DSOLs. Barium (430 mg/kg), cadmium (55 mg/kg), mercury (0.16 mg/kg), nickel (23 mg/kg), and silver (2 mg/kg) exceeded USEPA SSLs and Refuge background levels.<sup>7</sup> Lead (420 mg/kg), cobalt (21 mg/kg), and zinc (440 mg/kg) exceeded DSOLs and Refuge background levels.

**38.1.4 Observations during Site Visit**

The three concrete structures are located in a thin row of trees and the site is mostly overgrown. The site has woodlands on the east and west and open fields on the north and south.

**38.1.5 Recommendations Based on Preliminary Assessment**

AUS-0061 (the portion including the IOP detonation area) was included in the SI because USEPA sample results from this site exceeded preliminary screening levels for metals, and because of the probable past usage of the site. The disposal area part of the site was added after the SI had begun.

**38.2 SITE INVESTIGATION INFORMATION**

URS conducted a Site Investigation at AUS-0061 on May 3, 2000. The rationale for sample locations, media, and analytes is presented in the Field Sampling Plan (FSP)<sup>8</sup> for the AUS OU PA/SI. Since the time the FSP was prepared, additional information has become available, and the historic discussion (Section 38.1) has been updated to include that information. The sampling locations discussed below are based on the information that was available at the time the FSP was developed, and may not address all areas of potential releases.

AUS OU SI sample locations are shown on Figures 38-1 and 38-2. Survey coordinates for all sample locations in AUS-0061 are listed in Table 38-1. Table 38-2 lists the sample locations and the matrix sampled at that location. All samples are soil samples.

<sup>7</sup> See Table 1-11 of this report for Refuge background soil values used for the PA.

<sup>8</sup> U.S. Fish & Wildlife Service, Department of the Interior, March 2000, Draft Final Field Sampling Plan Site Inspection, Additional and Uncharacterized Sites Operable Unit, Crab Orchard National Wildlife Refuge Superfund Site, Marion, Illinois (Williamson County), prepared by URS Corporation.

**SECTION THIRTY-EIGHT****IOP Detonation and Disposal Area****38.2.1 Field Investigation**

As discussed above, the field investigation included only the Detonation Area. Sampling was done in accordance with the FSP, except as noted.

**Detonation Pits**

There were two samples collected from near the detonation pits. Sample 0061-001 was collected near the entrance to the south detonation pit and sample 0061-002 was collected near the entrance to the north detonation pit.

**Drainage Ditches/Depressions in the Detonation Area**

Samples 0061-003 and 0061-004 were collected from locations that appear to receive runoff from the detonation pit area. Sample 0061-003 was collected from a north flowing drainageway that flows from the center of the site into the enclosed depression along the south side of the roadway north of the site. Note that this drainageways is very small and does not appear in the topography shown in Figure 38-1. Sample 0061-004 is located in the enclosed depression along the roadway.

Samples 0061-005 and 0061-006 were collected from small depressions near the south detonation pit, which would probably collect some water after rain events. Note that these depressions are too small to appear in the topography shown in Figure 38-1.

**38.2.2 Field Results**

The following sections present the results of the field investigation. Note that the discussions include only the Detonation Area portion of the site.

**38.2.2.1 Site Conditions****38.2.2.1.1 *Geologic Conditions***

There were no test pits or monitoring wells installed at AUS-0061. Soil from the hand auger borings was described as fill (silty clay, with sand at 0061-006).

**38.2.2.1.2 *Hydrogeologic Conditions***

No hydrogeological information is available for this site.

**38.2.2.1.3 *Hydrologic Conditions***

According to the topography on Figure 38-1, which was developed from aerial photography taken in 2000, there is an enclosed depression along the former roadway north of the Detonation Area. Most of the runoff from the detonation pits appears to flow toward this depression, although, according to the topography, some runoff from near the south pit would be expected to flow to the south.

**SECTION THIRTY-EIGHT****IOP Detonation and Disposal Area****38.2.2.2 Chemical Results**

Table 38-3 lists the chemicals detected in the soil at the Detonation Area of AUS-0061 during this investigation, along with the frequency and range of detections. Results of all analyses are included in the Quality Control Summary Report (QCSR).

Sample results are presented on the following figures:

- Figure 38-1 – organic results for soil samples, and
- Figure 38-2 – inorganic results for soil samples at this site.

**38.3 SCREENING RISK ASSESSMENT**

Results of the screening are presented in Tables 38-4 and 38-5 as follows:

- Table 38-4--human health risk screening for soils, and
- Table 38-5--ecological risk screening for soils.

Each table lists the maximum detected concentration for each constituent analyzed at AUS-0061. The screening results are presented in the tables in terms of hazard quotients (HQs). The HQ for any chemical detected, for any particular screening criterion is simply the ratio of the maximum detected concentration to the screening concentration. For human health for carcinogens, a screening level “cancer risk” is calculated instead of an HQ.

Chemicals that are shaded in the tables are those that exceeded the screening criteria, and are identified as chemicals of potential concern (COPCs) for human health risk, and chemicals of potential ecological concern (COPECs) for ecological risk. The only COPCs/COPECs not shaded in the table are those inorganic constituents that exceeded the screening criteria but were detected at levels below Refuge background.

In cases where the chemical was analyzed but not detected, the HQ is the ratio between the maximum reporting limit and the screening concentration. Chemicals not detected are identified with a “U” qualifier in the qualifier column. When these HQ values exceed one, they are not shaded. These constituents are not identified as COPCs/COPECs, but rather as uncertainties.

In Figures 38-1 and 38-2 the shading convention used is the same as for the tables discussed above. The particular screening criteria exceeded are indicated by the code in the analytical results labels. Duplicate results are shown only if the duplicate result for an analyte exceeded the screening criteria and the result from the original sample did not; or, if the analyte was detected in the duplicate and not in the original sample. Since in the screening process results which are qualified as estimated (coded with “J”) are treated the same as unqualified results, data qualifiers are not included in the results shown in the figures. Refer to the QCSR for data qualifiers.

Tables 38-6 (human health risk) and 38-7 (ecological risk) list all the analytes and corresponding media sampled and indicate whether each is a COPC (or COPEC), not a COPC (or COPEC), or an uncertainty. The codes in the tables indicate the rationale for each classification. All COPCs (Table 38-6) and COPECs (Table 38-7) are shaded in the tables.



**SECTION THIRTY-EIGHT****IOP Detonation and Disposal Area****38.3.1 Human Health Risk****38.3.1.1 Soil**

Human health screening results for soil samples are presented in Table 38-4. For carcinogens, a cancer risk was calculated using the USEPA Region 9 Industrial Soil Preliminary Remediation Goals (PRGs) as screening values. The cancer risk was derived by calculating a ratio of the maximum detected concentrations, or the maximum reporting limits, to their appropriate screening values. These ratios were then multiplied by  $1 \times 10^{-6}$ . In addition, ratios were calculated using the USEPA Region 9 Industrial Soil PRG for Toxins, the USEPA Region 9 Migration to Groundwater Criteria (Dilution Attenuation Factor (DAF)=1), the Illinois Tiered Approach to Corrective Action Objectives (TACO) Industrial/Commercial Soil Ingestion Criteria, the Illinois TACO Construction Worker Soil Ingestion Criteria, and the Illinois TACO Class I Soil Component of Groundwater Criteria.

**38.3.2 Ecological Risk****38.3.2.1 Soil**

Ecological screening results for soil samples are presented in Table 38-5. Soil screening concentrations for direct exposures were developed using toxicity reference values (TRVs) derived from several sources, including the following:

- USEPA (2000)<sup>9</sup>
- Environment Canada (1995)<sup>10</sup>
- Talmage *et al.* (1999)<sup>11</sup>
- Efroymsen *et al.* (1997a, 1997b)<sup>12</sup>
- CCME (1999)<sup>13</sup>
- MHSPE (1994)<sup>14</sup>
- Other sources

A detailed discussion of the screening concentration selection is presented in Appendix G.

<sup>9</sup> USEPA. 2000. Ecological Soil Screening Level Guidance (Draft). USEPA Office of Emergency and Remedial Response, Washington, DC.

<sup>10</sup> Environment Canada. 1995. Toxicity Testing of NCSRP Priority Substances for Development of Soil Quality Guidelines for Contaminated Sites. Guidelines Division, Evaluation and Interpretation Branch, Environmental Conservation Directorate, Environment Canada. Hull, Quebec.

<sup>11</sup> Talmage, S.S., D.M. Opresko, C.J. Maxwell, C.J.E. Welsh, F. M. Cretella, P.H. Reno, and F. B. Daniel. 1999. Nitroaromatic Munition Compounds: Environmental Effects and Screening Values. *Rev Environ. Contam. Toxicol* 161:1-156.

<sup>12</sup> Efroymsen, R.A., M.E. Will, G.W. Suter II, and A.C. Wooten. 1997a. *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision*. Oak Ridge National Laboratory, Oak Ridge, Tennessee. ES/ER/TM-85/R3.

Efroymsen, R.A., M.E. Will, and G.W. Suter II. 1997b. *Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision*. Oak Ridge National Laboratory, Oak Ridge, Tennessee. ES/ER/TM-126/R2.

<sup>13</sup> Canadian Council of Ministers of the Environment. 1999. Canadian Environmental Quality Guidelines.

<sup>14</sup> Ministry of Housing, Spatial Planning, and the Environment (MHSPE). 1994. *Intervention Values and Target Values – Soil Quality Standards*. Directorate General for Environmental Protection, Department of Soil Protection, The Hague, The Netherlands.

**SECTION THIRTY-EIGHT****IOP Detonation and Disposal Area**

The screening approach for ingestion pathway exposures was based on the potential for a chemical to bioaccumulate. The potential for a chemical to bioaccumulate was based on the organic chemical-specific octanol-to-water partitioning coefficient ( $K_{ow}$ ), which provides an indication of the lipophilicity of an organic chemical, and its potential for sequestration in biological tissue. The document *Assessment and Control of Bioconcentratable Contaminants in Surface Waters* (USEPA 1991)<sup>15</sup> used a log  $K_{ow}$  of 3.5 as a target threshold value indicative of bioaccumulative chemicals to target organic chemicals of greatest concern. Using this as a guideline, organic chemicals with a log  $K_{ow}$  greater than 3.5 were considered potentially bioaccumulative chemicals. Among inorganics, mercury and selenium were considered as potentially bioaccumulative chemicals. Any potentially bioaccumulative chemical that is detected was retained as a COPEC.

**38.4 SCIENTIFIC MANAGEMENT DECISION POINT**

A Remedial Investigation (RI) is recommended for Site AUS-0061 based on exceedances of the SI screening criteria.

This report recommends that inorganic constituents that exceeded project screening criteria but were within Refuge background levels not be retained as COPCs/COPECs for further evaluation. These are the constituents coded with "D" on the COPC list, Table 38-6; and on the COPEC list, Table 38-7. COPCs in this category include chromium in soil. COPECs coded with "D" on Table 38-7 include chromium and manganese in soil. Soil was the only medium sampled. These chemicals may later be included in the RI for other reasons (for example, as standard components in an analytical method; if new information on site usage suggests they should be evaluated; or if they are of concern in other media) but the detections at the locations noted are not considered to be of concern since they are below Refuge background levels. All other COPCs/COPECs listed on these tables should be evaluated in the RI. In addition, all analytes listed as uncertainties on these tables should be considered for further evaluation in the RI Work Plan.

Chemicals that exceeded screening criteria and Refuge background (if applicable) are listed in Table 38-8.

Note that a number of the human health COPCs exceed migration to groundwater screening criteria. Groundwater has not been investigated at the locations where the migration to groundwater screening criteria were exceeded, and based on these data, should be considered in the RI.

In addition, the Disposal Area portion of the site, which includes 12 to 14 IOP-era trenches not previously investigated, should be included in the RI (See discussion in Section 38.1.2, above). A screening-level assessment, using the same screening criteria used for this PA/SI, is recommended for the Disposal Area during the first phase of the RI. Since the contents of the trenches are unknown, samples obtained should be analyzed for the full range of contaminants that might have been associated with the IOP and the PCB OU Job Corps Landfill. This includes

<sup>15</sup> USEPA 1991. *Assessment and Control of Bioconcentratable Contaminants in Surface Waters* (Draft). US Environmental Protection Agency Office of Research and Development, Washington, D.C.

**SECTION THIRTY-EIGHT****IOP Detonation and Disposal Area**

the Target Analyte List (TAL) inorganic constituents, the Target Compound List (TCL) organics (except pesticides), explosives, and dioxins/furans.

Other areas of the site and media and contaminants in addition to those addressed in this study may warrant investigation in the RI. These issues will be addressed in the work plan for the RI.

**SECTION THIRTY-EIGHT****IOP Detonation and Disposal Area**

TABLE 38-1  
SURVEY COORDINATES FOR SAMPLE LOCATIONS IN AUS-0061

Sample Location	Northing	Easting	Ground Surface Elevation	Top of Casing Elevation	Comments
0061-001	386720.0	773533.6	424.98	NA	
0061-002	386787.5	773527.9	424.80	NA	
0061-003	386780.1	773567.8	424.39	NA	
0061-004	386807.7	773521.4	423.69	NA	
0061-005	386722.7	773526.8	424.08	NA	
0061-006	386717.5	773517.2	423.87	NA	

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NA = Not Applicable

## SECTION THIRTY-EIGHT

## IOP Detonation and Disposal Area

TABLE 38-1A  
1998 USEPA SOIL SAMPLE ANALYTICAL RESULTS SUMMARY

Sample ID	Constituent	Result (mg/kg)
61-1	Acenaphthene	0.6J
	Acenaphthylene	0.93, 1.5J
	Anthracene	0.61, 2.0J
	Benzo[a]anthracene	3.8, 4.1J
	Benzo[a]pyrene	5.4, 5.0J
	Benzo[b]fluoranthene	1.2 <sup>1,2</sup> , 18J
	Benzo[g,h,i]perylene	1.5, 4.1J
	Benzo[k]fluoranthene	3.3, 18J
	Benzoic Acid	0.5J
	Carbazole	0.71
	Chrysene	6.5 <sup>1,2</sup> , 6.1J
	Dibenz[a,h]anthracene	0.52J, 2.3J
	Dibenzofuran	0.15J
	Fluoranthene	8.5 <sup>1,2</sup> , 11J
	Fluorene	0.16J
	Indeno[1,2,3-c,d]pyrene	2.0, 5.0J
	Naphthalene	0.31J
	Phenanthrene	2.2, 5.7J
	Pyrene	8.1 <sup>1,2</sup> , 9.2J
	Aluminum	8,900
	Barium	150
	Beryllium	0.9
	Cadmium	55
	Calcium	16,000
	Chromium	19
	Cobalt	8.3
	Copper	20
	Iron	21,000
	Lead	420
	Magnesium	1,400
	Manganese	2,100
	Mercury	0.13
	Nickel	23
Potassium	1,000	
Silver	1.4	
Vanadium	20	
Zinc	440	
61-2	Benzo[b]fluoranthene	0.9J
	Benzo[k]fluoranthene	0.9J
	Dibenz[a,h]anthracene	0.6J
	Indeno[1,2,3-c,d]pyrene	1.1J
	Aluminum	9,100
	Barium	120
	Beryllium	0.6
	Cadmium	5.2
	Calcium	1,900
Chromium	12	

Sheet 1 of 4

## SECTION THIRTY-EIGHT

## IOP Detonation and Disposal Area

TABLE 38-1A  
1998 USEPA SOIL SAMPLE ANALYTICAL RESULTS SUMMARY

Sample ID	Constituent	Result (mg/kg)
61-2	Cobalt	10
	Copper	8.9
	Iron	17,000
	Lead	25
	Magnesium	1,400
	Manganese	1,500
	Nickel	9.9
	Potassium	700
	Vanadium	28
	Zinc	59
61-3	Acenaphthene	0.9J
	Benzo[a]pyrene	0.9J
	Benzoic Acid	0.28J
	Chrysene	0.6J
	Aluminum	14,000
	Barium	430
	Beryllium	0.9
	Cadmium	7.3
	Calcium	1,600
	Chromium	17
	Cobalt	21
	Copper	15
	Iron	25,000
	Lead	160
	Magnesium	1,900
	Manganese	4,400
	Mercury	0.05
	Nickel	16
	Potassium	980
	Silver	2
Vanadium	42	
Zinc	67	
61-4	Acenaphthene	2.9J
	Anthracene	0.8J
	Benzo[a]anthracene	0.29J, 6.8J
	Benzo[a]pyrene	0.38J, 0.9J
	Benzo[b]fluoranthene	0.67J
	Benzo[g,h,i]perylene	0.5J
	Benzo[k]fluoranthene	0.28J, 3.5J
	Bis(2-Ethylhexyl)phthalate	3.5J
	Chrysene	0.37J, 0.6J
	Dibenz[a,h]anthracene	1.1J
	Fluoranthene	0.21J, 0.8J
	Indeno[1,2,3-c,d]pyrene	1.6J
	Pyrene	0.25J, 1.0J
	Aluminum	8,600
	Barium	120
	Beryllium	0.6

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## SECTION THIRTY-EIGHT

## IOP Detonation and Disposal Area

TABLE 38-1A  
1998 USEPA SOIL SAMPLE ANALYTICAL RESULTS SUMMARY

Sample ID	Constituent	Result (mg/kg)
61-4	Cadmium	4.6
	Calcium	1,500
	Chromium	11
	Cobalt	8
	Copper	14
	Iron	14,000
	Lead	76
	Magnesium	1,100
	Manganese	1,600
	Mercury	0.16
	Nickel	9.4
	Potassium	600
	Silver	1.4
	Vanadium	25
Zinc	53	
61-5	Bis(2-Ethylhexyl)phthalate	0.12J
	Aluminum	7,100
	Barium	110
	Beryllium	0.6
	Cadmium	2.7
	Calcium	2,700
	Chromium	11
	Cobalt	8.2
	Copper	17
	Iron	12,000
	Lead	40
	Magnesium	1,100
	Manganese	1,200
	Nickel	11
	Potassium	610
	Silver	1.3
Vanadium	28	
Zinc	63	
61-6	Benzo[b]fluoranthene	0.9J
	Benzo[k]fluoranthene	0.9J
	Bis(2-Ethylhexyl)phthalate	0.73
	Dibenz[a,h]anthracene	0.7J
	Aluminum	5,800
	Barium	71
	Beryllium	0.7
	Calcium	8,300
	Chromium	6.7
	Cobalt	5.4
	Copper	11
	Iron	5,600
	Lead	22
	Magnesium	1,100
	Manganese	450

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## SECTION THIRTY-EIGHT

## IOP Detonation and Disposal Area

TABLE 38-1A

## 1998 USEPA SOIL SAMPLE ANALYTICAL RESULTS SUMMARY

Sample ID	Constituent	Result (mg/kg)
61-6	Mercury	0.08
	Nickel	17
	Potassium	810
	Sodium	210
	Vanadium	12
	Zinc	130
61-7	Benzo[b]fluoranthene	0.7J
	Benzo[k]fluoranthene	0.7J

Sheet 4 of 4

<sup>1</sup> This sample was noted with a qualifier of "E" replaced manually with a "D" qualifier. No information was found defining "D" or "E" qualifiers.

<sup>2</sup> The original laboratory result was manually replaced with the number shown in this table. Refer to USEPA laboratory analysis data sheets for original result.

## Notes:

When two results are shown for one constituent, the first result is the semivolatile organics analysis data, and the second result is the polycyclic aromatic hydrocarbons analysis data.

mg/kg = milligrams per kilogram

J = Estimated

B = No explanation of "B" qualifier in report



TABLE 38-2  
MATRICES SAMPLED AT EACH SAMPLE LOCATION AT AUS-0061

Soil
AUS-0061-001
AUS-0061-002
AUS-0061-003*
AUS-0061-004*
AUS-0061-005*
AUS-0061-006*

Sheet 1 of 1

\* Note that the samples at this location were originally designated as sediment, but are actually soil samples.

## SECTION THIRTY-EIGHT

## IOP Detonation and Disposal Area

TABLE 38-3  
SOIL SAMPLE ANALYTICAL RESULTS SUMMARY

Constituent	Number of Detections	Range of Detections
<b>Semivolatile Organics Compounds</b>		
2-Methylnaphthalene	2/6	53 ug/kg to 70 ug/kg
Acenaphthylene	2/6	720 ug/kg to 850 ug/kg
Anthracene	2/6	580 ug/kg to 800 ug/kg
Benzo(a)anthracene	3/6	100 ug/kg to 3,000 ug/kg
Benzo(a)pyrene	3/6	130 ug/kg to 3,300 ug/kg
Benzo(b)fluoranthene	3/6	190 ug/kg to 5,400 ug/kg
Benzo(g,h,i)perylene	3/6	70 ug/kg to 2,200 ug/kg
Benzo(k)fluoranthene	3/6	200 ug/kg to 4,500 ug/kg
bis(2-ethylhexyl) phthalate	4/6	63 ug/kg to 1,100 ug/kg
Carbazole	2/6	440 ug/kg to 460 ug/kg
Chrysene	3/6	150 ug/kg to 4,600 ug/kg
Dibenz(a,h)anthracene	2/6	750 ug/kg to 850 ug/kg
Dibenzofuran	2/6	59 ug/kg to 84 ug/kg
Fluoranthene	3/6	150 ug/kg to 5,300 ug/kg
Fluorene	1/6	60 ug/kg
Indeno(1,2,3-c,d)pyrene	3/6	81 ug/kg to 2,400 ug/kg
Naphthalene	2/6	96 ug/kg to 130 ug/kg
Phenanthrene	2/6	860 ug/kg to 1,400 ug/kg
Pyrene	3/6	140 ug/kg to 5,400 ug/kg
<b>Metals</b>		
Aluminum	6/6	4,170 mg/kg to 12,800 mg/kg
Antimony	4/6	0.5 mg/kg to 7.3 mg/kg
Arsenic	6/6	2 mg/kg to 13.6 mg/kg
Barium	6/6	74.5 mg/kg to 141 mg/kg
Beryllium	6/6	0.15 mg/kg to 0.95 mg/kg
Boron	6/6	2.6 mg/kg to 34.9 mg/kg
Cadmium	6/6	1.3 mg/kg to 90.9 mg/kg
Calcium	6/6	2,030 mg/kg to 9,090 mg/kg
Chromium, Total	6/6	5.1 mg/kg to 23.9 mg/kg
Cobalt	6/6	2.4 mg/kg to 7.8 mg/kg
Copper	6/6	8.2 mg/kg to 69.9 mg/kg
Iron	6/6	6,770 mg/kg to 70,400 mg/kg
Lead	6/6	22.2 mg/kg to 544 mg/kg
Magnesium	6/6	696 mg/kg to 2,010 mg/kg
Manganese	6/6	303 mg/kg to 1,640 mg/kg
Mercury	5/6	0.055 mg/kg to 1.1 mg/kg
Nickel	6/6	9.7 mg/kg to 44.6 mg/kg
Potassium	6/6	343 mg/kg to 911 mg/kg
Selenium	6/6	0.87 mg/kg to 5.8 mg/kg
Sodium	6/6	25.1 mg/kg to 271 mg/kg
Thallium	1/6	0.61 mg/kg

Sheet 1 of 2

**SECTION THIRTY-EIGHT****IOP Detonation and Disposal Area**

TABLE 38-3  
SOIL SAMPLE ANALYTICAL RESULTS SUMMARY

Constituent	Number of Detections	Range of Detections
Vanadium	6/6	7.5 mg/kg to 26.6 mg/kg
Zinc	6/6	58.8 mg/kg to 893 mg/kg

Sheet 2 of 2

mg/kg = milligrams per kilogram

ug/kg = micrograms per kilogram

Notes: This table was derived from the figures that show the analytical results. As a result, duplicates are shown only if the duplicate result for an analyte exceeded the screening criteria and the result from the original sample did not; or, if the analyte was detected in the duplicate and not in the original sample.. There may be some duplicate results, not shown in the table, that are outside the range shown. In addition, the frequency and range of detections is based on the number of sample locations, not the total number of samples (the total number of samples includes originals plus duplicates).

Checked by: MMF 7/20/01

**TABLE 38-4  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0061**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
<b>Semivolatile Organic Compounds</b>								
120-82-1	1,2,4-Trichlorobenzene	640	U	UG/KG			8.40E-05	2.13E+00
95-50-1	1,2-Dichlorobenzene	640	U	UG/KG			1.93E-04	7.11E-01
541-73-1	1,3-Dichlorobenzene	640	U	UG/KG			1.24E-02	
106-46-7	1,4-Dichlorobenzene	640	U	UG/KG		7.87E-08	3.33E-04	6.40E+00
95-95-4	2,4,5-Trichlorophenol	3200	U	UG/KG			3.63E-05	3.20E-01
88-06-2	2,4,6-Trichlorophenol	640	U	UG/KG		2.85E-09		8.00E+01
120-83-2	2,4-Dichlorophenol	640	U	UG/KG			2.42E-04	1.28E+01
105-67-9	2,4-Dimethylphenol	640	U	UG/KG			3.63E-05	1.60E+00
51-28-5	2,4-Dinitrophenol	3200	U	UG/KG			1.82E-03	3.20E+02
91-58-7	2-Chloronaphthalene	640	U	UG/KG			2.35E-05	
95-57-8	2-Chlorophenol	640	U	UG/KG			2.65E-03	3.20E+00
91-57-6	2-Methylnaphthalene	70	J	UG/KG			1.29E-06	3.50E-04
95-48-7	2-Methylphenol	640	U	UG/KG			1.45E-05	8.00E-01
88-74-4	2-Nitroaniline	3200	U	UG/KG			6.36E-02	
88-75-5	2-Nitrophenol	640	U	UG/KG			9.08E-05	
91-94-1	3,3'-Dichlorobenzidine	640	U	UG/KG		1.17E-07		2.13E+03
99-09-2	3-Nitroaniline	3200	U	UG/KG			6.36E-02	
534-52-1	4,6-Dinitro-2-methylphenol	3200	U	UG/KG				
101-55-3	4-Bromophenyl phenyl ether	640	U	UG/KG				
59-50-7	4-Chloro-3-methylphenol	640	U	UG/KG			1.45E-05	
106-47-8	4-Chloroaniline	1300	U	UG/KG			3.69E-04	4.33E+01
7005-72-3	4-Chlorophenyl phenyl ether	640	U	UG/KG				
106-44-5	4-Methylphenol	640	U	UG/KG			1.45E-04	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 38-4  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0061**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
100-01-6	4-Nitroaniline	3200	U	UG/KG			6.36E-02	
100-02-7	4-Nitrophenol	3200	U	UG/KG			4.54E-04	
83-32-9	Acenaphthene	640	U	UG/KG			1.67E-05	2.13E-02
208-96-8	Acenaphthylene	850		UG/KG			1.57E-05	4.25E-03
120-12-7	Anthracene	800		UG/KG			2.05E-06	1.33E-03
56-55-3	Benzo(a)anthracene	3000		UG/KG		1.04E-06		3.75E+01
50-32-8	Benzo(a)pyrene	3300		UG/KG		1.14E-05		8.25E+00
205-99-2	Benzo(b)fluoranthene	5400		UG/KG		1.87E-06		2.70E+01
191-24-2	Benzo(g,h,i)perylene	2200		UG/KG			4.06E-05	1.10E-02
207-08-9	Benzo(k)fluoranthene	4500		UG/KG		1.56E-07		2.25E+00
111-91-1	bis(2-Chloroethoxy)methane	640	U	UG/KG				
111-44-4	bis(2-Chloroethyl) ether	640	U	UG/KG		1.03E-06		3.20E+04
108-60-1	bis(2-Chloroisopropyl) ether	640	U	UG/KG		7.92E-08	1.51E-04	
117-81-7	bis(2-Ethylhexyl) phthalate (DEHP)	1100		UG/KG		6.24E-09	6.24E-05	
85-68-7	Butyl benzyl phthalate	640	U	UG/KG			3.63E-06	8.00E-04
86-74-8	Carbazole	460	J	UG/KG		3.73E-09		1.53E+01
218-01-9	Chrysene	4600		UG/KG		1.59E-08		5.75E-01
84-74-2	Di-n-butyl phthalate	640	U	UG/KG			7.27E-06	2.13E-03
117-84-0	Di-n-octyl phthalate	640	U	UG/KG			3.63E-05	6.40E-05
53-70-3	Dibenz(a,h)anthracene	850		UG/KG		2.94E-06		1.06E+01
132-64-9	Dibenzofuran	84	J	UG/KG			1.66E-05	
84-66-2	Diethyl phthalate	640	U	UG/KG			9.08E-07	
131-11-3	Dimethyl phthalate	640	U	UG/KG			7.27E-08	
206-44-0	Fluoranthene	5300		UG/KG			1.76E-04	2.65E-02

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
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**TABLE 38-4  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0061**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
86-73-7	Fluorene	60	J	UG/KG			1.81E-06	2.00E-03
118-74-1	Hexachlorobenzene	640	U	UG/KG		4.15E-07	9.08E-04	6.40E+00
87-68-3	Hexachlorobutadiene	640	U	UG/KG		2.02E-08	3.63E-03	6.40E+00
77-47-4	Hexachlorocyclopentadiene	640	U	UG/KG			1.09E-04	3.20E-02
67-72-1	Hexachloroethane	640	U	UG/KG		3.63E-09	7.27E-04	3.20E+01
193-39-5	Indeno(1,2,3-c,d)pyrene	2400		UG/KG		8.31E-07		3.43E+00
78-59-1	Isophorone	640	U	UG/KG		2.46E-10	3.63E-06	2.13E+01
621-64-7	N-Nitroso-di-n-propylamine	640	U	UG/KG		1.82E-06		3.20E+05
86-30-6	N-Nitrosodiphenylamine	640	U	UG/KG		1.27E-09		1.07E+01
91-20-3	Naphthalene	130	J	UG/KG			6.89E-04	3.25E-02
87-86-5	Pentachlorophenol	3200	U	UG/KG		2.89E-07	2.24E-04	3.20E+03
85-01-8	Phenanthrene	1400		UG/KG			2.58E-05	7.00E-03
108-95-2	Phenol	640	U	UG/KG			1.21E-06	1.28E-01
129-00-0	Pyrene	5400		UG/KG			9.96E-05	2.70E-02
<b>Explosives</b>								
99-35-4	1,3,5-Trinitrobenzene	480	UJ	UG/KG			1.82E-05	
99-65-0	1,3-Dinitrobenzene	480	UJ	UG/KG			5.45E-03	
118-96-7	2,4,6-Trinitrotoluene (TNT)	960	UJ	UG/KG		1.17E-08	2.18E-03	
121-14-2	2,4-Dinitrotoluene	480	UJ	UG/KG			2.72E-04	1.20E+04
606-20-2	2,6-Dinitrotoluene	640	U	UG/KG			7.27E-04	2.13E+04
35572-78-2	2-Amino-4,6-Dinitrotoluene	960	UJ	UG/KG				
88-72-2	2-Nitrotoluene (ONT)	960	UJ	UG/KG				
99-08-1	3-Nitrotoluene	960	UJ	UG/KG			4.73E-04	
19406-51-0	4-Amino-2,6-Dinitrotoluene	960	UJ	UG/KG				

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
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HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0061**

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99-99-0	4-Nitrotoluene (PNT)	960	UJ	UG/KG			4.73E-04	
2691-41-0	HMX	960	UJ	UG/KG			2.18E-05	
98-95-3	Nitrobenzene	480	UJ	UG/KG			4.19E-03	
121-82-4	RDX	960	UJ	UG/KG		4.28E-08	3.63E-04	
479-45-8	Tetryl	1400	UJ	UG/KG			1.59E-04	
<b>Metals</b>								
7429-90-5	Aluminum	12800		MG/KG	4.44E-01		7.63E-03	
7440-36-0	Antimony	7.3		MG/KG	8.80E+00		8.93E-03	2.43E+01
7440-38-2	Arsenic	13.6		MG/KG	1.01E+00	4.99E-06	3.10E-02	1.36E+01
7440-39-3	Barium	141		MG/KG	7.23E-01		1.13E-03	1.76E+00
7440-41-7	Beryllium	0.95		MG/KG	1.25E+00	4.24E-10	2.57E-04	3.17E-01
7440-42-8	Boron	34.9		MG/KG	6.58E+00		4.41E-04	
7440-43-9	Cadmium	90.9		MG/KG	4.78E+02	3.04E-08	1.12E-01	2.27E+02
7440-70-2	Calcium	10200		MG/KG	4.08E+00			
7440-47-3	Chromium	23.9		MG/KG	9.48E-01	5.33E-08		1.20E+01
7440-48-4	Cobalt	7.8	J	MG/KG	3.59E-01		6.36E-05	
7440-50-8	Copper	69.9		MG/KG	6.19E+00		9.21E-04	
7439-89-6	Iron	70400		MG/KG	3.65E+00		1.15E-01	
7439-92-1	Lead	544		MG/KG	2.32E+01			
7439-95-4	Magnesium	2010		MG/KG	1.30E+00			
7439-96-5	Manganese	1640		MG/KG	4.51E-01		5.09E-02	
7439-97-6	Mercury	1.1		MG/KG	1.83E+01			
7440-02-0	Nickel	44.6		MG/KG	2.36E+00		1.09E-03	6.37E+00
2023695	Potassium	911		MG/KG	1.46E+00			

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 38-4  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0061**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
7782-49-2	Selenium	5.8		MG/KG	2.48E+00		5.68E-04	1.93E+01
7440-22-4	Silver	1.9	U	MG/KG	3.28E+00		1.86E-04	9.50E-01
7440-23-5	Sodium	271		MG/KG	1.59E+00			
7440-28-0	Thallium	0.61	J	MG/KG	1.49E+00		4.26E-06	
7440-62-2	Vanadium	26.6		MG/KG	5.64E-01		1.86E-03	8.87E-02
7440-66-6	Zinc	893		MG/KG	1.74E+01		1.46E-03	1.49E+00

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
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**TABLE 38-4  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0061**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
<b>Semivolatile Organic Compounds</b>							
120-82-1	1,2,4-Trichlorobenzene	640	U	UG/KG	3.20E-05	3.20E-04	1.28E-01
95-50-1	1,2-Dichlorobenzene	640	U	UG/KG	3.56E-06	3.56E-05	3.76E-02
541-73-1	1,3-Dichlorobenzene	640	U	UG/KG			
106-46-7	1,4-Dichlorobenzene	640	U	UG/KG			3.20E-01
95-95-4	2,4,5-Trichlorophenol	3200	U	UG/KG	1.60E-05	1.60E-05	1.19E-02
88-06-2	2,4,6-Trichlorophenol	640	U	UG/KG	1.23E-03	5.82E-05	3.20E+00
120-83-2	2,4-Dichlorophenol	640	U	UG/KG	1.05E-04	1.05E-03	6.40E-01
105-67-9	2,4-Dimethylphenol	640	U	UG/KG	1.56E-05	1.56E-05	7.11E-02
51-28-5	2,4-Dinitrophenol	3200	U	UG/KG	7.80E-04	7.80E-03	1.60E+01
91-58-7	2-Chloronaphthalene	640	U	UG/KG			
95-57-8	2-Chlorophenol	640	U	UG/KG	6.40E-05	6.40E-05	1.60E-01
91-57-6	2-Methylnaphthalene	70	J	UG/KG	1.15E-06	1.15E-06	1.67E-05
95-48-7	2-Methylphenol	640	U	UG/KG	6.40E-06	6.40E-06	4.27E-02
88-74-4	2-Nitroaniline	3200	U	UG/KG			
88-75-5	2-Nitrophenol	640	U	UG/KG			
91-94-1	3,3'-Dichlorobenzidine	640	U	UG/KG	4.92E-02	2.29E-03	9.14E+01
99-09-2	3-Nitroaniline	3200	U	UG/KG			
534-52-1	4,6-Dinitro-2-methylphenol	3200	U	UG/KG			
101-55-3	4-Bromophenyl phenyl ether	640	U	UG/KG			
59-50-7	4-Chloro-3-methylphenol	640	U	UG/KG			
106-47-8	4-Chloroaniline	1300	U	UG/KG	1.59E-04	1.59E-03	1.86E+00
7005-72-3	4-Chlorophenyl phenyl ether	640	U	UG/KG			
106-44-5	4-Methylphenol	640	U	UG/KG			

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**HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0061**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
100-01-6	4-Nitroaniline	3200	U	UG/KG			
100-02-7	4-Nitrophenol	3200	U	UG/KG			
83-32-9	Acenaphthene	640	U	UG/KG	5.33E-06	5.33E-06	1.12E-03
208-96-8	Acenaphthylene	850		UG/KG	1.39E-05	1.39E-05	2.02E-04
120-12-7	Anthracene	800		UG/KG	1.31E-06	1.31E-06	6.67E-05
56-55-3	Benzo(a)anthracene	3000		UG/KG	3.75E-01	1.76E-02	1.50E+00
50-32-8	Benzo(a)pyrene	3300		UG/KG	4.13E+00	1.94E-01	4.13E-01
205-99-2	Benzo(b)fluoranthene	5400		UG/KG	6.75E-01	3.18E-02	1.08E+00
191-24-2	Benzo(g,h,i)perylene	2200		UG/KG	3.61E-05	3.61E-05	5.24E-04
207-08-9	Benzo(k)fluoranthene	4500		UG/KG	5.77E-02	2.65E-03	9.18E-02
111-91-1	bis(2-Chloroethoxy)methane	640	U	UG/KG			
111-44-4	bis(2-Chloroethyl) ether	640	U	UG/KG	1.28E-01	8.53E-03	1.60E+03
108-60-1	bis(2-Chloroisopropyl) ether	640	U	UG/KG			
117-81-7	bis(2-Ethylhexyl) phthalate (DEHP)	1100		UG/KG	2.68E-03	2.68E-04	3.06E-04
85-68-7	Butyl benzyl phthalate	640	U	UG/KG	1.56E-06	1.56E-06	6.88E-04
86-74-8	Carbazole	460	J	UG/KG	1.59E-03	7.42E-05	7.67E-01
218-01-9	Chrysene	4600		UG/KG	5.90E-03	2.71E-04	2.88E-02
84-74-2	Di-n-butyl phthalate	640	U	UG/KG	3.20E-06	3.20E-06	2.78E-04
117-84-0	Di-n-octyl phthalate	640	U	UG/KG	1.56E-05	1.56E-04	6.40E-05
53-70-3	Dibenz(a,h)anthracene	850		UG/KG	1.06E+00	5.00E-02	4.25E-01
132-64-9	Dibenzofuran	84	J	UG/KG			
84-66-2	Diethyl phthalate	640	U	UG/KG	6.40E-07	6.40E-07	1.36E-03
131-11-3	Dimethyl phthalate	640	U	UG/KG			
206-44-0	Fluoranthene	5300		UG/KG	6.46E-05	6.46E-05	1.23E-03

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HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0061**

**ADDITIONAL AND UNCHARACTERIZED SITES ON  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
86-73-7	Fluorene	60	J	UG/KG	7.32E-07	7.32E-07	1.07E-04
118-74-1	Hexachlorobenzene	640	U	UG/KG	1.60E-01	8.21E-03	3.20E-01
87-68-3	Hexachlorobutadiene	640	U	UG/KG			
77-47-4	Hexachlorocyclopentadiene	640	U	UG/KG	4.57E-05	4.57E-05	1.60E-03
67-72-1	Hexachloroethane	640	U	UG/KG	3.20E-04	3.20E-04	1.28E+00
193-39-5	Indeno(1,2,3-c,d)pyrene	2400		UG/KG	3.00E-01	1.41E-02	1.71E-01
78-59-1	Isophorone	640	U	UG/KG	1.56E-06	1.56E-06	8.00E-02
621-64-7	N-Nitroso-di-n-propylamine	640	U	UG/KG	8.00E-01	3.56E-02	1.28E+04
86-30-6	N-Nitrosodiphenylamine	640	U	UG/KG	5.33E-04	2.56E-05	6.40E-01
91-20-3	Naphthalene	130	J	UG/KG	1.59E-06	1.59E-05	1.55E-03
87-86-5	Pentachlorophenol	3200	U	UG/KG	1.33E-01	6.15E-03	1.07E+02
85-01-8	Phenanthrene	1400		UG/KG	2.30E-05	2.30E-05	3.33E-04
108-95-2	Phenol	640	U	UG/KG	6.40E-07	5.33E-06	6.40E-03
129-00-0	Pyrene	5400		UG/KG	8.85E-05	8.85E-05	1.29E-03
<b>Explosives</b>							
99-35-4	1,3,5-Trinitrobenzene	480	UJ	UG/KG			
99-65-0	1,3-Dinitrobenzene	480	UJ	UG/KG			
118-96-7	2,4,6-Trinitrotoluene (TNT)	960	UJ	UG/KG			
121-14-2	2,4-Dinitrotoluene	480	UJ	UG/KG	5.71E-02	2.67E-03	6.00E+02
606-20-2	2,6-Dinitrotoluene	640	U	UG/KG	7.62E-02	3.56E-03	9.14E+02
35572-78-2	2-Amino-4,6-Dinitrotoluene	960	UJ	UG/KG			
88-72-2	2-Nitrotoluene (ONT)	960	UJ	UG/KG			
99-08-1	3-Nitrotoluene	960	UJ	UG/KG			
19406-51-0	4-Amino-2,6-Dinitrotoluene	960	UJ	UG/KG			

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**ADDITIONAL AND UNCHARACTERIZED SITES OU  
 CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
99-99-0	4-Nitrotoluene (PNT)	960	UJ	UG/KG			
2691-41-0	HMX	960	UJ	UG/KG			
98-95-3	Nitrobenzene	480	UJ	UG/KG	4.80E-04	4.80E-04	4.80E+00
121-82-4	RDX	960	UJ	UG/KG			
479-45-8	Tetryl	1400	UJ	UG/KG			
<b>Metals</b>							
7429-90-5	Aluminum	12800		MG/KG			
7440-36-0	Antimony	7.3		MG/KG	8.90E-03	8.90E-02	1.46E+00
7440-38-2	Arsenic	13.6		MG/KG	4.53E+00	2.23E-01	4.86E-01
7440-39-3	Barium	141		MG/KG	1.01E-03	1.01E-02	1.18E-01
7440-41-7	Beryllium	0.95		MG/KG	9.50E-01	3.28E-02	1.44E-01
7440-42-8	Boron	34.9		MG/KG	1.94E-04	1.94E-03	
7440-43-9	Cadmium	90.9		MG/KG	4.55E-02	4.55E-01	2.46E+01
7440-70-2	Calcium	10200		MG/KG			
7440-47-3	Chromium	23.9		MG/KG	2.39E-03	5.83E-03	8.54E-01
7440-48-4	Cobalt	7.8	J	MG/KG	6.50E-05	6.50E-04	
7440-50-8	Copper	69.9		MG/KG	8.52E-04	8.52E-03	6.35E-03
7439-89-6	Iron	70400		MG/KG			
7439-92-1	Lead	544		MG/KG	1.36E+00	1.36E+00	
7439-95-4	Magnesium	2010		MG/KG			
7439-96-5	Manganese	1640		MG/KG	1.71E-02	1.71E-01	
7439-97-6	Mercury	1.1		MG/KG	1.80E-03	1.80E-02	7.33E+00
7440-02-0	Nickel	44.6		MG/KG	1.09E-03	1.09E-02	5.87E-01
2023695	Potassium	911		MG/KG			

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**TABLE 38-4  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0061**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
7782-49-2	Selenium	5.8		MG/KG	5.80E-04	5.80E-03	2.42E+00
7440-22-4	Silver	1.9	U	MG/KG	1.90E-04	1.90E-03	1.27E+00
7440-23-5	Sodium	271		MG/KG			
7440-28-0	Thallium	0.61	J	MG/KG	3.81E-03	3.81E-03	2.54E-01
7440-62-2	Vanadium	26.6		MG/KG	1.90E-03	1.90E-02	2.71E-02
7440-66-6	Zinc	893		MG/KG	1.46E-03	1.46E-02	2.48E-01

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J = Estimated U = Nondetect

TABLE 38-5  
 ECOLOGICAL SCREENING OF SOIL RESULTS FROM AUS-0061

ADDITIONAL AND UNCHARACTERIZED SITES OU  
 CRAB ORCHARD NATIONAL WILDLIFE REFUGE

CAS Number	Chemical	Background (SOIL)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ) (SOIL)	Retained as Potential Bioaccumulator
<b>Semivolatile Organic Compounds</b>							
120-82-1	1,2,4-Trichlorobenzene		640	U	UG/KG	3.20E-02	
95-50-1	1,2-Dichlorobenzene		640	U	UG/KG	2.16E-01	
541-73-1	1,3-Dichlorobenzene		640	U	UG/KG	1.70E-02	
106-46-7	1,4-Dichlorobenzene		640	U	UG/KG	3.20E-02	
95-95-4	2,4,5-Trichlorophenol		3200	U	UG/KG	8.00E-01	
88-06-2	2,4,6-Trichlorophenol		640	U	UG/KG	6.40E-02	
120-83-2	2,4-Dichlorophenol		640	U	UG/KG	7.31E-03	
105-67-9	2,4-Dimethylphenol		640	U	UG/KG	6.40E+01	
51-28-5	2,4-Dinitrophenol		3200	U	UG/KG	1.60E-01	
91-58-7	2-Chloronaphthalene		640	U	UG/KG	5.25E+01	
95-57-8	2-Chlorophenol		640	U	UG/KG	2.64E+00	
91-57-6	2-Methylnaphthalene		70	J	UG/KG	2.16E-02	YES
95-48-7	2-Methylphenol		640	U	UG/KG	1.58E-02	
88-74-4	2-Nitroaniline		3200	U	UG/KG	4.32E-02	
88-75-5	2-Nitrophenol		640	U	UG/KG	4.00E-01	
91-94-1	3,3'-Dichlorobenzidine		640	U	UG/KG	9.90E-01	
99-09-2	3-Nitroaniline		3200	U	UG/KG	1.01E+00	
534-52-1	4,6-Dinitro-2-methylphenol		3200	U	UG/KG		
101-55-3	4-Bromophenyl phenyl ether		640	U	UG/KG		
59-50-7	4-Chloro-3-methylphenol		640	U	UG/KG	8.05E-02	
106-47-8	4-Chloroaniline		1300	U	UG/KG	1.18E+00	
7005-72-3	4-Chlorophenyl phenyl ether		640	U	UG/KG		
106-44-5	4-Methylphenol		640	U	UG/KG	3.93E-03	
100-01-6	4-Nitroaniline		3200	U	UG/KG	1.46E-01	
100-02-7	4-Nitrophenol		3200	U	UG/KG	4.57E-01	
83-32-9	Acenaphthene		640	U	UG/KG	9.38E-04	
208-96-8	Acenaphthylene		850		UG/KG	1.25E-03	
120-12-7	Anthracene		800		UG/KG	5.41E-04	YES
56-55-3	Benzo(a)anthracene		3000		UG/KG	5.76E-01	YES
50-32-8	Benzo(a)pyrene		3300		UG/KG	7.50E-04	YES
205-99-2	Benzo(b)fluoranthene		5400		UG/KG	9.03E-02	YES
191-24-2	Benzo(g,h,i)perylene		2200		UG/KG	1.85E-02	YES
207-08-9	Benzo(k)fluoranthene		4500		UG/KG	7.53E-02	YES
111-91-1	bis(2-Chloroethoxy)methane		640	U	UG/KG	2.11E+00	
111-44-4	bis(2-Chloroethyl) ether		640	U	UG/KG	2.70E-02	
108-60-1	bis(2-Chloroisopropyl) ether		640	U	UG/KG		
117-81-7	bis(2-Ethylhexyl) phthalate (DEHP)		1100		UG/KG	1.19E+00	YES
85-68-7	Butyl benzyl phthalate		640	U	UG/KG	2.68E+00	
86-74-8	Carbazole		460	J	UG/KG		YES
218-01-9	Chrysene		4600		UG/KG	9.73E-01	YES
84-74-2	Di-n-butyl phthalate		640	U	UG/KG	3.20E-03	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
 J = Estimated U = Nondetect

**TABLE 38-5  
ECOLOGICAL SCREENING OF SOIL RESULTS FROM AUS-0061**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Background (SOIL)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ) (SOIL)	Retained as Potential Bioaccumulator
117-84-0	Di-n-octyl phthalate		640	U	UG/KG	9.03E-04	
53-70-3	Dibenz(a,h)anthracene		850		UG/KG	4.62E-02	YES
132-64-9	Dibenzofuran		84	J	UG/KG		YES
84-66-2	Diethyl phthalate		640	U	UG/KG	6.40E-03	
131-11-3	Dimethyl phthalate		640	U	UG/KG	3.20E-03	
206-44-0	Fluoranthene		5300		UG/KG	4.34E-02	YES
86-73-7	Fluorene		60	J	UG/KG	2.00E-03	YES
118-74-1	Hexachlorobenzene		640	U	UG/KG	6.40E-04	
87-68-3	Hexachlorobutadiene		640	U	UG/KG	1.61E+01	
77-47-4	Hexachlorocyclopentadiene		640	U	UG/KG	6.40E-02	
67-72-1	Hexachloroethane		640	U	UG/KG	1.07E+00	
193-39-5	Indeno(1,2,3-c,d)pyrene		2400		UG/KG	2.20E-02	YES
78-59-1	Isophorone		640	U	UG/KG	4.60E-03	
621-64-7	N-Nitroso-di-n-propylamine		640	U	UG/KG	1.18E+00	
86-30-6	N-Nitrosodiphenylamine		640	U	UG/KG	3.20E-02	
91-20-3	Naphthalene		130	J	UG/KG	5.22E-04	
87-86-5	Pentachlorophenol		3200	U	UG/KG	5.33E-01	
85-01-8	Phenanthrene		1400		UG/KG	3.06E-02	YES
108-95-2	Phenol		640	U	UG/KG	1.60E-02	
129-00-0	Pyrene		5400		UG/KG	6.88E-02	YES
<b>Explosives</b>							
99-35-4	1,3,5-Trinitrobenzene		480	UJ	UG/KG	1.28E+00	
99-65-0	1,3-Dinitrobenzene		480	UJ	UG/KG	7.33E-01	
118-96-7	2,4,6-Trinitrotoluene (TNT)		960	UJ	UG/KG	3.20E-02	
121-14-2	2,4-Dinitrotoluene		480	UJ	UG/KG	3.75E-01	
606-20-2	2,6-Dinitrotoluene		640	U	UG/KG	1.95E+01	
35572-78-2	2-Amino-4,6-Dinitrotoluene		960	UJ	UG/KG	1.20E-02	
88-72-2	2-Nitrotoluene (ONT)		960	UJ	UG/KG		
99-08-1	3-Nitrotoluene		960	UJ	UG/KG		
19406-51-0	4-Amino-2,6-Dinitrotoluene		960	UJ	UG/KG		
99-99-0	4-Nitrotoluene (PNT)		960	UJ	UG/KG		
2691-41-0	HMX		960	UJ	UG/KG	3.84E-02	
98-95-3	Nitrobenzene		480	UJ	UG/KG	1.20E-02	
121-82-4	RDX		960	UJ	UG/KG	9.60E-03	
479-45-8	Tetryl		1400	UJ	UG/KG		
<b>Metals</b>							
7429-90-5	Aluminum	28800	12800		MG/KG		
7440-36-0	Antimony	0.83	7.3		MG/KG	1.46E+00	
7440-38-2	Arsenic	13.5	13.6		MG/KG	1.51E+00	
7440-39-3	Barium	195	141		MG/KG	2.82E-01	
7440-41-7	Beryllium	0.76	0.95		MG/KG	9.50E-02	
7440-42-8	Boron	5.3	34.9		MG/KG	6.98E+01	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 38-5  
ECOLOGICAL SCREENING OF SOIL RESULTS FROM AUS-0061**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Background (SOIL)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ) (SOIL)	Retained as Potential Bioaccumulator
7440-43-9	Cadmium	0.19	90.9		MG/KG	3.13E+00	
7440-70-2	Calcium	2497	10200		MG/KG		
7440-47-3	Chromium	25.2	23.9		MG/KG	4.78E+00	
7440-48-4	Cobalt	21.7	7.8	J	MG/KG	3.90E-01	
7440-50-8	Copper	11.3	69.9		MG/KG	2.25E+00	
7439-89-6	Iron	19306	70400		MG/KG	3.52E+02	
7439-92-1	Lead	23.4	544		MG/KG	1.26E+00	
7439-95-4	Magnesium	1552	2010		MG/KG		
7439-96-5	Manganese	3640	1640		MG/KG	1.64E+01	
7439-97-6	Mercury	0.06	1.1		MG/KG	1.57E-01	YES
7440-02-0	Nickel	18.9	44.6		MG/KG	1.49E+00	
2023695	Potassium	625	911		MG/KG		
7782-49-2	Selenium	2.34	5.8		MG/KG	5.80E+00	YES
7440-22-4	Silver	0.58	1.9	U	MG/KG	9.50E-01	
7440-23-5	Sodium	170	271		MG/KG		
7440-28-0	Thallium	0.41	0.61	J	MG/KG	6.10E-01	
7440-62-2	Vanadium	47.2	26.6		MG/KG	5.78E-01	
7440-66-6	Zinc	51.4	893		MG/KG	7.44E+00	



**TABLE 38-6, AUS-0061  
SUMMARY OF HUMAN HEALTH COPC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Groundwater		Sediment		Soil	
	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale
<b>Volatile Organic Compounds</b>								
1,1,1-Trichloroethane	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	NA	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloroethane	NA	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloroethene	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane (EDC)	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloroethene (total)	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloropropane	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone (MEK)	NA	NA	NA	NA	NA	NA	NA	NA
2-Hexanone	NA	NA	NA	NA	NA	NA	NA	NA
4-Methyl-2-pentanone (MIBK)	NA	NA	NA	NA	NA	NA	NA	NA
Acetone	NA	NA	NA	NA	NA	NA	NA	NA
Benzene	NA	NA	NA	NA	NA	NA	NA	NA
Bromodichloromethane	NA	NA	NA	NA	NA	NA	NA	NA
Bromoform	NA	NA	NA	NA	NA	NA	NA	NA
Bromomethane	NA	NA	NA	NA	NA	NA	NA	NA
Carbon disulfide	NA	NA	NA	NA	NA	NA	NA	NA
Carbon tetrachloride	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
Chloroethane	NA	NA	NA	NA	NA	NA	NA	NA
Chloroform	NA	NA	NA	NA	NA	NA	NA	NA
Chloromethane	NA	NA	NA	NA	NA	NA	NA	NA
cis-1,2-Dichloroethene	NA	NA	NA	NA	NA	NA	NA	NA
cis-1,3-Dichloropropene	NA	NA	NA	NA	NA	NA	NA	NA
Dibromochloromethane	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	NA	NA	NA	NA	NA	NA	NA	NA
Methylene chloride	NA	NA	NA	NA	NA	NA	NA	NA
N-Hexane	NA	NA	NA	NA	NA	NA	NA	NA
Styrene	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethylene (PCE)	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	NA	NA	NA	NA	NA	NA	NA	NA
total Xylenes	NA	NA	NA	NA	NA	NA	NA	NA
trans-1,2-Dichloroethene	NA	NA	NA	NA	NA	NA	NA	NA
trans-1,3-Dichloropropene	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethylene (TCE)	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl chloride	NA	NA	NA	NA	NA	NA	NA	NA
<b>Semivolatile Organic Compounds</b>								
1,2,4-Trichlorobenzene	NA	NA	NA	NA	NA	NA	Uncertainty	B
1,2-Dichlorobenzene	NA	NA	NA	NA	NA	NA	No	A
1,3-Dichlorobenzene	NA	NA	NA	NA	NA	NA	No	A
1,4-Dichlorobenzene	NA	NA	NA	NA	NA	NA	Uncertainty	B
2,4,5-Trichlorophenol	NA	NA	NA	NA	NA	NA	No	A

TABLE 38-6, AUS-0061  
SUMMARY OF HUMAN HEALTH COPC EVALUATION

AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Chemical	Surface Water		Groundwater		Sediment		Soil	
	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale
2,4,6-Trichlorophenol	NA	NA	NA	NA	NA	NA	Uncertainty	B
2,4-Dichlorophenol	NA	NA	NA	NA	NA	NA	Uncertainty	B
2,4-Dimethylphenol	NA	NA	NA	NA	NA	NA	Uncertainty	B
2,4-Dinitrophenol	NA	NA	NA	NA	NA	NA	Uncertainty	B
2-Chloronaphthalene	NA	NA	NA	NA	NA	NA	No	A
2-Chlorophenol	NA	NA	NA	NA	NA	NA	Uncertainty	B
1-Methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	NA	NA	NA	NA	NA	NA	No	F
2-Methylphenol	NA	NA	NA	NA	NA	NA	No	A
2-Nitroaniline	NA	NA	NA	NA	NA	NA	No	A
2-Nitrophenol	NA	NA	NA	NA	NA	NA	No	A
3,3'-Dichlorobenzidine	NA	NA	NA	NA	NA	NA	Uncertainty	B
3-Nitroaniline	NA	NA	NA	NA	NA	NA	No	A
4,6-Dinitro-2-methylphenol	NA	NA	NA	NA	NA	NA	No	C
4-Bromophenyl phenyl ether	NA	NA	NA	NA	NA	NA	No	C
4-Chloro-3-methylphenol	NA	NA	NA	NA	NA	NA	No	A
4-Chloroaniline	NA	NA	NA	NA	NA	NA	Uncertainty	B
4-Chlorophenyl phenyl ether	NA	NA	NA	NA	NA	NA	No	C
4-Methylphenol	NA	NA	NA	NA	NA	NA	No	A
4-Nitroaniline	NA	NA	NA	NA	NA	NA	No	A
4-Nitrophenol	NA	NA	NA	NA	NA	NA	No	A
Acenaphthene	NA	NA	NA	NA	NA	NA	No	A
Acenaphthylene	NA	NA	NA	NA	NA	NA	No	F
Anthracene	NA	NA	NA	NA	NA	NA	No	F
Benzo(a)anthracene	NA	NA	NA	NA	NA	NA	Yes	E
Benzo(a)pyrene	NA	NA	NA	NA	NA	NA	Yes	E
Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA	Yes	E
Benzo(g,h,i)perylene	NA	NA	NA	NA	NA	NA	No	F
Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	Yes	E
bis(2-Chloroethoxy)methane	NA	NA	NA	NA	NA	NA	No	C
bis(2-Chloroethyl) ether	NA	NA	NA	NA	NA	NA	Uncertainty	B
bis(2-Chloroisopropyl) ether	NA	NA	NA	NA	NA	NA	No	A
bis(2-Ethylhexyl) phthalate	NA	NA	NA	NA	NA	NA	No	F
Butyl benzyl phthalate	NA	NA	NA	NA	NA	NA	No	A
Carbazole	NA	NA	NA	NA	NA	NA	Yes	E
Chrysene	NA	NA	NA	NA	NA	NA	No	F
Di-n-butyl phthalate	NA	NA	NA	NA	NA	NA	No	A
Di-n-octyl phthalate	NA	NA	NA	NA	NA	NA	No	A
Dibenz(a,h)anthracene	NA	NA	NA	NA	NA	NA	Yes	E
Dibenzofuran	NA	NA	NA	NA	NA	NA	No	F
Diethyl phthalate	NA	NA	NA	NA	NA	NA	No	A
Dimethyl phthalate	NA	NA	NA	NA	NA	NA	No	A
Fluoranthene	NA	NA	NA	NA	NA	NA	No	F

TABLE 38-6, AUS-0061  
SUMMARY OF HUMAN HEALTH COPC EVALUATION

AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Chemical	Surface Water		Groundwater		Sediment		Soil	
	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale
Fluorene	NA	NA	NA	NA	NA	NA	No	F
Hexachlorobenzene	NA	NA	NA	NA	NA	NA	Uncertainty	B
Hexachlorobutadiene	NA	NA	NA	NA	NA	NA	Uncertainty	B
Hexachlorocyclopentadiene	NA	NA	NA	NA	NA	NA	No	A
Hexachloroethane	NA	NA	NA	NA	NA	NA	Uncertainty	B
Indeno(1,2,3-c,d)pyrene	NA	NA	NA	NA	NA	NA	Yes	E
Isophorone	NA	NA	NA	NA	NA	NA	Uncertainty	B
N-Nitroso-di-n-propylamine	NA	NA	NA	NA	NA	NA	Uncertainty	B
N-Nitrosodiphenylamine	NA	NA	NA	NA	NA	NA	Uncertainty	B
Naphthalene	NA	NA	NA	NA	NA	NA	No	F
Pentachlorophenol	NA	NA	NA	NA	NA	NA	Uncertainty	B
Phenanthrene	NA	NA	NA	NA	NA	NA	No	F
Phenol	NA	NA	NA	NA	NA	NA	No	A
Pyrene	NA	NA	NA	NA	NA	NA	No	F
<b>Metals and Inorganics</b>								
Aluminum	NA	NA	NA	NA	NA	NA	No	F
Antimony	NA	NA	NA	NA	NA	NA	Yes	E
Arsenic	NA	NA	NA	NA	NA	NA	Yes	E
Barium	NA	NA	NA	NA	NA	NA	Yes	J
Beryllium	NA	NA	NA	NA	NA	NA	No	F
Boron	NA	NA	NA	NA	NA	NA	No	F
Cadmium	NA	NA	NA	NA	NA	NA	Yes	E
Calcium	NA	NA	NA	NA	NA	NA	No	H
Chromium	NA	NA	NA	NA	NA	NA	Yes	D
Cobalt	NA	NA	NA	NA	NA	NA	No	F
Copper	NA	NA	NA	NA	NA	NA	No	F
Cyanide, Total	NA	NA	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	NA	NA	No	F
Lead	NA	NA	NA	NA	NA	NA	Yes	E
Magnesium	NA	NA	NA	NA	NA	NA	No	H
Manganese	NA	NA	NA	NA	NA	NA	No	F
Mercury	NA	NA	NA	NA	NA	NA	Yes	E
Nickel	NA	NA	NA	NA	NA	NA	Yes	E
Potassium	NA	NA	NA	NA	NA	NA	No	H
Selenium	NA	NA	NA	NA	NA	NA	Yes	E
Silver	NA	NA	NA	NA	NA	NA	Yes	J
Sodium	NA	NA	NA	NA	NA	NA	No	H
Thallium	NA	NA	NA	NA	NA	NA	No	F
Vanadium	NA	NA	NA	NA	NA	NA	No	F
Zinc	NA	NA	NA	NA	NA	NA	Yes	E
<b>Explosives</b>								
1,3,5-Trinitrobenzene	NA	NA	NA	NA	NA	NA	No	A
1,3-Dinitrobenzene	NA	NA	NA	NA	NA	NA	No	A

**TABLE 38-6, AUS-0061  
SUMMARY OF HUMAN HEALTH COPC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Groundwater		Sediment		Soil	
	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale
2,4,6-Trinitrotoluene (TNT)	NA	NA	NA	NA	NA	NA	No	A
2,4-Dinitrotoluene	NA	NA	NA	NA	NA	NA	Uncertainty	B
2,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA	Uncertainty	B
2-Amino-4,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA	No	C
2-Nitrotoluene (ONT)	NA	NA	NA	NA	NA	NA	No	C
3-Nitrotoluene	NA	NA	NA	NA	NA	NA	No	A
4-Amino-2,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA	No	C
4-Nitrotoluene (PNT)	NA	NA	NA	NA	NA	NA	No	A
HMX	NA	NA	NA	NA	NA	NA	No	A
Nitrobenzene	NA	NA	NA	NA	NA	NA	Uncertainty	B
Nitroglycerin	NA	NA	NA	NA	NA	NA	NA	NA
Pentaerythritol tetranitrate (PETN)	NA	NA	NA	NA	NA	NA	NA	NA
Perchloric Acid	NA	NA	NA	NA	NA	NA	NA	NA
RDX	NA	NA	NA	NA	NA	NA	No	A
Tetryl	NA	NA	NA	NA	NA	NA	No	A
<b>Other Parameters</b>								
Nitrogen, Nitrate-Nitrite	NA	NA	NA	NA	NA	NA	NA	NA
Phosphorus, Total (as P)	NA	NA	NA	NA	NA	NA	NA	NA

- A - Chemical was not detected and the reporting limit does not exceed the screening concentration.
- B - Chemical was not detected, but reporting limit was equal to or exceeded screening concentration.
- C - Chemical was not detected and there is no screening concentration.
- D - Chemical was detected and was equal to or exceeded screening concentration, but did not exceed background.
- E - Chemical was detected and was equal to or exceeded screening concentration and background, if applicable.
- F - Chemical was detected and did not exceed screening concentration.
- G - Chemical was detected, but no screening value was available.
- H - Chemical was detected, but it is an essential nutrient.
- J - Chemical was classified as a COPC based on USEPA 1998 data but was not a COPC based on SI data.
- NA - Not Analyzed or not applicable.

**TABLE 38-7, AUS-0061  
SUMMARY OF ECOLOGICAL COPEC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Sediment		Soil	
	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale
<b>Volatile Organic Compounds</b>						
1,1,1-Trichloroethane	NA	NA	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	NA	NA	NA	NA	NA	NA
1,1-Dichloroethane	NA	NA	NA	NA	NA	NA
1,1-Dichloroethene	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane (EDC)	NA	NA	NA	NA	NA	NA
1,2-Dichloroethene (total)	NA	NA	NA	NA	NA	NA
1,2-Dichloropropane	NA	NA	NA	NA	NA	NA
2-Butanone (MEK)	NA	NA	NA	NA	NA	NA
2-Hexanone	NA	NA	NA	NA	NA	NA
4-Methyl-2-pentanone (MIBK)	NA	NA	NA	NA	NA	NA
Acetone	NA	NA	NA	NA	NA	NA
Benzene	NA	NA	NA	NA	NA	NA
Bromodichloromethane	NA	NA	NA	NA	NA	NA
Bromoform	NA	NA	NA	NA	NA	NA
Bromomethane	NA	NA	NA	NA	NA	NA
Carbon disulfide	NA	NA	NA	NA	NA	NA
Carbon tetrachloride	NA	NA	NA	NA	NA	NA
Chlorobenzene	NA	NA	NA	NA	NA	NA
Chloroethane	NA	NA	NA	NA	NA	NA
Chloroform	NA	NA	NA	NA	NA	NA
Chloromethane	NA	NA	NA	NA	NA	NA
cis-1,2-Dichloroethene	NA	NA	NA	NA	NA	NA
cis-1,3-Dichloropropene	NA	NA	NA	NA	NA	NA
Dibromochloromethane	NA	NA	NA	NA	NA	NA
Ethylbenzene	NA	NA	NA	NA	NA	NA
Methylene chloride	NA	NA	NA	NA	NA	NA
N-Hexane	NA	NA	NA	NA	NA	NA
Styrene	NA	NA	NA	NA	NA	NA
Tetrachloroethylene (PCE)	NA	NA	NA	NA	NA	NA
Toluene	NA	NA	NA	NA	NA	NA
total Xylenes	NA	NA	NA	NA	NA	NA
trans-1,2-Dichloroethene	NA	NA	NA	NA	NA	NA
trans-1,3-Dichloropropene	NA	NA	NA	NA	NA	NA
Trichloroethylene (TCE)	NA	NA	NA	NA	NA	NA
Vinyl chloride	NA	NA	NA	NA	NA	NA
<b>Semivolatile Organic Compounds</b>						
1,2,4-Trichlorobenzene	NA	NA	NA	NA	No	A
1,2-Dichlorobenzene	NA	NA	NA	NA	No	A
1,3-Dichlorobenzene	NA	NA	NA	NA	No	A
1,4-Dichlorobenzene	NA	NA	NA	NA	No	A
2,4,5-Trichlorophenol	NA	NA	NA	NA	No	A

TABLE 38-7, AUS-0061  
SUMMARY OF ECOLOGICAL COPEC EVALUATION

AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Chemical	Surface Water		Sediment		Soil	
	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale
2,4,6-Trichlorophenol	NA	NA	NA	NA	No	A
2,4-Dichlorophenol	NA	NA	NA	NA	No	A
2,4-Dimethylphenol	NA	NA	NA	NA	Uncertainty	B
2,4-Dinitrophenol	NA	NA	NA	NA	No	A
2-Chloronaphthalene	NA	NA	NA	NA	Uncertainty	B
2-Chlorophenol	NA	NA	NA	NA	Uncertainty	B
1-Methylnaphthalene	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	NA	NA	NA	NA	Yes	E
2-Methylphenol	NA	NA	NA	NA	No	A
2-Nitroaniline	NA	NA	NA	NA	No	A
2-Nitrophenol	NA	NA	NA	NA	No	A
3,3'-Dichlorobenzidine	NA	NA	NA	NA	No	A
3-Nitroaniline	NA	NA	NA	NA	Uncertainty	B
4,6-Dinitro-2-methylphenol	NA	NA	NA	NA	No	C
4-Bromophenyl phenyl ether	NA	NA	NA	NA	No	C
4-Chloro-3-methylphenol	NA	NA	NA	NA	No	A
4-Chloroaniline	NA	NA	NA	NA	Uncertainty	B
4-Chlorophenyl phenyl ether	NA	NA	NA	NA	No	C
4-Methylphenol	NA	NA	NA	NA	No	A
4-Nitroaniline	NA	NA	NA	NA	No	A
4-Nitrophenol	NA	NA	NA	NA	No	A
Acenaphthene	NA	NA	NA	NA	No	A
Acenaphthylene	NA	NA	NA	NA	No	F
Anthracene	NA	NA	NA	NA	Yes	E
Benzo(a)anthracene	NA	NA	NA	NA	Yes	E
Benzo(a)pyrene	NA	NA	NA	NA	Yes	E
Benzo(b)fluoranthene	NA	NA	NA	NA	Yes	E
Benzo(g,h,i)perylene	NA	NA	NA	NA	Yes	E
Benzo(k)fluoranthene	NA	NA	NA	NA	Yes	E
bis(2-Chloroethoxy)methane	NA	NA	NA	NA	Uncertainty	B
bis(2-Chloroethyl) ether	NA	NA	NA	NA	No	A
bis(2-Chloroisopropyl) ether	NA	NA	NA	NA	No	C
bis(2-Ethylhexyl) phthalate	NA	NA	NA	NA	Yes	E
Butyl benzyl phthalate	NA	NA	NA	NA	Uncertainty	B
Carbazole	NA	NA	NA	NA	Yes	E
Chrysene	NA	NA	NA	NA	Yes	E
Di-n-butyl phthalate	NA	NA	NA	NA	No	A
Di-n-octyl phthalate	NA	NA	NA	NA	No	A
Dibenz(a,h)anthracene	NA	NA	NA	NA	Yes	E
Dibenzofuran	NA	NA	NA	NA	Yes	E
Diethyl phthalate	NA	NA	NA	NA	No	A
Dimethyl phthalate	NA	NA	NA	NA	No	A
Fluoranthene	NA	NA	NA	NA	Yes	E

TABLE 38-7, AUS-0061  
SUMMARY OF ECOLOGICAL COPEC EVALUATION

AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Chemical	Surface Water		Sediment		Soil	
	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale
Fluorene	NA	NA	NA	NA	Yes	E
Hexachlorobenzene	NA	NA	NA	NA	No	A
Hexachlorobutadiene	NA	NA	NA	NA	Uncertainty	B
Hexachlorocyclopentadiene	NA	NA	NA	NA	No	A
Hexachloroethane	NA	NA	NA	NA	Uncertainty	B
Indeno(1,2,3-c,d)pyrene	NA	NA	NA	NA	Yes	E
Isophorone	NA	NA	NA	NA	No	A
N-Nitroso-di-n-propylamine	NA	NA	NA	NA	Uncertainty	B
N-Nitrosodiphenylamine	NA	NA	NA	NA	No	A
Naphthalene	NA	NA	NA	NA	No	F
Pentachlorophenol	NA	NA	NA	NA	No	A
Phenanthrene	NA	NA	NA	NA	Yes	E
Phenol	NA	NA	NA	NA	No	A
Pyrene	NA	NA	NA	NA	Yes	E
<b>Metals and Inorganics</b>						
Aluminum	NA	NA	NA	NA	Uncertainty	I
Antimony	NA	NA	NA	NA	Yes	E
Arsenic	NA	NA	NA	NA	Yes	E
Barium	NA	NA	NA	NA	No	F
Beryllium	NA	NA	NA	NA	No	F
Boron	NA	NA	NA	NA	Yes	E
Cadmium	NA	NA	NA	NA	Yes	E
Calcium	NA	NA	NA	NA	Uncertainty	G,H
Chromium	NA	NA	NA	NA	Yes	D
Cobalt	NA	NA	NA	NA	No	F
Copper	NA	NA	NA	NA	Yes	E
Cyanide, Total	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	Yes	E
Lead	NA	NA	NA	NA	Yes	E
Magnesium	NA	NA	NA	NA	Uncertainty	G,H
Manganese	NA	NA	NA	NA	Yes	D
Mercury	NA	NA	NA	NA	Yes	E
Nickel	NA	NA	NA	NA	Yes	E
Potassium	NA	NA	NA	NA	Uncertainty	G,H
Selenium	NA	NA	NA	NA	Yes	E
Silver	NA	NA	NA	NA	Yes	J
Sodium	NA	NA	NA	NA	Uncertainty	G,H
Thallium	NA	NA	NA	NA	No	F
Vanadium	NA	NA	NA	NA	No	F
Zinc	NA	NA	NA	NA	Yes	E
<b>Explosives</b>						
1,3,5-Trinitrobenzene	NA	NA	NA	NA	Uncertainty	B
1,3-Dinitrobenzene	NA	NA	NA	NA	No	A

**TABLE 38-7, AUS-0061  
SUMMARY OF ECOLOGICAL COPEC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Sediment		Soil	
	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale
2,4,6-Trinitrotoluene (TNT)	NA	NA	NA	NA	No	A
2,4-Dinitrotoluene	NA	NA	NA	NA	No	A
2,6-Dinitrotoluene	NA	NA	NA	NA	Uncertainty	B
2-Amino-4,6-Dinitrotoluene	NA	NA	NA	NA	No	A
2-Nitrotoluene (ONT)	NA	NA	NA	NA	No	C
3-Nitrotoluene	NA	NA	NA	NA	No	C
4-Amino-2,6-Dinitrotoluene	NA	NA	NA	NA	No	C
4-Nitrotoluene (PNT)	NA	NA	NA	NA	No	C
HMX	NA	NA	NA	NA	No	A
Nitrobenzene	NA	NA	NA	NA	No	A
Nitroglycerin	NA	NA	NA	NA	NA	NA
Pentaerythritol tetranitrate (PETN)	NA	NA	NA	NA	NA	NA
Perchloric Acid	NA	NA	NA	NA	NA	NA
RDX	NA	NA	NA	NA	No	A
Tetryl	NA	NA	NA	NA	No	C

- A - Chemical was not detected and the reporting limit does not exceed the screening concentration.
- B - Chemical was not detected, but reporting limit was equal to or exceeded screening concentration.
- C - Chemical was not detected and there is no screening concentration.
- D - Chemical was detected and was equal to or exceeded screening concentration, but did not exceed background.
- E - Chemical was detected and was equal to or exceeded screening concentration and background, if applicable.
- F - Chemical was detected and did not exceed screening concentration.
- G - Chemical was detected, but no screening value was available.
- H - Chemical was detected, but it is an essential nutrient.
- I - If pH<5.5, Aluminum is a COPEC, otherwise it is not.
- J - Chemical was classified as a COPEC based on USEPA 1998 data but was not a COPEC based on SI data.
- NA - Not Analyzed or not applicable.



**TABLE 38-8**  
**AUS-0061 - IOP DETONATION AND DISPOSAL AREA**  
**CHEMICALS DETECTED ABOVE SCREENING CRITERIA AND ABOVE REFUGE BACKGROUND**  
**(WHERE APPLICABLE)**

**ADDITIONAL AND UNCHARACTERIZED SITES OU SI**

Chemical	Drum <sup>1</sup>	Soil	Sediment	Ground Water	Surface Water
<b>SVOCs</b>					
2-Methylnaphthalene		E	NA	NA	NA
Anthracene		E	NA	NA	NA
Benzo(a)anthracene		H,E	NA	NA	NA
Benzo(a)pyrene		H,E	NA	NA	NA
Benzo(b)fluoranthene		H,E	NA	NA	NA
Benzo(g,h,i)perylene		E	NA	NA	NA
Benzo(k)fluoranthene		H,E	NA	NA	NA
bis(2-Ethylhexyl)phthalate (DEHP)		E	NA	NA	NA
Carbazole		H,E	NA	NA	NA
Chrysene		E	NA	NA	NA
Dibenz(a,h)anthracene		H,E	NA	NA	NA
Dibenzofuran		E	NA	NA	NA
Fluoranthene		E	NA	NA	NA
Fluorene		E	NA	NA	NA
Indeno(1,2,3-c,d)pyrene		H,E	NA	NA	NA
Phenanthrene		E	NA	NA	NA
Pyrene		E	NA	NA	NA
<b>Metals</b>					
Antimony		H,E	NA	NA	NA
Arsenic		H,E	NA	NA	NA
Barium		H	NA	NA	NA
Boron		E	NA	NA	NA
Cadmium		H,E	NA	NA	NA
Copper		E	NA	NA	NA
Iron		E	NA	NA	NA
Lead		H,E	NA	NA	NA
Mercury		H,E	NA	NA	NA
Nickel		H,E	NA	NA	NA
Selenium		H,E	NA	NA	NA
Silver		H,E	NA	NA	NA
Zinc		H,E	NA	NA	NA

Key:

<sup>1</sup> Drums were not present at this site.




NA = not analyzed

H = human health screening criteria exceeded

E = ecological screening criteria exceeded

File: E:\232000026\PA-SI REPORT-AUS OU\AUS-SAMPLE LOCATION 2\AUS-0061.DWG Last edited: SEP. 24, 01 @ 10:32 a.m. URS Corp.

**LEGEND**

-  MONITORING WELL LOCATION
-  HAND AUGER LOCATION
-  USEPA 1998 SAMPLE LOCATIONS

Screening Reference	Reference Code
AUS Background Soil UTL	b1
Little Grassy Background Sediment UTL	b2
Little Grassy Background Surface Water UTL	b3
Ecological Direct Exposure Pathway TRV - Soil	e1
Ecological Direct Exposure Pathway TRV - Sediment	e2
Ecological Direct Exposure Pathway TRV - Surface Water	e3
IEPA General Use Surface Water Quality Aquatic Life Toxicity	e4
Superfund Chemical Data Matrix Kow values (potential bioaccumulator)	e5
USEPA Region IX Industrial Soil PRG- cancerous	h1
USEPA Region IX Industrial Soil PRG- noncancerous	h2
USEPA Region IX Tap Water PRG- cancerous	h3
USEPA Region IX Tap Water PRG- noncancerous	h4
USEPA Region IX Migration to Groundwater PRG(DAF=1)	h5
USEPA MCL Drinking Water Standards	h6
IEPA TACO Industrial/Commercial Soil Ingestion	h7
IEPA TACO Construction Worker Soil Ingestion	h8
IEPA TACO Class I Soil Component of Groundwater	h9
IEPA General Use Surface Water Quality Human Health	h10

AUS-0061-004	Units	Result:	Reference
		0 - 6 in	Code
<b>Semivolatile Organic Compounds</b>			
All SVOCs	UG/KG	ND	
<b>Explosives</b>			
All Explosives	UG/KG	ND	

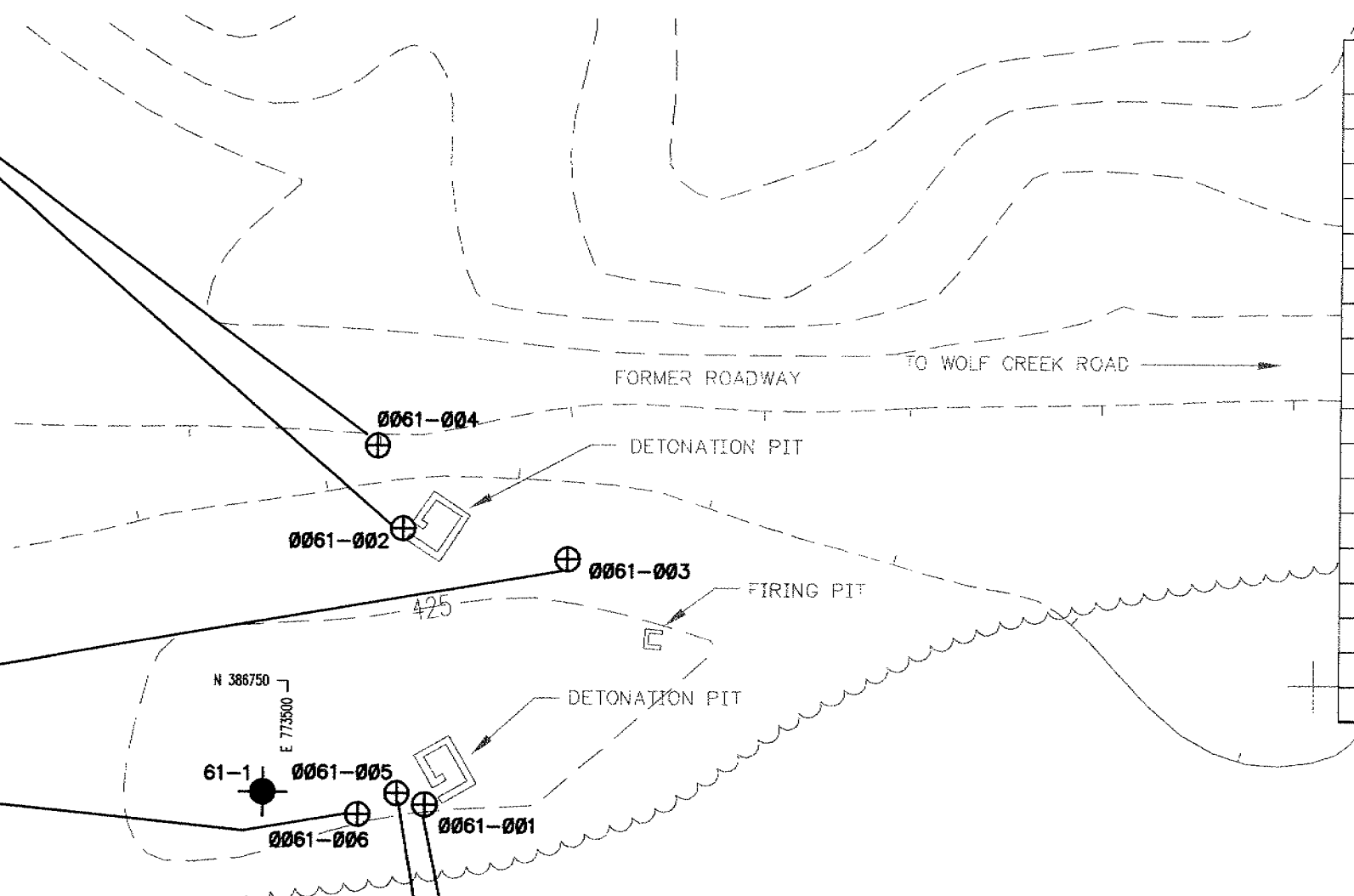
AUS-0061-002	Units	Result:	Reference
		0 - 6 in	Code
<b>Semivolatile Organic Compounds</b>			
2-Methylnaphthalene	UG/KG	53	e5
Acenaphthylene	UG/KG	720	
Anthracene	UG/KG	800	e5
Benzo(a)anthracene	UG/KG	2300	e5,h5,h9
Benzo(a)pyrene	UG/KG	2800	e5,h1,h5,h7
Benzo(b)fluoranthene	UG/KG	4800	e5,h1,h5
Benzo(g,h)perylene	UG/KG	2200	e5
Benzo(k)fluoranthene	UG/KG	3800	e5,h5
bis(2-Ethylhexyl)phthalate (DEHP)	UG/KG	860	e5
Carbazole	UG/KG	440	e5,h5
Chrysene	UG/KG	3700	e5
Dibenz(a,h)anthracene	UG/KG	750	e5,h1,h5
Dibenzokran	UG/KG	59	e5
Fluoranthene	UG/KG	3700	e5
Fluorene	UG/KG	60	e5
Indeno(1,2,3-c-d)pyrene	UG/KG	2200	e5,h5
Naphthalene	UG/KG	96	
Phenanthrene	UG/KG	860	e5
Pyrene	UG/KG	4800	e5
<b>Explosives</b>			
All Explosives	UG/KG	ND	

AUS-0061-003	Units	Result:	Reference
		0 - 6 in	Code
<b>Semivolatile Organic Compounds</b>			
bis(2-Ethylhexyl)phthalate (DEHP)	UG/KG	910	e5
<b>Explosives</b>			
All Explosives	UG/KG	ND	

AUS-0061-006	Units	Result:	Reference
		0 - 6 in	Code
<b>Semivolatile Organic Compounds</b>			
bis(2-Ethylhexyl)phthalate (DEHP)	UG/KG	63	e5
<b>Explosives</b>			
All Explosives	UG/KG	ND	

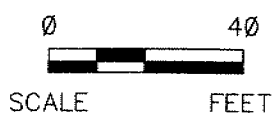
AUS-0061-005	Units	Result:	Reference
		0 - 6 in	Code
<b>Semivolatile Organic Compounds</b>			
Benzo(a)anthracene	UG/KG	100	e5,h5
Benzo(a)pyrene	UG/KG	130	e5
Benzo(b)fluoranthene	UG/KG	190	e5
Benzo(g,h)perylene	UG/KG	70	e5
Benzo(k)fluoranthene	UG/KG	200	e5
Chrysene	UG/KG	150	e5
Fluoranthene	UG/KG	150	e5
Indeno(1,2,3-c-d)pyrene	UG/KG	81	e5
Pyrene	UG/KG	140	e5
<b>Explosives</b>			
All Explosives	UG/KG	ND	

AUS-0061-001	Units	Result:	Reference
		0 - 6 in	Code
<b>Semivolatile Organic Compounds</b>			
2-Methylnaphthalene	UG/KG	70	e5
Acenaphthylene	UG/KG	850	
Anthracene	UG/KG	550	e5
Benzo(a)anthracene	UG/KG	3000	e5,h1,h5,h7
Benzo(a)pyrene	UG/KG	3300	e5,h1,h5,h7
Benzo(b)fluoranthene	UG/KG	5400	e5,h1,h5,h9
Benzo(g,h)perylene	UG/KG	2200	e5
Benzo(k)fluoranthene	UG/KG	4500	e5,h5
bis(2-Ethylhexyl)phthalate (DEHP)	UG/KG	1100	e1,e5
Carbazole	UG/KG	460	e5,h5
Chrysene	UG/KG	4800	e5
Dibenz(a,h)anthracene	UG/KG	850	e5,h1,h5,h7
Dibenzokran	UG/KG	84	e5
Fluoranthene	UG/KG	5300	e5
Indeno(1,2,3-c-d)pyrene	UG/KG	2400	e5,h5
Naphthalene	UG/KG	130	
Phenanthrene	UG/KG	1400	e5
Pyrene	UG/KG	5400	e5
<b>Explosives</b>			
All Explosives	UG/KG	ND	



**NOTE:**

- BASE TOPOGRAPHIC MAP PREPARED BY WALKER & ASSOCIATES, FROM FLYOVER IN JANUARY 2000. CONTOUR INTERVAL IS ONE FOOT.
- DATA QUALIFIERS FOR ANALYTICAL RESULTS ARE NOT INDICATED. REFER TO THE QCSR FOR DATA QUALIFIERS.
- THE FOLLOWING COMPOUNDS ARE INCLUDED IN THE ANALYTE LIST FOR BOTH SVOCs AND EXPLOSIVES: 2,4-DINITROTOLUENE, 2,6-DINITROTOLUENE, AND NITROBENZENE. THESE COMPOUNDS MAY BE REPORTED AS EITHER SVOCs OR EXPLOSIVES.



**AUS-0061-IOP DETONATION AND DISPOSAL AREA**

PA/SI REPORT-AUS OU CRAB ORCHARD NWR MARION, ILLINOIS	PROJECT NO. 232000026.00
<b>URS</b>	
DRN. BY: djd 7/28/00 DSGN. BY: mam CHKD. BY: mch/cmw	FIG. NO. 38-1

AUS-0061-004	Units	Result:	Reference
		0 - 6 In	Code
<b>Metals</b>			
Aluminum	MG/KG	12800	
Arsenic	MG/KG	6.5	h1,h5,h7
Barium	MG/KG	141	h5
Beryllium	MG/KG	0.52	
Boron	MG/KG	2.8	e1
Cadmium	MG/KG	2.1	b1,h5
Calcium	MG/KG	3620	b1
Chromium	MG/KG	14.1	e1,h5
Cobalt	MG/KG	5.1	
Copper	MG/KG	12.7	b1
Iron	MG/KG	14900	e1
Lead	MG/KG	22.2	
Magnesium	MG/KG	2010	b1
Manganese	MG/KG	1220	e1
Mercury	MG/KG	0.055	e5
Nickel	MG/KG	15.8	h5
Potassium	MG/KG	911	b1
Selenium	MG/KG	1.7	e1,e5,h5
Sodium	MG/KG	43.2	
Vanadium	MG/KG	26.6	
Zinc	MG/KG	60.7	b1

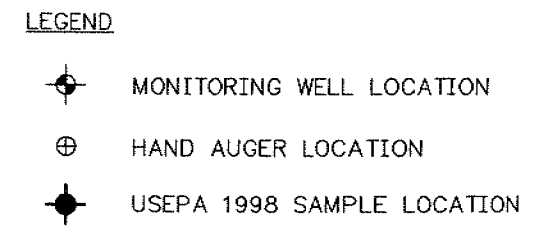
AUS-0061-002	Units	Result:	Reference
		0 - 6 In	Code
<b>Metals</b>			
Aluminum	MG/KG	8570	
Antimony	MG/KG	0.5	h5
Arsenic	MG/KG	5.4	h1,h5,h7
Barium	MG/KG	74.5	
Beryllium	MG/KG	0.95	b1
Boron	MG/KG	34.9	b1,e1
Cadmium	MG/KG	22.7	b1,h5,h9
Calcium	MG/KG	6690	b1
Chromium	MG/KG	13	e1,h5
Cobalt	MG/KG	6.3	
Copper	MG/KG	18.3	b1
Iron	MG/KG	12300	e1
Lead	MG/KG	111	b1
Magnesium	MG/KG	994	
Manganese	MG/KG	713	e1
Mercury	MG/KG	1.1	b1,e5,h9
Nickel	MG/KG	23.6	b1,h5
Potassium	MG/KG	830	b1
Selenium	MG/KG	1.5	e1,e5,h5
Sodium	MG/KG	271	b1
Vanadium	MG/KG	18	
Zinc	MG/KG	227	b1,e1

AUS-0061-006	Units	Result:	Reference
		0 - 6 In	Code
<b>Metals</b>			
Aluminum	MG/KG	4170	
Antimony	MG/KG	1.4	b1,h5
Arsenic	MG/KG	2	h5
Barium	MG/KG	97.3	h5
Beryllium	MG/KG	0.15	
Boron	MG/KG	3.8	e1
Cadmium	MG/KG	4.8	b1,h5,h9
Calcium	MG/KG	2460	
Chromium	MG/KG	5.1	e1,h5
Cobalt	MG/KG	2.4	
Copper	MG/KG	12.8	b1
Iron	MG/KG	6770	e1
Lead	MG/KG	43.7	b1
Magnesium	MG/KG	696	
Manganese	MG/KG	303	e1
Mercury	MG/KG	0.3	b1,e5,h9
Nickel	MG/KG	9.7	h5
Potassium	MG/KG	343	
Selenium	MG/KG	0.87	e5,h5
Sodium	MG/KG	25.1	
Vanadium	MG/KG	7.5	
Zinc	MG/KG	58.8	b1

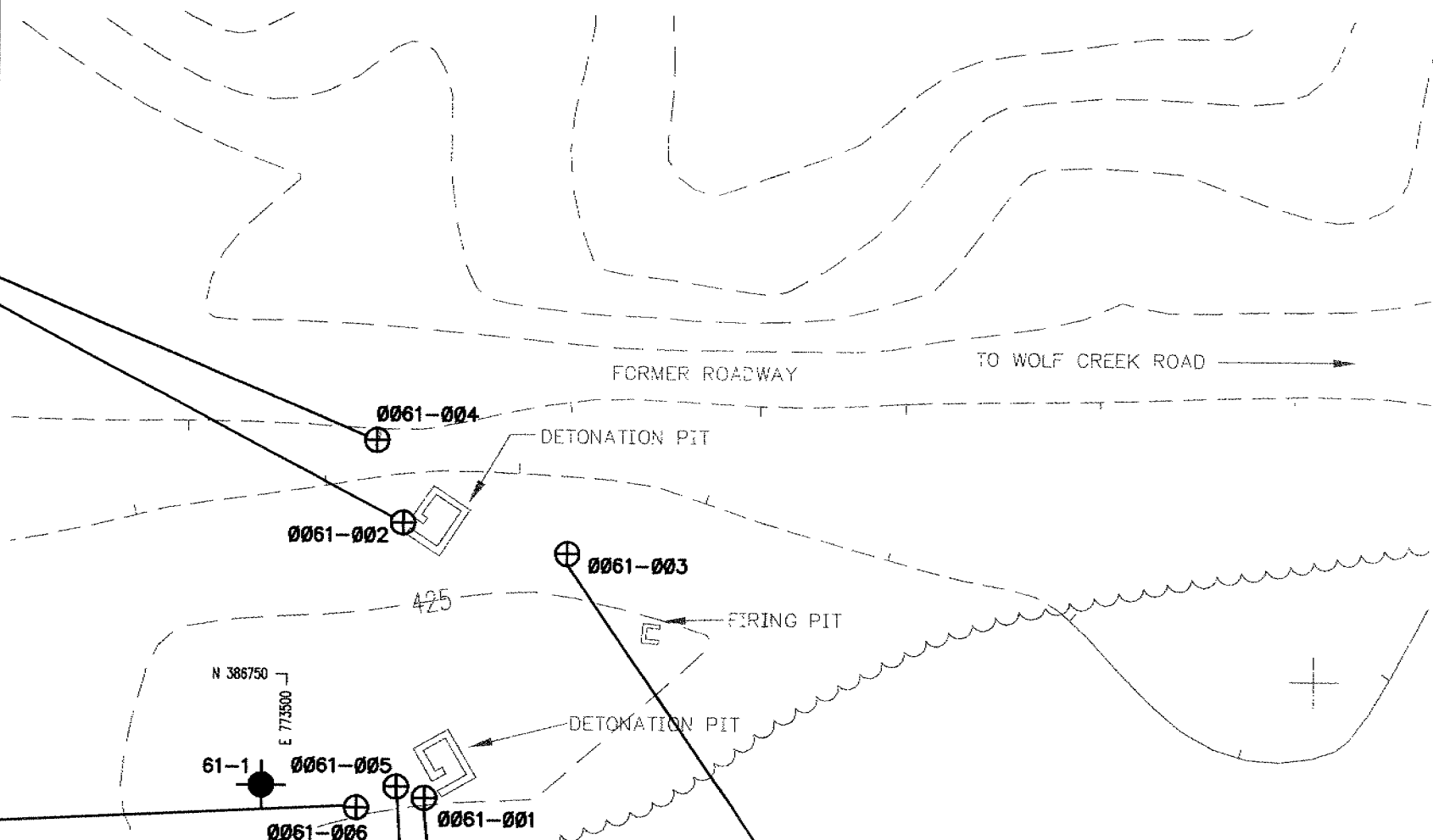
AUS-0061-005	Units	Result:	Reference
		0 - 6 In	Code
<b>Metals</b>			
Aluminum	MG/KG	8320	
Antimony	MG/KG	3.5	b1,h5
Arsenic	MG/KG	5.2	h1,h5,h7
Barium	MG/KG	90.2	h5
Beryllium	MG/KG	0.39	
Calcium	MG/KG	2.6	e1
Chromium	MG/KG	61.3	b1,e1,h5,h9
Cobalt	MG/KG	2030	
Copper	MG/KG	12.9	e1,h5
Iron	MG/KG	7	
Lead	MG/KG	54.7	b1,e1
Magnesium	MG/KG	34700	b1,e1
Manganese	MG/KG	230	b1
Mercury	MG/KG	1270	
Nickel	MG/KG	544	e1
Potassium	MG/KG	0.46	b1,e5,h9
Selenium	MG/KG	13.8	h5
Sodium	MG/KG	689	b1
Vanadium	MG/KG	2.7	b1,e1,e5,h5,h9
Zinc	MG/KG	34.1	
	MG/KG	19.1	
	MG/KG	245	b1,e1

AUS-0061-001	Units	Result:	Reference
		0 - 6 In	Code
<b>Metals</b>			
Aluminum	MG/KG	7370	
Antimony	MG/KG	7.3	b1,e1,h5,h9
Arsenic	MG/KG	13.6	b1,e1,h1,h5,h7
Barium	MG/KG	139	h5
Beryllium	MG/KG	0.51	
Boron	MG/KG	4.4	e1
Cadmium	MG/KG	90.9	b1,e1,h5,h9
Calcium	MG/KG	9090	b1
Chromium	MG/KG	23.9	e1,h5
Cobalt	MG/KG	7.8	
Copper	MG/KG	69.9	b1,e1
Iron	MG/KG	70400	b1,e1
Lead	MG/KG	544	b1,e1,h7,h9
Magnesium	MG/KG	1740	b1
Manganese	MG/KG	1400	e1
Mercury	MG/KG	0.7	b1,e5,h9
Nickel	MG/KG	44.6	b1,e1,h5
Potassium	MG/KG	810	b1
Selenium	MG/KG	5.8	b1,e1,e5,h5,h9
Sodium	MG/KG	64.3	
Vanadium	MG/KG	21.4	
Zinc	MG/KG	893	b1,e1,h5

AUS-0061-003	Units	Result:	Reference
		0 - 6 In	Code
<b>Metals</b>			
Aluminum	MG/KG	8480	
Arsenic	MG/KG	6.7	h1,h5,h7
Barium	MG/KG	126	h5
Beryllium	MG/KG	0.53	
Boron	MG/KG	6.2	b1,e1
Cadmium	MG/KG	1.3	b1,h5
Calcium	MG/KG	2690	b1
Chromium	MG/KG	11.3	e1,h5
Cobalt	MG/KG	7.6	
Copper	MG/KG	8.2	
Iron	MG/KG	11300	e1
Lead	MG/KG	32.2	b1
Magnesium	MG/KG	1210	
Manganese	MG/KG	1640	e1
Nickel	MG/KG	11.2	h5
Potassium	MG/KG	657	b1
Selenium	MG/KG	1.1	e1,e5,h5
Sodium	MG/KG	56.1	
Thallium	MG/KG	0.61	b1
Vanadium	MG/KG	25.3	
Zinc	MG/KG	64.4	b1



Screening Reference	Reference Code
AUS Background Soil UTL	b1
Little Grassy Background Sediment UTL	b2
Little Grassy Background Surface Water UTL	b3
Ecological Direct Exposure Pathway TRV - Soil	e1
Ecological Direct Exposure Pathway TRV - Sediment	e2
Ecological Direct Exposure Pathway TRV - Surface Water	e3
IEPA General Use Surface Water Quality Aquatic Life Toxicity	e4
Superfund Chemical Data Matrix Kow values (potential bioaccumulator)	e5
USEPA Region IX Industrial Soil PRG - cancerous	h1
USEPA Region IX Industrial Soil PRG - noncancerous	h2
USEPA Region IX Tap Water PRG - cancerous	h3
USEPA Region IX Tap Water PRG - noncancerous	h4
USEPA Region IX Migration to Groundwater PRG (DAF=1)	h5
USEPA MCL Drinking Water Standards	h6
IEPA TACO Industrial/Commercial Soil Ingestion	h7
IEPA TACO Construction Worker Soil Ingestion	h8
IEPA TACO Class 1 Soil Component of Groundwater	h9
IEPA General Use Surface Water Quality Human Health	h10

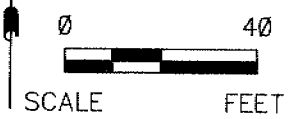


**NOTE:**

1. BASE TOPOGRAPHIC MAP PREPARED BY WALKER & ASSOCIATES, FROM FLYOVER IN JANUARY 2000. CONTOUR INTERVAL IS ONE FOOT.
2. DATA QUALIFIERS FOR ANALYTICAL RESULTS ARE NOT INDICATED. REFER TO THE QCSR FOR DATA QUALIFIERS.

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DRN. BY: djd 7/28/00 DSGN. BY: mam CHKD. BY: mch/cm	AUS-0061 Sample Locations and Detections of Inorganic Compounds in Soils	FIG. NO. 38-2

## AUS-0061-IOP DETONATION AND DISPOSAL AREA



**SECTION THIRTY-NINE****Drum Disposal Area East of Area 11**

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 (which is impassable to vehicular traffic). 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. The location of AUS-106A is shown in Figure 30-1, along with the other sites included in the volume.

**AUS Original Site Designations**

AUS-106A was not one of the original Additional and Uncharacterized Sites Operable Unit (AUS OU) sites designated in 1997-1999 by the United States Fish & Wildlife Service (USFWS). This site was discovered during the site visit to AUS-0057, one of the original AUS OU sites. Entech also later independently identified this site on a 1951 aerial photograph.<sup>1</sup>

AUS-0057 was described as a dump with a "metal object on [the] ground." This metal object may have been either an oven hood or one of two stacks that were identified in this location. These objects are located near the drum disposal area; therefore AUS-0057 was incorporated into AUS-106A. The site number AUS-0057 has been dropped and the area is included with AUS-106A.

**39.1 HISTORIC SEARCH INFORMATION****39.1.1 Site Description**

There is a north-south roadway on the east side of former Building 9 in AUS-A11N. This former building is just to the north of a very deep drainage ditch that flows underneath the roadway. The former access road to AUS-106A is located just east of former Building 9, on the other side of another deep drainage ditch. AUS-106A is located on the north side of this former access road, approximately 1,100 ft due east of the north-south roadway on the east side of former Building 9. About midway between the site and the north-south roadway is an intermittent stream and fence line which cross the former access road.

**39.1.2 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 (the abandoned roadway mentioned above).<sup>2</sup> There was no evidence

<sup>1</sup> Entech, Inc., 1999, Historical Aerial Photographic Analysis – Inventory of Potential Disposal Sites: Additional and Uncharacterized Sites (AUS) Operable Unit, Crab Orchard National Wildlife Refuge, Marion, Illinois, Volume I (Text) Page 3-66, and Volume II (Maps) Page JJ.

<sup>2</sup> Entech, Inc., 1999, Historical Aerial Photographic Analysis – Inventory of Potential Disposal Sites: Additional and Uncharacterized Sites (AUS) Operable Unit, Crab Orchard National Wildlife Refuge, Marion, Illinois, Volume I (Text) Page 3-66, and Volume II (Maps) Page JJ. The Entech reports analyze historic aerial overflight photographs of industrial areas at the Refuge, from 1943 to 1993. The photos were obtained from the National Archives and Records Administration (NARA) and the U.S. Department of Agriculture Agricultural Stabilization and Conservation Service (ASCS).

**SECTION THIRTY-NINE****Drum Disposal Area East of Area 11**

of this disposal site in the 1943 aerial photographs.<sup>3</sup> The disposal site was located in a topographically low area.<sup>4</sup> In 1951, portions of the site were vegetated, indicating that these parts 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,<sup>5</sup> 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 Sherwin-Williams Defense Corporation, under contract with the War Department (SWDC/War Department) (operator, 1942-1945), Hoosier Cardinal (tenant, 1948 through 1954) or Silas Mason (operator, 1947 through 1950). Some evidence was found that suggested Hoosier Cardinal might have used this disposal area. USFWS found an old Ford emblem at the site. Hoosier Cardinal manufactured plastic Ford emblems in 1950, 1951 and 1952 according to Mr. Ray Almaroad, a former Hoosier Cardinal employee.<sup>6</sup> It is also possible that the SWDC/War Department used this site, alone or in addition to later tenants, since the 1951 aerial photographs (taken while Hoosier Cardinal was present in Area 11) showed that portions of the site were already overgrown.

There were no known industrial lessees of this property.

**39.1.3 AUS-106A Previous Sampling Results**

There has been no previous sampling at this site.

**39.1.4 Observations During Site Visit**

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.

**39.1.5 Recommendations Based on Preliminary Assessment**

AUS-106A was included in the Site Investigation (SI) because it contains a large number of abandoned drums of unknown materials and the site has not been previously investigated.

<sup>3</sup> Entech, Inc., 1999, Historical Aerial Photographic Analysis – Inventory of Potential Disposal Sites: Additional and Uncharacterized Sites (AUS) Operable Unit, Crab Orchard National Wildlife Refuge, Marion, Illinois, Volume I (Text) Page 3-66, and Volume II (Maps) Page JJ. The Entech reports analyze historic aerial overflight photographs of industrial areas at the Refuge, from 1943 to 1993. The photos were obtained from the National Archives and Records Administration (NARA) and the U.S. Department of Agriculture Agricultural Stabilization and Conservation Service (ASCS).

<sup>4</sup> Entech, Inc., 1999, Historical Aerial Photographic Analysis – Inventory of Potential Disposal Sites: Additional and Uncharacterized Sites (AUS) Operable Unit, Crab Orchard National Wildlife Refuge, Marion, Illinois, Volume I (Text) Page 3-66.

<sup>5</sup> Entech, Inc., 1999, Historical Aerial Photographic Analysis – Inventory of Potential Disposal Sites: Additional and Uncharacterized Sites (AUS) Operable Unit, Crab Orchard National Wildlife Refuge, Marion, Illinois, Volume I (Text) Page 3-66.

<sup>6</sup> Ray Almaroad, personal interview, September 8, 1999.

**SECTION THIRTY-NINE****Drum Disposal Area East of Area 11****39.2 SITE INVESTIGATION INFORMATION**

URS conducted a Site Investigation at AUS-106A on May 10, 2000. The rationale for sample locations, media, and analytes is presented in the Field Sampling Plan (FSP)<sup>7</sup> for the AUS OU PA/SI. Since the time the FSP was prepared, additional information has become available, and the historic discussion (Section 39.1) has been updated to include that information. The sampling locations discussed below are based on the information that was available at the time the FSP was developed, and may not address all areas of potential releases.

AUS OU SI sample locations are shown on Figures 39-1, 39-2, and 39-3. Survey coordinates for all sample locations in AUS-106A are listed in Table 39-1. Table 39-2 lists the sample locations and the matrix sampled at that location. Nine soil samples and three samples of drum contents were obtained. All samples are soil samples unless otherwise noted.

**39.2.1 Field Investigation**

Sampling was done in accordance with the FSP, except as noted.

**Drum Disposal Area**

Soil sample locations 106A-001 through 106A-007 are in the soil mound, beneath the drums. Sample locations 106A-008, 106A-009 and 106A-010 (not shown in the figure) are from the materials that remained inside the drums.

**Nearby Creeks/Drainageways**

Soil sample locations 106A-011 and 106A-012 were along drainageways that appear to receive runoff from the site. Location 106A-011 was from a drainageway along the north side of the mound of partially buried drums. Location 106A-012 is in the drainageway that some of the drums are in, downstream of the mound (see Figure 39-1).

**39.2.2 Field Results****39.2.2.1 Site Conditions****39.2.2.1.1 *Geologic Conditions***

There were no test pits or monitoring wells installed at AUS-106A. Soil collected from the hand auger borings, which extended to depths of two ft, was described as silty clay fill. Several samples showed that the fill included debris such as bricks and paint-like material.

**39.2.2.1.2 *Hydrogeologic Conditions***

No hydrogeological information is available for this site.

<sup>7</sup> U.S. Fish & Wildlife Service, Department of the Interior, March 2000, Draft Final Field Sampling Plan Site Inspection, Additional and Uncharacterized Sites Operable Unit, Crab Orchard National Wildlife Refuge Superfund Site, Marion, Illinois (Williamson County), prepared by URS Corporation.

**SECTION THIRTY-NINE****Drum Disposal Area East of Area 11****39.2.2.1.3 Hydrologic Conditions**

A drainageway flows through the site, beginning in the south and exiting at the east side of the site (Figure 39-1). The drum mound is partially within this drainageway, as shown in the figure.

**39.2.2.2 Chemical Results**

The sample analytical results are summarized in the following tables:

- Table 39-3 -- soil samples results, and
- Table 39-4 -- drum content sample results.

These tables list all the chemicals detected in AUS-106A during this investigation, along with the frequency and range of detections.<sup>8</sup> Tabulated results of all analyses are included in the Quality Control Summary Report.

Sample results are presented on figures as follows:

- Figure 39-1 -- organic results for soil samples,
- Figure 39-2 -- inorganic results for soil samples, and
- Figure 39-3 -- all results for drum samples.

**39.3 SCREENING RISK ASSESSMENT**

Results of the screening are presented in Tables 39-5 through 39-8 as follows:

- Table 39-5--human health risk screening for soils,
- Table 39-6--human health risk screening for drum samples,
- Table 39-7--ecological risk screening for soils, and
- Table 39-8--ecological risk screening for drum samples.

Each table lists the maximum detected concentration for each constituent analyzed at Site 106A. The screening results are presented in the tables in terms of hazard quotients (HQs). The HQ for any chemical detected, for any particular screening criterion is simply the ratio of the maximum detected concentration to the screening concentration. For human health for carcinogens, a screening level "cancer risk" is calculated instead of an HQ.

Chemicals that are shaded in the tables are those that exceeded the screening criteria, and are identified as chemicals of potential concern (COPCs) for human health risk, and chemicals of potential ecological concern (COPECs) for ecological risk. The only COPCs/COPECs not shaded in the table are those inorganic constituents that exceeded the screening criteria but were detected at levels below Refuge background.

In cases where the chemical was analyzed but not detected, the HQ is the ratio between the maximum reporting limit and the screening concentration. Chemicals not detected are identified

<sup>8</sup> Duplicate results were not included in the range except when the maximum value detected was in a duplicate sample. Therefore there may be some duplicate samples with results below the low end of the range reported in the tables, that are not shown in the tables.

**SECTION THIRTY-NINE****Drum Disposal Area East of Area 11**

with a "U" qualifier in the qualifier column. When these HQ values exceed one, they are not shaded. These constituents are not identified as COPCs/COPECs, but rather as uncertainties.

In Figures 39-1 through 39-3 the shading convention used is the same as for the tables discussed above. The particular screening criteria exceeded are indicated by the code in the analytical results labels. Duplicate results are shown only if the duplicate result for an analyte exceeded the screening criteria and the result from the original sample did not; or, if the analyte was detected in the duplicate and not in the original sample. Since in the screening process results which are qualified as estimated (coded with "J") are treated the same as unqualified results, data qualifiers are not included in the results shown in the figures. Refer to the QCSR for data qualifiers.

Tables 39-9 and 39-9A (human health risk), and 39-10 and 39-10A (ecological risk) list all the analytes and corresponding media sampled and indicate whether each is a COPC (or COPEC), not a COPC (or COPEC), or an uncertainty. The codes in the tables indicate the rationale for each classification. All COPCs (Tables 39-9 and 39-9A) and COPECs (Tables 39-10 and 39-10A) are shaded in the tables.

**39.3.1 Human Health Risk****39.3.1.1 Soil/Drum**

Human health screening results for soil and drum samples are presented in Tables 39-5 and 39-6, respectively. Soil screening values were conservatively used to screen the drum samples.

A cancer risk was calculated using the United States Environmental Protection Agency (USEPA) Region 9 Industrial Soil Preliminary Remediation Goal (PRG) for carcinogens screening values. For carcinogens, a cancer risk was calculated using the USEPA Region 9 Industrial Soil PRGs as screening values. The cancer risk was derived by calculating a ratio of the maximum detected concentrations, or the maximum reporting limits, to their appropriate screening values. These ratios were then multiplied by  $1 \times 10^{-6}$ . In addition, ratios were calculated using the USEPA Region 9 Industrial Soil PRG for Toxins, the USEPA Region 9 Migration to Groundwater Criteria (Dilution Attenuation Factor (DAF)=1), the Illinois Tiered Approach to Corrective Action Objectives (TACO) Industrial/Commercial Soil Ingestion Criteria, the Illinois TACO Construction Worker Soil Ingestion Criteria, and the Illinois TACO Class I Soil Component of Groundwater Criteria.

**39.3.2 Ecological Risk****3.3.2.1 Soil/Drum**

Ecological screening results for soil and drum samples are presented in Tables 39-7 and 39-8, respectively. Soil screening values were conservatively used to screen the drum samples.

Soil screening concentrations for direct exposures were developed using toxicity reference values (TRVs) derived from several sources, including the following:



## SECTION THIRTY-NINE

## Drum Disposal Area East of Area 11

- USEPA (2000)<sup>9</sup>
- Environment Canada (1995)<sup>10</sup>
- Talmage *et al.* (1999)<sup>11</sup>
- Efroymsen *et al.* (1997a, 1997b)<sup>12</sup>
- CCME (1999)<sup>13</sup>
- MHSPE (1994)<sup>14</sup>
- Other sources

A detailed discussion of the screening concentration selection is presented in Appendix G.

The screening approach for ingestion pathway exposures was based on the potential for a chemical to bioaccumulate. The potential for a chemical to bioaccumulate was based on the organic chemical-specific octanol-to-water partitioning coefficient ( $K_{ow}$ ), which provides an indication of the lipophilicity of an organic chemical, and its potential for sequestration in biological tissue. The document *Assessment and Control of Bioconcentratable Contaminants in Surface Waters* (USEPA 1991)<sup>15</sup> used a log  $K_{ow}$  of 3.5 as a target threshold value indicative of bioaccumulative chemicals to target organic chemicals of greatest concern. Using this as a guideline, organic chemicals with a log  $K_{ow}$  greater than 3.5 were considered potentially bioaccumulative chemicals. Among inorganics, mercury and selenium were considered as potentially bioaccumulative chemicals. Any potentially bioaccumulative chemical that is detected was retained as a COPEC.

#### 39.4 SCIENTIFIC MANAGEMENT DECISION POINT

A Remedial Investigation (RI) is recommended for Site AUS-106A, based on exceedances of the SI screening criteria.

This report recommends that inorganic constituents that exceeded project screening criteria but were within Refuge background levels not be retained as COPCs/COPECs for further evaluation.

<sup>9</sup> USEPA. 2000. Ecological Soil Screening Level Guidance (Draft). USEPA Office of Emergency and Remedial Response, Washington, DC.

<sup>10</sup> Environment Canada. 1995. Toxicity Testing of NCSRP Priority Substances for Development of Soil Quality Guidelines for Contaminated Sites. Guidelines Division, Evaluation and Interpretation Branch, Environmental Conservation Directorate, Environment Canada. Hull, Quebec.

<sup>11</sup> Talmage, S.S., D.M. Opresko, C.J. Maxwell, C.J.E. Welsh, F. M. Cretella, P.H. Reno, and F. B. Daniel. 1999. Nitroaromatic Munition Compounds: Environmental Effects and Screening Values. *Rev Environ. Contam. Toxicol* 161:1-156.

<sup>12</sup> Efroymsen, R.A., M.E. Will, G.W. Suter II, and A.C. Wooten. 1997a. *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision*. Oak Ridge National Laboratory, Oak Ridge, Tennessee. ES/ER/TM-85/R3.

Efroymsen, R.A., M.E. Will, and G.W. Suter II. 1997b. *Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision*. Oak Ridge National Laboratory, Oak Ridge, Tennessee. ES/ER/TM-126/R2.

<sup>13</sup> Canadian Council of Ministers of the Environment. 1999. Canadian Environmental Quality Guidelines.

<sup>14</sup> Ministry of Housing, Spatial Planning, and the Environment (MHSPE). 1994. *Intervention Values and Target Values – Soil Quality Standards*. Directorate General for Environmental Protection, Department of Soil Protection, The Hague, The Netherlands.

<sup>15</sup> USEPA 1991. *Assessment and Control of Bioconcentratable Contaminants in Surface Waters* (Draft). US Environmental Protection Agency Office of Research and Development, Washington, D.C.

**SECTION THIRTY-NINE****Drum Disposal Area East of Area 11**

These are the constituents coded with "D" on the COPC list for drum samples, Table 39-9A which includes antimony. The only COPEC coded with "D" on Tables 39-10 and 39-10A is manganese. This chemicals may later be included in the RI for other reasons (for example, as standard components in an analytical method; if new information on site usage suggests they should be evaluated; or if they are of concern in other media) but the detections at the locations noted are not considered to be of concern since they are below Refuge background levels. All other COPCs/COPECs listed on these tables should be evaluated in the RI. In addition, all analytes listed as uncertainties on these tables should be considered for further evaluation in the RI Work Plan.

Chemicals that exceeded screening criteria and Refuge background (if applicable) are listed in Table 39-11.

Note that a number of the human health COPCs exceed migration to groundwater screening criteria. Groundwater has not been investigated at this site, and based on these data, should be considered in the RI. Other areas of the site and media and contaminants in addition to those addressed in this study may warrant investigation in the RI. These issues will be addressed in the work plan for the RI.

**SECTION THIRTY-NINE****Drum Disposal Area East of Area 11**

TABLE 39-1  
 SURVEY COORDINATES FOR SAMPLE LOCATIONS IN AUS-106A

Sample Location	Northing	Easting	Ground Surface Elevation	Top of Casing Elevation	Comments
106A-001	364899.4	784077.2	429.60	NA	
106A-002	364897.8	784094.8	428.97	NA	
106A-003	364899.7	784113.5	429.31	NA	
106A-004	364896.4	784129.6	429.24	NA	
106A-005	364892.8	784143.8	429.62	NA	
106A-006	364872.2	784158.2	427.62	NA	
106A-007	364848.8	784168.2	428.49	NA	
106A-008	364904.3	784093.5	428.58	NA	
106A-009	364902.6	784131.5	429.55	NA	
106A-010	364853.0	784176.7	425.86	NA	
106A-011	364904.1	784139.2	426.76	NA	
106A-012	364873.6	784193.6	424.10	NA	

Sheet 1 of 1

NA = Not Applicable

**TABLE 39-2  
MATRICES SAMPLED AT EACH  
SAMPLE LOCATION AT AUS-106A**

<b>Drum</b>	<b>Soil</b>
AUS-106A-008	AUS-106A-001
AUS-106A-009	AUS-106A-002
AUS-106A-010	AUS-106A-003
	AUS-106A-004
	AUS-106A-005
	AUS-106A-006
	AUS-106A-007
	AUS-106A-011
	AUS-106A-012

Sheet 1 of 1

## SECTION THIRTY-NINE

## Drum Disposal Area East of Area 11

TABLE 39-3  
SOIL SAMPLE ANALYTICAL RESULTS SUMMARY

Constituents	Number of Detections	Range of Detections
<b>Volatile Organic Compounds</b>		
1,2-Dichloroethene (Total)	1/9	24 ug/kg
2-Butanone (Methyl Ethyl Ketone)	1/9	53 ug/kg
cis-1,2-Dichloroethylene	1/9	24 ug/kg
Ethylbenzene	1/9	6 ug/kg
Styrene	1/9	200 ug/kg
total Xylenes	3/9	3 ug/kg to 440 ug/kg
Trichloroethylene (TCE)	7/9	18 ug/kg to 13,000 ug/kg
<b>Semivolatile Organic Compounds</b>		
2-Methylnaphthalene	7/9	76 ug/kg to 820 ug/kg
Benzo(a)anthracene	2/9	66 ug/kg to 68 ug/kg
Benzo(a)pyrene	2/9	59 ug/kg to 66 ug/kg
Benzo(b)fluoranthene	3/9	57 ug/kg to 74 ug/kg
Benzo(g,h,i)perylene	3/9	50 ug/kg to 95 ug/kg
Benzo(k)fluoranthene	2/9	52 ug/kg to 56 ug/kg
Bis(2-ethylhexyl) phthalate	6/9	1,600 ug/kg to 18,000 ug/kg
Chrysene	7/9	59 ug/kg to 170 ug/kg
Di-n-butyl phthalate	7/9	110 ug/kg to 11,000 ug/kg
Di-n-octyl phthalate	1/9	72 ug/kg
Dibenzofuran	4/9	68 ug/kg to 140 ug/kg
Diethyl phthalate	5/9	63 ug/kg to 220 ug/kg
Dimethyl phthalate	4/9	52 ug/kg to 6,100 ug/kg
Fluoranthene	3/9	66 ug/kg to 74 ug/kg
Indeno(1,2,3-c,d)pyrene	2/9	53 ug/kg to 61 ug/kg
Naphthalene	7/9	87 ug/kg to 590 ug/kg
Phenanthrene	7/9	120 ug/kg to 320 ug/kg
Pyrene	7/9	57 ug/kg to 140 ug/kg
<b>Explosives</b>		
HMX	1/9	1,500 ug/kg
Tetryl	1/9	1,500 ug/kg
<b>Metals</b>		
Aluminum	9/9	11,500 mg/kg to 51,500 mg/kg
Antimony	8/9	0.41 mg/kg to 6.2 mg/kg
Arsenic	9/9	4.3 mg/kg to 22.6 mg/kg
Barium	9/9	64.3 mg/kg to 1,730 mg/kg
Beryllium	8/9	0.34 mg/kg to 0.97 mg/kg
Boron	9/9	2 mg/kg to 43.5 mg/kg
Cadmium	9/9	1.6 mg/kg to 150 mg/kg
Calcium	9/9	1,500 mg/kg to 39,800 mg/kg
Chromium, Total	9/9	15.4 mg/kg to 222 mg/kg
Cobalt	9/9	5.3 mg/kg to 11.1 mg/kg
Copper	9/9	17 mg/kg to 3,300 mg/kg

Sheet 1 of 2

**SECTION THIRTY-NINE****Drum Disposal Area East of Area 11**

**TABLE 39-3  
SOIL SAMPLE ANALYTICAL RESULTS SUMMARY**

Constituents	Number of Detections	Range of Detections
Iron	9/9	13,600 mg/kg to 95,600 mg/kg
Lead	9/9	17.9 mg/kg to 2,470 mg/kg
Magnesium	9/9	1,460 mg/kg to 15,500 mg/kg
Manganese	9/9	263 mg/kg to 1,380 mg/kg
Mercury	9/9	0.022 mg/kg to 1.1 mg/kg
Nickel	9/9	11.3 mg/kg to 370 mg/kg
Potassium	9/9	666 mg/kg to 2,930 mg/kg
Selenium	8/9	1.5 mg/kg to 21.8 mg/kg
Silver	6/9	0.31 mg/kg to 5.3 mg/kg
Sodium	9/9	48 mg/kg to 2,090 mg/kg
Vanadium	9/9	19.1 mg/kg to 49.1 mg/kg
Zinc	9/9	71.3 mg/kg to 3,160 mg/kg

Sheet 2 of 2

mg/kg = milligrams per kilogram

ug/kg = micrograms per kilogram

Notes: This table was derived from the figures that show the analytical results. As a result, duplicates are shown only if the duplicate result for an analyte exceeded the screening criteria and the result from the original sample did not; or, if the analyte was detected in the duplicate and not in the original sample. There may be some duplicate results, not shown in the table, that are outside the range shown. In addition, the frequency and range of detections is based on the number of sample locations, not the total number of samples (the total number of samples includes originals plus duplicates).

Checked by: MMF 7/20/01

## SECTION THIRTY-NINE

## Drum Disposal Area East of Area 11

TABLE 39-4  
DRUM SAMPLE ANALYTICAL RESULTS SUMMARY

Constituents	Number of Detections	Range of Detections
<b>Volatile Organic Compounds</b>		
1,2-Dichloroethene (Total)	1/3	6 ug/kg
Benzene	1/3	9 ug/kg
cis-1,2-Dichloroethylene	1/3	6 ug/kg
Toluene	1/3	4 ug/kg
Trichloroethylene (TCE)	2/3	9 ug/kg to 62 ug/kg
<b>Semivolatile Organic Compounds</b>		
2-Methylnaphthalene	1/3	1,200 ug/kg
Anthracene	2/3	51 ug/kg to 77 ug/kg
Benzo(a)anthracene	2/3	87 ug/kg to 120 ug/kg
Benzo(a)pyrene	2/3	63 ug/kg to 120 ug/kg
Benzo(b)fluoranthene	1/3	180 ug/kg
Benzo(g,h,i)perylene	1/3	140 ug/kg
Benzo(k)fluoranthene	1/3	170 ug/kg
Chrysene	3/3	110 ug/kg to 130 ug/kg
Di-n-butyl phthalate	2/3	180 ug/kg to 670 ug/kg
Di-n-octylphthalate	2/3	80 ug/kg to 83 ug/kg
Dibenzofuran	1/3	300 ug/kg
Fluoranthene	2/3	68 ug/kg to 80 ug/kg
Indeno(1,2,3-c,d)pyrene	1/3	120 ug/kg
Naphthalene	1/3	540 ug/kg
Phenanthrene	2/3	200 ug/kg to 470 ug/kg
Pyrene	2/3	110 ug/kg to 160 ug/kg
<b>Metals</b>		
Aluminum	3/3	5490 mg/kg to 10,500 mg/kg
Antimony	3/3	1.9 mg/kg to 6.5 mg/kg
Arsenic	2/3	8 mg/kg to 14.1 mg/kg
Barium	3/3	284 mg/kg to 385 mg/kg
Beryllium	2/3	0.2 mg/kg
Boron	3/3	4.7 mg/kg to 33.6 mg/kg
Cadmium	2/3	12.3 mg/kg to 45.8 mg/kg
Calcium	3/3	5,120 mg/kg to 10,000 mg/kg
Chromium, Total	3/3	4.7 mg/kg to 57.1 mg/kg
Cobalt	2/3	4.1 mg/kg to 7.1 mg/kg
Copper	3/3	23.3 mg/kg to 410 mg/kg
Iron	3/3	4,440 mg/kg to 101,000 mg/kg
Lead	3/3	236 mg/kg to 279 mg/kg
Magnesium	3/3	902 mg/kg to 4,330 mg/kg
Manganese	3/3	367 mg/kg to 879 mg/kg
Mercury	2/3	0.049 mg/kg to 0.11 mg/kg
Nickel	3/3	5.2 mg/kg to 76 mg/kg

Sheet 1 of 2

**SECTION THIRTY-NINE****Drum Disposal Area East of Area 11**

**TABLE 39-4  
DRUM SAMPLE ANALYTICAL RESULTS SUMMARY**

<b>Constituents</b>	<b>Number of Detections</b>	<b>Range of Detections</b>
Potassium	3/3	273 mg/kg to 725 mg/kg
Selenium	2/3	2.5 mg/kg to 2.8 mg/kg
Silver	1/3	0.33 mg/kg
Sodium	3/3	217 mg/kg to 2,550 mg/kg
Thallium	1/3	0.95 mg/kg
Vanadium	3/3	1.3 mg/kg to 18.6 mg/kg
Zinc	3/3	530 mg/kg to 10,700 mg/kg

Sheet 2 of 2

mg/kg = milligrams per kilogram

ug/kg = micrograms per kilogram

Notes: This table was derived from the figures that show the analytical results. As a result, duplicates are shown only if the duplicate result for an analyte exceeded the screening criteria and the result from the original sample did not; or, if the analyte was detected in the duplicate and not in the original sample. There may be some duplicate results, not shown in the table, that are outside the range shown. In addition, the frequency and range of detections is based on the number of sample locations, not the total number of samples (the total number of samples includes originals plus duplicates).

Checked by: MMF 7/20/01



**TABLE 39-5  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-106A**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
<b>Volatile Organic Compounds</b>								
71-55-6	1,1,1-Trichloroethane	8	U	UG/KG			2.40E-06	8.00E-02
79-34-5	1,1,2,2-Tetrachloroethane	8	U	UG/KG		8.91E-09	2.05E-06	4.00E+01
79-00-5	1,1,2-Trichloroethane	8	U	UG/KG		4.21E-09	5.26E-05	8.89E+00
75-34-3	1,1-Dichloroethane	8	U	UG/KG			3.88E-06	8.00E-03
75-35-4	1,1-Dichloroethene	8	U	UG/KG		6.74E-08	1.19E-04	2.67E+00
107-06-2	1,2-Dichloroethane (EDC)	8	U	UG/KG		1.05E-08	2.27E-04	8.00E+00
540-59-0	1,2-Dichloroethene (total)	24	J	UG/KG			1.63E-04	1.20E+00
78-87-5	1,2-Dichloropropane	8	U	UG/KG		1.04E-08	3.76E-04	8.00E+00
78-93-3	2-Butanone (MEK)	53	J	UG/KG			1.91E-06	
591-78-6	2-Hexanone	17	UJ	UG/KG				
108-10-1	4-Methyl-2-pentanone (MIBK)	17	UJ	UG/KG			5.89E-06	
67-64-1	Acetone	80	UJ	UG/KG			1.29E-05	1.00E-01
71-43-2	Benzene	8	U	UG/KG		5.46E-09	3.30E-04	4.00E+00
75-27-4	Bromodichloromethane	8	UJ	UG/KG		3.39E-09	7.66E-06	2.67E-01
75-25-2	Bromoform	8	U	UG/KG		2.56E-11	4.54E-07	2.00E-01
74-83-9	Bromomethane	8	U	UG/KG			6.09E-04	8.00E-01
75-15-0	Carbon disulfide	8	U	UG/KG			6.62E-06	4.00E-03
56-23-5	Carbon tetrachloride	8	U	UG/KG		1.51E-08	1.14E-03	2.67E+00
108-90-7	Chlorobenzene	8	U	UG/KG			1.47E-05	1.14E-01
75-00-3	Chloroethane	8	U	UG/KG		1.23E-09	4.24E-07	
67-66-3	Chloroform	8	U	UG/KG		1.54E-08	6.21E-03	2.67E-01
74-87-3	Chloromethane	8	U	UG/KG		3.01E-09		
156-59-2	cis-1,2-Dichloroethene	24	J	UG/KG			1.63E-04	1.20E+00

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 39-5  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-106A**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
10061-01-5	cis-1,3-Dichloropropene	8	U	UG/KG		4.50E-08	1.82E-04	
124-48-1	Dibromochloromethane	8	U	UG/KG		3.01E-09	5.02E-06	4.00E-01
100-41-4	Ethylbenzene	6	J	UG/KG			1.00E-06	8.57E-03
75-09-2	Methylene chloride	8	U	UG/KG		3.90E-10	8.18E-07	8.00E+00
110-54-3	N-Hexane	8	U	UG/KG			1.98E-05	
100-42-5	Styrene	200	J	UG/KG			9.78E-06	1.00E+00
127-18-4	Tetrachloroethylene (PCE)	8	UJ	UG/KG		4.29E-10	4.70E-06	2.67E+00
108-88-3	Toluene	8	U	UG/KG			4.03E-06	1.33E-02
1330-20-7	total Xylenes	440	J	UG/KG			9.88E-05	4.40E-02
156-60-5	trans-1,2-Dichloroethene	8	U	UG/KG			3.74E-05	2.67E-01
10061-02-6	trans-1,3-Dichloropropene	8	UJ	UG/KG		4.50E-08	1.82E-04	
79-01-6	Trichloroethylene (TCE)	13000	J	UG/KG		2.13E-06	1.64E-01	4.33E+03
75-01-4	Vinyl chloride	8	UJ	UG/KG		1.64E-07		1.14E+01
<b>Semivolatile Organic Compounds</b>								
120-82-1	1,2,4-Trichlorobenzene	500	U	UG/KG			6.56E-05	1.67E+00
95-50-1	1,2-Dichlorobenzene	500	U	UG/KG			1.51E-04	5.56E-01
541-73-1	1,3-Dichlorobenzene	500	U	UG/KG			9.66E-03	
106-46-7	1,4-Dichlorobenzene	500	U	UG/KG		6.15E-08	2.60E-04	5.00E+00
95-95-4	2,4,5-Trichlorophenol	2500	U	UG/KG			2.84E-05	2.50E-01
88-06-2	2,4,6-Trichlorophenol	500	U	UG/KG		2.23E-09		6.25E+01
120-83-2	2,4-Dichlorophenol	500	U	UG/KG			1.89E-04	1.00E+01
105-67-9	2,4-Dimethylphenol	500	U	UG/KG			2.84E-05	1.25E+00
51-28-5	2,4-Dinitrophenol	2500	U	UG/KG			1.42E-03	2.50E+02
91-58-7	2-Chloronaphthalene	500	U	UG/KG			1.83E-05	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 39-5**  
**HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-106A**

**ADDITIONAL AND UNCHARACTERIZED SITES OU**  
**CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
85-01-8	Phenanthrene	320	J	UG/KG			5.90E-06	1.60E-03
108-95-2	Phenol	500	U	UG/KG			9.46E-07	1.00E-01
129-00-0	Pyrene	140	J	UG/KG			2.58E-06	7.00E-04
<b>Explosives</b>								
99-35-4	1,3,5-Trinitrobenzene	370	U	UG/KG			1.40E-05	
99-65-0	1,3-Dinitrobenzene	370	U	UG/KG			4.20E-03	
118-96-7	2,4,6-Trinitrotoluene (TNT)	750	U	UG/KG		9.12E-09	1.70E-03	
121-14-2	2,4-Dinitrotoluene	370	U	UG/KG			2.10E-04	9.25E+03
606-20-2	2,6-Dinitrotoluene	500	U	UG/KG			5.68E-04	1.67E+04
35572-78-2	2-Amino-4,6-Dinitrotoluene	750	U	UG/KG				
88-72-2	2-Nitrotoluene (ONT)	750	U	UG/KG				
99-08-1	3-Nitrotoluene	750	U	UG/KG			3.69E-04	
19406-51-0	4-Amino-2,6-Dinitrotoluene	750	U	UG/KG				
99-99-0	4-Nitrotoluene (PNT)	750	U	UG/KG			3.69E-04	
2691-41-0	HMX	1500		UG/KG			3.41E-05	
98-95-3	Nitrobenzene	370	U	UG/KG			3.23E-03	
121-82-4	RDX	750	U	UG/KG		3.34E-08	2.84E-04	
479-45-8	Tetryl	1500		UG/KG			1.70E-04	
<b>Metals</b>								
7429-90-5	Aluminum	51500		MG/KG	1.79E+00		3.07E-02	
7440-36-0	Antimony	6.2		MG/KG	7.47E+00		7.58E-03	2.07E+01
7440-38-2	Arsenic	22.6	J	MG/KG	1.67E+00	8.29E-06	5.15E-02	2.26E+01
7440-39-3	Barium	1730	J	MG/KG	8.87E+00		1.39E-02	2.16E+01
7440-41-7	Beryllium	0.97		MG/KG	1.28E+00	4.33E-10	2.63E-04	3.23E-01

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
 J = Estimated U = Nondetect

**TABLE 39-5  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-106A**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
7440-42-8	Boron	43.5		MG/KG	8.21E+00		5.50E-04	
7440-43-9	Cadmium	150		MG/KG	7.89E+02	5.02E-08	1.85E-01	3.75E+02
7440-70-2	Calcium	39800		MG/KG	1.59E+01			
7440-47-3	Chromium	239	J	MG/KG	9.48E+00	5.33E-07		1.20E+02
7440-48-4	Cobalt	11.8		MG/KG	5.44E-01		9.62E-05	
7440-50-8	Copper	3300		MG/KG	2.92E+02		4.35E-02	
7439-89-6	Iron	95600		MG/KG	4.95E+00		1.56E-01	
7439-92-1	Lead	2470		MG/KG	1.06E+02			
7439-95-4	Magnesium	15500		MG/KG	9.99E+00			
7439-96-5	Manganese	1490	J	MG/KG	4.09E-01		4.62E-02	
7439-97-6	Mercury	1.1		MG/KG	1.83E+01			
7440-02-0	Nickel	370	J	MG/KG	1.96E+01		9.05E-03	5.29E+01
2023695	Potassium	2930		MG/KG	4.69E+00			
7782-49-2	Selenium	21.8		MG/KG	9.32E+00		2.13E-03	7.27E+01
7440-22-4	Silver	5.3		MG/KG	9.14E+00		5.19E-04	2.65E+00
7440-23-5	Sodium	2090		MG/KG	1.23E+01			
7440-28-0	Thallium	5.9	U	MG/KG	1.44E+01		4.12E-05	
7440-62-2	Vanadium	49.1		MG/KG	1.04E+00		3.43E-03	1.64E-01
7440-66-6	Zinc	3160		MG/KG	6.15E+01		5.16E-03	5.27E+00

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 39-5  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-106A**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
95-57-8	2-Chlorophenol	500	U	UG/KG			2.07E-03	2.50E+00
91-57-6	2-Methylnaphthalene	820		UG/KG			1.51E-05	4.10E-03
95-48-7	2-Methylphenol	500	U	UG/KG			1.14E-05	6.25E-01
88-74-4	2-Nitroaniline	2500	U	UG/KG			4.97E-02	
88-75-5	2-Nitrophenol	500	U	UG/KG			7.09E-05	
91-94-1	3,3'-Dichlorobenzidine	500	U	UG/KG		9.12E-08		1.67E+03
99-09-2	3-Nitroaniline	2500	U	UG/KG			4.97E-02	
534-52-1	4,6-Dinitro-2-methylphenol	2500	U	UG/KG				
101-55-3	4-Bromophenyl phenyl ether	500	U	UG/KG				
59-50-7	4-Chloro-3-methylphenol	500	U	UG/KG			1.14E-05	
106-47-8	4-Chloroaniline	1000	U	UG/KG			2.84E-04	3.33E+01
7005-72-3	4-Chlorophenyl phenyl ether	500	U	UG/KG				
106-44-5	4-Methylphenol	500	U	UG/KG			1.14E-04	
100-01-6	4-Nitroaniline	2500	U	UG/KG			4.97E-02	
100-02-7	4-Nitrophenol	2500	U	UG/KG			3.55E-04	
83-32-9	Acenaphthene	500	U	UG/KG			1.30E-05	1.67E-02
208-96-8	Acenaphthylene	500	U	UG/KG			9.22E-06	2.50E-03
120-12-7	Anthracene	500	U	UG/KG			1.28E-06	8.33E-04
56-55-3	Benzo(a)anthracene	68	J	UG/KG		2.36E-08		8.50E-01
50-32-8	Benzo(a)pyrene	66	J	UG/KG		2.29E-07		1.65E-01
205-99-2	Benzo(b)fluoranthene	74	J	UG/KG		2.56E-08		3.70E-01
191-24-2	Benzo(g,h,i)perylene	95	J	UG/KG			1.75E-06	4.75E-04
207-08-9	Benzo(k)fluoranthene	56	J	UG/KG		1.94E-09		2.80E-02
111-91-1	bis(2-Chloroethoxy)methane	500	U	UG/KG				

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 39-5  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-106A**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
111-44-4	bis(2-Chloroethyl) ether	500	U	UG/KG		8.07E-07		2.50E+04
108-60-1	bis(2-Chloroisopropyl) ether	500	U	UG/KG		6.19E-08	1.18E-04	
117-81-7	bis(2-Ethylhexyl) phthalate (DEHP)	18000		UG/KG		1.02E-07	1.02E-03	
85-68-7	Butyl benzyl phthalate	500	U	UG/KG			2.84E-06	6.25E-04
86-74-8	Carbazole	500	U	UG/KG		4.05E-09		1.67E+01
218-01-9	Chrysene	170	J	UG/KG		5.89E-10		2.13E-02
84-74-2	Di-n-butyl phthalate	11000		UG/KG			1.25E-04	3.67E-02
117-84-0	Di-n-octyl phthalate	72	J	UG/KG			4.09E-06	7.20E-06
53-70-3	Dibenz(a,h)anthracene	500	U	UG/KG		1.73E-06		6.25E+00
132-64-9	Dibenzofuran	140	J	UG/KG			2.77E-05	
84-66-2	Diethyl phthalate	220	J	UG/KG			3.12E-07	
131-11-3	Dimethyl phthalate	6100		UG/KG			6.92E-07	
206-44-0	Fluoranthene	74	J	UG/KG			2.46E-06	3.70E-04
86-73-7	Fluorene	500	U	UG/KG			1.51E-05	1.67E-02
118-74-1	Hexachlorobenzene	500	U	UG/KG		3.24E-07	7.09E-04	5.00E+00
87-68-3	Hexachlorobutadiene	500	U	UG/KG		1.58E-08	2.84E-03	5.00E+00
77-47-4	Hexachlorocyclopentadiene	500	U	UG/KG			8.48E-05	2.50E-02
67-72-1	Hexachloroethane	500	U	UG/KG		2.84E-09	5.68E-04	2.50E+01
193-39-5	Indeno(1,2,3-c,d)pyrene	61	J	UG/KG		2.11E-08		8.71E-02
78-59-1	Isophorone	500	U	UG/KG		1.93E-10	2.84E-06	1.67E+01
621-64-7	N-Nitroso-di-n-propylamine	500	U	UG/KG		1.42E-06		2.50E+05
86-30-6	N-Nitrosodiphenylamine	500	U	UG/KG		9.93E-10		8.33E+00
91-20-3	Naphthalene	590		UG/KG			3.13E-03	1.48E-01
87-86-5	Pentachlorophenol	2500	U	UG/KG		2.25E-07	1.75E-04	2.50E+03

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

TABLE 39-5  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-106A

ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
<b>Volatile Organic Compounds</b>							
71-55-6	1,1,1-Trichloroethane	8	U	UG/KG			4.00E-03
79-34-5	1,1,2,2-Tetrachloroethane	8	U	UG/KG			
79-00-5	1,1,2-Trichloroethane	8	U	UG/KG	9.76E-07	9.76E-07	4.00E-01
75-34-3	1,1-Dichloroethane	8	U	UG/KG	4.00E-08	4.00E-08	3.48E-04
75-35-4	1,1-Dichloroethene	8	U	UG/KG	4.44E-07	4.44E-06	1.33E-01
107-06-2	1,2-Dichloroethane (EDC)	8	U	UG/KG	1.27E-04	5.71E-06	4.00E-01
540-59-0	1,2-Dichloroethene (total)	24	J	UG/KG	1.20E-06	1.20E-06	6.00E-02
78-87-5	1,2-Dichloropropane	8	U	UG/KG	9.52E-05	4.44E-06	2.67E-01
78-93-3	2-Butanone (MEK)	53	J	UG/KG			
591-78-6	2-Hexanone	17	UJ	UG/KG			
108-10-1	4-Methyl-2-pentanone (MIBK)	17	UJ	UG/KG			
67-64-1	Acetone	80	UJ	UG/KG	4.00E-07	4.00E-07	5.00E-03
71-43-2	Benzene	8	U	UG/KG	4.00E-05	1.86E-06	2.67E-01
75-27-4	Bromodichloromethane	8	UJ	UG/KG	8.70E-05	4.00E-06	1.33E-02
75-25-2	Bromoform	8	U	UG/KG	1.11E-05	5.00E-07	1.00E-02
74-83-9	Bromomethane	8	U	UG/KG	2.76E-06	8.00E-06	4.00E-02
75-15-0	Carbon disulfide	8	U	UG/KG	4.00E-08	4.00E-07	2.50E-04
56-23-5	Carbon tetrachloride	8	U	UG/KG	1.82E-04	1.95E-05	1.14E-01
108-90-7	Chlorobenzene	8	U	UG/KG	1.95E-07	1.95E-06	8.00E-03
75-00-3	Chloroethane	8	U	UG/KG			
67-66-3	Chloroform	8	U	UG/KG	8.51E-06	4.00E-06	1.33E-02
74-87-3	Chloromethane	8	U	UG/KG			
156-59-2	cis-1,2-Dichloroethene	24	J	UG/KG	1.20E-06	1.20E-06	6.00E-02

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 39-5  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-106A**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
10061-01-5	cis-1,3-Dichloropropene	8	U	UG/KG			
124-48-1	Dibromochloromethane	8	U	UG/KG	1.95E-07	1.95E-07	2.00E-02
100-41-4	Ethylbenzene	6	J	UG/KG	3.00E-08	3.00E-07	4.62E-04
75-09-2	Methylene chloride	8	U	UG/KG	1.05E-05	6.67E-07	4.00E-01
110-54-3	N-Hexane	8	U	UG/KG			
100-42-5	Styrene	200	J	UG/KG	4.88E-07	4.88E-06	5.00E-02
127-18-4	Tetrachloroethylene (PCE)	8	UJ	UG/KG	7.27E-05	3.33E-06	1.33E-01
108-88-3	Toluene	8	U	UG/KG	1.95E-08	1.95E-08	6.67E-04
1330-20-7	total Xylenes	440	J	UG/KG	4.40E-07	1.07E-06	2.93E-03
156-60-5	trans-1,2-Dichloroethene	8	U	UG/KG	1.95E-07	1.95E-07	1.14E-02
10061-02-6	trans-1,3-Dichloropropene	8	UJ	UG/KG			
79-01-6	Trichloroethylene (TCE)	13000	J	UG/KG	2.50E-02	1.08E-02	2.17E+02
75-01-4	Vinyl chloride	8	UJ	UG/KG	2.67E-03	1.23E-04	8.00E-01
<b>Semivolatile Organic Compounds</b>							
120-82-1	1,2,4-Trichlorobenzene	500	U	UG/KG	2.50E-05	2.50E-04	1.00E-01
95-50-1	1,2-Dichlorobenzene	500	U	UG/KG	2.78E-06	2.78E-05	2.94E-02
541-73-1	1,3-Dichlorobenzene	500	U	UG/KG			
106-46-7	1,4-Dichlorobenzene	500	U	UG/KG			2.50E-01
95-95-4	2,4,5-Trichlorophenol	2500	U	UG/KG	1.25E-05	1.25E-05	9.26E-03
88-06-2	2,4,6-Trichlorophenol	500	U	UG/KG	9.62E-04	4.55E-05	2.50E+00
120-83-2	2,4-Dichlorophenol	500	U	UG/KG	8.20E-05	8.20E-04	5.00E-01
105-67-9	2,4-Dimethylphenol	500	U	UG/KG	1.22E-05	1.22E-05	5.56E-02
51-28-5	2,4-Dinitrophenol	2500	U	UG/KG	6.10E-04	6.10E-03	1.25E+01
91-58-7	2-Chloronaphthalene	500	U	UG/KG			

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect



**TABLE 39-5  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-106A**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
95-57-8	2-Chlorophenol	500	U	UG/KG	5.00E-05	5.00E-05	1.25E-01
91-57-6	2-Methylnaphthalene	820		UG/KG	1.34E-05	1.34E-05	1.95E-04
95-48-7	2-Methylphenol	500	U	UG/KG	5.00E-06	5.00E-06	3.33E-02
88-74-4	2-Nitroaniline	2500	U	UG/KG			
88-75-5	2-Nitrophenol	500	U	UG/KG			
91-94-1	3,3'-Dichlorobenzidine	500	U	UG/KG	3.85E-02	1.79E-03	7.14E+01
99-09-2	3-Nitroaniline	2500	U	UG/KG			
534-52-1	4,6-Dinitro-2-methylphenol	2500	U	UG/KG			
101-55-3	4-Bromophenyl phenyl ether	500	U	UG/KG			
59-50-7	4-Chloro-3-methylphenol	500	U	UG/KG			
106-47-8	4-Chloroaniline	1000	U	UG/KG	1.22E-04	1.22E-03	1.43E+00
7005-72-3	4-Chlorophenyl phenyl ether	500	U	UG/KG			
106-44-5	4-Methylphenol	500	U	UG/KG			
100-01-6	4-Nitroaniline	2500	U	UG/KG			
100-02-7	4-Nitrophenol	2500	U	UG/KG			
83-32-9	Acenaphthene	500	U	UG/KG	4.17E-06	4.17E-06	8.77E-04
208-96-8	Acenaphthylene	500	U	UG/KG	8.20E-06	8.20E-06	1.19E-04
120-12-7	Anthracene	500	U	UG/KG	8.20E-07	8.20E-07	4.17E-05
56-55-3	Benzo(a)anthracene	68	J	UG/KG	8.50E-03	4.00E-04	3.40E-02
50-32-8	Benzo(a)pyrene	66	J	UG/KG	8.25E-02	3.88E-03	8.25E-03
205-99-2	Benzo(b)fluoranthene	74	J	UG/KG	9.25E-03	4.35E-04	1.48E-02
191-24-2	Benzo(g,h,i)perylene	95	J	UG/KG	1.56E-06	1.56E-06	2.26E-05
207-08-9	Benzo(k)fluoranthene	56	J	UG/KG	7.18E-04	3.29E-05	1.14E-03
111-91-1	bis(2-Chloroethoxy)methane	500	U	UG/KG			

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 39-5  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-106A**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
111-44-4	bis(2-Chloroethyl) ether	500	U	UG/KG	1.00E-01	6.67E-03	1.25E+03
108-60-1	bis(2-Chloroisopropyl) ether	500	U	UG/KG			
117-81-7	bis(2-Ethylhexyl) phthalate (DEHP)	18000		UG/KG	4.39E-02	4.39E-03	5.00E-03
85-68-7	Butyl benzyl phthalate	500	U	UG/KG	1.22E-06	1.22E-06	5.38E-04
86-74-8	Carbazole	500	U	UG/KG	1.72E-03	8.06E-05	8.33E-01
218-01-9	Chrysene	170	J	UG/KG	2.18E-04	1.00E-05	1.06E-03
84-74-2	Di-n-butyl phthalate	11000		UG/KG	5.50E-05	5.50E-05	4.78E-03
117-84-0	Di-n-octyl phthalate	72	J	UG/KG	1.76E-06	1.76E-05	7.20E-06
53-70-3	Dibenz(a,h)anthracene	500	U	UG/KG	6.25E-01	2.94E-02	2.50E-01
132-64-9	Dibenzofuran	140	J	UG/KG			
84-66-2	Diethyl phthalate	220	J	UG/KG	2.20E-07	2.20E-07	4.68E-04
131-11-3	Dimethyl phthalate	6100		UG/KG			
206-44-0	Fluoranthene	74	J	UG/KG	9.02E-07	9.02E-07	1.72E-05
86-73-7	Fluorene	500	U	UG/KG	6.10E-06	6.10E-06	8.93E-04
118-74-1	Hexachlorobenzene	500	U	UG/KG	1.25E-01	6.41E-03	2.50E-01
87-68-3	Hexachlorobutadiene	500	U	UG/KG			
77-47-4	Hexachlorocyclopentadiene	500	U	UG/KG	3.57E-05	3.57E-05	1.25E-03
67-72-1	Hexachloroethane	500	U	UG/KG	2.50E-04	2.50E-04	1.00E+00
193-39-5	Indeno(1,2,3-c,d)pyrene	61	J	UG/KG	7.63E-03	3.59E-04	4.36E-03
78-59-1	Isophorone	500	U	UG/KG	1.22E-06	1.22E-06	6.25E-02
621-64-7	N-Nitroso-di-n-propylamine	500	U	UG/KG	6.25E-01	2.78E-02	1.00E+04
86-30-6	N-Nitrosodiphenylamine	500	U	UG/KG	4.17E-04	2.00E-05	5.00E-01
91-20-3	Naphthalene	590		UG/KG	7.20E-06	7.20E-05	7.02E-03
87-86-5	Pentachlorophenol	2500	U	UG/KG	1.04E-01	4.81E-03	8.33E+01

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 39-5  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-106A**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
85-01-8	Phenanthrene	320	J	UG/KG	5.25E-06	5.25E-06	7.62E-05
108-95-2	Phenol	500	U	UG/KG	5.00E-07	4.17E-06	5.00E-03
129-00-0	Pyrene	140	J	UG/KG	2.30E-06	2.30E-06	3.33E-05
<b>Explosives</b>							
99-35-4	1,3,5-Trinitrobenzene	370	U	UG/KG			
99-65-0	1,3-Dinitrobenzene	370	U	UG/KG			
118-96-7	2,4,6-Trinitrotoluene (TNT)	750	U	UG/KG			
121-14-2	2,4-Dinitrotoluene	370	U	UG/KG	4.40E-02	2.06E-03	4.63E+02
606-20-2	2,6-Dinitrotoluene	500	U	UG/KG	5.95E-02	2.78E-03	7.14E+02
35572-78-2	2-Amino-4,6-Dinitrotoluene	750	U	UG/KG			
88-72-2	2-Nitrotoluene (ONT)	750	U	UG/KG			
99-08-1	3-Nitrotoluene	750	U	UG/KG			
19406-51-0	4-Amino-2,6-Dinitrotoluene	750	U	UG/KG			
99-99-0	4-Nitrotoluene (PNT)	750	U	UG/KG			
2691-41-0	HMX	1500		UG/KG			
98-95-3	Nitrobenzene	370	U	UG/KG	3.70E-04	3.70E-04	3.70E+00
121-82-4	RDX	750	U	UG/KG			
479-45-8	Tetryl	1500		UG/KG			
<b>Metals</b>							
7429-90-5	Aluminum	51500		MG/KG			
7440-36-0	Antimony	6.2		MG/KG	7.56E-03	7.56E-02	1.24E+00
7440-38-2	Arsenic	22.6	J	MG/KG	7.53E+00	3.70E-01	8.07E-01
7440-39-3	Barium	1730	J	MG/KG	1.24E-02	1.24E-01	1.44E+00
7440-41-7	Beryllium	0.97		MG/KG	9.70E-01	3.34E-02	1.47E-01

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 39-5  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-106A**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
7440-42-8	Boron	43.5		MG/KG	2.42E-04	2.42E-03	
7440-43-9	Cadmium	150		MG/KG	7.50E-02	7.50E-01	4.05E+01
7440-70-2	Calcium	39800		MG/KG			
7440-47-3	Chromium	239	J	MG/KG	2.39E-02	5.83E-02	8.54E+00
7440-48-4	Cobalt	11.8		MG/KG	9.83E-05	9.83E-04	
7440-50-8	Copper	3300		MG/KG	4.02E-02	4.02E-01	3.00E-01
7439-89-6	Iron	95600		MG/KG			
7439-92-1	Lead	2470		MG/KG	6.18E+00	6.18E+00	
7439-95-4	Magnesium	15500		MG/KG			
7439-96-5	Manganese	1490	J	MG/KG	1.55E-02	1.55E-01	
7439-97-6	Mercury	1.1		MG/KG	1.80E-03	1.80E-02	7.33E+00
7440-02-0	Nickel	370	J	MG/KG	9.02E-03	9.02E-02	4.87E+00
2023695	Potassium	2930		MG/KG			
7782-49-2	Selenium	21.8		MG/KG	2.18E-03	2.18E-02	9.08E+00
7440-22-4	Silver	5.3		MG/KG	5.30E-04	5.30E-03	3.53E+00
7440-23-5	Sodium	2090		MG/KG			
7440-28-0	Thallium	5.9	U	MG/KG	3.69E-02	3.69E-02	2.46E+00
7440-62-2	Vanadium	49.1		MG/KG	3.51E-03	3.51E-02	5.01E-02
7440-66-6	Zinc	3160		MG/KG	5.18E-03	5.18E-02	8.78E-01

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

TABLE 39-6

## HUMAN HEALTH SCREENING OF DRUM RESULTS FROM AUS-106A

ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
<b>Volatile Organic Compounds</b>								
71-55-6	1,1,1-Trichloroethane	10	U	UG/KG			3.00E-06	1.00E-01
79-34-5	1,1,2,2-Tetrachloroethane	10	U	UG/KG		1.11E-08	2.56E-06	5.00E+01
79-00-5	1,1,2-Trichloroethane	10	U	UG/KG		5.26E-09	6.57E-05	1.11E+01
75-34-3	1,1-Dichloroethane	10	U	UG/KG			4.85E-06	1.00E-02
75-35-4	1,1-Dichloroethene	10	U	UG/KG		8.42E-08	1.48E-04	3.33E+00
107-06-2	1,2-Dichloroethane (EDC)	10	U	UG/KG		1.31E-08	2.84E-04	1.00E+01
540-59-0	1,2-Dichloroethene (total)	6	J	UG/KG			4.07E-05	3.00E-01
78-87-5	1,2-Dichloropropane	10	U	UG/KG		1.30E-08	4.69E-04	1.00E+01
78-93-3	2-Butanone (MEK)	19	U	UG/KG			6.86E-07	
591-78-6	2-Hexanone	19	U	UG/KG				
108-10-1	4-Methyl-2-pentanone (MIBK)	19	U	UG/KG			6.58E-06	
67-64-1	Acetone	62	U	UG/KG			9.97E-06	7.75E-02
71-43-2	Benzene	9		UG/KG		6.14E-09	3.71E-04	4.50E+00
75-27-4	Bromodichloromethane	10	U	UG/KG		4.24E-09	9.58E-06	3.33E-01
75-25-2	Bromoform	10	U	UG/KG		3.20E-11	5.68E-07	2.50E-01
74-83-9	Bromomethane	10	U	UG/KG			7.61E-04	1.00E+00
75-15-0	Carbon disulfide	10	U	UG/KG			8.27E-06	5.00E-03
56-23-5	Carbon tetrachloride	10	U	UG/KG		1.89E-08	1.43E-03	3.33E+00
108-90-7	Chlorobenzene	10	U	UG/KG			1.84E-05	1.43E-01
75-00-3	Chloroethane	10	U	UG/KG		1.54E-09	5.30E-07	
67-66-3	Chloroform	10	U	UG/KG		1.92E-08	7.76E-03	3.33E-01
74-87-3	Chloromethane	10	U	UG/KG		3.76E-09		
156-59-2	cis-1,2-Dichloroethene	6	J	UG/KG			4.07E-05	3.00E-01

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 39-6  
HUMAN HEALTH SCREENING OF DRUM RESULTS FROM AUS-106A**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
10061-01-5	cis-1,3-Dichloropropene	10	U	UG/KG		5.62E-08	2.27E-04	
124-48-1	Dibromochloromethane	10	U	UG/KG		3.77E-09	6.28E-06	5.00E-01
100-41-4	Ethylbenzene	10	U	UG/KG			1.67E-06	1.43E-02
75-09-2	Methylene chloride	10	U	UG/KG		4.87E-10	1.02E-06	1.00E+01
110-54-3	N-Hexane	10	U	UG/KG			2.48E-05	
100-42-5	Styrene	10	U	UG/KG			4.89E-07	5.00E-02
127-18-4	Tetrachloroethylene (PCE)	10	U	UG/KG		5.36E-10	5.87E-06	3.33E+00
108-88-3	Toluene	4	J	UG/KG			2.01E-06	6.67E-03
1330-20-7	total Xylenes	10	U	UG/KG			2.25E-06	1.00E-03
156-60-5	trans-1,2-Dichloroethene	10	U	UG/KG			4.67E-05	3.33E-01
10061-02-6	trans-1,3-Dichloropropene	10	U	UG/KG		5.62E-08	2.27E-04	
79-01-6	Trichloroethylene (TCE)	62	J	UG/KG		1.01E-08	7.84E-04	2.07E+01
75-01-4	Vinyl chloride	10	U	UG/KG		2.05E-07		1.43E+01
<b>Semivolatile Organic Compounds</b>								
120-82-1	1,2,4-Trichlorobenzene	540	U	UG/KG			7.09E-05	1.80E+00
95-50-1	1,2-Dichlorobenzene	540	U	UG/KG			1.63E-04	6.00E-01
541-73-1	1,3-Dichlorobenzene	540	U	UG/KG			1.04E-02	
106-46-7	1,4-Dichlorobenzene	540	U	UG/KG		6.64E-08	2.81E-04	5.40E+00
95-95-4	2,4,5-Trichlorophenol	2700	U	UG/KG			3.06E-05	2.70E-01
88-06-2	2,4,6-Trichlorophenol	540	U	UG/KG		2.41E-09		6.75E+01
120-83-2	2,4-Dichlorophenol	540	U	UG/KG			2.04E-04	1.08E+01
105-67-9	2,4-Dimethylphenol	540	U	UG/KG			3.06E-05	1.35E+00
51-28-5	2,4-Dinitrophenol	2700	U	UG/KG			1.53E-03	2.70E+02
91-58-7	2-Chloronaphthalene	540	U	UG/KG			1.98E-05	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

TABLE 39-6

## HUMAN HEALTH SCREENING OF DRUM RESULTS FROM AUS-106A

ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
95-57-8	2-Chlorophenol	540	U	UG/KG			2.24E-03	2.70E+00
91-57-6	2-Methylnaphthalene	1200		UG/KG			2.21E-05	6.00E-03
95-48-7	2-Methylphenol	540	U	UG/KG			1.23E-05	6.75E-01
88-74-4	2-Nitroaniline	2700	U	UG/KG			5.36E-02	
88-75-5	2-Nitrophenol	540	U	UG/KG			7.66E-05	
91-94-1	3,3'-Dichlorobenzidine	540	U	UG/KG		9.85E-08		1.80E+03
99-09-2	3-Nitroaniline	2700	U	UG/KG			5.36E-02	
534-52-1	4,6-Dinitro-2-methylphenol	2700	U	UG/KG				
101-55-3	4-Bromophenyl phenyl ether	540	U	UG/KG				
59-50-7	4-Chloro-3-methylphenol	540	U	UG/KG			1.23E-05	
106-47-8	4-Chloroaniline	1100	U	UG/KG			3.12E-04	3.67E+01
7005-72-3	4-Chlorophenyl phenyl ether	540	U	UG/KG				
106-44-5	4-Methylphenol	540	U	UG/KG			1.23E-04	
100-01-6	4-Nitroaniline	2700	U	UG/KG			5.36E-02	
100-02-7	4-Nitrophenol	2700	U	UG/KG			3.83E-04	
83-32-9	Acenaphthene	540	U	UG/KG			1.41E-05	1.80E-02
208-96-8	Acenaphthylene	540	U	UG/KG			9.96E-06	2.70E-03
120-12-7	Anthracene	77	J	UG/KG			1.98E-07	1.28E-04
56-55-3	Benzo(a)anthracene	140	J	UG/KG		4.85E-08		1.75E+00
50-32-8	Benzo(a)pyrene	180	J	UG/KG		6.24E-07		4.50E-01
205-99-2	Benzo(b)fluoranthene	260	J	UG/KG		9.01E-08		1.30E+00
191-24-2	Benzo(g,h,i)perylene	140	J	UG/KG			2.58E-06	7.00E-04
207-08-9	Benzo(k)fluoranthene	270	J	UG/KG		9.35E-09		1.35E-01
111-91-1	bis(2-Chloroethoxy)methane	540	U	UG/KG				

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 39-6**  
**HUMAN HEALTH SCREENING OF DRUM RESULTS FROM AUS-106A**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
111-44-4	bis(2-Chloroethyl) ether	540	U	UG/KG		8.71E-07		2.70E+04
108-60-1	bis(2-Chloroisopropyl) ether	540	U	UG/KG		6.68E-08	1.27E-04	
117-81-7	bis(2-Ethylhexyl) phthalate (DEHP)	600	U	UG/KG		3.41E-09	3.41E-05	
85-68-7	Butyl benzyl phthalate	540	U	UG/KG			3.06E-06	6.75E-04
86-74-8	Carbazole	540	U	UG/KG		4.38E-09		1.80E+01
218-01-9	Chrysene	220	J	UG/KG		7.62E-10		2.75E-02
84-74-2	Di-n-butyl phthalate	1400		UG/KG			1.59E-05	4.67E-03
117-84-0	Di-n-octyl phthalate	300	J	UG/KG			1.70E-05	3.00E-05
53-70-3	Dibenz(a,h)anthracene	540	U	UG/KG		1.87E-06		6.75E+00
132-64-9	Dibenzofuran	300	J	UG/KG			5.93E-05	
84-66-2	Diethyl phthalate	540	U	UG/KG			7.66E-07	
131-11-3	Dimethyl phthalate	540	U	UG/KG			6.13E-08	
206-44-0	Fluoranthene	230	J	UG/KG			7.64E-06	1.15E-03
86-73-7	Fluorene	540	U	UG/KG			1.63E-05	1.80E-02
118-74-1	Hexachlorobenzene	540	U	UG/KG		3.50E-07	7.66E-04	5.40E+00
87-68-3	Hexachlorobutadiene	540	U	UG/KG		1.71E-08	3.06E-03	5.40E+00
77-47-4	Hexachlorocyclopentadiene	540	U	UG/KG			9.16E-05	2.70E-02
67-72-1	Hexachloroethane	540	U	UG/KG		3.06E-09	6.13E-04	2.70E+01
193-39-5	Indeno(1,2,3-c,d)pyrene	140	J	UG/KG		4.85E-08		2.00E-01
78-59-1	Isophorone	540	U	UG/KG		2.08E-10	3.06E-06	1.80E+01
621-64-7	N-Nitroso-di-n-propylamine	540	U	UG/KG		1.53E-06		2.70E+05
86-30-6	N-Nitrosodiphenylamine	540	U	UG/KG		1.07E-09		9.00E+00
91-20-3	Naphthalene	540		UG/KG			2.86E-03	1.35E-01
87-86-5	Pentachlorophenol	2700	U	UG/KG		2.43E-07	1.89E-04	2.70E+03

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect



**TABLE 39-6  
HUMAN HEALTH SCREENING OF DRUM RESULTS FROM AUS-106A**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
85-01-8	Phenanthrene	470	J	UG/KG			8.67E-06	2.35E-03
108-95-2	Phenol	540	U	UG/KG			1.02E-06	1.08E-01
129-00-0	Pyrene	350	J	UG/KG			6.45E-06	1.75E-03
<b>Explosives</b>								
99-35-4	1,3,5-Trinitrobenzene	400	U	UG/KG			1.51E-05	
99-65-0	1,3-Dinitrobenzene	400	U	UG/KG			4.54E-03	
118-96-7	2,4,6-Trinitrotoluene (TNT)	810	U	UG/KG		9.85E-09	1.84E-03	
121-14-2	2,4-Dinitrotoluene	400	U	UG/KG			2.27E-04	1.00E+04
606-20-2	2,6-Dinitrotoluene	540	U	UG/KG			6.13E-04	1.80E+04
35572-78-2	2-Amino-4,6-Dinitrotoluene	810	U	UG/KG				
88-72-2	2-Nitrotoluene (ONT)	810	U	UG/KG				
99-08-1	3-Nitrotoluene	810	U	UG/KG			3.99E-04	
19406-51-0	4-Amino-2,6-Dinitrotoluene	810	U	UG/KG				
99-99-0	4-Nitrotoluene (PNT)	810	U	UG/KG			3.99E-04	
2691-41-0	HMX	810	U	UG/KG			1.84E-05	
98-95-3	Nitrobenzene	400	U	UG/KG			3.49E-03	
121-82-4	RDX	810	U	UG/KG		3.61E-08	3.06E-04	
479-45-8	Tetryl	1200	U	UG/KG			1.36E-04	
<b>Metals</b>								
7429-90-5	Aluminum	12500		MG/KG	4.34E-01		7.46E-03	
7440-36-0	Antimony	6.5		MG/KG	9.29E-01		7.95E-03	2.17E+01
7440-38-2	Arsenic	14.1		MG/KG	1.04E+00	5.17E-06	3.21E-02	1.41E+01
7440-39-3	Barium	385	J	MG/KG	1.97E+00		3.09E-03	4.81E+00
7440-41-7	Beryllium	0.35	J	MG/KG	4.61E-01	1.56E-10	9.47E-05	1.17E-01

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 39-6  
HUMAN HEALTH SCREENING OF DRUM RESULTS FROM AUS-106A**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
7440-42-8	Boron	33.6		MG/KG	6.34E+00		4.25E-04	
7440-43-9	Cadmium	45.8	J	MG/KG	2.41E+02	1.53E-08	5.65E-02	1.15E+02
7440-70-2	Calcium	10000		MG/KG	4.00E+00			
7440-47-3	Chromium	57.1		MG/KG	2.27E+00	1.27E-07		2.86E+01
7440-48-4	Cobalt	7.7		MG/KG	3.55E-01		6.28E-05	
7440-50-8	Copper	410		MG/KG	3.63E+01		5.40E-03	
7439-89-6	Iron	101000		MG/KG	5.23E+00		1.65E-01	
7439-92-1	Lead	279	J	MG/KG	1.19E+01			
7439-95-4	Magnesium	4330		MG/KG	2.79E+00			
7439-96-5	Manganese	879		MG/KG	2.41E-01		2.73E-02	
7439-97-6	Mercury	0.11	J	MG/KG	1.83E+00			
7440-02-0	Nickel	76		MG/KG	4.02E+00		1.86E-03	1.09E+01
2023695	Potassium	725	J	MG/KG	1.16E+00			
7782-49-2	Selenium	2.8		MG/KG	1.20E+00		2.74E-04	9.33E+00
7440-22-4	Silver	0.33	J	MG/KG	5.69E-01		3.23E-05	1.65E-01
7440-23-5	Sodium	2550		MG/KG	1.50E+01			
7440-28-0	Thallium	0.95	J	MG/KG	2.32E+00		6.64E-06	
7440-62-2	Vanadium	25.4	J	MG/KG	5.38E-01		1.78E-03	8.47E-02
7440-66-6	Zinc	10700	J	MG/KG	2.08E+02		1.75E-02	1.78E+01

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 39-6  
HUMAN HEALTH SCREENING OF DRUM RESULTS FROM AUS-106A**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class Soil Component of Groundwater Criteria
<b>Volatile Organic Compounds</b>							
71-55-6	1,1,1-Trichloroethane	10	U	UG/KG			5.00E-03
79-34-5	1,1,2,2-Tetrachloroethane	10	U	UG/KG			
79-00-5	1,1,2-Trichloroethane	10	U	UG/KG	1.22E-06	1.22E-06	5.00E-01
75-34-3	1,1-Dichloroethane	10	U	UG/KG	5.00E-08	5.00E-08	4.35E-04
75-35-4	1,1-Dichloroethene	10	U	UG/KG	5.56E-07	5.56E-06	1.67E-01
107-06-2	1,2-Dichloroethane (EDC)	10	U	UG/KG	1.59E-04	7.14E-06	5.00E-01
540-59-0	1,2-Dichloroethene (total)	6	J	UG/KG	3.00E-07	3.00E-07	1.50E-02
78-87-5	1,2-Dichloropropane	10	U	UG/KG	1.19E-04	5.56E-06	3.33E-01
78-93-3	2-Butanone (MEK)	19	U	UG/KG			
591-78-6	2-Hexanone	19	U	UG/KG			
108-10-1	4-Methyl-2-pentanone (MIBK)	19	U	UG/KG			
67-64-1	Acetone	62	U	UG/KG	3.10E-07	3.10E-07	3.88E-03
71-43-2	Benzene	9		UG/KG	4.50E-05	2.09E-06	3.00E-01
75-27-4	Bromodichloromethane	10	U	UG/KG	1.09E-04	5.00E-06	1.67E-02
75-25-2	Bromoform	10	U	UG/KG	1.39E-05	6.25E-07	1.25E-02
74-83-9	Bromomethane	10	U	UG/KG	3.45E-06	1.00E-05	5.00E-02
75-15-0	Carbon disulfide	10	U	UG/KG	5.00E-08	5.00E-07	3.13E-04
56-23-5	Carbon tetrachloride	10	U	UG/KG	2.27E-04	2.44E-05	1.43E-01
108-90-7	Chlorobenzene	10	U	UG/KG	2.44E-07	2.44E-06	1.00E-02
75-00-3	Chloroethane	10	U	UG/KG			
67-66-3	Chloroform	10	U	UG/KG	1.06E-05	5.00E-06	1.67E-02
74-87-3	Chloromethane	10	U	UG/KG			
156-59-2	cis-1,2-Dichloroethene	6	J	UG/KG	3.00E-07	3.00E-07	1.50E-02

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 39-6  
HUMAN HEALTH SCREENING OF DRUM RESULTS FROM AUS-106A**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class 1 Soil Component of Groundwater Criteria
10061-01-5	cis-1,3-Dichloropropene	10	U	UG/KG			
124-48-1	Dibromochloromethane	10	U	UG/KG	2.44E-07	2.44E-07	2.50E-02
100-41-4	Ethylbenzene	10	U	UG/KG	5.00E-08	5.00E-07	7.69E-04
75-09-2	Methylene chloride	10	U	UG/KG	1.32E-05	8.33E-07	5.00E-01
110-54-3	N-Hexane	10	U	UG/KG			
100-42-5	Styrene	10	U	UG/KG	2.44E-08	2.44E-07	2.50E-03
127-18-4	Tetrachloroethylene (PCE)	10	U	UG/KG	9.09E-05	4.17E-06	1.67E-01
108-88-3	Toluene	4	J	UG/KG	9.76E-09	9.76E-09	3.33E-04
1330-20-7	total Xylenes	10	U	UG/KG	1.00E-08	2.44E-08	6.67E-05
156-60-5	trans-1,2-Dichloroethene	10	U	UG/KG	2.44E-07	2.44E-07	1.43E-02
10061-02-6	trans-1,3-Dichloropropene	10	U	UG/KG			
79-01-6	Trichloroethylene (TCE)	62	J	UG/KG	1.19E-04	5.17E-05	1.03E+00
75-01-4	Vinyl chloride	10	U	UG/KG	3.33E-03	1.54E-04	1.00E+00
<b>Semivolatile Organic Compounds</b>							
120-82-1	1,2,4-Trichlorobenzene	540	U	UG/KG	2.70E-05	2.70E-04	1.08E-01
95-50-1	1,2-Dichlorobenzene	540	U	UG/KG	3.00E-06	3.00E-05	3.18E-02
541-73-1	1,3-Dichlorobenzene	540	U	UG/KG			
106-46-7	1,4-Dichlorobenzene	540	U	UG/KG			2.70E-01
95-95-4	2,4,5-Trichlorophenol	2700	U	UG/KG	1.35E-05	1.35E-05	1.00E-02
88-06-2	2,4,6-Trichlorophenol	540	U	UG/KG	1.04E-03	4.91E-05	2.70E+00
120-83-2	2,4-Dichlorophenol	540	U	UG/KG	8.85E-05	8.85E-04	5.40E-01
105-67-9	2,4-Dimethylphenol	540	U	UG/KG	1.32E-05	1.32E-05	6.00E-02
51-28-5	2,4-Dinitrophenol	2700	U	UG/KG	6.59E-04	6.59E-03	1.35E+01
91-58-7	2-Chloronaphthalene	540	U	UG/KG			

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

TABLE 39-6

## HUMAN HEALTH SCREENING OF DRUM RESULTS FROM AUS-106A

ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
95-57-8	2-Chlorophenol	540	U	UG/KG	5.40E-05	5.40E-05	1.35E-01
91-57-6	2-Methylnaphthalene	1200		UG/KG	1.97E-05	1.97E-05	2.86E-04
95-48-7	2-Methylphenol	540	U	UG/KG	5.40E-06	5.40E-06	3.60E-02
88-74-4	2-Nitroaniline	2700	U	UG/KG			
88-75-5	2-Nitrophenol	540	U	UG/KG			
91-94-1	3,3'-Dichlorobenzidine	540	U	UG/KG	4.15E-02	1.93E-03	7.71E+01
99-09-2	3-Nitroaniline	2700	U	UG/KG			
534-52-1	4,6-Dinitro-2-methylphenol	2700	U	UG/KG			
101-55-3	4-Bromophenyl phenyl ether	540	U	UG/KG			
59-50-7	4-Chloro-3-methylphenol	540	U	UG/KG			
106-47-8	4-Chloroaniline	1100	U	UG/KG	1.34E-04	1.34E-03	1.57E+00
7005-72-3	4-Chlorophenyl phenyl ether	540	U	UG/KG			
106-44-5	4-Methylphenol	540	U	UG/KG			
100-01-6	4-Nitroaniline	2700	U	UG/KG			
100-02-7	4-Nitrophenol	2700	U	UG/KG			
83-32-9	Acenaphthene	540	U	UG/KG	4.50E-06	4.50E-06	9.47E-04
208-96-8	Acenaphthylene	540	U	UG/KG	8.85E-06	8.85E-06	1.29E-04
120-12-7	Anthracene	77	J	UG/KG	1.26E-07	1.26E-07	6.42E-06
56-55-3	Benzo(a)anthracene	140	J	UG/KG	1.75E-02	8.24E-04	7.00E-02
50-32-8	Benzo(a)pyrene	180	J	UG/KG	2.25E-01	1.06E-02	2.25E-02
205-99-2	Benzo(b)fluoranthene	260	J	UG/KG	3.25E-02	1.53E-03	5.20E-02
191-24-2	Benzo(g,h,i)perylene	140	J	UG/KG	2.30E-06	2.30E-06	3.33E-05
207-08-9	Benzo(k)fluoranthene	270	J	UG/KG	3.46E-03	1.59E-04	5.51E-03
111-91-1	bis(2-Chloroethoxy)methane	540	U	UG/KG			

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 39-6  
HUMAN HEALTH SCREENING OF DRUM RESULTS FROM AUS-106A**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
111-44-4	bis(2-Chloroethyl) ether	540	U	UG/KG	1.08E-01	7.20E-03	1.35E+03
108-60-1	bis(2-Chloroisopropyl) ether	540	U	UG/KG			
117-81-7	bis(2-Ethylhexyl) phthalate (DEHP)	600	U	UG/KG	1.46E-03	1.46E-04	1.67E-04
85-68-7	Butyl benzyl phthalate	540	U	UG/KG	1.32E-06	1.32E-06	5.81E-04
86-74-8	Carbazole	540	U	UG/KG	1.86E-03	8.71E-05	9.00E-01
218-01-9	Chrysene	220	J	UG/KG	2.82E-04	1.29E-05	1.38E-03
84-74-2	Di-n-butyl phthalate	1400		UG/KG	7.00E-06	7.00E-06	6.09E-04
117-84-0	Di-n-octyl phthalate	300	J	UG/KG	7.32E-06	7.32E-05	3.00E-05
53-70-3	Dibenz(a,h)anthracene	540	U	UG/KG	6.75E-01	3.18E-02	2.70E-01
132-64-9	Dibenzofuran	300	J	UG/KG			
84-66-2	Diethyl phthalate	540	U	UG/KG	5.40E-07	5.40E-07	1.15E-03
131-11-3	Dimethyl phthalate	540	U	UG/KG			
206-44-0	Fluoranthene	230	J	UG/KG	2.80E-06	2.80E-06	5.35E-05
86-73-7	Fluorene	540	U	UG/KG	6.59E-06	6.59E-06	9.64E-04
118-74-1	Hexachlorobenzene	540	U	UG/KG	1.35E-01	6.92E-03	2.70E-01
87-68-3	Hexachlorobutadiene	540	U	UG/KG			
77-47-4	Hexachlorocyclopentadiene	540	U	UG/KG	3.86E-05	3.86E-05	1.35E-03
67-72-1	Hexachloroethane	540	U	UG/KG	2.70E-04	2.70E-04	1.08E+00
193-39-5	Indeno(1,2,3-c,d)pyrene	140	J	UG/KG	1.75E-02	8.24E-04	1.00E-02
78-59-1	Isophorone	540	U	UG/KG	1.32E-06	1.32E-06	6.75E-02
621-64-7	N-Nitroso-di-n-propylamine	540	U	UG/KG	6.75E-01	3.00E-02	1.08E+04
86-30-6	N-Nitrosodiphenylamine	540	U	UG/KG	4.50E-04	2.16E-05	5.40E-01
91-20-3	Naphthalene	540		UG/KG	6.59E-06	6.59E-05	6.43E-03
87-86-5	Pentachlorophenol	2700	U	UG/KG	1.13E-01	5.19E-03	9.00E+01

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

TABLE 39-6

## HUMAN HEALTH SCREENING OF DRUM RESULTS FROM AUS-106A

ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
85-01-8	Phenanthrene	470	J	UG/KG	7.70E-06	7.70E-06	1.12E-04
108-95-2	Phenol	540	U	UG/KG	5.40E-07	4.50E-06	5.40E-03
129-00-0	Pyrene	350	J	UG/KG	5.74E-06	5.74E-06	8.33E-05
<b>Explosives</b>							
99-35-4	1,3,5-Trinitrobenzene	400	U	UG/KG			
99-65-0	1,3-Dinitrobenzene	400	U	UG/KG			
118-96-7	2,4,6-Trinitrotoluene (TNT)	810	U	UG/KG			
121-14-2	2,4-Dinitrotoluene	400	U	UG/KG	4.76E-02	2.22E-03	5.00E+02
606-20-2	2,6-Dinitrotoluene	540	U	UG/KG	6.43E-02	3.00E-03	7.71E+02
35572-78-2	2-Amino-4,6-Dinitrotoluene	810	U	UG/KG			
88-72-2	2-Nitrotoluene (ONT)	810	U	UG/KG			
99-08-1	3-Nitrotoluene	810	U	UG/KG			
19406-51-0	4-Amino-2,6-Dinitrotoluene	810	U	UG/KG			
99-99-0	4-Nitrotoluene (PNT)	810	U	UG/KG			
2691-41-0	HMX	810	U	UG/KG			
98-95-3	Nitrobenzene	400	U	UG/KG	4.00E-04	4.00E-04	4.00E+00
121-82-4	RDX	810	U	UG/KG			
479-45-8	Tetryl	1200	U	UG/KG			
<b>Metals</b>							
7429-90-5	Aluminum	12500		MG/KG			
7440-36-0	Antimony	6.5		MG/KG	7.93E-03	7.93E-02	1.30E+00
7440-38-2	Arsenic	14.1		MG/KG	4.70E+00	2.31E-01	5.04E-01
7440-39-3	Barium	385	J	MG/KG	2.75E-03	2.75E-02	3.21E-01
7440-41-7	Beryllium	0.35	J	MG/KG	3.50E-01	1.21E-02	5.30E-02

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 39-6  
HUMAN HEALTH SCREENING OF DRUM RESULTS FROM AUS-106A**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
7440-42-8	Boron	33.6		MG/KG	1.87E-04	1.87E-03	
7440-43-9	Cadmium	45.8	J	MG/KG	2.29E-02	2.29E-01	1.24E+01
7440-70-2	Calcium	10000		MG/KG			
7440-47-3	Chromium	57.1		MG/KG	5.71E-03	1.39E-02	2.04E+00
7440-48-4	Cobalt	7.7		MG/KG	6.42E-05	6.42E-04	
7440-50-8	Copper	410		MG/KG	5.00E-03	5.00E-02	3.73E-02
7439-89-6	Iron	101000		MG/KG			
7439-92-1	Lead	279	J	MG/KG	6.98E-01	6.98E-01	
7439-95-4	Magnesium	4330		MG/KG			
7439-96-5	Manganese	879		MG/KG	9.16E-03	9.16E-02	
7439-97-6	Mercury	0.11	J	MG/KG	1.80E-04	1.80E-03	7.33E-01
7440-02-0	Nickel	76		MG/KG	1.85E-03	1.85E-02	1.00E+00
2023695	Potassium	725	J	MG/KG			
7782-49-2	Selenium	2.8		MG/KG	2.80E-04	2.80E-03	1.17E+00
7440-22-4	Silver	0.33	J	MG/KG	3.30E-05	3.30E-04	2.20E-01
7440-23-5	Sodium	2550		MG/KG			
7440-28-0	Thallium	0.95	J	MG/KG	5.94E-03	5.94E-03	3.96E-01
7440-62-2	Vanadium	25.4	J	MG/KG	1.81E-03	1.81E-02	2.59E-02
7440-66-6	Zinc	10700	J	MG/KG	1.75E-02	1.75E-01	2.97E+00

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect



TABLE 39-7  
 ECOLOGICAL SCREENING OF SOIL RESULTS FROM AUS-106A

ADDITIONAL AND UNCHARACTERIZED SITES OU  
 CRAB ORCHARD NATIONAL WILDLIFE REFUGE

CAS Number	Chemical	Background (SOIL)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ) (SOIL)	Retained as Potential Bioaccumulator
<b>Volatile Organic Compounds</b>							
71-55-6	1,1,1-Trichloroethane		8	U	UG/KG	2.68E-04	
79-34-5	1,1,2,2-Tetrachloroethane		8	U	UG/KG	6.29E-02	
79-00-5	1,1,2-Trichloroethane		8	U	UG/KG	2.80E-04	
75-34-3	1,1-Dichloroethane		8	U	UG/KG	3.98E-04	
75-35-4	1,1-Dichloroethene		8	U	UG/KG	9.66E-04	
107-06-2	1,2-Dichloroethane (EDC)		8	U	UG/KG	3.77E-04	
540-59-0	1,2-Dichloroethene (total)		24	J	UG/KG	3.05E-02	
78-87-5	1,2-Dichloropropane		8	U	UG/KG	1.14E-05	
78-93-3	2-Butanone (MEK)		53	J	UG/KG	5.92E-04	
591-78-6	2-Hexanone		17	UJ	UG/KG	1.35E-03	
108-10-1	4-Methyl-2-pentanone (MIBK)		17	UJ	UG/KG	3.84E-05	
67-64-1	Acetone		80	UJ	UG/KG	3.20E-02	
71-43-2	Benzene		8	U	UG/KG	5.00E-04	
75-27-4	Bromodichloromethane		8	UJ	UG/KG	1.48E-02	
75-25-2	Bromoform		8	U	UG/KG	5.03E-04	
74-83-9	Bromomethane		8	U	UG/KG	3.40E-02	
75-15-0	Carbon disulfide		8	U	UG/KG	8.50E-02	
56-23-5	Carbon tetrachloride		8	U	UG/KG	8.00E-06	
108-90-7	Chlorobenzene		8	U	UG/KG	2.00E-04	
75-00-3	Chloroethane		8	U	UG/KG		
67-66-3	Chloroform		8	U	UG/KG	6.72E-03	
74-87-3	Chloromethane		8	U	UG/KG	7.69E-04	
156-59-2	cis-1,2-Dichloroethene		24	J	UG/KG	3.05E-02	
10061-01-5	cis-1,3-Dichloropropene		8	U	UG/KG	2.01E-02	
124-48-1	Dibromochloromethane		8	U	UG/KG	3.90E-03	
100-41-4	Ethylbenzene		6	J	UG/KG	1.20E-03	
75-09-2	Methylene chloride		8	U	UG/KG	1.98E-03	
110-54-3	N-Hexane		8	U	UG/KG		
100-42-5	Styrene		200	J	UG/KG	6.67E-04	
127-18-4	Tetrachloroethylene (PCE)		8	UJ	UG/KG	6.15E-04	
108-88-3	Toluene		8	U	UG/KG	2.67E-03	
1330-20-7	total Xylenes		440	J	UG/KG	7.33E-01	
156-60-5	trans-1,2-Dichloroethene		8	U	UG/KG	1.02E-02	
10061-02-6	trans-1,3-Dichloropropene		8	UJ	UG/KG	2.01E-02	
79-01-6	Trichloroethylene (TCE)		13000	J	UG/KG	1.44E+00	
75-01-4	Vinyl chloride		8	UJ	UG/KG	1.24E-02	
<b>Semivolatile Organic Compounds</b>							
120-82-1	1,2,4-Trichlorobenzene		500	U	UG/KG	2.50E-02	
95-50-1	1,2-Dichlorobenzene		500	U	UG/KG	1.69E-01	
541-73-1	1,3-Dichlorobenzene		500	U	UG/KG	1.33E-02	
106-46-7	1,4-Dichlorobenzene		500	U	UG/KG	2.50E-02	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
 J = Estimated U = Nondetect

TABLE 39-7  
 ECOLOGICAL SCREENING OF SOIL RESULTS FROM AUS-106A

ADDITIONAL AND UNCHARACTERIZED SITES OU  
 CRAB ORCHARD NATIONAL WILDLIFE REFUGE

CAS Number	Chemical	Background (SOIL)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ) (SOIL)	Retained as Potential Bioaccumulator
95-95-4	2,4,5-Trichlorophenol		2500	U	UG/KG	6.25E-01	
88-06-2	2,4,6-Trichlorophenol		500	U	UG/KG	5.00E-02	
120-83-2	2,4-Dichlorophenol		500	U	UG/KG	5.71E-03	
105-67-9	2,4-Dimethylphenol		500	U	UG/KG	5.00E+01	
51-28-5	2,4-Dinitrophenol		2500	U	UG/KG	1.25E-01	
91-58-7	2-Chloronaphthalene		500	U	UG/KG	4.11E+01	
95-57-8	2-Chlorophenol		500	U	UG/KG	2.06E+00	
91-57-6	2-Methylnaphthalene		820		UG/KG	2.53E-01	YES
95-48-7	2-Methylphenol		500	U	UG/KG	1.24E-02	
88-74-4	2-Nitroaniline		2500	U	UG/KG	3.37E-02	
88-75-5	2-Nitrophenol		500	U	UG/KG	3.13E-01	
91-94-1	3,3'-Dichlorobenzidine		500	U	UG/KG	7.74E-01	
99-09-2	3-Nitroaniline		2500	U	UG/KG	7.91E-01	
534-52-1	4,6-Dinitro-2-methylphenol		2500	U	UG/KG		
101-55-3	4-Bromophenyl phenyl ether		500	U	UG/KG		
59-50-7	4-Chloro-3-methylphenol		500	U	UG/KG	6.29E-02	
106-47-8	4-Chloroaniline		1000	U	UG/KG	9.09E-01	
7005-72-3	4-Chlorophenyl phenyl ether		500	U	UG/KG		
106-44-5	4-Methylphenol		500	U	UG/KG	3.07E-03	
100-01-6	4-Nitroaniline		2500	U	UG/KG	1.14E-01	
100-02-7	4-Nitrophenol		2500	U	UG/KG	3.57E-01	
83-32-9	Acenaphthene		500	U	UG/KG	7.33E-04	
208-96-8	Acenaphthylene		500	U	UG/KG	7.33E-04	
120-12-7	Anthracene		500	U	UG/KG	3.38E-04	
56-55-3	Benzo(a)anthracene		68	J	UG/KG	1.31E-02	YES
50-32-8	Benzo(a)pyrene		66	J	UG/KG	1.50E-05	YES
205-99-2	Benzo(b)fluoranthene		74	J	UG/KG	1.24E-03	YES
191-24-2	Benzo(g,h,i)perylene		95	J	UG/KG	7.98E-04	YES
207-08-9	Benzo(k)fluoranthene		56	J	UG/KG	9.36E-04	YES
111-91-1	bis(2-Chloroethoxy)methane		500	U	UG/KG	1.65E+00	
111-44-4	bis(2-Chloroethyl) ether		500	U	UG/KG	2.11E-02	
108-60-1	bis(2-Chloroisopropyl) ether		500	U	UG/KG		
117-81-7	bis(2-Ethylhexyl) phthalate (DEHP)		18000		UG/KG	1.94E+01	YES
85-68-7	Butyl benzyl phthalate		500	U	UG/KG	2.09E+00	
86-74-8	Carbazole		500	U	UG/KG		
218-01-9	Chrysene		170	J	UG/KG	3.59E-02	YES
84-74-2	Di-n-butyl phthalate		11000		UG/KG	5.50E-02	YES
117-84-0	Di-n-octyl phthalate		72	J	UG/KG	1.02E-04	YES
53-70-3	Dibenz(a,h)anthracene		500	U	UG/KG	2.72E-02	
132-64-9	Dibenzofuran		140	J	UG/KG		YES
84-66-2	Diethyl phthalate		220	J	UG/KG	2.20E-03	
131-11-3	Dimethyl phthalate		6100		UG/KG	3.05E-02	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
 J = Estimated U = Nondetect

TABLE 39-7  
 ECOLOGICAL SCREENING OF SOIL RESULTS FROM AUS-106A

ADDITIONAL AND UNCHARACTERIZED SITES OU  
 CRAB ORCHARD NATIONAL WILDLIFE REFUGE

CAS Number	Chemical	Background (SOIL)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ) (SOIL)	Retained as Potential Bioaccumulator
206-44-0	Fluoranthene		74	J	UG/KG	6.07E-04	YES
86-73-7	Fluorene		500	U	UG/KG	1.67E-02	
118-74-1	Hexachlorobenzene		500	U	UG/KG	5.00E-04	
87-68-3	Hexachlorobutadiene		500	U	UG/KG	1.26E+01	
77-47-4	Hexachlorocyclopentadiene		500	U	UG/KG	5.00E-02	
67-72-1	Hexachloroethane		500	U	UG/KG	8.38E-01	
193-39-5	Indeno(1,2,3-c,d)pyrene		61	J	UG/KG	5.60E-04	YES
78-59-1	Isophorone		500	U	UG/KG	3.60E-03	
621-64-7	N-Nitroso-di-n-propylamine		500	U	UG/KG	9.20E-01	
86-30-6	N-Nitrosodiphenylamine		500	U	UG/KG	2.50E-02	
91-20-3	Naphthalene		590		UG/KG	2.37E-03	
87-86-5	Pentachlorophenol		2500	U	UG/KG	4.17E-01	
85-01-8	Phenanthrene		320	J	UG/KG	7.00E-03	YES
108-95-2	Phenol		500	U	UG/KG	1.25E-02	
129-00-0	Pyrene		140	J	UG/KG	1.78E-03	YES
<b>Explosives</b>							
99-35-4	1,3,5-Trinitrobenzene		370	U	UG/KG	9.84E-01	
99-65-0	1,3-Dinitrobenzene		370	U	UG/KG	5.65E-01	
118-96-7	2,4,6-Trinitrotoluene (TNT)		750	U	UG/KG	2.50E-02	
121-14-2	2,4-Dinitrotoluene		370	U	UG/KG	2.89E-01	
606-20-2	2,6-Dinitrotoluene		500	U	UG/KG	1.52E+01	
35572-78-2	2-Amino-4,6-Dinitrotoluene		750	U	UG/KG	9.38E-03	
88-72-2	2-Nitrotoluene (ONT)		750	U	UG/KG		
99-08-1	3-Nitrotoluene		750	U	UG/KG		
19406-51-0	4-Amino-2,6-Dinitrotoluene		750	U	UG/KG		
99-99-0	4-Nitrotoluene (PNT)		750	U	UG/KG		
2691-41-0	HMX		1500		UG/KG	6.00E-02	
98-95-3	Nitrobenzene		370	U	UG/KG	9.25E-03	
121-82-4	RDX		750	U	UG/KG	7.50E-03	
479-45-8	Tetryl		1500		UG/KG		
<b>Metals</b>							
7429-90-5	Aluminum	28800	51500		MG/KG		
7440-36-0	Antimony	0.83	6.2		MG/KG	1.24E+00	
7440-38-2	Arsenic	13.5	22.6	J	MG/KG	2.51E+00	
7440-39-3	Barium	195	1730	J	MG/KG	3.46E+00	
7440-41-7	Beryllium	0.76	0.97		MG/KG	9.70E-02	
7440-42-8	Boron	5.3	43.5		MG/KG	8.70E+01	
7440-43-9	Cadmium	0.19	150		MG/KG	5.17E+00	
7440-70-2	Calcium	2497	39800		MG/KG		
7440-47-3	Chromium	25.2	239	J	MG/KG	4.78E+01	
7440-48-4	Cobalt	21.7	11.8		MG/KG	5.90E-01	
7440-50-8	Copper	11.3	3300		MG/KG	1.06E+02	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
 J = Estimated U = Nondetect

TABLE 39-7  
 ECOLOGICAL SCREENING OF SOIL RESULTS FROM AUS-106A

ADDITIONAL AND UNCHARACTERIZED SITES OU  
 CRAB ORCHARD NATIONAL WILDLIFE REFUGE

CAS Number	Chemical	Background (SOIL)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ) (SOIL)	Retained as Potential Bioaccumulator
7439-89-6	Iron	19306	95600		MG/KG	4.78E+02	
7439-92-1	Lead	23.4	2470		MG/KG	5.70E+00	
7439-95-4	Magnesium	1552	15500		MG/KG		
7439-96-5	Manganese	3640	1490	J	MG/KG	1.49E+01	
7439-97-6	Mercury	0.06	1.1		MG/KG	1.57E-01	YES
7440-02-0	Nickel	18.9	370	J	MG/KG	1.23E+01	
2023695	Potassium	625	2930		MG/KG		
7782-49-2	Selenium	2.34	21.8		MG/KG	2.18E+01	YES
7440-22-4	Silver	0.58	5.3		MG/KG	2.65E+00	
7440-23-5	Sodium	170	2090		MG/KG		
7440-28-0	Thallium	0.41	5.9	U	MG/KG	5.90E+00	
7440-62-2	Vanadium	47.2	49.1		MG/KG	1.07E+00	
7440-66-6	Zinc	51.4	3160		MG/KG	2.63E+01	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
 J = Estimated U = Nondetect

TABLE 39-8  
 ECOLOGICAL SCREENING OF DRUM RESULTS FROM AUS-106A

ADDITIONAL AND UNCHARACTERIZED SITES OU  
 CRAB ORCHARD NATIONAL WILDLIFE REFUGE

CAS Number	Chemical	Background (SOIL)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ) (SOIL)	Retained as Potential Bioaccumulator
<b>Volatile Organic Compounds</b>							
71-55-6	1,1,1-Trichloroethane		10	U	UG/KG	3.36E-04	
79-34-5	1,1,2,2-Tetrachloroethane		10	U	UG/KG	7.86E-02	
79-00-5	1,1,2-Trichloroethane		10	U	UG/KG	3.50E-04	
75-34-3	1,1-Dichloroethane		10	U	UG/KG	4.98E-04	
75-35-4	1,1-Dichloroethene		10	U	UG/KG	1.21E-03	
107-06-2	1,2-Dichloroethane (EDC)		10	U	UG/KG	4.72E-04	
540-59-0	1,2-Dichloroethene (total)		6	J	UG/KG	7.62E-03	
78-87-5	1,2-Dichloropropane		10	U	UG/KG	1.43E-05	
78-93-3	2-Butanone (MEK)		19	U	UG/KG	2.12E-04	
591-78-6	2-Hexanone		19	U	UG/KG	1.51E-03	
108-10-1	4-Methyl-2-pentanone (MIBK)		19	U	UG/KG	4.29E-05	
67-64-1	Acetone		62	U	UG/KG	2.48E-02	
71-43-2	Benzene		9		UG/KG	5.63E-04	
75-27-4	Bromodichloromethane		10	U	UG/KG	1.85E-02	
75-25-2	Bromoform		10	U	UG/KG	6.29E-04	
74-83-9	Bromomethane		10	U	UG/KG	4.25E-02	
75-15-0	Carbon disulfide		10	U	UG/KG	1.06E-01	
56-23-5	Carbon tetrachloride		10	U	UG/KG	1.00E-05	
108-90-7	Chlorobenzene		10	U	UG/KG	2.50E-04	
75-00-3	Chloroethane		10	U	UG/KG		
67-66-3	Chloroform		10	U	UG/KG	8.40E-03	
74-87-3	Chloromethane		10	U	UG/KG	9.62E-04	
156-59-2	cis-1,2-Dichloroethene		6	J	UG/KG	7.62E-03	
10061-01-5	cis-1,3-Dichloropropene		10	U	UG/KG	2.51E-02	
124-48-1	Dibromochloromethane		10	U	UG/KG	4.88E-03	
100-41-4	Ethylbenzene		10	U	UG/KG	2.00E-03	
75-09-2	Methylene chloride		10	U	UG/KG	2.47E-03	
110-54-3	N-Hexane		10	U	UG/KG		
100-42-5	Styrene		10	U	UG/KG	3.33E-05	
127-18-4	Tetrachloroethylene (PCE)		10	U	UG/KG	7.69E-04	
108-88-3	Toluene		4	J	UG/KG	1.33E-03	
1330-20-7	total Xylenes		10	U	UG/KG	1.67E-02	
156-60-5	trans-1,2-Dichloroethene		10	U	UG/KG	1.27E-02	
10061-02-6	trans-1,3-Dichloropropene		10	U	UG/KG	2.51E-02	
79-01-6	Trichloroethylene (TCE)		62	J	UG/KG	6.89E-03	
75-01-4	Vinyl chloride		10	U	UG/KG	1.55E-02	
<b>Semivolatile Organic Compounds</b>							
120-82-1	1,2,4-Trichlorobenzene		540	U	UG/KG	2.70E-02	
95-50-1	1,2-Dichlorobenzene		540	U	UG/KG	1.82E-01	
541-73-1	1,3-Dichlorobenzene		540	U	UG/KG	1.43E-02	
106-46-7	1,4-Dichlorobenzene		540	U	UG/KG	2.70E-02	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
 J = Estimated U = Nondetect

TABLE 39-8  
 ECOLOGICAL SCREENING OF DRUM RESULTS FROM AUS-106A

ADDITIONAL AND UNCHARACTERIZED SITES OU  
 CRAB ORCHARD NATIONAL WILDLIFE REFUGE

CAS Number	Chemical	Background (SOIL)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ) (SOIL)	Retained as Potential Bioaccumulator
95-95-4	2,4,5-Trichlorophenol		2700	U	UG/KG	6.75E-01	
88-06-2	2,4,6-Trichlorophenol		540	U	UG/KG	5.40E-02	
120-83-2	2,4-Dichlorophenol		540	U	UG/KG	6.17E-03	
105-67-9	2,4-Dimethylphenol		540	U	UG/KG	5.40E+01	
51-28-5	2,4-Dinitrophenol		2700	U	UG/KG	1.35E-01	
91-58-7	2-Chloronaphthalene		540	U	UG/KG	4.43E+01	
95-57-8	2-Chlorophenol		540	U	UG/KG	2.23E+00	
91-57-6	2-Methylnaphthalene		1200		UG/KG	3.70E-01	YES
95-48-7	2-Methylphenol		540	U	UG/KG	1.34E-02	
88-74-4	2-Nitroaniline		2700	U	UG/KG	3.64E-02	
88-75-5	2-Nitrophenol		540	U	UG/KG	3.38E-01	
91-94-1	3,3'-Dichlorobenzidine		540	U	UG/KG	8.35E-01	
99-09-2	3-Nitroaniline		2700	U	UG/KG	8.54E-01	
534-52-1	4,6-Dinitro-2-methylphenol		2700	U	UG/KG		
101-55-3	4-Bromophenyl phenyl ether		540	U	UG/KG		
59-50-7	4-Chloro-3-methylphenol		540	U	UG/KG	6.79E-02	
106-47-8	4-Chloroaniline		1100	U	UG/KG	1.00E+00	
7005-72-3	4-Chlorophenyl phenyl ether		540	U	UG/KG		
106-44-5	4-Methylphenol		540	U	UG/KG	3.31E-03	
100-01-6	4-Nitroaniline		2700	U	UG/KG	1.23E-01	
100-02-7	4-Nitrophenol		2700	U	UG/KG	3.86E-01	
83-32-9	Acenaphthene		540	U	UG/KG	7.91E-04	
208-96-8	Acenaphthylene		540	U	UG/KG	7.91E-04	
120-12-7	Anthracene		77	J	UG/KG	5.20E-05	YES
56-55-3	Benzo(a)anthracene		140	J	UG/KG	2.69E-02	YES
50-32-8	Benzo(a)pyrene		180	J	UG/KG	4.09E-05	YES
205-99-2	Benzo(b)fluoranthene		260	J	UG/KG	4.35E-03	YES
191-24-2	Benzo(g,h,i)perylene		140	J	UG/KG	1.18E-03	YES
207-08-9	Benzo(k)fluoranthene		270	J	UG/KG	4.52E-03	YES
111-91-1	bis(2-Chloroethoxy)methane		540	U	UG/KG	1.78E+00	
111-44-4	bis(2-Chloroethyl) ether		540	U	UG/KG	2.28E-02	
108-60-1	bis(2-Chloroisopropyl) ether		540	U	UG/KG		
117-81-7	bis(2-Ethylhexyl) phthalate (DEHP)		600	U	UG/KG	6.48E-01	
85-68-7	Butyl benzyl phthalate		540	U	UG/KG	2.26E+00	
86-74-8	Carbazole		540	U	UG/KG		
218-01-9	Chrysene		220	J	UG/KG	4.65E-02	YES
84-74-2	Di-n-butyl phthalate		1400		UG/KG	7.00E-03	YES
117-84-0	Di-n-octyl phthalate		300	J	UG/KG	4.23E-04	YES
53-70-3	Dibenz(a,h)anthracene		540	U	UG/KG	2.93E-02	
132-64-9	Dibenzofuran		300	J	UG/KG		YES
84-66-2	Diethyl phthalate		540	U	UG/KG	5.40E-03	
131-11-3	Dimethyl phthalate		540	U	UG/KG	2.70E-03	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
 J = Estimated U = Nondetect

TABLE 39-8  
 ECOLOGICAL SCREENING OF DRUM RESULTS FROM AUS-106A

ADDITIONAL AND UNCHARACTERIZED SITES OU  
 CRAB ORCHARD NATIONAL WILDLIFE REFUGE

CAS Number	Chemical	Background (SOIL)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ) (SOIL)	Retained as Potential Bioaccumulator
206-44-0	Fluoranthene		230	J	UG/KG	1.89E-03	YES
86-73-7	Fluorene		540	U	UG/KG	1.80E-02	
118-74-1	Hexachlorobenzene		540	U	UG/KG	5.40E-04	
87-68-3	Hexachlorobutadiene		540	U	UG/KG	1.36E+01	
77-47-4	Hexachlorocyclopentadiene		540	U	UG/KG	5.40E-02	
67-72-1	Hexachloroethane		540	U	UG/KG	9.06E-01	
193-39-5	Indeno(1,2,3-c,d)pyrene		140	J	UG/KG	1.28E-03	YES
78-59-1	Isophorone		540	U	UG/KG	3.88E-03	
621-64-7	N-Nitroso-di-n-propylamine		540	U	UG/KG	9.93E-01	
86-30-6	N-Nitrosodiphenylamine		540	U	UG/KG	2.70E-02	
91-20-3	Naphthalene		540		UG/KG	2.17E-03	
87-86-5	Pentachlorophenol		2700	U	UG/KG	4.50E-01	
85-01-8	Phenanthrene		470	J	UG/KG	1.03E-02	YES
108-95-2	Phenol		540	U	UG/KG	1.35E-02	
129-00-0	Pyrene		350	J	UG/KG	4.46E-03	YES
<b>Explosives</b>							
99-35-4	1,3,5-Trinitrobenzene		400	U	UG/KG	1.06E+00	
99-65-0	1,3-Dinitrobenzene		400	U	UG/KG	6.11E-01	
118-96-7	2,4,6-Trinitrotoluene (TNT)		810	U	UG/KG	2.70E-02	
121-14-2	2,4-Dinitrotoluene		400	U	UG/KG	3.13E-01	
606-20-2	2,6-Dinitrotoluene		540	U	UG/KG	1.64E+01	
35572-78-2	2-Amino-4,6-Dinitrotoluene		810	U	UG/KG	1.01E-02	
88-72-2	2-Nitrotoluene (ONT)		810	U	UG/KG		
99-08-1	3-Nitrotoluene		810	U	UG/KG		
19406-51-0	4-Amino-2,6-Dinitrotoluene		810	U	UG/KG		
99-99-0	4-Nitrotoluene (PNT)		810	U	UG/KG		
2691-41-0	HMX		810	U	UG/KG	3.24E-02	
98-95-3	Nitrobenzene		400	U	UG/KG	1.00E-02	
121-82-4	RDX		810	U	UG/KG	8.10E-03	
479-45-8	Tetryl		1200	U	UG/KG		
<b>Metals</b>							
7429-90-5	Aluminum	28800	12500		MG/KG		
7440-36-0	Antimony	0.83	6.5		MG/KG	1.30E+00	
7440-38-2	Arsenic	13.5	14.1		MG/KG	1.57E+00	
7440-39-3	Barium	195	385	J	MG/KG	7.70E-01	
7440-41-7	Beryllium	0.76	0.35	J	MG/KG	3.50E-02	
7440-42-8	Boron	5.3	33.6		MG/KG	6.72E+01	
7440-43-9	Cadmium	0.19	45.8	J	MG/KG	1.58E+00	
7440-70-2	Calcium	2497	10000		MG/KG		
7440-47-3	Chromium	25.2	57.1		MG/KG	1.14E+01	
7440-48-4	Cobalt	21.7	7.7		MG/KG	3.85E-01	
7440-50-8	Copper	11.3	410		MG/KG	1.32E+01	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
 J = Estimated U = Nondetect

TABLE 39-8  
 ECOLOGICAL SCREENING OF DRUM RESULTS FROM AUS-106A

ADDITIONAL AND UNCHARACTERIZED SITES OU  
 CRAB ORCHARD NATIONAL WILDLIFE REFUGE

CAS Number	Chemical	Background (SOIL)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ) (SOIL)	Retained as Potential Bioaccumulator
7439-89-6	Iron	19306	101000		MG/KG	5.05E+02	
7439-92-1	Lead	23.4	279	J	MG/KG	6.44E-01	
7439-95-4	Magnesium	1552	4330		MG/KG		
7439-96-5	Manganese	3640	879		MG/KG	8.79E+00	
7439-97-6	Mercury	0.06	0.11	J	MG/KG	1.57E-02	YES
7440-02-0	Nickel	18.9	76		MG/KG	2.53E+00	
2023695	Potassium	625	725	J	MG/KG		
7782-49-2	Selenium	2.34	2.8		MG/KG	2.80E+00	YES
7440-22-4	Silver	0.58	0.33	J	MG/KG	1.65E-01	
7440-23-5	Sodium	170	2550		MG/KG		
7440-28-0	Thallium	0.41	0.95	J	MG/KG	9.50E-01	
7440-62-2	Vanadium	47.2	25.4	J	MG/KG	5.52E-01	
7440-66-6	Zinc	51.4	10700	J	MG/KG	8.92E+01	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
 J = Estimated U = Nondetect



TABLE 39-9, AUS-106A  
SUMMARY OF HUMAN HEALTH COPC EVALUATION

AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Chemical	Surface Water		Groundwater		Sediment		Soil	
	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale
<b>Volatile Organic Compounds</b>								
1,1,1-Trichloroethane	NA	NA	NA	NA	NA	NA	No	A
1,1,2,2-Tetrachloroethane	NA	NA	NA	NA	NA	NA	Uncertainty	B
1,1,2-Trichloroethane	NA	NA	NA	NA	NA	NA	Uncertainty	B
1,1-Dichloroethane	NA	NA	NA	NA	NA	NA	No	A
1,1-Dichloroethene	NA	NA	NA	NA	NA	NA	Uncertainty	B
1,2-Dichloroethane (EDC)	NA	NA	NA	NA	NA	NA	Uncertainty	B
1,2-Dichloroethene (total)	NA	NA	NA	NA	NA	NA	Yes	E
1,2-Dichloropropane	NA	NA	NA	NA	NA	NA	Uncertainty	B
2-Butanone (MEK)	NA	NA	NA	NA	NA	NA	No	F
2-Hexanone	NA	NA	NA	NA	NA	NA	No	C
4-Methyl-2-pentanone (MIBK)	NA	NA	NA	NA	NA	NA	No	A
Acetone	NA	NA	NA	NA	NA	NA	No	A
Benzene	NA	NA	NA	NA	NA	NA	Uncertainty	B
Bromodichloromethane	NA	NA	NA	NA	NA	NA	No	A
Bromoform	NA	NA	NA	NA	NA	NA	No	A
Bromomethane	NA	NA	NA	NA	NA	NA	No	A
Carbon disulfide	NA	NA	NA	NA	NA	NA	No	A
Carbon tetrachloride	NA	NA	NA	NA	NA	NA	Uncertainty	B
Chlorobenzene	NA	NA	NA	NA	NA	NA	No	A
Chloroethane	NA	NA	NA	NA	NA	NA	No	A
Chloroform	NA	NA	NA	NA	NA	NA	No	A
Chloromethane	NA	NA	NA	NA	NA	NA	No	A
cis-1,2-Dichloroethene	NA	NA	NA	NA	NA	NA	Yes	E
cis-1,3-Dichloropropene	NA	NA	NA	NA	NA	NA	No	A
Dibromochloromethane	NA	NA	NA	NA	NA	NA	No	A
Ethylbenzene	NA	NA	NA	NA	NA	NA	No	F
Methylene chloride	NA	NA	NA	NA	NA	NA	Uncertainty	B
N-Hexane	NA	NA	NA	NA	NA	NA	No	A
Styrene	NA	NA	NA	NA	NA	NA	Yes	E
Tetrachloroethylene (PCE)	NA	NA	NA	NA	NA	NA	Uncertainty	B
Toluene	NA	NA	NA	NA	NA	NA	No	A
total Xylenes	NA	NA	NA	NA	NA	NA	No	F
trans-1,2-Dichloroethene	NA	NA	NA	NA	NA	NA	No	A
trans-1,3-Dichloropropene	NA	NA	NA	NA	NA	NA	No	A
Trichloroethylene (TCE)	NA	NA	NA	NA	NA	NA	Yes	E
Vinyl chloride	NA	NA	NA	NA	NA	NA	Uncertainty	B
<b>Semivolatile Organic Compounds</b>								
1,2,4-Trichlorobenzene	NA	NA	NA	NA	NA	NA	Uncertainty	B
1,2-Dichlorobenzene	NA	NA	NA	NA	NA	NA	No	A
1,3-Dichlorobenzene	NA	NA	NA	NA	NA	NA	No	A
1,4-Dichlorobenzene	NA	NA	NA	NA	NA	NA	Uncertainty	B
2,4,5-Trichlorophenol	NA	NA	NA	NA	NA	NA	No	A

TABLE 39-9, AUS-106A  
SUMMARY OF HUMAN HEALTH COPC EVALUATION

AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Chemical	Surface Water		Groundwater		Sediment		Soil	
	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale
2,4,6-Trichlorophenol	NA	NA	NA	NA	NA	NA	Uncertainty	B
2,4-Dichlorophenol	NA	NA	NA	NA	NA	NA	Uncertainty	B
2,4-Dimethylphenol	NA	NA	NA	NA	NA	NA	Uncertainty	B
2,4-Dinitrophenol	NA	NA	NA	NA	NA	NA	Uncertainty	B
2-Chloronaphthalene	NA	NA	NA	NA	NA	NA	No	A
2-Chlorophenol	NA	NA	NA	NA	NA	NA	Uncertainty	B
1-Methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	NA	NA	NA	NA	NA	NA	No	F
2-Methylphenol	NA	NA	NA	NA	NA	NA	No	A
2-Nitroaniline	NA	NA	NA	NA	NA	NA	No	A
2-Nitrophenol	NA	NA	NA	NA	NA	NA	No	A
3,3'-Dichlorobenzidine	NA	NA	NA	NA	NA	NA	Uncertainty	B
3-Nitroaniline	NA	NA	NA	NA	NA	NA	No	A
4,6-Dinitro-2-methylphenol	NA	NA	NA	NA	NA	NA	No	C
4-Bromophenyl phenyl ether	NA	NA	NA	NA	NA	NA	No	C
4-Chloro-3-methylphenol	NA	NA	NA	NA	NA	NA	No	A
4-Chloroaniline	NA	NA	NA	NA	NA	NA	Uncertainty	B
4-Chlorophenyl phenyl ether	NA	NA	NA	NA	NA	NA	No	C
4-Methylphenol	NA	NA	NA	NA	NA	NA	No	A
4-Nitroaniline	NA	NA	NA	NA	NA	NA	No	A
4-Nitrophenol	NA	NA	NA	NA	NA	NA	No	A
Acenaphthene	NA	NA	NA	NA	NA	NA	No	A
Acenaphthylene	NA	NA	NA	NA	NA	NA	No	A
Anthracene	NA	NA	NA	NA	NA	NA	No	A
Benzo(a)anthracene	NA	NA	NA	NA	NA	NA	No	F
Benzo(a)pyrene	NA	NA	NA	NA	NA	NA	No	F
Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA	No	F
Benzo(g,h,i)perylene	NA	NA	NA	NA	NA	NA	No	F
Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	No	F
bis(2-Chloroethoxy)methane	NA	NA	NA	NA	NA	NA	No	C
bis(2-Chloroethyl) ether	NA	NA	NA	NA	NA	NA	Uncertainty	B
bis(2-Chloroisopropyl) ether	NA	NA	NA	NA	NA	NA	No	A
bis(2-Ethylhexyl) phthalate	NA	NA	NA	NA	NA	NA	No	F
Butyl benzyl phthalate	NA	NA	NA	NA	NA	NA	No	A
Carbazole	NA	NA	NA	NA	NA	NA	Uncertainty	B
Chrysene	NA	NA	NA	NA	NA	NA	No	F
Di-n-butyl phthalate	NA	NA	NA	NA	NA	NA	No	F
Di-n-octyl phthalate	NA	NA	NA	NA	NA	NA	No	F
Dibenz(a,h)anthracene	NA	NA	NA	NA	NA	NA	Uncertainty	B
Dibenzofuran	NA	NA	NA	NA	NA	NA	No	F
Diethyl phthalate	NA	NA	NA	NA	NA	NA	No	F
Dimethyl phthalate	NA	NA	NA	NA	NA	NA	No	F
Fluoranthene	NA	NA	NA	NA	NA	NA	No	F

TABLE 39-9, AUS-106A  
SUMMARY OF HUMAN HEALTH COPC EVALUATION

AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Chemical	Surface Water		Groundwater		Sediment		Soil	
	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale
Fluorene	NA	NA	NA	NA	NA	NA	No	A
Hexachlorobenzene	NA	NA	NA	NA	NA	NA	Uncertainty	B
Hexachlorobutadiene	NA	NA	NA	NA	NA	NA	Uncertainty	B
Hexachlorocyclopentadiene	NA	NA	NA	NA	NA	NA	No	A
Hexachloroethane	NA	NA	NA	NA	NA	NA	Uncertainty	B
Indeno(1,2,3-c,d)pyrene	NA	NA	NA	NA	NA	NA	No	F
Isophorone	NA	NA	NA	NA	NA	NA	Uncertainty	B
N-Nitroso-di-n-propylamine	NA	NA	NA	NA	NA	NA	Uncertainty	B
N-Nitrosodiphenylamine	NA	NA	NA	NA	NA	NA	Uncertainty	B
Naphthalene	NA	NA	NA	NA	NA	NA	No	F
Pentachlorophenol	NA	NA	NA	NA	NA	NA	Uncertainty	B
Phenanthrene	NA	NA	NA	NA	NA	NA	No	F
Phenol	NA	NA	NA	NA	NA	NA	No	A
Pyrene	NA	NA	NA	NA	NA	NA	No	F
<b>Metals and Inorganics</b>								
Aluminum	NA	NA	NA	NA	NA	NA	No	F
Antimony	NA	NA	NA	NA	NA	NA	Yes	E
Arsenic	NA	NA	NA	NA	NA	NA	Yes	E
Barium	NA	NA	NA	NA	NA	NA	Yes	E
Beryllium	NA	NA	NA	NA	NA	NA	No	F
Boron	NA	NA	NA	NA	NA	NA	No	F
Cadmium	NA	NA	NA	NA	NA	NA	Yes	E
Calcium	NA	NA	NA	NA	NA	NA	No	H
Chromium	NA	NA	NA	NA	NA	NA	Yes	E
Cobalt	NA	NA	NA	NA	NA	NA	No	F
Copper	NA	NA	NA	NA	NA	NA	No	F
Cyanide, Total	NA	NA	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	NA	NA	No	F
Lead	NA	NA	NA	NA	NA	NA	Yes	E
Magnesium	NA	NA	NA	NA	NA	NA	No	H
Manganese	NA	NA	NA	NA	NA	NA	No	F
Mercury	NA	NA	NA	NA	NA	NA	Yes	E
Nickel	NA	NA	NA	NA	NA	NA	Yes	E
Potassium	NA	NA	NA	NA	NA	NA	No	H
Selenium	NA	NA	NA	NA	NA	NA	Yes	E
Silver	NA	NA	NA	NA	NA	NA	Yes	E
Sodium	NA	NA	NA	NA	NA	NA	No	H
Thallium	NA	NA	NA	NA	NA	NA	Uncertainty	B
Vanadium	NA	NA	NA	NA	NA	NA	No	F
Zinc	NA	NA	NA	NA	NA	NA	Yes	E
<b>Explosives</b>								
1,3,5-Trinitrobenzene	NA	NA	NA	NA	NA	NA	No	A
1,3-Dinitrobenzene	NA	NA	NA	NA	NA	NA	No	A

TABLE 39-9, AUS-106A  
SUMMARY OF HUMAN HEALTH COPC EVALUATION

AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Chemical	Surface Water		Groundwater		Sediment		Soil	
	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale
2,4,6-Trinitrotoluene (TNT)	NA	NA	NA	NA	NA	NA	No	A
2,4-Dinitrotoluene	NA	NA	NA	NA	NA	NA	Uncertainty	B
2,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA	Uncertainty	B
2-Amino-4,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA	No	C
2-Nitrotoluene (ONT)	NA	NA	NA	NA	NA	NA	No	C
3-Nitrotoluene	NA	NA	NA	NA	NA	NA	No	A
4-Amino-2,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA	No	C
4-Nitrotoluene (PNT)	NA	NA	NA	NA	NA	NA	No	A
HMX	NA	NA	NA	NA	NA	NA	No	F
Nitrobenzene	NA	NA	NA	NA	NA	NA	Uncertainty	B
Nitroglycerin	NA	NA	NA	NA	NA	NA	NA	NA
Pentaerythritol tetranitrate (PETN)	NA	NA	NA	NA	NA	NA	NA	NA
Perchloric Acid	NA	NA	NA	NA	NA	NA	NA	NA
RDX	NA	NA	NA	NA	NA	NA	No	A
Tetryl	NA	NA	NA	NA	NA	NA	No	F
<b>Other Parameters</b>								
Nitrogen, Nitrate-Nitrite	NA	NA	NA	NA	NA	NA	NA	NA
Phosphorus, Total (as P)	NA	NA	NA	NA	NA	NA	NA	NA

- A - Chemical was not detected and the reporting limit does not exceed the screening concentration.
- B - Chemical was not detected, but reporting limit was equal to or exceeded screening concentration.
- C - Chemical was not detected and there is no screening concentration.
- D - Chemical was detected and was equal to or exceeded screening concentration, but did not exceed background.
- E - Chemical was detected and was equal to or exceeded screening concentration and background, if applicable.
- F - Chemical was detected and did not exceed screening concentration.
- G - Chemical was detected, but no screening value was available.
- H - Chemical was detected, but it is an essential nutrient.
- J - Chemical was classified as a COPC based on USEPA 1998 data but was not a COPC based on SI data.
- NA - Not Analyzed or not applicable.

TABLE 39-9A, AUS-106A  
(DRUM SAMPLES)  
SUMMARY OF HUMAN HEALTH COPC EVALUATION

AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Chemical	Drum	
	COPC (yes/no)	Rationale
<b>Volatile Organic Compounds</b>		
1,1,1-Trichloroethane	No	A
1,1,2,2-Tetrachloroethane	Uncertainty	B
1,1,2-Trichloroethane	Uncertainty	B
1,1-Dichloroethane	No	A
1,1-Dichloroethene	Uncertainty	B
1,2-Dichloroethane (EDC)	Uncertainty	B
1,2-Dichloroethene (total)	No	F
1,2-Dichloropropane	Uncertainty	B
2-Butanone (MEK)	No	A
2-Hexanone	No	C
4-Methyl-2-pentanone (MIBK)	No	A
Acetone	No	A
Benzene	Yes	E
Bromodichloromethane	No	A
Bromoform	No	A
Bromomethane	Uncertainty	B
Carbon disulfide	No	A
Carbon tetrachloride	Uncertainty	B
Chlorobenzene	No	A
Chloroethane	No	A
Chloroform	No	A
Chloromethane	No	A
cis-1,2-Dichloroethene	No	F
cis-1,3-Dichloropropene	No	A
Dibromochloromethane	No	A
Ethylbenzene	No	A
Methylene chloride	Uncertainty	B
N-Hexane	No	A
Styrene	No	A
Tetrachloroethylene (PCE)	Uncertainty	B
Toluene	No	F
total Xylenes	No	A
trans-1,2-Dichloroethene	No	A
trans-1,3-Dichloropropene	No	A
Trichloroethylene (TCE)	Yes	E
Vinyl chloride	Uncertainty	B
<b>Semivolatile Organic Compounds</b>		
1,2,4-Trichlorobenzene	Uncertainty	B
1,2-Dichlorobenzene	No	A
1,3-Dichlorobenzene	No	A

TABLE 39-9A, AUS-106A  
(DRUM SAMPLES)  
SUMMARY OF HUMAN HEALTH COPC EVALUATION

AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Chemical	Drum	
	COPC (yes/no)	Rationale
1,4-Dichlorobenzene	Uncertainty	B
2,4,5-Trichlorophenol	No	A
2,4,6-Trichlorophenol	Uncertainty	B
2,4-Dichlorophenol	Uncertainty	B
2,4-Dimethylphenol	Uncertainty	B
2,4-Dinitrophenol	Uncertainty	B
2-Chloronaphthalene	No	A
2-Chlorophenol	Uncertainty	B
1-Methylnaphthalene	NA	NA
2-Methylnaphthalene	No	F
2-Methylphenol	No	A
2-Nitroaniline	No	A
2-Nitrophenol	No	A
3,3'-Dichlorobenzidine	Uncertainty	B
3-Nitroaniline	No	A
4,6-Dinitro-2-methylphenol	No	C
4-Bromophenyl phenyl ether	No	C
4-Chloro-3-methylphenol	No	A
4-Chloroaniline	Uncertainty	B
4-Chlorophenyl phenyl ether	No	C
4-Methylphenol	No	A
4-Nitroaniline	No	A
4-Nitrophenol	No	A
Acenaphthene	No	A
Acenaphthylene	No	A
Anthracene	No	F
Benzo(a)anthracene	Yes	E
Benzo(a)pyrene	No	F
Benzo(b)fluoranthene	Yes	E
Benzo(g,h,i)perylene	No	F
Benzo(k)fluoranthene	No	F
bis(2-Chloroethoxy)methane	No	C
bis(2-Chloroethyl) ether	Uncertainty	B
bis(2-Chloroisopropyl) ether	No	A
bis(2-Ethylhexyl) phthalate	No	A
Butyl benzyl phthalate	No	A
Carbazole	Uncertainty	B
Chrysene	No	F
Di-n-butyl phthalate	No	F
Di-n-octyl phthalate	No	F
Dibenz(a,h)anthracene	Uncertainty	B

TABLE 39-9A, AUS-106A  
(DRUM SAMPLES)  
SUMMARY OF HUMAN HEALTH COPC EVALUATION

AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Chemical	Drum	
	COPC (yes/no)	Rationale
Dibenzofuran	No	F
Diethyl phthalate	No	A
Dimethyl phthalate	No	A
Fluoranthene	No	F
Fluorene	No	A
Hexachlorobenzene	Uncertainty	B
Hexachlorobutadiene	Uncertainty	B
Hexachlorocyclopentadiene	No	A
Hexachloroethane	Uncertainty	B
Indeno(1,2,3-c,d)pyrene	No	F
Isophorone	Uncertainty	B
N-Nitroso-di-n-propylamine	Uncertainty	B
N-Nitrosodiphenylamine	Uncertainty	B
Naphthalene	No	F
Pentachlorophenol	Uncertainty	B
Phenanthrene	No	F
Phenol	No	A
Pyrene	No	F
<b>Metals and Inorganics</b>		
Aluminum	No	F
Antimony	Yes	D
Arsenic	Yes	E
Barium	Yes	E
Beryllium	No	F
Boron	No	F
Cadmium	Yes	E
Calcium	Uncertainty	G
Chromium	Yes	E
Cobalt	No	F
Copper	No	F
Cyanide, Total	NA	NA
Iron	No	F
Lead	No	F
Magnesium	Uncertainty	G
Manganese	No	F
Mercury	No	F
Nickel	Yes	E
Potassium	Uncertainty	G
Selenium	Yes	E
Silver	No	F
Sodium	Uncertainty	G

TABLE 39-9A, AUS-106A  
(DRUM SAMPLES)  
SUMMARY OF HUMAN HEALTH COPC EVALUATION

AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Chemical	Drum	
	COPC (yes/no)	Rationale
Thallium	No	F
Vanadium	No	F
Zinc	Yes	E
<b>Explosives</b>		
1,3,5-Trinitrobenzene	No	A
1,3-Dinitrobenzene	No	A
2,4,6-Trinitrotoluene (TNT)	No	A
2,4-Dinitrotoluene	Uncertainty	B
2,6-Dinitrotoluene	Uncertainty	B
2-Amino-4,6-Dinitrotoluene	No	C
2-Nitrotoluene (ONT)	No	C
3-Nitrotoluene	No	A
4-Amino-2,6-Dinitrotoluene	No	C
4-Nitrotoluene (PNT)	No	A
HMX	No	A
Nitrobenzene	Uncertainty	B
Nitroglycerin	NA	NA
Pentaerythritol tetranitrate (PETN)	NA	NA
Perchloric Acid	NA	NA
RDX	No	A
Tetryl	No	A

- A - Chemical was not detected and the reporting limit does not exceed the screening concentration.
- B - Chemical was not detected, but reporting limit was equal to or exceeded screening concentration.
- C - Chemical was not detected and there is no screening concentration.
- D - Chemical was detected and was equal to or exceeded screening concentration, but did not exceed background.
- E - Chemical was detected and was equal to or exceeded screening concentration and background, if applicable.
- F - Chemical was detected and did not exceed screening concentration.
- G - Chemical was detected, but no screening value was available.
- H - Chemical was detected, but it is an essential nutrient.
- J - Chemical was classified as a COPC based on USEPA 1998 data but was not a COPC based on SI data.
- NA - Not Analyzed or not applicable.



TABLE 39-10, AUS-106A  
SUMMARY OF ECOLOGICAL COPEC EVALUATION

AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Chemical	Surface Water		Sediment		Soil	
	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale
<b>Volatile Organic Compounds</b>						
1,1,1-Trichloroethane	NA	NA	NA	NA	No	A
1,1,2,2-Tetrachloroethane	NA	NA	NA	NA	No	A
1,1,2-Trichloroethane	NA	NA	NA	NA	No	A
1,1-Dichloroethane	NA	NA	NA	NA	No	A
1,1-Dichloroethene	NA	NA	NA	NA	No	A
1,2-Dichloroethane (EDC)	NA	NA	NA	NA	No	A
1,2-Dichloroethene (total)	NA	NA	NA	NA	No	F
1,2-Dichloropropane	NA	NA	NA	NA	No	A
2-Butanone (MEK)	NA	NA	NA	NA	No	F
2-Hexanone	NA	NA	NA	NA	No	A
4-Methyl-2-pentanone (MIBK)	NA	NA	NA	NA	No	A
Acetone	NA	NA	NA	NA	No	A
Benzene	NA	NA	NA	NA	No	A
Bromodichloromethane	NA	NA	NA	NA	No	A
Bromoform	NA	NA	NA	NA	No	A
Bromomethane	NA	NA	NA	NA	No	A
Carbon disulfide	NA	NA	NA	NA	No	A
Carbon tetrachloride	NA	NA	NA	NA	No	A
Chlorobenzene	NA	NA	NA	NA	No	A
Chloroethane	NA	NA	NA	NA	No	C
Chloroform	NA	NA	NA	NA	No	A
Chloromethane	NA	NA	NA	NA	No	A
cis-1,2-Dichloroethene	NA	NA	NA	NA	No	F
cis-1,3-Dichloropropene	NA	NA	NA	NA	No	A
Dibromochloromethane	NA	NA	NA	NA	No	A
Ethylbenzene	NA	NA	NA	NA	No	F
Methylene chloride	NA	NA	NA	NA	No	A
N-Hexane	NA	NA	NA	NA	No	C
Styrene	NA	NA	NA	NA	No	F
Tetrachloroethylene (PCE)	NA	NA	NA	NA	No	A
Toluene	NA	NA	NA	NA	No	A
total Xylenes	NA	NA	NA	NA	No	F
trans-1,2-Dichloroethene	NA	NA	NA	NA	No	A
trans-1,3-Dichloropropene	NA	NA	NA	NA	No	A
Trichloroethylene (TCE)	NA	NA	NA	NA	Yes	E
Vinyl chloride	NA	NA	NA	NA	No	A
<b>Semivolatile Organic Compounds</b>						
1,2,4-Trichlorobenzene	NA	NA	NA	NA	No	A
1,2-Dichlorobenzene	NA	NA	NA	NA	No	A
1,3-Dichlorobenzene	NA	NA	NA	NA	No	A
1,4-Dichlorobenzene	NA	NA	NA	NA	No	A
2,4,5-Trichlorophenol	NA	NA	NA	NA	No	A

TABLE 39-10, AUS-106A  
SUMMARY OF ECOLOGICAL COPEC EVALUATION

AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Chemical	Surface Water		Sediment		Soil	
	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale
2,4,6-Trichlorophenol	NA	NA	NA	NA	No	A
2,4-Dichlorophenol	NA	NA	NA	NA	No	A
2,4-Dimethylphenol	NA	NA	NA	NA	Uncertainty	B
2,4-Dinitrophenol	NA	NA	NA	NA	No	A
2-Chloronaphthalene	NA	NA	NA	NA	Uncertainty	B
2-Chlorophenol	NA	NA	NA	NA	Uncertainty	B
1-Methylnaphthalene	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	NA	NA	NA	NA	Yes	E
2-Methylphenol	NA	NA	NA	NA	No	A
2-Nitroaniline	NA	NA	NA	NA	No	A
2-Nitrophenol	NA	NA	NA	NA	No	A
3,3'-Dichlorobenzidine	NA	NA	NA	NA	No	A
3-Nitroaniline	NA	NA	NA	NA	No	A
4,6-Dinitro-2-methylphenol	NA	NA	NA	NA	No	C
4-Bromophenyl phenyl ether	NA	NA	NA	NA	No	C
4-Chloro-3-methylphenol	NA	NA	NA	NA	No	A
4-Chloroaniline	NA	NA	NA	NA	No	A
4-Chlorophenyl phenyl ether	NA	NA	NA	NA	No	C
4-Methylphenol	NA	NA	NA	NA	No	A
4-Nitroaniline	NA	NA	NA	NA	No	A
4-Nitrophenol	NA	NA	NA	NA	No	A
Acenaphthene	NA	NA	NA	NA	No	A
Acenaphthylene	NA	NA	NA	NA	No	A
Anthracene	NA	NA	NA	NA	No	A
Benzo(a)anthracene	NA	NA	NA	NA	Yes	E
Benzo(a)pyrene	NA	NA	NA	NA	Yes	E
Benzo(b)fluoranthene	NA	NA	NA	NA	Yes	E
Benzo(g,h,i)perylene	NA	NA	NA	NA	Yes	E
Benzo(k)fluoranthene	NA	NA	NA	NA	Yes	E
bis(2-Chloroethoxy)methane	NA	NA	NA	NA	Uncertainty	B
bis(2-Chloroethyl) ether	NA	NA	NA	NA	No	A
bis(2-Chloroisopropyl) ether	NA	NA	NA	NA	No	C
bis(2-Ethylhexyl) phthalate	NA	NA	NA	NA	Yes	E
Butyl benzyl phthalate	NA	NA	NA	NA	Uncertainty	B
Carbazole	NA	NA	NA	NA	No	C
Chrysene	NA	NA	NA	NA	Yes	E
Di-n-butyl phthalate	NA	NA	NA	NA	Yes	E
Di-n-octyl phthalate	NA	NA	NA	NA	Yes	E
Dibenz(a,h)anthracene	NA	NA	NA	NA	No	A
Dibenzofuran	NA	NA	NA	NA	Yes	E
Diethyl phthalate	NA	NA	NA	NA	No	F
Dimethyl phthalate	NA	NA	NA	NA	No	F
Fluoranthene	NA	NA	NA	NA	Yes	E

TABLE 39-10, AUS-106A  
SUMMARY OF ECOLOGICAL COPEC EVALUATION

AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Chemical	Surface Water		Sediment		Soil	
	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale
Fluorene	NA	NA	NA	NA	No	A
Hexachlorobenzene	NA	NA	NA	NA	No	A
Hexachlorobutadiene	NA	NA	NA	NA	Uncertainty	B
Hexachlorocyclopentadiene	NA	NA	NA	NA	No	A
Hexachloroethane	NA	NA	NA	NA	No	A
Indeno(1,2,3-c,d)pyrene	NA	NA	NA	NA	Yes	E
Isophorone	NA	NA	NA	NA	No	A
N-Nitroso-di-n-propylamine	NA	NA	NA	NA	No	A
N-Nitrosodiphenylamine	NA	NA	NA	NA	No	A
Naphthalene	NA	NA	NA	NA	No	F
Pentachlorophenol	NA	NA	NA	NA	No	A
Phenanthrene	NA	NA	NA	NA	Yes	E
Phenol	NA	NA	NA	NA	No	A
Pyrene	NA	NA	NA	NA	Yes	E
<b>Metals and Inorganics</b>						
Aluminum	NA	NA	NA	NA	Uncertainty	I
Antimony	NA	NA	NA	NA	Yes	E
Arsenic	NA	NA	NA	NA	Yes	E
Barium	NA	NA	NA	NA	Yes	E
Beryllium	NA	NA	NA	NA	No	F
Boron	NA	NA	NA	NA	Yes	E
Cadmium	NA	NA	NA	NA	Yes	E
Calcium	NA	NA	NA	NA	Uncertainty	G,H
Chromium	NA	NA	NA	NA	Yes	E
Cobalt	NA	NA	NA	NA	No	F
Copper	NA	NA	NA	NA	Yes	E
Cyanide, Total	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	Yes	E
Lead	NA	NA	NA	NA	Yes	E
Magnesium	NA	NA	NA	NA	Uncertainty	G,H
Manganese	NA	NA	NA	NA	Yes	D
Mercury	NA	NA	NA	NA	Yes	E
Nickel	NA	NA	NA	NA	Yes	E
Potassium	NA	NA	NA	NA	Uncertainty	G,H
Selenium	NA	NA	NA	NA	Yes	E
Silver	NA	NA	NA	NA	Yes	E
Sodium	NA	NA	NA	NA	Uncertainty	G,H
Thallium	NA	NA	NA	NA	Uncertainty	B
Vanadium	NA	NA	NA	NA	Yes	E
Zinc	NA	NA	NA	NA	Yes	E
<b>Explosives</b>						
1,3,5-Trinitrobenzene	NA	NA	NA	NA	No	A
1,3-Dinitrobenzene	NA	NA	NA	NA	No	A

TABLE 39-10, AUS-106A  
SUMMARY OF ECOLOGICAL COPEC EVALUATION

AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Chemical	Surface Water		Sediment		Soil	
	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale
2,4,6-Trinitrotoluene (TNT)	NA	NA	NA	NA	No	A
2,4-Dinitrotoluene	NA	NA	NA	NA	No	A
2,6-Dinitrotoluene	NA	NA	NA	NA	Uncertainty	B
2-Amino-4,6-Dinitrotoluene	NA	NA	NA	NA	No	A
2-Nitrotoluene (ONT)	NA	NA	NA	NA	No	C
3-Nitrotoluene	NA	NA	NA	NA	No	C
4-Amino-2,6-Dinitrotoluene	NA	NA	NA	NA	No	C
4-Nitrotoluene (PNT)	NA	NA	NA	NA	No	C
HMX	NA	NA	NA	NA	No	F
Nitrobenzene	NA	NA	NA	NA	No	A
Nitroglycerin	NA	NA	NA	NA	NA	NA
Pentaerythritol tetranitrate (PETN)	NA	NA	NA	NA	NA	NA
Perchloric Acid	NA	NA	NA	NA	NA	NA
RDX	NA	NA	NA	NA	No	A
Tetryl	NA	NA	NA	NA	Uncertainty	G

- A - Chemical was not detected and the reporting limit does not exceed the screening concentration.
- B - Chemical was not detected, but reporting limit was equal to or exceeded screening concentration.
- C - Chemical was not detected and there is no screening concentration.
- D - Chemical was detected and was equal to or exceeded screening concentration, but did not exceed background.
- E - Chemical was detected and was equal to or exceeded screening concentration and background, if applicable.
- F - Chemical was detected and did not exceed screening concentration.
- G - Chemical was detected, but no screening value was available.
- H - Chemical was detected, but it is an essential nutrient.
- I - If pH<5.5, Aluminum is a COPEC, otherwise it is not.
- J - Chemical was classified as a COPEC based on USEPA 1998 data but was not a COPEC based on SI data.
- NA - Not Analyzed or not applicable.

TABLE 39-10A, AUS-106A  
(DRUM SAMPLES)  
SUMMARY OF ECOLOGICAL COPEC EVALUATION

AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Chemical	Drum	
	COPC (yes/no)	Rationale
<b>Volatile Organic Compounds</b>		
1,1,1-Trichloroethane	No	A
1,1,2,2-Tetrachloroethane	No	A
1,1,2-Trichloroethane	No	A
1,1-Dichloroethane	No	A
1,1-Dichloroethene	No	A
1,2-Dichloroethane (EDC)	No	A
1,2-Dichloroethene (total)	No	F
1,2-Dichloropropane	No	A
2-Butanone (MEK)	No	A
2-Hexanone	No	A
4-Methyl-2-pentanone (MIBK)	No	A
Acetone	No	A
Benzene	No	F
Bromodichloromethane	No	A
Bromoform	No	A
Bromomethane	No	A
Carbon disulfide	No	A
Carbon tetrachloride	No	A
Chlorobenzene	No	A
Chloroethane	No	C
Chloroform	No	A
Chloromethane	No	A
cis-1,2-Dichloroethene	No	F
cis-1,3-Dichloropropene	No	A
Dibromochloromethane	No	A
Ethylbenzene	No	A
Methylene chloride	No	A
N-Hexane	No	C
Styrene	No	A
Tetrachloroethylene (PCE)	No	A
Toluene	No	F
total Xylenes	No	A
trans-1,2-Dichloroethene	No	A
trans-1,3-Dichloropropene	No	A
Trichloroethylene (TCE)	No	F
Vinyl chloride	No	A
<b>Semivolatile Organic Compounds</b>		
1,2,4-Trichlorobenzene	No	A
1,2-Dichlorobenzene	No	A
1,3-Dichlorobenzene	No	A

TABLE 39-10A, AUS-106A  
(DRUM SAMPLES)  
SUMMARY OF ECOLOGICAL COPEC EVALUATION

AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Chemical	Drum	
	COPC (yes/no)	Rationale
1,4-Dichlorobenzene	No	A
2,4,5-Trichlorophenol	No	A
2,4,6-Trichlorophenol	No	A
2,4-Dichlorophenol	No	A
2,4-Dimethylphenol	Uncertainty	B
2,4-Dinitrophenol	No	A
2-Chloronaphthalene	Uncertainty	B
2-Chlorophenol	Uncertainty	B
1-Methylnaphthalene	NA	NA
2-Methylnaphthalene	Yes	E
2-Methylphenol	No	A
2-Nitroaniline	No	A
2-Nitrophenol	No	A
3,3'-Dichlorobenzidine	No	A
3-Nitroaniline	No	A
4,6-Dinitro-2-methylphenol	No	C
4-Bromophenyl phenyl ether	No	C
4-Chloro-3-methylphenol	No	A
4-Chloroaniline	Uncertainty	B
4-Chlorophenyl phenyl ether	No	C
4-Methylphenol	No	A
4-Nitroaniline	No	A
4-Nitrophenol	No	A
Acenaphthene	No	A
Acenaphthylene	No	A
Anthracene	Yes	E
Benzo(a)anthracene	Yes	E
Benzo(a)pyrene	Yes	E
Benzo(b)fluoranthene	Yes	E
Benzo(g,h,i)perylene	Yes	E
Benzo(k)fluoranthene	Yes	E
bis(2-Chloroethoxy)methane	Uncertainty	B
bis(2-Chloroethyl) ether	No	A
bis(2-Chloroisopropyl) ether	No	C
bis(2-Ethylhexyl) phthalate	No	A
Butyl benzyl phthalate	Uncertainty	B
Carbazole	No	C
Chrysene	Yes	E
Di-n-butyl phthalate	Yes	E
Di-n-octyl phthalate	Yes	E
Dibenz(a,h)anthracene	No	A

TABLE 39-10A, AUS-106A  
(DRUM SAMPLES)  
SUMMARY OF ECOLOGICAL COPEC EVALUATION

AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Chemical	Drum	
	COPC (yes/no)	Rationale
Dibenzofuran	Yes	E
Diethyl phthalate	No	A
Dimethyl phthalate	No	A
Fluoranthene	Yes	E
Fluorene	No	A
Hexachlorobenzene	No	A
Hexachlorobutadiene	Uncertainty	B
Hexachlorocyclopentadiene	No	A
Hexachloroethane	No	A
Indeno(1,2,3-c,d)pyrene	Yes	E
Isophorone	No	A
N-Nitroso-di-n-propylamine	No	A
N-Nitrosodiphenylamine	No	A
Naphthalene	No	F
Pentachlorophenol	No	A
Phenanthrene	Yes	E
Phenol	No	A
Pyrene	Yes	E
<b>Metals and Inorganics</b>		
Aluminum	Uncertainty	G
Antimony	Yes	E
Arsenic	Yes	E
Barium	No	F
Beryllium	No	F
Boron	Yes	E
Cadmium	Yes	E
Calcium	Uncertainty	G
Chromium	Yes	E
Cobalt	No	F
Copper	Yes	E
Cyanide, Total	NA	NA
Iron	Yes	E
Lead	No	F
Magnesium	Uncertainty	G
Manganese	Yes	D
Mercury	Yes	E
Nickel	Yes	E
Potassium	Uncertainty	G
Selenium	Yes	E
Silver	No	F
Sodium	Uncertainty	G

TABLE 39-10A, AUS-106A  
(DRUM SAMPLES)  
SUMMARY OF ECOLOGICAL COPEC EVALUATION

AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Chemical	Drum	
	COPC (yes/no)	Rationale
Thallium	No	F
Vanadium	No	F
Zinc	Yes	E
<b>Explosives</b>		
1,3,5-Trinitrobenzene	Uncertainty	B
1,3-Dinitrobenzene	No	A
2,4,6-Trinitrotoluene (TNT)	No	A
2,4-Dinitrotoluene	No	A
2,6-Dinitrotoluene	Uncertainty	B
2-Amino-4,6-Dinitrotoluene	No	A
2-Nitrotoluene (ONT)	No	C
3-Nitrotoluene	No	C
4-Amino-2,6-Dinitrotoluene	No	C
4-Nitrotoluene (PNT)	No	C
HMX	No	A
Nitrobenzene	No	A
Nitroglycerin	NA	NA
Pentaerythritol tetranitrate (PETN)	NA	NA
Perchloric Acid	NA	NA
RDX	No	A
Tetryl	No	C

- A - Chemical was not detected and the reporting limit does not exceed the screening concentration.
- B - Chemical was not detected, but reporting limit was equal to or exceeded screening concentration.
- C - Chemical was not detected and there is no screening concentration.
- D - Chemical was detected and was equal to or exceeded screening concentration, but did not exceed background.
- E - Chemical was detected and was equal to or exceeded screening concentration and background, if applicable.
- F - Chemical was detected and did not exceed screening concentration.
- G - Chemical was detected, but no screening value was available.
- H - Chemical was detected, but it is an essential nutrient.
- I - If pH<5.5, Aluminum is a COPEC, otherwise it is not.
- J - Chemical was classified as a COPEC based on USEPA 1998 data but was not a COPEC based on SI data.
- NA - Not Analyzed or not applicable.



TABLE 39-11  
 AUS-106A - DRUM DISPOSAL AREA EAST OF AREA 11  
 CHEMICALS DETECTED ABOVE SCREENING CRITERIA AND ABOVE REFUGE BACKGROUND  
 (WHERE APPLICABLE)

ADDITIONAL AND UNCHARACTERIZED SITES OU SI

Chemical	Drum	Soil	Sediment	Ground Water	Surface Water
<b>VOCs</b>					
1,2-Dichloroethene (total)		H	NA	NA	NA
Benzene	H		NA	NA	NA
cis-1,2-Dichloroethene		H	NA	NA	NA
Styrene		H	NA	NA	NA
Trichloroethylene (TCE)	H	H,E	NA	NA	NA
<b>SVOCs</b>					
2-Methylnaphthalene	E	E	NA	NA	NA
Anthracene	E		NA	NA	NA
Benzo(a)anthracene	H,E	E	NA	NA	NA
Benzo(a)pyrene	E	E	NA	NA	NA
Benzo(b)fluoranthene	H,E	E	NA	NA	NA
Benzo(g,h,i)perylene	E	E	NA	NA	NA
Benzo(k)fluoranthene	E	E	NA	NA	NA
bis(2-Ethylhexyl)phthalate (DEHP)		E	NA	NA	NA
Chrysene	E	E	NA	NA	NA
Di-n-butyl phthalate	E	E	NA	NA	NA
Di-n-octyl phthalate	E	E	NA	NA	NA
Dibenzofuran	E	E	NA	NA	NA
Fluoranthene	E	E	NA	NA	NA
Indeno(1,2,3-c,d)pyrene	E	E	NA	NA	NA
Phenanthrene	E	E	NA	NA	NA
Pyrene	E	E	NA	NA	NA
<b>Metals</b>					
Antimony	E	H,E	NA	NA	NA
Arsenic	H,E	H,E	NA	NA	NA
Barium	H	H,E	NA	NA	NA
Boron	E	E	NA	NA	NA
Cadmium	H,E	H,E	NA	NA	NA
Chromium	H,E	H,E	NA	NA	NA
Copper	E	E	NA	NA	NA
Iron	E	E	NA	NA	NA
Lead		H,E	NA	NA	NA
Mercury	E	H,E	NA	NA	NA
Nickel	H,E	H,E	NA	NA	NA
Selenium	H,E	H,E	NA	NA	NA
Silver		H,E	NA	NA	NA
Vanadium		E	NA	NA	NA
Zinc	H,E	H,E	NA	NA	NA

Key:

NA = not analyzed

H = human health screening criteria exceeded

E = ecological screening criteria exceeded

File: E:\232000026.00\PA-SI REPORT-AUS OU\FWSAUS66FIG39-1.DWG Last edited: 09/24/01 @ 11:23 a.m. WC-ST.LOUIS, MO

AUS-106A-001			
	Units	Result:	Reference
		2 ft	Code
<b>Volatile Organic Compounds</b>			
Trichloroethylene (TCE)	UG/KG	94	h5,h9
<b>Semivolatile Organic Compounds</b>			
2-Methylnaphthalene	UG/KG	650	e5
Benzo(a)anthracene	UG/KG	66	e5
Benzo(a)pyrene	UG/KG	66	e5
Benzo(b)fluoranthene	UG/KG	58	e5
Benzo(g,h,i)perylene	UG/KG	91	e5
Benzo(k)fluoranthene	UG/KG	56	e5
bis(2-Ethylhexyl) phthalate (DEHP)	UG/KG	2000	e1,e5
Chrysene	UG/KG	100	e5
Di-n-butyl phthalate	UG/KG	250	e5
Dibenzofuran	UG/KG	140	e5
Diethyl phthalate	UG/KG	65	
Dimethyl phthalate	UG/KG	52	
Fluoranthene	UG/KG	66	e5
Indeno(1,2,3-c)pyrene	UG/KG	53	e5
Naphthalene	UG/KG	370	
Phenanthrene	UG/KG	320	e5
Pyrene	UG/KG	130	e5
<b>Explosives</b>			
All Explosives	UG/KG	ND	

AUS-106A-002			
	Units	Result:	Reference
		2 ft	Code
<b>Volatile Organic Compounds</b>			
1,2-Dichloroethene (total)	UG/KG	24	h5
cis-1,2-Dichloroethene	UG/KG	24	h5
total Xylenes	UG/KG	440	
Trichloroethylene (TCE)	UG/KG	13000	e1,h1,h5,h9
<b>Semivolatile Organic Compounds</b>			
2-Methylnaphthalene	UG/KG	76	e5
Benzo(a)anthracene	UG/KG	52	e5
bis(2-Ethylhexyl) phthalate (DEHP)	UG/KG	2400	e1,e5
Chrysene	UG/KG	60	e5
Di-n-butyl phthalate	UG/KG	1700	e5
Diethyl phthalate	UG/KG	140	
Dimethyl phthalate	UG/KG	780	
Naphthalene	UG/KG	97	
Phenanthrene	UG/KG	240	e5
Pyrene	UG/KG	57	e5
<b>Explosives</b>			
Tetryl (duplicate)	UG/KG	1500	

AUS-106A-003			
	Units	Result:	Reference
		2 ft	Code
<b>Volatile Organic Compounds</b>			
Trichloroethylene (TCE)	UG/KG	140	h5,h9
<b>Semivolatile Organic Compounds</b>			
2-Methylnaphthalene	UG/KG	230	e5
Chrysene	UG/KG	60	e5
Di-n-butyl phthalate	UG/KG	110	e5
Dibenzofuran	UG/KG	71	e5
Naphthalene	UG/KG	96	
Phenanthrene	UG/KG	170	e5
Pyrene	UG/KG	61	e5
<b>Explosives</b>			
All Explosives	UG/KG	ND	

AUS-106A-004			
	Units	Result:	Reference
		2 ft	Code
<b>Volatile Organic Compounds</b>			
2-Butanone (MEK)	UG/KG	53	
Ethylbenzene	UG/KG	6	
Styrene	UG/KG	200	
total Xylenes	UG/KG	75	
Trichloroethylene (TCE)	UG/KG	2500	h5,h9
<b>Semivolatile Organic Compounds</b>			
2-Methylnaphthalene	UG/KG	120	e5
Benzo(a)pyrene	UG/KG	59	e5
Benzo(b)fluoranthene	UG/KG	74	e5
Benzo(g,h,i)perylene	UG/KG	95	e5
bis(2-Ethylhexyl) phthalate (DEHP)	UG/KG	6600	e1,e5
Chrysene	UG/KG	110	e5
Di-n-butyl phthalate	UG/KG	220	e5
Fluoranthene	UG/KG	71	e5
Indeno(1,2,3-c)pyrene	UG/KG	61	e5
Naphthalene	UG/KG	100	
Phenanthrene	UG/KG	190	e5
Pyrene	UG/KG	120	e5
<b>Explosives</b>			
All Explosives	UG/KG	ND	

AUS-106A-005			
	Units	Result:	Reference
		2 ft	Code
<b>Volatile Organic Compounds</b>			
total Xylenes	UG/KG	3	
Trichloroethylene (TCE)	UG/KG	110	h5,h9
<b>Semivolatile Organic Compounds</b>			
2-Methylnaphthalene	UG/KG	820	e5
Benzo(a)anthracene	UG/KG	57	e5
bis(2-Ethylhexyl) phthalate (DEHP)	UG/KG	4800	e1,e5
Chrysene	UG/KG	170	e5
Di-n-butyl phthalate	UG/KG	1000	e5
Diethyl phthalate	UG/KG	63	
Naphthalene	UG/KG	590	
Phenanthrene	UG/KG	170	e5
Pyrene	UG/KG	120	e5
<b>Explosives</b>			
All Explosives	UG/KG	ND	

AUS-106A-006			
	Units	Result:	Reference
		2 ft	Code
<b>Volatile Organic Compounds</b>			
Trichloroethylene (TCE)	UG/KG	18	h5
<b>Semivolatile Organic Compounds</b>			
2-Methylnaphthalene	UG/KG	150	e5
bis(2-Ethylhexyl) phthalate (DEHP)	UG/KG	18000	e1,e5
Chrysene	UG/KG	59	e5
Di-n-butyl phthalate	UG/KG	11000	e5
Di-n-octyl phthalate	UG/KG	72	e5
Dibenzofuran	UG/KG	68	e5
Diethyl phthalate	UG/KG	100	
Dimethyl phthalate	UG/KG	6100	
Naphthalene	UG/KG	87	
Phenanthrene	UG/KG	120	e5
Pyrene	UG/KG	57	e5
<b>Explosives</b>			
All Explosives	UG/KG	ND	

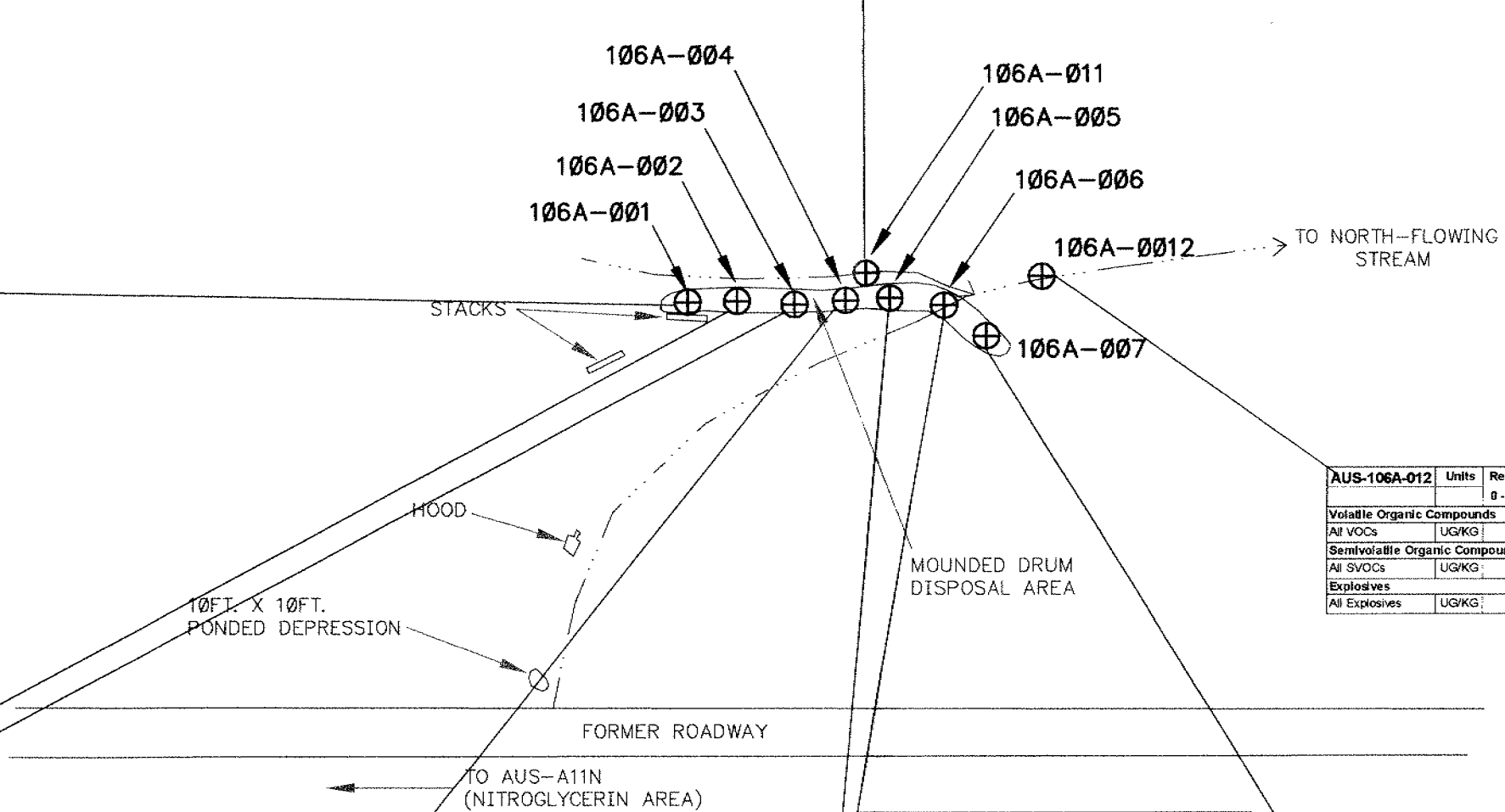
AUS-106A-007			
	Units	Result:	Reference
		2 ft	Code
<b>Volatile Organic Compounds</b>			
Trichloroethylene (TCE)	UG/KG	260	h5,h9
<b>Semivolatile Organic Compounds</b>			
2-Methylnaphthalene	UG/KG	210	e5
Benzo(a)anthracene	UG/KG	68	e5
Benzo(g,h,i)perylene	UG/KG	50	e5
bis(2-Ethylhexyl) phthalate (DEHP)	UG/KG	1600	e1,e5
Chrysene	UG/KG	87	e5
Di-n-butyl phthalate	UG/KG	5300	e5
Dibenzofuran	UG/KG	93	e5
Diethyl phthalate	UG/KG	220	
Dimethyl phthalate	UG/KG	1900	
Fluoranthene	UG/KG	74	e5
Naphthalene	UG/KG	120	
Phenanthrene	UG/KG	300	e5
Pyrene	UG/KG	140	e5
<b>Explosives</b>			
HMX	UG/KG	1500	

AUS-106A-011			
	Units	Result:	Reference
		0 - 6 in	Code
<b>Volatile Organic Compounds</b>			
All VOCs	UG/KG	ND	
<b>Semivolatile Organic Compounds</b>			
All SVOCs	UG/KG	ND	
<b>Explosives</b>			
All Explosives	UG/KG	ND	

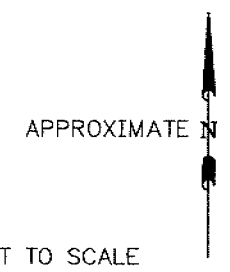
AUS-106A-012			
	Units	Result:	Reference
		0 - 6 in	Code
<b>Volatile Organic Compounds</b>			
All VOCs	UG/KG	ND	
<b>Semivolatile Organic Compounds</b>			
All SVOCs	UG/KG	ND	
<b>Explosives</b>			
All Explosives	UG/KG	ND	

Screening Reference	Reference Code
AUS Background Soil UTL	b1
Little Grass Background Sediment UTL	b2
Little Grass Background Surface Water UTL	b3
Ecological Direct Exposure Pathway TRV - Soil	e1
Ecological Direct Exposure Pathway TRV - Sediment	e2
Ecological Direct Exposure Pathway TRV - Surface Water	e3
IEPA General Use Surface Water Quality Aquatic Life Toxicity	e4
Superfund Chemical Data Matrix Kow values (potential bioaccumulato)	e5
USEPA Region IX Industrial Soil PRG - carcinous	h1
USEPA Region IX Industrial Soil PRG - noncarcinous	h2
USEPA Region IX Tap Water PRG - carcinous	h3
USEPA Region IX Tap Water PRG - noncarcinous	h4
USEPA Region IX Migration to Groundwater PRG (DAF=1)	h5
USEPA MCL Drinking Water Standards	h6
IEPA TACO Industrial/Commercial Soil Ingestion	h7
IEPA TACO Construction Worker Soil Ingestion	h8
IEPA TACO Class I Soil Component of Groundwater	h9
IEPA General Use Surface Water Quality Human Health	h10

**LEGEND**  
 ⊕ HAND AUGER LOCATION  
 - - - - - INTERMITTENT STREAM



**NOTES:**  
 1. SITE MAP PREPARED FROM SITE RECONNAISSANCE SKETCH, APRIL 30, 1999. ALL SAMPLE LOCATIONS ARE APPROXIMATE, SEE TABLE 39-1 OF REPORT FOR SURVEY COORDINATES, SAMPLE LOCATIONS 8, 9, & 10 WERE COLLECTED FROM MATERIAL INSIDE OF DRUMS, AND ARE NOT SHOWN IN FIGURE.  
 2. DATA QUALIFIERS FOR ANALYTICAL RESULTS ARE NOT INDICATED. REFER TO THE QCSR FOR DATA QUALIFIERS.  
 3. THE FOLLOWING COMPOUNDS ARE INCLUDED IN THE ANALYTE LIST FOR BOTH SVOCs AND EXPLOSIVES: 2,4-DINITROTOLUENE, 2,6-DINITROTOLUENE, AND NITROBENZEZE. THESE COMPOUNDS MAY BE REPORTED AS EITHER SVOCs OR EXPLOSIVES.



# AUS-106A-DRUM DISPOSAL AREA

PA/SI REPORT-AUS OU CRAB ORCHARD NWR MARION, ILLINOIS	PROJECT NO. 232000026.00
<b>URS</b>	
DRN. BY: djd 12/19/00 DSGN. BY: mam CHKD. BY: mch/cmw	AUS-106A Sample Locations and Detections of Organic Compounds in Soils
FIG. NO. 39-1	

AUS-106A-001	Units	Result:	Reference
		2 ft	Code
<b>Metals</b>			
Aluminum	MG/KG	14900	
Antimony	MG/KG	2	b1,h5
Arsenic	MG/KG	16.2	b1,e1,h1,h5,h7
Barium	MG/KG	516	b1,e1,h5
Beryllium	MG/KG	0.49	
Boron	MG/KG	16.3	b1,e1
Cadmium	MG/KG	34.9	b1,e1,h5,h9
Calcium	MG/KG	39800	b1
Chromium	MG/KG	54	b1,e1,h5,h9
Cobalt	MG/KG	7.3	
Copper	MG/KG	861	b1,e1
Iron	MG/KG	58400	b1,e1
Lead	MG/KG	442	b1,e1,h7,h8
Magnesium	MG/KG	10600	b1
Manganese	MG/KG	734	e1
Mercury	MG/KG	0.13	b1,e5
Nickel	MG/KG	77.5	b1,e1,h5,h9
Potassium	MG/KG	1260	b1
Selenium	MG/KG	2.2	e1,e5,h5
Sodium	MG/KG	318	b1
Vanadium	MG/KG	26.1	
Zinc	MG/KG	1660	b1,e1,h5

AUS-106A-011	Units	Result:	Reference
		0 - 6 In	Code
<b>Metals</b>			
Aluminum	MG/KG	11500	
Arsenic	MG/KG	5.6	h1,h5,h7
Barium	MG/KG	64.3	
Beryllium	MG/KG	0.34	
Boron	MG/KG	2	e1
Cadmium	MG/KG	1.8	b1,h5
Calcium	MG/KG	1800	
Chromium	MG/KG	15.4	e1,h5
Cobalt	MG/KG	5.3	
Copper	MG/KG	47.3	b1,e1
Iron	MG/KG	13600	e1
Lead	MG/KG	28	b1
Magnesium	MG/KG	1550	
Manganese	MG/KG	263	e1
Mercury	MG/KG	0.03	e5
Nickel	MG/KG	11.3	h5
Potassium	MG/KG	713	b1
Selenium	MG/KG	1.5	e1,e5,h5
Sodium	MG/KG	48	
Vanadium	MG/KG	26.9	
Zinc	MG/KG	81	b1

AUS-106A-002	Units	Result:	Reference
		2 ft	Code
<b>Metals</b>			
Aluminum	MG/KG	35000	b1
Antimony	MG/KG	3	b1,h5
Arsenic (duplicate)	MG/KG	22.6	b1,e1,h1,h5,h7
Barium	MG/KG	1730	b1,e1,h5,h9
Beryllium	MG/KG	0.57	
Boron	MG/KG	43.5	b1,e1
Cadmium	MG/KG	32.7	b1,e1,h5,h9
Calcium	MG/KG	30000	b1
Chromium	MG/KG	108	b1,e1,h5,h9
Cobalt	MG/KG	10.5	
Copper	MG/KG	3300	b1,e1
Iron	MG/KG	43600	b1,e1
Lead	MG/KG	583	b1,e1,h7,h8
Magnesium	MG/KG	9200	b1
Manganese	MG/KG	711	e1
Mercury (duplicate)	MG/KG	0.32	b1,e5,h9
Nickel	MG/KG	370	b1,e1,h5,h9
Potassium	MG/KG	1230	b1
Selenium (duplicate)	MG/KG	5.6	b1,e1,e5,h5,h9
Silver	MG/KG	5.3	b1,e1,h5,h9
Sodium	MG/KG	980	b1
Vanadium	MG/KG	28.7	
Zinc	MG/KG	3160	b1,e1,h5

AUS-106A-003	Units	Result:	Reference
		2 ft	Code
<b>Metals</b>			
Aluminum	MG/KG	36900	b1
Antimony	MG/KG	3.9	b1,h5
Arsenic	MG/KG	21.6	b1,e1,h1,h5,h7
Barium	MG/KG	356	b1,h5
Beryllium	MG/KG	0.84	b1
Boron	MG/KG	43.4	b1,e1
Cadmium	MG/KG	59.1	b1,e1,h5,h9
Calcium	MG/KG	24500	b1
Chromium	MG/KG	203	b1,e1,h5,h9
Cobalt	MG/KG	9.3	
Copper	MG/KG	1790	b1,e1
Iron	MG/KG	56300	b1,e1
Lead	MG/KG	416	b1,h7,h8
Magnesium	MG/KG	9380	b1
Manganese	MG/KG	1380	e1
Mercury	MG/KG	0.2	b1,e5,h9
Nickel	MG/KG	87.4	b1,e1,h5,h9
Potassium	MG/KG	2930	b1
Selenium	MG/KG	4.1	b1,e1,e5,h5,h9
Silver	MG/KG	0.31	
Sodium	MG/KG	718	b1
Vanadium	MG/KG	34.4	
Zinc	MG/KG	2510	b1,e1,h5

AUS-106A-004	Units	Result:	Reference
		2 ft	Code
<b>Metals</b>			
Aluminum	MG/KG	30100	b1
Antimony	MG/KG	3.8	b1,h5
Arsenic	MG/KG	4.3	h1,h5,h7
Barium	MG/KG	519	b1,e1,h5
Beryllium	MG/KG	0.52	
Boron	MG/KG	19.5	b1,e1
Cadmium	MG/KG	48.1	b1,e1,h5,h9
Calcium	MG/KG	19800	b1
Chromium	MG/KG	99	b1,e1,h5,h9
Cobalt	MG/KG	8.1	
Copper	MG/KG	1570	b1,e1
Iron	MG/KG	46100	b1,e1
Lead	MG/KG	434	b1,e1,h7,h8
Magnesium	MG/KG	8950	b1
Manganese	MG/KG	631	e1
Mercury	MG/KG	0.11	b1,e5
Nickel	MG/KG	143	b1,e1,h5,h9
Potassium	MG/KG	1360	b1
Silver	MG/KG	1.1	b1
Sodium	MG/KG	678	b1
Vanadium	MG/KG	28.4	
Zinc	MG/KG	1590	b1,e1,h5

AUS-106A-005	Units	Result:	Reference
		2 ft	Code
<b>Metals</b>			
Aluminum	MG/KG	51500	b1
Antimony	MG/KG	6.2	b1,e1,h5,h9
Arsenic	MG/KG	13.7	b1,e1,h1,h5,h7
Barium	MG/KG	479	b1,h5
Beryllium	MG/KG	0.34	
Boron	MG/KG	14.3	b1,e1
Cadmium	MG/KG	28	b1,h5,h9
Calcium	MG/KG	13200	b1
Chromium	MG/KG	103	b1,e1,h5,h9
Cobalt	MG/KG	7	
Copper	MG/KG	1800	b1,e1
Iron	MG/KG	95600	b1,e1
Lead	MG/KG	2470	b1,e1,h7,h8
Magnesium	MG/KG	5080	b1
Manganese	MG/KG	789	e1
Mercury	MG/KG	1.1	b1,e5,h9
Nickel	MG/KG	124	b1,e1,h5,h9
Potassium	MG/KG	875	b1
Selenium	MG/KG	1.6	e1,e5,h5
Silver	MG/KG	1	b1
Sodium	MG/KG	2090	b1
Vanadium	MG/KG	19.1	
Zinc	MG/KG	1140	b1,e1,h5

NOTES:  
 1. SITE MAP PREPARED FROM SITE RECONNAISSANCE SKETCH, APRIL 30, 1999. ALL SAMPLE LOCATIONS ARE APPROXIMATE, SEE TABLE 39-1 OF REPORT FOR SURVEY COORDINATES. SAMPLE LOCATIONS 8, 9, & 10 WERE COLLECTED FROM MATERIAL INSIDE OF DRUMS, AND ARE NOT SHOWN IN FIGURE.  
 2. DATA QUALIFIERS FOR ANALYTICAL RESULTS ARE NOT INDICATED. REFER TO THE QCSR FOR DATA QUALIFIERS.

AUS-106A-006	Units	Result:	Reference
		2 ft	Code
<b>Metals</b>			
Aluminum	MG/KG	49500	b1
Antimony	MG/KG	3.9	b1,h5
Arsenic	MG/KG	9.6	e1,h1,h5,h7
Barium	MG/KG	1130	b1,e1,h5
Boron	MG/KG	30.2	b1,e1
Cadmium	MG/KG	50.4	b1,e1,h5,h9
Calcium	MG/KG	10100	b1
Chromium	MG/KG	137	b1,e1,h5,h9
Cobalt	MG/KG	6.5	
Copper	MG/KG	2370	b1,e1
Iron	MG/KG	43300	b1,e1
Lead	MG/KG	514	b1,e1,h7,h8
Magnesium	MG/KG	7440	b1
Manganese	MG/KG	862	e1
Mercury	MG/KG	0.12	b1,e5
Nickel	MG/KG	149	b1,e1,h5,h9
Potassium	MG/KG	1820	b1
Selenium	MG/KG	7.7	b1,e1,e5,h5,h9
Silver	MG/KG	2.2	b1,e1,h5,h9
Sodium	MG/KG	603	b1
Vanadium	MG/KG	31.6	
Zinc	MG/KG	2110	b1,e1,h5

AUS-106A-007	Units	Result:	Reference
		2 ft	Code
<b>Metals</b>			
Aluminum	MG/KG	47300	b1
Antimony	MG/KG	5.2	b1,e1,h5,h9
Arsenic	MG/KG	15.2	b1,e1,h1,h5,h7
Barium	MG/KG	783	b1,e1,h5
Beryllium	MG/KG	0.97	b1
Boron	MG/KG	24.1	b1,e1
Cadmium	MG/KG	150	b1,e1,h5,h9
Calcium	MG/KG	24300	b1
Chromium	MG/KG	222	b1,e1,h5,h9
Cobalt	MG/KG	11.1	
Copper	MG/KG	2530	b1,e1
Iron	MG/KG	63000	b1,e1
Lead	MG/KG	1260	b1,e1,h7,h8
Magnesium	MG/KG	15500	b1
Manganese	MG/KG	921	e1
Mercury	MG/KG	0.15	b1,e5
Nickel	MG/KG	171	b1,e1,h5,h9
Potassium	MG/KG	2060	b1
Selenium	MG/KG	21.8	b1,e1,e5,h5,h9
Silver	MG/KG	1.4	b1
Sodium	MG/KG	588	b1
Vanadium	MG/KG	49.1	b1,e1
Zinc	MG/KG	2100	b1,e1,h5

AUS-106A-012	Units	Result:	Reference
		0 - 6 In	Code
<b>Metals</b>			
Aluminum	MG/KG	12300	
Antimony	MG/KG	0.41	h5
Arsenic	MG/KG	11.9	e1,h1,h5,h7
Barium	MG/KG	91.7	h5
Beryllium	MG/KG	0.75	
Boron	MG/KG	2.4	e1
Cadmium	MG/KG	1.6	b1,h5
Calcium	MG/KG	1500	
Chromium	MG/KG	33.3	b1,e1,h5,h9
Cobalt	MG/KG	6.2	
Copper	MG/KG	17	b1
Iron	MG/KG	24600	b1,e1
Lead	MG/KG	17.9	
Magnesium	MG/KG	1460	
Manganese	MG/KG	913	e1
Mercury	MG/KG	0.022	e5
Nickel	MG/KG	11.4	h5
Potassium	MG/KG	666	b1
Selenium	MG/KG	2.3	e1,e5,h5
Sodium	MG/KG	59.6	
Vanadium	MG/KG	42.8	
Zinc	MG/KG	71.3	b1

LEGEND  
 ⊕ HAND AUGER LOCATION  
 - - - - - INTERMITTENT STREAM

Screening Reference	Reference Code
AUS Background Soil UTL	b1
Little Grassy Background Sediment UTL	b2
Little Grassy Background Surface Water UTL	b3
Ecological Direct Exposure Pathway TRV - Soil	e1
Ecological Direct Exposure Pathway TRV - Sediment	e2
Ecological Direct Exposure Pathway TRV - Surface Water	e3
IEPA General Use Surface Water Quality Aquatic Life Toxicity	e4
Superfund Chemical Data Matrix Kow values (potential bioaccumulators)	e5
USEPA Region IX Industrial Soil PRG - cancerous	h1
USEPA Region IX Industrial Soil PRG - noncancerous	h2
USEPA Region IX Tap Water PRG - cancerous	h3
USEPA Region IX Tap Water PRG - noncancerous	h4
USEPA Region IX Migration to Groundwater PRG (DAF=1)	h5
USEPA MCL Drinking Water Standards	h6
IEPA TACO Industrial/Commercial Soil Ingestion	h7
IEPA TACO Construction Worker Soil Ingestion	h8
IEPA TACO Class I Soil Component of Groundwater	h9
IEPA General Use Surface Water Quality Human Health	h10

AUS-106A-DRUM DISPOSAL AREA

APPROXIMATE N  
 NOT TO SCALE

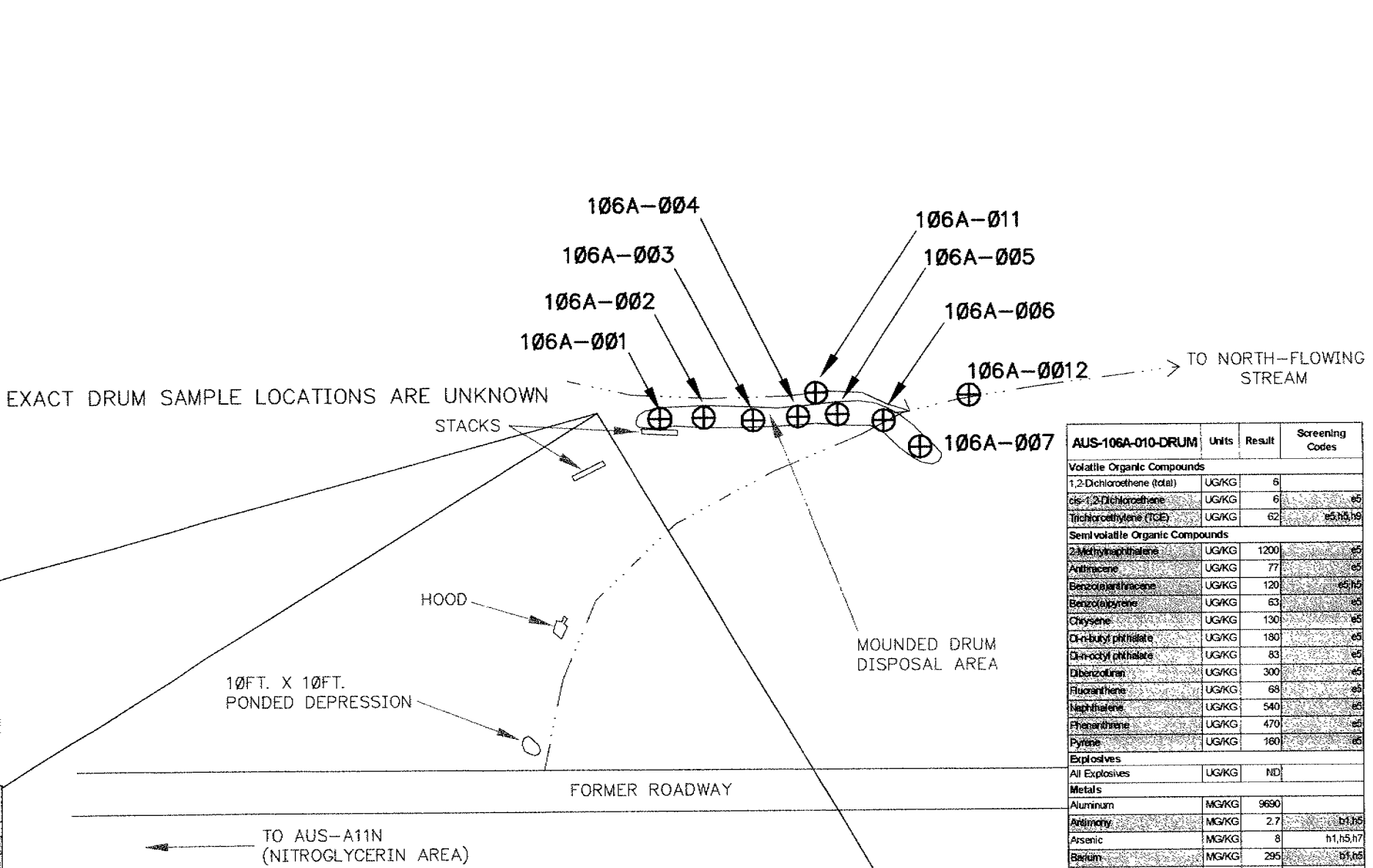
PA/SI REPORT-AUS OU CRAB ORCHARD NWR MARION, ILLINOIS	PROJECT NO. 2320000026.00
<b>URS</b>	
DRN. BY:djd 12/19/00 DSGN. BY:mam CHKD. BY:mch/cmw	FIG. NO. 39-2

File: E:\2320000026.00\PA-SI REPORT-AUS OU\FWSAUS66FIG39-3.DWG Last edited: 09/24/01 @ 11:28 a.m. WC-ST. LOUIS, MO

AUS-106A-009-DRUM	Units	Result	Screening Codes
<b>Volatile Organic Compounds</b>			
All VOCs	UG/KG	ND	
<b>Semivolatile Organic Compounds</b>			
Anthracene (duplicate)	UG/KG	51	e5
Benzo(a)anthracene	UG/KG	87	e5,h5
Benzo(a)pyrene	UG/KG	120	e5
Benzo(b)fluoranthene	UG/KG	180	e5
Benzo(g,h,i)perylene	UG/KG	140	e5
Benzo(k)fluoranthene	UG/KG	170	e5
Chrysene	UG/KG	130	e5
Di-n-butyl phthalate	UG/KG	670	e5
Di-n-octyl phthalate	UG/KG	80	e5
Fluoranthene	UG/KG	80	e5
Indeno(1,2,3-c,d)pyrene	UG/KG	120	e5
Phenanthrene (duplicate)	UG/KG	200	e5
Pyrene	UG/KG	110	e5
<b>Explosives</b>			
All Explosives	UG/KG	ND	
<b>Metals</b>			
Aluminum	MG/KG	10500	
Antimony	MG/KG	6.5	b1,e1,h5,h9
Arsenic	MG/KG	14.1	b1,e1,h1,h5,h7
Barium	MG/KG	385	b1,h5
Beryllium	MG/KG	0.2	
Boron	MG/KG	5.2	e1
Cadmium	MG/KG	45.8	b1,e1,h5,h9
Calcium	MG/KG	5120	b1
Chromium	MG/KG	17.6	e1,h5
Cobalt	MG/KG	4.1	
Copper	MG/KG	319	b1,e1
Iron	MG/KG	36500	b1,e1
Lead	MG/KG	279	b1
Magnesium	MG/KG	1200	
Manganese	MG/KG	879	e1
Mercury	MG/KG	0.049	e5
Nickel	MG/KG	22.1	b1,h5
Potassium	MG/KG	451	
Selenium	MG/KG	2.5	b1,e1,e5,h5,h9
Sodium	MG/KG	256	b1
Vanadium	MG/KG	15.2	
Zinc	MG/KG	10700	b1,e1,h5,h9

AUS-106A-008-DRUM	Units	Result	Screening Codes
<b>Volatile Organic Compounds</b>			
Benzene	UG/KG	9	e5,h5
Toluene	UG/KG	4	e5
Trichloroethylene (TCE)	UG/KG	9	e5,h5
<b>Semivolatile Organic Compounds</b>			
Chrysene	UG/KG	110	e5
<b>Explosives</b>			
All Explosives	UG/KG	ND	
<b>Metals</b>			
Aluminum	MG/KG	5490	
Antimony	MG/KG	1.9	b1,h5
Barium	MG/KG	284	b1,h5
Boron	MG/KG	33.6	b1,e1
Calcium	MG/KG	8310	b1
Chromium	MG/KG	4.7	h5
Copper	MG/KG	23.3	b1
Iron	MG/KG	4440	e1
Lead	MG/KG	246	b1
Magnesium	MG/KG	902	
Manganese	MG/KG	387	e1
Nickel	MG/KG	5.2	
Potassium	MG/KG	273	
Sodium	MG/KG	2550	b1
Thallium	MG/KG	0.95	b1
Vanadium	MG/KG	1.3	
Zinc	MG/KG	530	b1,e1

AUS-106A-010-DRUM	Units	Result	Screening Codes
<b>Volatile Organic Compounds</b>			
1,2-Dichloroethene (total)	UG/KG	6	
cis-1,2-Dichloroethene	UG/KG	6	e5
Trichloroethylene (TCE)	UG/KG	62	e5,h5,h9
<b>Semivolatile Organic Compounds</b>			
2-Methylnaphthalene	UG/KG	1200	e5
Anthracene	UG/KG	77	e5
Benzo(a)anthracene	UG/KG	120	e5,h5
Benzo(a)pyrene	UG/KG	63	e5
Chrysene	UG/KG	130	e5
Di-n-butyl phthalate	UG/KG	180	e5
Di-n-octyl phthalate	UG/KG	83	e5
Dibenzofuran	UG/KG	300	e5
Fluoranthene	UG/KG	68	e5
Naphthalene	UG/KG	540	e5
Phenanthrene	UG/KG	470	e5
Pyrene	UG/KG	160	e5
<b>Explosives</b>			
All Explosives	UG/KG	ND	
<b>Metals</b>			
Aluminum	MG/KG	9690	
Antimony	MG/KG	2.7	b1,h5
Arsenic	MG/KG	8	h1,h5,h7
Barium	MG/KG	295	b1,h5
Beryllium	MG/KG	0.2	
Boron	MG/KG	4.7	e1
Cadmium	MG/KG	12.3	b1,h5,h9
Calcium	MG/KG	10000	b1
Chromium	MG/KG	57.1	b1,e1,h5,h9
Cobalt	MG/KG	7.1	
Copper	MG/KG	410	b1,e1
Iron	MG/KG	101000	b1,e1
Lead	MG/KG	236	b1
Magnesium	MG/KG	4330	b1
Manganese	MG/KG	862	e1
Mercury	MG/KG	0.11	b1,e5
Nickel	MG/KG	76	b1,e1,h5
Potassium	MG/KG	725	b1
Selenium	MG/KG	2.8	b1,e1,e5,h5,h9
Silver	MG/KG	0.33	
Sodium	MG/KG	217	b1
Vanadium	MG/KG	18.6	
Zinc	MG/KG	734	b1,e1,h5



**LEGEND**

⊕ HAND AUGER LOCATION

— · — · — INTERMITTENT STREAM

Screening Reference	Reference Code
AUS Background Soil UTL	b1
Little Grassy Background Sediment UTL	b2
Little Grassy Background Surface Water UTL	b3
Ecological Direct Exposure Pathway TRV - Soil	e1
Ecological Direct Exposure Pathway TRV - Sediment	e2
Ecological Direct Exposure Pathway TRV - Surface Water	e3
IEPA General Use Surface Water Quality Aquatic Life Toxicity	e4
Superfund Chemical Data Matrix Kow values (potential bioaccumulator)	e5
USEPA Region IX Industrial Soil PRG - carcinous	h1
USEPA Region IX Industrial Soil PRG - noncarcinous	h2
USEPA Region IX Tap Water PRG - carcinous	h3
USEPA Region IX Tap Water PRG - noncarcinous	h4
USEPA Region IX Migration to Groundwater PRG (DAP=1)	h5
USEPA MCL Drinking Water Standards	h6
IEPA TACO Industrial/Commercial Soil Ingestion	h7
IEPA TACO Construction Worker Soil Ingestion	h8
IEPA TACO Class I Soil Component of Groundwater	h9
IEPA General Use Surface Water Quality Human Health	h10

**NOTES:**

- SITE MAP PREPARED FROM SITE RECONNAISSANCE SKETCH, APRIL 30, 1999. ALL SAMPLE LOCATIONS ARE APPROXIMATE, SEE TABLE 39-1 OF REPORT FOR SURVEY COORDINATES, SAMPLE LOCATIONS 8, 9, & 10 WERE COLLECTED FROM MATERIAL INSIDE OF DRUMS, AND ARE NOT SHOWN IN FIGURE.
- DATA QUALIFIERS FOR ANALYTICAL RESULTS ARE NOT INDICATED. REFER TO THE QCSR FOR DATA QUALIFIERS.
- THE FOLLOWING COMPOUNDS ARE INCLUDED IN THE ANALYTE LIST FOR BOTH SVOCs AND EXPLOSIVES: 2,4-DINITROTOLUENE, 2,6-DINITROTOLUENE, AND NITROBENZEZE. THESE COMPOUNDS MAY BE REPORTED AS EITHER SVOCs OR EXPLOSIVES.

APPROXIMATE N

NOT TO SCALE

**AUS-106A-DRUM DISPOSAL AREA**

PA/SI REPORT-AUS OU CRAB ORCHARD NWR MARION, ILLINOIS	PROJECT NO. 2320000026.00
<b>URS</b>	
DRN. BY:djd 12/19/00 DSGN. BY:mam CHKD. BY:mch/cmw	FIG. NO. 39-3

**SECTION FORTY****Possible Disposal Area Northwest of Area 8**

AUS-0107 is a possible former disposal area that was identified from historical aerial photographs. AUS-0107 is located just to the northwest of Area 8, 400 feet (ft) south of Ogden Road and approximately 800 ft west of the entrance to Area 8. The general location of AUS-0107 is shown in Figure 30-1 and a larger-scale map is shown in Figure 40-1.

**AUS Original Site Designations**

AUS-0107 is not one of the original Additional and Uncharacterized Sites Operable Unit (AUS OU) sites designated in 1997-1999 by the United States Fish & Wildlife Service (USFWS).

**40.1 HISTORIC SEARCH INFORMATION****40.1.1 Site Description**

The site is woodland and the eastern portion of the site is bounded by a field of tall grass.

**40.1.2 Operational History and Waste Characteristics**

This site was a possible former disposal area according to historical aerial photograph interpretation by Entech, Inc.<sup>1</sup> The 1943 aerial photograph identified a scarred area just outside the Area 8 fence line that contained dark-toned, deposited materials, a possible disposal trench and a well-maintained access road leading to this area.<sup>2</sup> The possible disposal trench was approximately 100 ft long and 2-5 ft wide. By 1951, this site appeared to have been abandoned and was re-vegetating.<sup>3</sup> In 1951, there was only a linear scar remaining in the area of the possible former disposal trench.<sup>4</sup>

There were no known industrial lessees of this property.

**40.1.3 AUS-0107 Previous Sampling Results**

There have been no previous investigations done at this site.

<sup>1</sup> Entech, Inc., 1999, Historical Aerial Photographic Analysis – Inventory of Potential Disposal Sites: Additional and Uncharacterized Sites (AUS) Operable Unit, Crab Orchard National Wildlife Refuge, Marion, Illinois, Volume I (Text) Page 3-51, and Volume II (Maps) Page DD. The Entech reports analyze historic aerial overflight photographs of industrial areas at the Refuge, from 1943 to 1993. The photos were obtained from the National Archives and Records Administration (NARA) and the U.S. Department of Agriculture Agricultural Stabilization and Conservation Service (ASCS).

<sup>2</sup> Entech, Inc., 1999, Historical Aerial Photographic Analysis – Inventory of Potential Disposal Sites: Additional and Uncharacterized Sites (AUS) Operable Unit, Crab Orchard National Wildlife Refuge, Marion, Illinois, Volume I (Text) Page 3-51.

<sup>3</sup> Entech, Inc., 1999, Historical Aerial Photographic Analysis – Inventory of Potential Disposal Sites: Additional and Uncharacterized Sites (AUS) Operable Unit, Crab Orchard National Wildlife Refuge, Marion, Illinois, Volume I (Text) Page 3-51.

<sup>4</sup> Entech, Inc., 1999, Historical Aerial Photographic Analysis – Inventory of Potential Disposal Sites: Additional and Uncharacterized Sites (AUS) Operable Unit, Crab Orchard National Wildlife Refuge, Marion, Illinois, Volume I (Text) Page 3-51.

**SECTION FORTY****Possible Disposal Area Northwest of Area 8****40.1.4 Observations During Site Visit**

Figure 40-1 shows site features observed during the site reconnaissance. There is no visible evidence of any past disposal activity on the site.

**40.1.5 Recommendations Based on Preliminary Assessment**

AUS-0107 was included in the Site Investigation (SI) because, based on the aerial photographs, it is a suspected disposal site.

**40.2 SITE INVESTIGATION INFORMATION**

URS conducted a Site Investigation at AUS-0107 on April 14, 2000, which consisted of excavating a single test pit. The rationale for sample locations, media, and analytes is presented in the Field Sampling Plan (FSP)<sup>5</sup> for the AUS OU Preliminary Assessment/Site Investigation (PA/SI). Since the time the FSP was prepared, additional information has become available, and the historic discussion (Section 40.1) has been updated to include that information. The sampling locations discussed below are based on the information that was available at the time the FSP was developed, and may not address all areas of potential releases.

AUS OU SI sample locations are shown on Figure 40-1. The sample location was determined from aerial photographs.<sup>6</sup> Survey coordinates for all sample locations in AUS-0107 are listed in Table 40-1. Table 40-2 lists the sample locations and the matrix sampled at that location.

**40.2.1 Field Investigation**

Sampling was done in accordance with the FSP, except as noted.

**Possible Disposal Trench**

One test pit was dug at the location of the possible former disposal trench. This location (0107-001) was identified from coordinates determined from the aerial photograph. Soil samples and a water sample (trench water) from the test pit were collected from this location.

**40.2.2 Field Results**

The following sections present the results of the field investigation.

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<sup>5</sup> U.S. Fish & Wildlife Service, Department of the Interior, March 2000, Draft Final Field Sampling Plan Site Inspection, Additional and Uncharacterized Sites Operable Unit, Crab Orchard National Wildlife Refuge Superfund Site, Marion, Illinois (Williamson County), prepared by URS Corporation.

<sup>6</sup> At the beginning of the project, a test was conducted to estimate the accuracy of locating features from historic aerial photos. Using conventional methods, survey coordinates were obtained of a number of existing features at the Refuge that also appeared on a series of historic photos (for example, the corners of IOP buildings that are still existing). Entech independently obtained coordinates from the aerial photos. The coordinates obtained from the aerial photos were found to be in agreement with the coordinates obtained by conventional methods, within a few ft.

**SECTION FORTY****Possible Disposal Area Northwest of Area 8****40.2.2.1 Site Conditions****40.2.2.1.1 Geologic Conditions**

The test pit indicates that fill material and topsoil are present from ground surface to two ft below ground surface (bgs). Below the fill to approximately ten ft bgs the soil was described as low plastic silty clay and silt loess.

**40.2.2.1.2 Hydrogeologic Conditions**

Groundwater was encountered during the excavation of the test pit.

**40.2.2.1.3 Hydrologic Conditions**

There was no evidence of surface water noted at the site, and no noticeable drainageways.

**40.2.2.2 Chemical Results**

The sample analytical results are summarized in the following tables:

- Table 40-3 – soil samples results, and
- Table 40-4 – trench water results.

These tables list all the chemicals detected in AUS-0107 during this investigation, along with the frequency and range of detections.<sup>7</sup> Tabulated results of all analyses are included in the Quality Control Summary Report. All results are shown in Figure 40-1.

**40.3 SCREENING RISK ASSESSMENT**

Results of the screening are presented in Tables 40-5 through 40-7 as follows:

- Table 40-5--human health risk screening for soils,
- Table 40-6--human health risk screening for trench water, and
- Table 40-7--ecological risk screening for soils.

Each table lists the maximum detected concentration for each constituent analyzed at AUS-0107. The screening results are presented in the tables in terms of hazard quotients (HQs). The HQ for any chemical detected, for any particular screening criterion is simply the ratio of the maximum detected concentration to the screening concentration. For human health for carcinogens, a screening level “cancer risk” is calculated instead of an HQ.

Chemicals that are shaded in the tables are those that exceeded the screening criteria, and are identified as chemicals of potential concern (COPCs) for human health risk, and chemicals of potential ecological concern (COPECs) for ecological risk. The only COPCs/COPECs not

<sup>7</sup> Duplicate results were not included in the range except when the maximum value detected was in a duplicate sample. Therefore there may be some duplicate samples with results below the low end of the range reported in the tables, that are not shown in the tables.

**SECTION FORTY****Possible Disposal Area Northwest of Area 8**

shaded in the table are those inorganic constituents that exceeded the screening criteria but were detected at levels below Refuge background.

In cases where the chemical was analyzed but not detected, the HQ is the ratio between the maximum reporting limit and the screening concentration. Chemicals not detected are identified with a "U" qualifier in the qualifier column. When these HQ values exceed one, they are not shaded. These constituents are not identified as COPCs/COPECs, but rather as uncertainties.

In Figure 40-1 the shading convention used is the same as for the tables discussed above. The particular screening criteria exceeded are indicated by the code in the analytical results labels. Duplicate results are shown only if the duplicate result for an analyte exceeded the screening criteria and the result from the original sample did not; or, if the analyte was detected in the duplicate and not in the original sample. Since in the screening process results which are qualified as estimated (coded with "J") are treated the same as unqualified results, data qualifiers are not included in the results shown in the figures. Refer to the QCSR for data qualifiers.

Tables 40-8 (human health risk) and 40-9 (ecological risk) list all the analytes and corresponding media sampled and indicate whether each is a COPC (or COPEC), not a COPC (or COPEC), or an uncertainty. The codes in the tables indicate the rationale for each classification. All COPCs (Table 40-8) and COPECs (Table 40-9) are shaded in the tables.

**40.3.1 Human Health Risk****40.3.1.1 Soil**

Human health screening results for soil samples are presented in Table 40-5. For carcinogens, a cancer risk was calculated using the USEPA Region 9 Industrial Soil Preliminary Remediation Goals (PRGs) as screening values. The cancer risk was derived by calculating a ratio of the maximum detected concentrations, or the maximum reporting limits, to their appropriate screening values. These ratios were then multiplied by  $1 \times 10^{-6}$ . In addition, ratios were calculated using the USEPA Region 9 Industrial Soil PRG for Toxins, the USEPA Region 9 Migration to Groundwater Criteria (Dilution Attenuation Factor (DAF)=1), the Illinois Tiered Approach to Corrective Action Objectives (TACO) Industrial/Commercial Soil Ingestion Criteria, the Illinois TACO Construction Worker Soil Ingestion Criteria, and the Illinois TACO Class I Soil Component of Groundwater Criteria.

**40.3.1.2 Trench Water**

Human health screening results for trench water are presented in Table 40-6. The maximum trench water concentrations from AUS-0107 were screened against maximum contaminant levels (MCLs) and Illinois Class I groundwater standards. Using these criteria for screening the trench water is extremely conservative because of the turbidity of the trench water compared with groundwater.



**SECTION FORTY****Possible Disposal Area Northwest of Area 8****40.3.2 Ecological Risk****40.3.2.1 Soil**

Ecological screening results for soil samples are presented in Table 40-7. Soil screening concentrations for direct exposures were developed using toxicity reference values (TRVs) derived from several sources, including the following:

- USEPA (2000)<sup>8</sup>
- Environment Canada (1995)<sup>9</sup>
- Talmage *et al.* (1999)<sup>10</sup>
- Efroymsen *et al.* (1997a, 1997b)<sup>11</sup>
- CCME (1999)<sup>12</sup>
- MHSPE (1994)<sup>13</sup>
- Other sources

A detailed discussion of the screening concentration selection is presented in Appendix G.

The screening approach for ingestion pathway exposures was based on the potential for a chemical to bioaccumulate. The potential for a chemical to bioaccumulate was based on the organic chemical-specific octanol-to-water partitioning coefficient ( $K_{ow}$ ), which provides an indication of the lipophilicity of an organic chemical, and its potential for sequestration in biological tissue. The document *Assessment and Control of Bioconcentratable Contaminants in Surface Waters* (USEPA 1991)<sup>14</sup> used a log  $K_{ow}$  of 3.5 as a target threshold value indicative of bioaccumulative chemicals to target organic chemicals of greatest concern. Using this as a guideline, organic chemicals with a log  $K_{ow}$  greater than 3.5 were considered potentially bioaccumulative chemicals. Among inorganics, mercury and selenium were considered as potentially bioaccumulative chemicals. Any potentially bioaccumulative chemical that is detected was retained as a COPEC.

<sup>8</sup> USEPA. 2000. Ecological Soil Screening Level Guidance (Draft). USEPA Office of Emergency and Remedial Response, Washington, DC.

<sup>9</sup> Environment Canada. 1995. Toxicity Testing of NCSRP Priority Substances for Development of Soil Quality Guidelines for Contaminated Sites. Guidelines Division, Evaluation and Interpretation Branch, Environmental Conservation Directorate, Environment Canada. Hull, Quebec.

<sup>10</sup> Talmage, S.S., D.M. Opresko, C.J. Maxwell, C.J.E. Welsh, F. M. Cretella, P.H. Reno, and F. B. Daniel. 1999. Nitroaromatic Munition Compounds: Environmental Effects and Screening Values. *Rev Environ. Contam. Toxicol* 161:1-156.

<sup>11</sup> Efroymsen, R.A., M.E. Will, G.W. Suter II, and A.C. Wooten. 1997a. *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision*. Oak Ridge National Laboratory, Oak Ridge, Tennessee. ES/ER/TM-85/R3.

Efroymsen, R.A., M.E. Will, and G.W. Suter II. 1997b. *Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision*. Oak Ridge National Laboratory, Oak Ridge, Tennessee. ES/ER/TM-126/R2.

<sup>12</sup> Canadian Council of Ministers of the Environment. 1999. Canadian Environmental Quality Guidelines.

<sup>13</sup> Ministry of Housing, Spatial Planning, and the Environment (MHSPE). 1994. *Intervention Values and Target Values – Soil Quality Standards*. Directorate General for Environmental Protection, Department of Soil Protection, The Hague, The Netherlands.

<sup>14</sup> USEPA 1991. *Assessment and Control of Bioconcentratable Contaminants in Surface Waters (Draft)*. US Environmental Protection Agency Office of Research and Development, Washington, D.C.

**SECTION FORTY****Possible Disposal Area Northwest of Area 8****40.4 SCIENTIFIC MANAGEMENT DECISION POINT****40.4.1 Human Health Risk Evaluation**

One soil sample and one sample of water from a trench were analyzed.

*Trench Water Sample.* This sample was obtained to evaluate potential contaminants that may have migrated to groundwater, and was not intended for use in screening. Lead slightly exceeded the MCL/Class I Groundwater Standard. This result is not considered significant because of the high suspended solids content of the trench water.

*Soil.* The only constituents that exceeded any human health screening criteria were detected within Refuge background levels. This report recommends that inorganic constituents that exceeded project screening criteria but were within Refuge background levels not be retained as COPCs for further evaluation. These are the constituents coded with "D" on the COPC list, Table 40-8, and include arsenic, chromium and selenium in soil.

Several chemicals represent uncertainties for AUS-0107 because, while they were not detected, the reporting limit was equal to or exceeded the screening criteria. These are indicated as uncertainties on Table 40-8, and coded with a "B." The uncertainty associated with these chemicals is not considered to be significant.

In summary, results of the soil analyses at AUS-0107 indicate there are no chemicals present at levels of potential human health concern warranting further evaluation. It is recommended that none of the chemicals be retained as COPCs for this site.

**40.4.2 Ecological Risk Evaluation**

Among the organic compounds, an HQ of 5 was indicated for *carbon tetrachloride* based on a reporting limit of 5 micrograms per kilogram (ug/kg). Because none were actually detected, the volatile organic compounds, including carbon tetrachloride, are not considered to be ecological concerns. Among the semivolatile organic compounds, HQs for several chemicals exceeded 1, ranging as high as 4.0. However, this was based entirely on the reporting limit, as none of these semivolatile organic compounds were detected at a reporting limit of 400 ug/kg. In fact, there were no volatile or semivolatile organic compounds or explosives detected, lending weight of evidence that organic chemicals are not of ecological concern at AUS-0107.

Among the inorganic compounds, HQs exceeded 1 for iron, magnesium, thallium and zinc. Both mercury and selenium were detected and are potentially bioaccumulative constituents. This report recommends that inorganic constituents which exceeded project screening criteria but were within Refuge background levels not be retained as COPECs for further evaluation. These are the constituents coded with "D" on Table 40-9 and include chromium, iron, manganese, and selenium.

*Magnesium* – The maximum concentration of magnesium (56,300 mg/kg) was high relative to the screening concentration (HQ = 12.8), and also high relative to the background level (1550

**SECTION FORTY****Possible Disposal Area Northwest of Area 8**

mg/kg). However, calcium was also very high (96,500 mg/kg). High concentrations of magnesium in combination with calcium suggest the source may be a dolomitic limestone (a calcium-magnesium carbonate). Though the magnesium concentrations are above background levels, magnesium is an essential nutrient and is generally not a toxic constituent in soils. Though the hazard quotient was elevated, magnesium is not considered an ecological concern.

*Mercury* - The screening hazard quotient for mercury was less than one, indicating that mercury does not pose a risk associated with direct exposures in soils. Mercury was retained as a COPEC because it was detected and is a potential bioaccumulating constituent. However, the maximum concentration of mercury (0.07 mg/kg) was only slightly above background (0.06 mg/kg). Though mercury is a potentially bioaccumulative constituent, this is much less pronounced in terrestrial as compared to aquatic systems.<sup>15</sup> Based on its concentration relative to background and a lower bioaccumulation potential in terrestrial systems, mercury is not believed to be sufficiently elevated as to warrant further evaluation of the site.

*Thallium* - Though the HQ exceeded 1 (1.2), thallium was not detected. The hazard quotient is a function of the reporting limit in comparison with the ecological screening concentration. Because it was not detected, and the associated HQ is also low and based on a no-observed-effect concentration (NOEC), thallium is not considered a significant ecological concern.

*Zinc* - The maximum concentration of zinc resulted in a HQ of 1.3. Because this represents a maximum concentration, only slightly exceeds an HQ of unity, and is based on a NOEC, zinc is not considered a significant ecological concern.

Two inorganic chemicals represent uncertainties for AUS-0107 since they were detected but no screening concentrations were identified. These are potassium and sodium. Potassium was below its background concentrations. Though sodium slightly exceeds background (factor of 1.1), it is an essential nutrients and uptake is physiologically controlled. The uncertainty associated with these chemicals is not significant, and these are not considered ecological concerns.

In summary, results of the soil analyses at AUS-0107 indicate there are no chemicals present at levels of potential ecological concern that would warrant further evaluation of the site. It is recommended that none of the chemicals be retained as COPECs for AUS-0107.

#### 40.4.3 Summary of Recommendations

Based on the above discussions, it is recommended that none of the constituents detected at Site AUS-0107 be retained for further evaluation. Site AUS-0107 is judged to require no further action.

<sup>15</sup> Lodenius, M. 1994. Mercury in terrestrial Ecosystems: A Review. In Mercury Pollution Integration and Synthesis, Carl J. Watras and John W. Huckabee, editors. Lewis Publishers, Boca Raton, Florida.

**SECTION FORTY**

**Possible Disposal Area Northwest of Area 8**

**TABLE 40-1  
SURVEY COORDINATES FOR SAMPLE LOCATIONS IN AUS-0107**

<b>Sample Location</b>	<b>Northing</b>	<b>Easting</b>	<b>Ground Surface Elevation</b>	<b>Top of Casing Elevation</b>	<b>Comments</b>
0107-001	368210.3	789403.8	435.31	NA	

Sheet 1 of 1

NA = Not Applicable

**SECTION FORTY****Possible Disposal Area Northwest of Area 8**

TABLE 40-2  
MATRICES SAMPLED AT EACH  
SAMPLE LOCATION AT AUS-0107

Soil	Trench Water
AUS-0107-001	AUS-0107-001 <sup>1</sup>

Sheet 1 of 1

- <sup>1</sup> This sample was originally designated as groundwater, but is actually a trench water sample.

**SECTION FORTY****Possible Disposal Area Northwest of Area 8**

**TABLE 40-3  
SOIL SAMPLE ANALYTICAL RESULTS SUMMARY**

Constituent	Number of Detections	Range of Detections
<b>Metals</b>		
Aluminum	2/2	2,860 mg/kg to 7,680 mg/kg
Antimony	1/1	0.26 mg/kg
Arsenic	2/2	2.4 mg/kg to 6.2 mg/kg
Barium	2/2	40.5 mg/kg to 68.1 mg/kg
Cadmium	1/2	0.2 mg/kg
Calcium	2/2	2,390 mg/kg to 93,200 mg/kg
Chromium, Total	2/2	5.2 mg/kg to 11.5 mg/kg
Cobalt	1/2	1.5 mg/kg
Copper	1/2	7.9 mg/kg
Iron	2/2	9,280 mg/kg to 9,720 mg/kg
Lead	2/2	7.7 mg/kg to 14 mg/kg
Magnesium	2/2	1,920 mg/kg to 53,800 mg/kg
Manganese	2/2	94.1 mg/kg to 592 mg/kg
Mercury	1/1	0.07 mg/kg
Nickel	2/2	3.9 mg/kg to 6.7 mg/kg
Potassium	2/2	218 mg/kg to 296 mg/kg
Selenium	1/2	0.52 mg/kg
Vanadium	2/2	12.8 mg/kg to 20.1 mg/kg
Zinc	2/2	22.1 mg/kg to 199 mg/kg

Sheet 1 of 1

mg/kg = milligrams per kilogram

Notes: This table was derived from the figures that show the analytical results. As a result, duplicates are shown only if the duplicate result for an analyte exceeded the screening criteria and the result from the original sample did not; or, if the analyte was detected in the duplicate and not in the original sample. There may be some duplicate results, not shown in the table, that are outside the range shown. In addition, the frequency and range of detections is based on the number of sample locations, not the total number of samples (the total number of samples includes originals plus duplicates).

Checked by: MMF 7/20/01

**SECTION FORTY****Possible Disposal Area Northwest of Area 8**

**TABLE 40-4  
TRENCH WATER SAMPLE ANALYTICAL RESULTS SUMMARY**

Constituent	Number of Detections	Range of Detections
<b>Metals</b>		
Aluminum	1/1	23,800 ug/L
Arsenic	1/1	13.5 ug/L
Barium	1/1	355 ug/L
Calcium	1/1	127,000 ug/L
Chromium, Total	1/1	30.8 ug/L
Iron	1/1	27,200 ug/L
Lead	1/1	24.5 ug/L
Magnesium	1/1	70,400 ug/L
Manganese	1/1	840 ug/L
Mercury	1/1	0.13 ug/L
Nickel	1/1	23 ug/L
Potassium	1/1	1,790 ug/L
Sodium	1/1	39,400 ug/L
Vanadium	1/1	48.3 ug/L
Zinc	1/1	90.3 ug/L

Sheet 1 of 1

ug/L = micrograms per Liter

Notes: This table was derived from the figures that show the analytical results. As a result, duplicates are shown only if the duplicate result for an analyte exceeded the screening criteria and the result from the original sample did not; or, if the analyte was detected in the duplicate and not in the original sample. There may be some duplicate results, not shown in the table, that are outside the range shown. In addition, the frequency and range of detections is based on the number of sample locations, not the total number of samples (the total number of samples includes originals plus duplicates).

Checked by: MMF 7/20/01

**TABLE 40-5  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0107**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
<b>Volatile Organic Compounds</b>								
71-55-6	1,1,1-Trichloroethane	5	U	UG/KG			1.50E-06	5.00E-02
79-34-5	1,1,2,2-Tetrachloroethane	5	U	UG/KG		5.57E-09	1.28E-06	2.50E+01
79-00-5	1,1,2-Trichloroethane	5	U	UG/KG		2.63E-09	3.29E-05	5.56E+00
75-34-3	1,1-Dichloroethane	5	U	UG/KG			2.43E-06	5.00E-03
75-35-4	1,1-Dichloroethene	5	U	UG/KG		4.21E-08	7.42E-05	1.67E+00
107-06-2	1,2-Dichloroethane (EDC)	5	U	UG/KG		6.54E-09	1.42E-04	5.00E+00
540-59-0	1,2-Dichloroethene (total)	5	U	UG/KG			3.39E-05	2.50E-01
78-87-5	1,2-Dichloropropane	5	U	UG/KG		6.51E-09	2.35E-04	5.00E+00
78-93-3	2-Butanone (MEK)	11	U	UG/KG			3.97E-07	
591-78-6	2-Hexanone	11	U	UG/KG				
108-10-1	4-Methyl-2-pentanone (MIBK)	11	U	UG/KG			3.81E-06	
67-64-1	Acetone	11	U	UG/KG			1.77E-06	1.38E-02
71-43-2	Benzene	5	U	UG/KG		3.41E-09	2.06E-04	2.50E+00
75-27-4	Bromodichloromethane	5	U	UG/KG		2.12E-09	4.79E-06	1.67E-01
75-25-2	Bromoform	5	U	UG/KG		1.60E-11	2.84E-07	1.25E-01
74-83-9	Bromomethane	5	U	UG/KG			3.81E-04	5.00E-01
75-15-0	Carbon disulfide	5	U	UG/KG			4.14E-06	2.50E-03
56-23-5	Carbon tetrachloride	5	U	UG/KG		9.45E-09	7.15E-04	1.67E+00
108-90-7	Chlorobenzene	5	U	UG/KG			9.21E-06	7.14E-02
75-00-3	Chloroethane	5	U	UG/KG		7.68E-10	2.65E-07	
67-66-3	Chloroform	5	U	UG/KG		9.60E-09	3.88E-03	1.67E-01
74-87-3	Chloromethane	5	U	UG/KG		1.88E-09		
156-59-2	cis-1,2-Dichloroethene	5	U	UG/KG			3.39E-05	2.50E-01

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect



**TABLE 40-5  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0107**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
10061-01-5	cis-1,3-Dichloropropene	5	U	UG/KG		2.81E-08	1.14E-04	
124-48-1	Dibromochloromethane	5	U	UG/KG		1.88E-09	3.14E-06	2.50E-01
100-41-4	Ethylbenzene	5	U	UG/KG			8.37E-07	7.14E-03
75-09-2	Methylene chloride	5	U	UG/KG		2.44E-10	5.11E-07	5.00E+00
110-54-3	N-Hexane	5	U	UG/KG			1.24E-05	
100-42-5	Styrene	5	U	UG/KG			2.45E-07	2.50E-02
127-18-4	Tetrachloroethylene (PCE)	5	U	UG/KG		2.68E-10	2.94E-06	1.67E+00
108-88-3	Toluene	5	U	UG/KG			2.52E-06	8.33E-03
1330-20-7	total Xylenes	5	U	UG/KG			1.12E-06	5.00E-04
156-60-5	trans-1,2-Dichloroethene	5	U	UG/KG			2.33E-05	1.67E-01
10061-02-6	trans-1,3-Dichloropropene	5	U	UG/KG		2.81E-08	1.14E-04	
79-01-6	Trichloroethylene (TCE)	5	U	UG/KG		8.17E-10	6.32E-05	1.67E+00
75-01-4	Vinyl chloride	5	U	UG/KG		1.03E-07		7.14E+00
<b>Semivolatile Organic Compounds</b>								
120-82-1	1,2,4-Trichlorobenzene	400	U	UG/KG			5.25E-05	1.33E+00
95-50-1	1,2-Dichlorobenzene	400	U	UG/KG			1.20E-04	4.44E-01
541-73-1	1,3-Dichlorobenzene	400	U	UG/KG			7.73E-03	
106-46-7	1,4-Dichlorobenzene	400	U	UG/KG		4.92E-08	2.08E-04	4.00E+00
95-95-4	2,4,5-Trichlorophenol	2000	U	UG/KG			2.27E-05	2.00E-01
88-06-2	2,4,6-Trichlorophenol	400	U	UG/KG		1.78E-09		5.00E+01
120-83-2	2,4-Dichlorophenol	400	U	UG/KG			1.51E-04	8.00E+00
105-67-9	2,4-Dimethylphenol	400	U	UG/KG			2.27E-05	1.00E+00
51-28-5	2,4-Dinitrophenol	2000	U	UG/KG			1.14E-03	2.00E+02
91-58-7	2-Chloronaphthalene	400	U	UG/KG			1.47E-05	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 40-5  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0107**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
95-57-8	2-Chlorophenol	400	U	UG/KG			1.66E-03	2.00E+00
91-57-6	2-Methylnaphthalene	400	U	UG/KG			7.38E-06	2.00E-03
95-48-7	2-Methylphenol	400	U	UG/KG			9.08E-06	5.00E-01
88-74-4	2-Nitroaniline	2000	U	UG/KG			3.97E-02	
88-75-5	2-Nitrophenol	400	U	UG/KG			5.68E-05	
91-94-1	3,3'-Dichlorobenzidine	400	U	UG/KG		7.30E-08		1.33E+03
99-09-2	3-Nitroaniline	2000	U	UG/KG			3.97E-02	
534-52-1	4,6-Dinitro-2-methylphenol	2000	U	UG/KG				
101-55-3	4-Bromophenyl phenyl ether	400	U	UG/KG				
59-50-7	4-Chloro-3-methylphenol	400	U	UG/KG			9.08E-06	
106-47-8	4-Chloroaniline	790	U	UG/KG			2.24E-04	2.63E+01
7005-72-3	4-Chlorophenyl phenyl ether	400	U	UG/KG				
106-44-5	4-Methylphenol	400	U	UG/KG			9.08E-05	
100-01-6	4-Nitroaniline	2000	U	UG/KG			3.97E-02	
100-02-7	4-Nitrophenol	2000	U	UG/KG			2.84E-04	
83-32-9	Acenaphthene	400	U	UG/KG			1.04E-05	1.33E-02
208-96-8	Acenaphthylene	400	U	UG/KG			7.38E-06	2.00E-03
120-12-7	Anthracene	400	U	UG/KG			1.03E-06	6.67E-04
56-55-3	Benzo(a)anthracene	400	U	UG/KG		1.39E-07		5.00E+00
50-32-8	Benzo(a)pyrene	400	U	UG/KG		1.39E-06		1.00E+00
205-99-2	Benzo(b)fluoranthene	400	U	UG/KG		1.39E-07		2.00E+00
191-24-2	Benzo(g,h,i)perylene	400	U	UG/KG			7.38E-06	2.00E-03
207-08-9	Benzo(k)fluoranthene	400	U	UG/KG		1.39E-08		2.00E-01
111-91-1	bis(2-Chloroethoxy)methane	400	U	UG/KG				

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
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**TABLE 40-5  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0107**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
111-44-4	bis(2-Chloroethyl) ether	400	U	UG/KG		6.45E-07		2.00E+04
108-60-1	bis(2-Chloroisopropyl) ether	400	U	UG/KG		4.95E-08	9.41E-05	
117-81-7	bis(2-Ethylhexyl) phthalate (DEHP)	400	U	UG/KG		2.27E-09	2.27E-05	
85-68-7	Butyl benzyl phthalate	400	U	UG/KG			2.27E-06	5.00E-04
86-74-8	Carbazole	400	U	UG/KG		3.24E-09		1.33E+01
218-01-9	Chrysene	400	U	UG/KG		1.39E-09		5.00E-02
84-74-2	Di-n-butyl phthalate	400	U	UG/KG			4.54E-06	1.33E-03
117-84-0	Di-n-octyl phthalate	400	U	UG/KG			2.27E-05	4.00E-05
53-70-3	Dibenz(a,h)anthracene	400	U	UG/KG		1.39E-06		5.00E+00
132-64-9	Dibenzofuran	400	U	UG/KG			7.90E-05	
84-66-2	Diethyl phthalate	400	U	UG/KG			5.68E-07	
131-11-3	Dimethyl phthalate	400	U	UG/KG			4.54E-08	
206-44-0	Fluoranthene	400	U	UG/KG			1.33E-05	2.00E-03
86-73-7	Fluorene	400	U	UG/KG			1.21E-05	1.33E-02
118-74-1	Hexachlorobenzene	400	U	UG/KG		2.59E-07	5.68E-04	4.00E+00
87-68-3	Hexachlorobutadiene	400	U	UG/KG		1.26E-08	2.27E-03	4.00E+00
77-47-4	Hexachlorocyclopentadiene	400	U	UG/KG			6.78E-05	2.00E-02
67-72-1	Hexachloroethane	400	U	UG/KG		2.27E-09	4.54E-04	2.00E+01
193-39-5	Indeno(1,2,3-c,d)pyrene	400	U	UG/KG		1.39E-07		5.71E-01
78-59-1	Isophorone	400	U	UG/KG		1.54E-10	2.27E-06	1.33E+01
621-64-7	N-Nitroso-di-n-propylamine	400	U	UG/KG		1.14E-06		2.00E+05
86-30-6	N-Nitrosodiphenylamine	400	U	UG/KG		7.95E-10		6.67E+00
91-20-3	Naphthalene	400	U	UG/KG			2.12E-03	1.00E-01
87-86-5	Pentachlorophenol	2000	U	UG/KG		1.80E-07	1.40E-04	2.00E+03

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TABLE 40-5

## HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0107

ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
85-01-8	Phenanthrene	400	U	UG/KG			7.38E-06	2.00E-03
108-95-2	Phenol	400	U	UG/KG			7.57E-07	8.00E-02
129-00-0	Pyrene	400	U	UG/KG			7.38E-06	2.00E-03
<b>Explosives</b>								
99-35-4	1,3,5-Trinitrobenzene	300	UJ	UG/KG			1.14E-05	
99-65-0	1,3-Dinitrobenzene	300	UJ	UG/KG			3.41E-03	
118-96-7	2,4,6-Trinitrotoluene (TNT)	590	UJ	UG/KG		7.18E-09	1.34E-03	
121-14-2	2,4-Dinitrotoluene	300	UJ	UG/KG			1.70E-04	7.50E+03
606-20-2	2,6-Dinitrotoluene	400	U	UG/KG			4.54E-04	1.33E+04
35572-78-2	2-Amino-4,6-Dinitrotoluene	590	UJ	UG/KG				
88-72-2	2-Nitrotoluene (ONT)	590	UJ	UG/KG				
99-08-1	3-Nitrotoluene	590	UJ	UG/KG			2.90E-04	
19406-51-0	4-Amino-2,6-Dinitrotoluene	590	UJ	UG/KG				
99-99-0	4-Nitrotoluene (PNT)	590	UJ	UG/KG			2.90E-04	
2691-41-0	HMX	590	UJ	UG/KG			1.34E-05	
98-95-3	Nitrobenzene	300	UJ	UG/KG			2.62E-03	
121-82-4	RDX	590	UJ	UG/KG		2.63E-08	2.23E-04	
479-45-8	Tetryl	890	UJ	UG/KG			1.01E-04	
<b>Metals</b>								
7429-90-5	Aluminum	7680		MG/KG	2.67E-01		4.58E-03	
7440-36-0	Antimony	0.26	J	MG/KG	3.13E-01		3.18E-04	8.67E-01
7440-38-2	Arsenic	6.2		MG/KG	4.59E-01	2.27E-06	1.41E-02	6.20E+00
7440-39-3	Barium	68.1		MG/KG	3.49E-01		5.47E-04	8.51E-01
7440-41-7	Beryllium	0.59	U	MG/KG	7.76E-01	2.63E-10	1.60E-04	1.97E-01

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**TABLE 40-5  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0107**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
7440-42-8	Boron	12	U	MG/KG	2.26E+00		1.52E-04	
7440-43-9	Cadmium	0.28	J	MG/KG	1.47E+00	9.37E-11	3.46E-04	7.00E-01
7440-70-2	Calcium	96500		MG/KG	3.86E+01			
7440-47-3	Chromium	11.5		MG/KG	4.56E-01	2.57E-08		5.75E+00
7440-48-4	Cobalt	1.5	J	MG/KG	6.91E-02		1.22E-05	
7440-50-8	Copper	7.9		MG/KG	6.99E-01		1.04E-04	
7439-89-6	Iron	9720		MG/KG	5.03E-01		1.59E-02	
7439-92-1	Lead	14		MG/KG	5.98E-01			
7439-95-4	Magnesium	56300		MG/KG	3.63E+01			
7439-96-5	Manganese	592		MG/KG	1.63E-01		1.84E-02	
7439-97-6	Mercury	0.07	J	MG/KG	1.17E+00			
7440-02-0	Nickel	6.7		MG/KG	3.54E-01		1.64E-04	9.57E-01
2023695	Potassium	296		MG/KG	4.74E-01			
7782-49-2	Selenium	0.52	J	MG/KG	2.22E-01		5.09E-05	1.73E+00
7440-22-4	Silver	1.2	U	MG/KG	2.07E+00		1.17E-04	6.00E-01
7440-23-5	Sodium	180	U	MG/KG	1.06E+00			
7440-28-0	Thallium	1.2	U	MG/KG	2.93E+00		8.39E-06	
7440-62-2	Vanadium	20.1		MG/KG	4.26E-01		1.40E-03	6.70E-02
7440-66-6	Zinc	199	J	MG/KG	3.87E+00		3.25E-04	3.32E-01

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HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0107**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
<b>Volatile Organic Compounds</b>							
71-55-6	1,1,1-Trichloroethane	5	U	UG/KG			2.50E-03
79-34-5	1,1,2,2-Tetrachloroethane	5	U	UG/KG			
79-00-5	1,1,2-Trichloroethane	5	U	UG/KG	6.10E-07	6.10E-07	2.50E-01
75-34-3	1,1-Dichloroethane	5	U	UG/KG	2.50E-08	2.50E-08	2.17E-04
75-35-4	1,1-Dichloroethene	5	U	UG/KG	2.78E-07	2.78E-06	8.33E-02
107-06-2	1,2-Dichloroethane (EDC)	5	U	UG/KG	7.94E-05	3.57E-06	2.50E-01
540-59-0	1,2-Dichloroethene (total)	5	U	UG/KG	2.50E-07	2.50E-07	1.25E-02
78-87-5	1,2-Dichloropropane	5	U	UG/KG	5.95E-05	2.78E-06	1.67E-01
78-93-3	2-Butanone (MEK)	11	U	UG/KG			
591-78-6	2-Hexanone	11	U	UG/KG			
108-10-1	4-Methyl-2-pentanone (MIBK)	11	U	UG/KG			
67-64-1	Acetone	11	U	UG/KG	5.50E-08	5.50E-08	6.88E-04
71-43-2	Benzene	5	U	UG/KG	2.50E-05	1.16E-06	1.67E-01
75-27-4	Bromodichloromethane	5	U	UG/KG	5.43E-05	2.50E-06	8.33E-03
75-25-2	Bromoform	5	U	UG/KG	6.94E-06	3.13E-07	6.25E-03
74-83-9	Bromomethane	5	U	UG/KG	1.72E-06	5.00E-06	2.50E-02
75-15-0	Carbon disulfide	5	U	UG/KG	2.50E-08	2.50E-07	1.56E-04
56-23-5	Carbon tetrachloride	5	U	UG/KG	1.14E-04	1.22E-05	7.14E-02
108-90-7	Chlorobenzene	5	U	UG/KG	1.22E-07	1.22E-06	5.00E-03
75-00-3	Chloroethane	5	U	UG/KG			
67-66-3	Chloroform	5	U	UG/KG	5.32E-06	2.50E-06	8.33E-03
74-87-3	Chloromethane	5	U	UG/KG			
156-59-2	cis-1,2-Dichloroethene	5	U	UG/KG	2.50E-07	2.50E-07	1.25E-02

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 40-5  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0107**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
10061-01-5	cis-1,3-Dichloropropene	5	U	UG/KG			
124-48-1	Dibromochloromethane	5	U	UG/KG	1.22E-07	1.22E-07	1.25E-02
100-41-4	Ethylbenzene	5	U	UG/KG	2.50E-08	2.50E-07	3.85E-04
75-09-2	Methylene chloride	5	U	UG/KG	6.58E-06	4.17E-07	2.50E-01
110-54-3	N-Hexane	5	U	UG/KG			
100-42-5	Styrene	5	U	UG/KG	1.22E-08	1.22E-07	1.25E-03
127-18-4	Tetrachloroethylene (PCE)	5	U	UG/KG	4.55E-05	2.08E-06	8.33E-02
108-88-3	Toluene	5	U	UG/KG	1.22E-08	1.22E-08	4.17E-04
1330-20-7	total Xylenes	5	U	UG/KG	5.00E-09	1.22E-08	3.33E-05
156-60-5	trans-1,2-Dichloroethene	5	U	UG/KG	1.22E-07	1.22E-07	7.14E-03
10061-02-6	trans-1,3-Dichloropropene	5	U	UG/KG			
79-01-6	Trichloroethylene (TCE)	5	U	UG/KG	9.62E-06	4.17E-06	8.33E-02
75-01-4	Vinyl chloride	5	U	UG/KG	1.67E-03	7.69E-05	5.00E-01
<b>Semivolatile Organic Compounds</b>							
120-82-1	1,2,4-Trichlorobenzene	400	U	UG/KG	2.00E-05	2.00E-04	8.00E-02
95-50-1	1,2-Dichlorobenzene	400	U	UG/KG	2.22E-06	2.22E-05	2.35E-02
541-73-1	1,3-Dichlorobenzene	400	U	UG/KG			
106-46-7	1,4-Dichlorobenzene	400	U	UG/KG			2.00E-01
95-95-4	2,4,5-Trichlorophenol	2000	U	UG/KG	1.00E-05	1.00E-05	7.41E-03
88-06-2	2,4,6-Trichlorophenol	400	U	UG/KG	7.69E-04	3.64E-05	2.00E+00
120-83-2	2,4-Dichlorophenol	400	U	UG/KG	6.56E-05	6.56E-04	4.00E-01
105-67-9	2,4-Dimethylphenol	400	U	UG/KG	9.76E-06	9.76E-06	4.44E-02
51-28-5	2,4-Dinitrophenol	2000	U	UG/KG	4.88E-04	4.88E-03	1.00E+01
91-58-7	2-Chloronaphthalene	400	U	UG/KG			

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 40-5  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0107**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
95-57-8	2-Chlorophenol	400	U	UG/KG	4.00E-05	4.00E-05	1.00E-01
91-57-6	2-Methylnaphthalene	400	U	UG/KG	6.56E-06	6.56E-06	9.52E-05
95-48-7	2-Methylphenol	400	U	UG/KG	4.00E-06	4.00E-06	2.67E-02
88-74-4	2-Nitroaniline	2000	U	UG/KG			
88-75-5	2-Nitrophenol	400	U	UG/KG			
91-94-1	3,3'-Dichlorobenzidine	400	U	UG/KG	3.08E-02	1.43E-03	5.71E+01
99-09-2	3-Nitroaniline	2000	U	UG/KG			
534-52-1	4,6-Dinitro-2-methylphenol	2000	U	UG/KG			
101-55-3	4-Bromophenyl phenyl ether	400	U	UG/KG			
59-50-7	4-Chloro-3-methylphenol	400	U	UG/KG			
106-47-8	4-Chloroaniline	790	U	UG/KG	9.63E-05	9.63E-04	1.13E+00
7005-72-3	4-Chlorophenyl phenyl ether	400	U	UG/KG			
106-44-5	4-Methylphenol	400	U	UG/KG			
100-01-6	4-Nitroaniline	2000	U	UG/KG			
100-02-7	4-Nitrophenol	2000	U	UG/KG			
83-32-9	Acenaphthene	400	U	UG/KG	3.33E-06	3.33E-06	7.02E-04
208-96-8	Acenaphthylene	400	U	UG/KG	6.56E-06	6.56E-06	9.52E-05
120-12-7	Anthracene	400	U	UG/KG	6.56E-07	6.56E-07	3.33E-05
56-55-3	Benzo(a)anthracene	400	U	UG/KG	5.00E-02	2.35E-03	2.00E-01
50-32-8	Benzo(a)pyrene	400	U	UG/KG	5.00E-01	2.35E-02	5.00E-02
205-99-2	Benzo(b)fluoranthene	400	U	UG/KG	5.00E-02	2.35E-03	8.00E-02
191-24-2	Benzo(g,h,i)perylene	400	U	UG/KG	6.56E-06	6.56E-06	9.52E-05
207-08-9	Benzo(k)fluoranthene	400	U	UG/KG	5.13E-03	2.35E-04	8.16E-03
111-91-1	bis(2-Chloroethoxy)methane	400	U	UG/KG			

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect



**TABLE 40-5  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0107**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
111-44-4	bis(2-Chloroethyl) ether	400	U	UG/KG	8.00E-02	5.33E-03	1.00E+03
108-60-1	bis(2-Chloroisopropyl) ether	400	U	UG/KG			
117-81-7	bis(2-Ethylhexyl) phthalate (DEHP)	400	U	UG/KG	9.76E-04	9.76E-05	1.11E-04
85-68-7	Butyl benzyl phthalate	400	U	UG/KG	9.76E-07	9.76E-07	4.30E-04
86-74-8	Carbazole	400	U	UG/KG	1.38E-03	6.45E-05	6.67E-01
218-01-9	Chrysene	400	U	UG/KG	5.13E-04	2.35E-05	2.50E-03
84-74-2	Di-n-butyl phthalate	400	U	UG/KG	2.00E-06	2.00E-06	1.74E-04
117-84-0	Di-n-octyl phthalate	400	U	UG/KG	9.76E-06	9.76E-05	4.00E-05
53-70-3	Dibenz(a,h)anthracene	400	U	UG/KG	5.00E-01	2.35E-02	2.00E-01
132-64-9	Dibenzofuran	400	U	UG/KG			
84-66-2	Diethyl phthalate	400	U	UG/KG	4.00E-07	4.00E-07	8.51E-04
131-11-3	Dimethyl phthalate	400	U	UG/KG			
206-44-0	Fluoranthene	400	U	UG/KG	4.88E-06	4.88E-06	9.30E-05
86-73-7	Fluorene	400	U	UG/KG	4.88E-06	4.88E-06	7.14E-04
118-74-1	Hexachlorobenzene	400	U	UG/KG	1.00E-01	5.13E-03	2.00E-01
87-68-3	Hexachlorobutadiene	400	U	UG/KG			
77-47-4	Hexachlorocyclopentadiene	400	U	UG/KG	2.86E-05	2.86E-05	1.00E-03
67-72-1	Hexachloroethane	400	U	UG/KG	2.00E-04	2.00E-04	8.00E-01
193-39-5	Indeno(1,2,3-c,d)pyrene	400	U	UG/KG	5.00E-02	2.35E-03	2.86E-02
78-59-1	Isophorone	400	U	UG/KG	9.76E-07	9.76E-07	5.00E-02
621-64-7	N-Nitroso-di-n-propylamine	400	U	UG/KG	5.00E-01	2.22E-02	8.00E+03
86-30-6	N-Nitrosodiphenylamine	400	U	UG/KG	3.33E-04	1.60E-05	4.00E-01
91-20-3	Naphthalene	400	U	UG/KG	4.88E-06	4.88E-05	4.76E-03
87-86-5	Pentachlorophenol	2000	U	UG/KG	8.33E-02	3.85E-03	6.67E+01

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 40-5  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0107**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class II Soil Component of Groundwater Criteria
85-01-8	Phenanthrene	400	U	UG/KG	6.56E-06	6.56E-06	9.52E-05
108-95-2	Phenol	400	U	UG/KG	4.00E-07	3.33E-06	4.00E-03
129-00-0	Pyrene	400	U	UG/KG	6.56E-06	6.56E-06	9.52E-05
<b>Explosives</b>							
99-35-4	1,3,5-Trinitrobenzene	300	UJ	UG/KG			
99-65-0	1,3-Dinitrobenzene	300	UJ	UG/KG			
118-96-7	2,4,6-Trinitrotoluene (TNT)	590	UJ	UG/KG			
121-14-2	2,4-Dinitrotoluene	300	UJ	UG/KG	3.57E-02	1.67E-03	3.75E+02
606-20-2	2,6-Dinitrotoluene	400	U	UG/KG	4.76E-02	2.22E-03	5.71E+02
35572-78-2	2-Amino-4,6-Dinitrotoluene	590	UJ	UG/KG			
88-72-2	2-Nitrotoluene (ONT)	590	UJ	UG/KG			
99-08-1	3-Nitrotoluene	590	UJ	UG/KG			
19406-51-0	4-Amino-2,6-Dinitrotoluene	590	UJ	UG/KG			
99-99-0	4-Nitrotoluene (PNT)	590	UJ	UG/KG			
2691-41-0	HMX	590	UJ	UG/KG			
98-95-3	Nitrobenzene	300	UJ	UG/KG	3.00E-04	3.00E-04	3.00E+00
121-82-4	RDX	590	UJ	UG/KG			
479-45-8	Tetryl	890	UJ	UG/KG			
<b>Metals</b>							
7429-90-5	Aluminum	7680		MG/KG			
7440-36-0	Antimony	0.26	J	MG/KG	3.17E-04	3.17E-03	5.20E-02
7440-38-2	Arsenic	6.2		MG/KG	2.07E+00	1.02E-01	2.21E-01
7440-39-3	Barium	68.1		MG/KG	4.86E-04	4.86E-03	5.68E-02
7440-41-7	Beryllium	0.59	U	MG/KG	5.90E-01	2.03E-02	8.94E-02

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J = Estimated U = Nondetect

**TABLE 40-5  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0107**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
7440-42-8	Boron	12	U	MG/KG	6.67E-05	6.67E-04	
7440-43-9	Cadmium	0.28	J	MG/KG	1.40E-04	1.40E-03	7.57E-02
7440-70-2	Calcium	96500		MG/KG			
7440-47-3	Chromium	11.5		MG/KG	1.15E-03	2.80E-03	4.11E-01
7440-48-4	Cobalt	1.5	J	MG/KG	1.25E-05	1.25E-04	
7440-50-8	Copper	7.9		MG/KG	9.63E-05	9.63E-04	7.18E-04
7439-89-6	Iron	9720		MG/KG			
7439-92-1	Lead	14		MG/KG	3.50E-02	3.50E-02	
7439-95-4	Magnesium	56300		MG/KG			
7439-96-5	Manganese	592		MG/KG	6.17E-03	6.17E-02	
7439-97-6	Mercury	0.07	J	MG/KG	1.15E-04	1.15E-03	4.67E-01
7440-02-0	Nickel	6.7		MG/KG	1.63E-04	1.63E-03	8.82E-02
2023695	Potassium	296		MG/KG			
7782-49-2	Selenium	0.52	J	MG/KG	5.20E-05	5.20E-04	2.17E-01
7440-22-4	Silver	1.2	U	MG/KG	1.20E-04	1.20E-03	8.00E-01
7440-23-5	Sodium	180	U	MG/KG			
7440-28-0	Thallium	1.2	U	MG/KG	7.50E-03	7.50E-03	5.00E-01
7440-62-2	Vanadium	20.1		MG/KG	1.44E-03	1.44E-02	2.05E-02
7440-66-6	Zinc	199	J	MG/KG	3.26E-04	3.26E-03	5.53E-02

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
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**TABLE 40-6  
HUMAN HEALTH SCREENING OF TRENCH WATER RESULTS FROM AUS-0107**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Cancer Risk Based on USEPA Region 9 PRG for Carcinogens (Tap Water)	Hazard Quotient (HQ) Based on USEPA Region 9 PRG for Toxins (Tap Water)	Ratio of Max Concentration (or Max RL) to USEPA MCL and/or IEPA Class I Groundwater Standard
<b>Volatile Organic Compounds</b>							
71-55-6	1,1,1-Trichloroethane	1	U	UG/L		1.26E-03	5.00E-03
79-34-5	1,1,2,2-Tetrachloroethane	1	U	UG/L	1.81E-05	2.74E-03	
79-00-5	1,1,2-Trichloroethane	1	U	UG/L	5.01E-06	4.11E-02	2.00E-01
75-34-3	1,1-Dichloroethane	1	U	UG/L		1.23E-03	
75-35-4	1,1-Dichloroethene	1	U	UG/L	2.19E-05	1.83E-02	1.43E-01
107-06-2	1,2-Dichloroethane (EDC)	1	U	UG/L	8.12E-06	9.88E-02	2.00E-01
78-87-5	1,2-Dichloropropane	1	U	UG/L	6.07E-06	1.45E-01	2.00E-01
78-93-3	2-Butanone (MEK)	5	U	UG/L		2.63E-03	
591-78-6	2-Hexanone	5	U	UG/L			
108-10-1	4-Methyl-2-pentanone (MIBK)	5	U	UG/L		3.17E-02	
67-64-1	Acetone	5	U	UG/L		8.22E-03	
71-43-2	Benzene	1	U	UG/L	2.44E-06	8.92E-02	2.00E-01
75-27-4	Bromodichloromethane	1	U	UG/L	5.53E-06	8.22E-03	
75-25-2	Bromoform	1	U	UG/L	1.18E-07	1.37E-03	
74-83-9	Bromomethane	1	U	UG/L		1.15E-01	
75-15-0	Carbon disulfide	1	U	UG/L		9.59E-04	
56-23-5	Carbon tetrachloride	1	U	UG/L	5.84E-06	2.35E-01	2.00E-01
108-90-7	Chlorobenzene	1	U	UG/L		9.43E-03	1.00E-02
75-00-3	Chloroethane	1	U	UG/L	2.16E-07	1.16E-04	
67-66-3	Chloroform	1	U	UG/L	6.08E-06	1.60E+00	
74-87-3	Chloromethane	1	U	UG/L	6.62E-07		
156-59-2	cis-1,2-Dichloroethene	1	U	UG/L		1.64E-02	1.43E-02
10061-01-5	cis-1,3-Dichloropropene	1	U	UG/L	1.23E-05	1.15E-01	
124-48-1	Dibromochloromethane	1	U	UG/L	7.50E-06	8.22E-03	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 40-6  
HUMAN HEALTH SCREENING OF TRENCH WATER RESULTS FROM AUS-0107**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Cancer Risk Based on USEPA Region 9 PRG for Carcinogens (Tap Water)	Hazard Quotient (HQ) Based on USEPA Region 9 PRG for Toxins (Tap Water)	Ratio of Max Concentration (or Max RL) to USEPA MCL and/or IEPA Class I Groundwater Standard
100-41-4	Ethylbenzene	1	U	UG/L		7.46E-04	1.43E-03
75-09-2	Methylene chloride	1	U	UG/L	2.34E-07	6.16E-04	2.00E-01
110-54-3	N-Hexane	1	U	UG/L		2.85E-03	
100-42-5	Styrene	1	U	UG/L		6.09E-04	1.00E-02
127-18-4	Tetrachloroethylene (PCE)	1	U	UG/L	9.24E-07	3.94E-03	2.00E-01
108-88-3	Toluene	1	U	UG/L		1.38E-03	1.00E-03
1330-20-7	total Xylenes	1	U	UG/L		6.99E-04	1.00E-04
156-60-5	trans-1,2-Dichloroethene	1	U	UG/L		8.22E-03	1.00E-02
10061-02-6	trans-1,3-Dichloropropene	1	U	UG/L	1.23E-05	1.15E-01	
79-01-6	Trichloroethylene (TCE)	1	U	UG/L	6.10E-07	2.74E-02	2.00E-01
75-01-4	Vinyl chloride	1	U	UG/L	5.06E-05		5.00E-01
<b>Semivolatle Organic Compounds</b>							
120-82-1	1,2,4-Trichlorobenzene	10	U	UG/L		5.14E-02	1.43E-01
95-50-1	1,2-Dichlorobenzene	10	U	UG/L		2.70E-02	1.67E-02
541-73-1	1,3-Dichlorobenzene	10	U	UG/L		1.83E+00	
106-46-7	1,4-Dichlorobenzene	10	U	UG/L	1.99E-05	5.48E-02	1.33E-01
95-95-4	2,4,5-Trichlorophenol	50	U	UG/L		1.37E-02	
88-06-2	2,4,6-Trichlorophenol	10	U	UG/L	1.64E-06		
120-83-2	2,4-Dichlorophenol	10	U	UG/L		9.13E-02	
105-67-9	2,4-Dimethylphenol	10	U	UG/L		1.37E-02	
51-28-5	2,4-Dinitrophenol	50	U	UG/L		6.85E-01	
91-58-7	2-Chloronaphthalene	10	U	UG/L		2.05E-02	
95-57-8	2-Chlorophenol	10	U	UG/L		3.29E-01	
91-57-6	2-Methylnaphthalene	10	U	UG/L		5.48E-02	
95-48-7	2-Methylphenol	10	U	UG/L		5.48E-03	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

TABLE 40-6

## HUMAN HEALTH SCREENING OF TRENCH WATER RESULTS FROM AUS-0107

ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Cancer Risk Based on USEPA Region 9 PRG for Carcinogens (Tap Water)	Hazard Quotient (HQ) Based on USEPA Region 9 PRG for Toxins (Tap Water)	Ratio of Max Concentration (or Max RL) to USEPA MCL and/or IEPA Class I Groundwater Standard
88-74-4	2-Nitroaniline	50	U	UG/L		2.40E+01	
88-75-5	2-Nitrophenol	10	U	UG/L		3.42E-02	
91-94-1	3,3'-Dichlorobenzidine	20	U	UG/L	1.34E-04		
99-09-2	3-Nitroaniline	50	U	UG/L		2.40E+01	
534-52-1	4,6-Dinitro-2-methylphenol	50	U	UG/L			
101-55-3	4-Bromophenyl phenyl ether	10	U	UG/L			
59-50-7	4-Chloro-3-methylphenol	10	U	UG/L		5.48E-03	
106-47-8	4-Chloroaniline	20	U	UG/L		1.37E-01	
7005-72-3	4-Chlorophenyl phenyl ether	10	U	UG/L			
106-44-5	4-Methylphenol	10	U	UG/L		5.48E-02	
100-01-6	4-Nitroaniline	50	U	UG/L		2.40E+01	
100-02-7	4-Nitrophenol	50	U	UG/L		1.71E-01	
83-32-9	Acenaphthene	10	U	UG/L		2.74E-02	
208-96-8	Acenaphthylene	10	U	UG/L		5.48E-02	
120-12-7	Anthracene	10	U	UG/L		5.48E-03	
56-55-3	Benzo(a)anthracene	10	U	UG/L	1.09E-04		
50-32-8	Benzo(a)pyrene	10	U	UG/L	1.09E-03		5.00E+01
205-99-2	Benzo(b)fluoranthene	10	U	UG/L	1.09E-04		
191-24-2	Benzo(g,h,i)perylene	10	U	UG/L		5.48E-02	
207-08-9	Benzo(k)fluoranthene	10	U	UG/L	1.09E-05		
111-91-1	bis(2-Chloroethoxy)methane	10	U	UG/L			
111-44-4	bis(2-Chloroethyl) ether	10	U	UG/L	1.02E-03		
108-60-1	bis(2-Chloroisopropyl) ether	10	U	UG/L	3.64E-05	4.11E-02	
117-81-7	bis(2-Ethylhexyl) phthalate (DEHP)	10	U	UG/L	2.08E-06	1.37E-02	
85-68-7	Butyl benzyl phthalate	10	U	UG/L		1.37E-03	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 40-6  
HUMAN HEALTH SCREENING OF TRENCH WATER RESULTS FROM AUS-0107**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Cancer Risk Based on USEPA Region 9 PRG for Carcinogens (Tap Water)	Hazard Quotient (HQ) Based on USEPA Region 9 PRG for Toxins (Tap Water)	Ratio of Max Concentration (or Max RL) to USEPA MCL and/or IEPA Class I Groundwater Standard
86-74-8	Carbazole	10	U	UG/L	2.97E-06		
218-01-9	Chrysene	10	U	UG/L	1.09E-06		
84-74-2	Di-n-butyl phthalate	10	U	UG/L		2.74E-03	
117-84-0	Di-n-octyl phthalate	10	U	UG/L		1.37E-02	
53-70-3	Dibenz(a,h)anthracene	10	U	UG/L	1.09E-03		
132-64-9	Dibenzofuran	10	U	UG/L		4.11E-01	
84-66-2	Diethyl phthalate	10	U	UG/L		3.42E-04	
131-11-3	Dimethyl phthalate	10	U	UG/L		2.74E-05	
206-44-0	Fluoranthene	10	U	UG/L		6.85E-03	
86-73-7	Fluorene	10	U	UG/L		4.11E-02	
118-74-1	Hexachlorobenzene	10	U	UG/L	2.38E-04	3.42E-01	1.00E+01
87-68-3	Hexachlorobutadiene	10	U	UG/L	1.16E-05	1.37E+00	
77-47-4	Hexachlorocyclopentadiene	10	U	UG/L		3.91E-02	2.00E-01
67-72-1	Hexachloroethane	10	U	UG/L	2.08E-06	2.74E-01	
193-39-5	Indeno(1,2,3-c,d)pyrene	10	U	UG/L	1.09E-04		
78-59-1	Isophorone	10	U	UG/L	1.41E-07	1.37E-03	
621-64-7	N-Nitroso-di-n-propylamine	10	U	UG/L	1.04E-03		
86-30-6	N-Nitrosodiphenylamine	10	U	UG/L	7.29E-07		
91-20-3	Naphthalene	10	U	UG/L		1.61E+00	
87-86-5	Pentachlorophenol	50	U	UG/L	8.92E-05	4.57E-02	5.00E+01
85-01-8	Phenanthrene	10	U	UG/L		5.48E-02	
108-95-2	Phenol	10	U	UG/L		4.57E-04	1.00E-01
129-00-0	Pyrene	10	U	UG/L		5.48E-02	
<b>Explosives</b>							
99-35-4	1,3,5-Trinitrobenzene	0.25	UJ	UG/L		2.28E-04	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

TABLE 40-6

## HUMAN HEALTH SCREENING OF TRENCH WATER RESULTS FROM AUS-0107

ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Cancer Risk Based on USEPA Region 9 PRG for Carcinogens (Tap Water)	Hazard Quotient (HQ) Based on USEPA Region 9 PRG for Toxins (Tap Water)	Ratio of Max Concentration (or Max RL) to USEPA MCL and/or IEPA Class I Groundwater Standard
99-65-0	1,3-Dinitrobenzene	0.25	UJ	UG/L		6.85E-02	
118-96-7	2,4,6-Trinitrotoluene (TNT)	0.5	UJ	UG/L	2.23E-07	2.74E-02	
121-14-2	2,4-Dinitrotoluene	0.25	UJ	UG/L		3.42E-03	
606-20-2	2,6-Dinitrotoluene	0.5	UJ	UG/L		1.37E-02	
35572-78-2	2-Amino-4,6-Dinitrotoluene	0.5	UJ	UG/L			
88-72-2	2-Nitrotoluene (ONT)	0.5	UJ	UG/L			
99-08-1	3-Nitrotoluene	0.5	UJ	UG/L		8.22E-03	
19406-51-0	4-Amino-2,6-Dinitrotoluene	0.5	UJ	UG/L			
99-99-0	4-Nitrotoluene (PNT)	0.5	UJ	UG/L		8.22E-03	
2691-41-0	HMX	0.5	UJ	UG/L		2.74E-04	
98-95-3	Nitrobenzene	0.25	UJ	UG/L		7.36E-02	
121-82-4	RDX	0.5	UJ	UG/L	8.18E-07	4.57E-03	
479-45-8	Tetryl	0.75	UJ	UG/L		2.05E-03	
<b>Metals</b>							
7429-90-5	Aluminum	23800		UG/L		6.52E-01	
7440-36-0	Antimony	1.7	UJ	UG/L		1.16E-01	2.83E-01
7440-38-2	Arsenic	13.5		UG/L	3.01E-04	1.23E+00	2.70E-01
7440-39-3	Barium	355		UG/L		1.39E-01	1.78E-01
7440-41-7	Beryllium	5	U	UG/L		6.85E-02	1.25E+00
7440-42-8	Boron	100	U	UG/L		3.04E-02	5.00E-02
7440-43-9	Cadmium	5	U	UG/L		2.74E-01	1.00E+00
7440-70-2	Calcium	127000		UG/L			
7440-47-3	Chromium	30.8		UG/L			3.08E-01
7440-48-4	Cobalt	50	U	UG/L		2.28E-02	5.00E-02
7440-50-8	Copper	20	U	UG/L		1.48E-02	3.08E-02

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect



**TABLE 40-6  
HUMAN HEALTH SCREENING OF TRENCH WATER RESULTS FROM AUS-0107**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Cancer Risk Based on USEPA Region 9 PRG for Carcinogens (Tap Water)	Hazard Quotient (HQ) Based on USEPA Region 9 PRG for Toxins (Tap Water)	Ratio of Max Concentration (or Max RL) to USEPA MCL and/or IEPA Class I Groundwater Standard
7439-89-6	Iron	27200		UG/L		2.48E+00	5.44E+00
7439-92-1	Lead	24.5	J	UG/L			3.27E+00
7439-95-4	Magnesium	70400		UG/L			
7439-96-5	Manganese	840	J	UG/L		9.59E-01	5.60E+00
7439-97-6	Mercury	0.13	J	UG/L			6.50E-02
7440-02-0	Nickel	23		UG/L		3.15E-02	2.30E-01
2023695	Potassium	1790		UG/L			
7782-49-2	Selenium	3.4	U	UG/L		1.86E-02	6.80E-02
7440-22-4	Silver	10	U	UG/L		5.48E-02	2.00E-01
7440-23-5	Sodium	39400		UG/L			
7440-28-0	Thallium	10	U	UG/L		3.91E+00	5.00E+00
7440-62-2	Vanadium	48.3		UG/L		1.89E-01	
7440-66-6	Zinc	90.3		UG/L		8.25E-03	1.81E-02

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

TABLE 40-7  
ECOLOGICAL SCREENING OF SOIL RESULTS FROM AUS-0107

ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

CAS Number	Chemical	Background (SOIL)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ) (SOIL)	Retained as Potential Bioaccumulator
<b>Volatile Organic Compounds</b>							
71-55-6	1,1,1-Trichloroethane		5	U	UG/KG	1.68E-04	
79-34-5	1,1,2,2-Tetrachloroethane		5	U	UG/KG	3.93E-02	
79-00-5	1,1,2-Trichloroethane		5	U	UG/KG	1.75E-04	
75-34-3	1,1-Dichloroethane		5	U	UG/KG	2.49E-04	
75-35-4	1,1-Dichloroethene		5	U	UG/KG	6.04E-04	
107-06-2	1,2-Dichloroethane (EDC)		5	U	UG/KG	2.36E-04	
540-59-0	1,2-Dichloroethene (total)		5	U	UG/KG	6.35E-03	
78-87-5	1,2-Dichloropropane		5	U	UG/KG	7.14E-06	
78-93-3	2-Butanone (MEK)		11	U	UG/KG	1.23E-04	
591-78-6	2-Hexanone		11	U	UG/KG	8.73E-04	
108-10-1	4-Methyl-2-pentanone (MIBK)		11	U	UG/KG	2.48E-05	
67-64-1	Acetone		11	U	UG/KG	4.40E-03	
71-43-2	Benzene		5	U	UG/KG	3.13E-04	
75-27-4	Bromodichloromethane		5	U	UG/KG	9.26E-03	
75-25-2	Bromoform		5	U	UG/KG	3.14E-04	
74-83-9	Bromomethane		5	U	UG/KG	2.13E-02	
75-15-0	Carbon disulfide		5	U	UG/KG	5.31E-02	
56-23-5	Carbon tetrachloride		5	U	UG/KG	5.00E-06	
108-90-7	Chlorobenzene		5	U	UG/KG	1.25E-04	
75-00-3	Chloroethane		5	U	UG/KG		
67-66-3	Chloroform		5	U	UG/KG	4.20E-03	
74-87-3	Chloromethane		5	U	UG/KG	4.81E-04	
156-59-2	cis-1,2-Dichloroethene		5	U	UG/KG	6.35E-03	
10061-01-5	cis-1,3-Dichloropropene		5	U	UG/KG	1.26E-02	
124-48-1	Dibromochloromethane		5	U	UG/KG	2.44E-03	
100-41-4	Ethylbenzene		5	U	UG/KG	1.00E-03	
75-09-2	Methylene chloride		5	U	UG/KG	1.23E-03	
110-54-3	N-Hexane		5	U	UG/KG		
100-42-5	Styrene		5	U	UG/KG	1.67E-05	
127-18-4	Tetrachloroethylene (PCE)		5	U	UG/KG	3.85E-04	
108-88-3	Toluene		5	U	UG/KG	1.67E-03	
1330-20-7	total Xylenes		5	U	UG/KG	8.33E-03	
156-60-5	trans-1,2-Dichloroethene		5	U	UG/KG	6.35E-03	
10061-02-6	trans-1,3-Dichloropropene		5	U	UG/KG	1.26E-02	
79-01-6	Trichloroethylene (TCE)		5	U	UG/KG	5.56E-04	
75-01-4	Vinyl chloride		5	U	UG/KG	7.74E-03	
<b>Semivolatile Organic Compounds</b>							
120-82-1	1,2,4-Trichlorobenzene		400	U	UG/KG	2.00E-02	
95-50-1	1,2-Dichlorobenzene		400	U	UG/KG	1.35E-01	
541-73-1	1,3-Dichlorobenzene		400	U	UG/KG	1.06E-02	
106-46-7	1,4-Dichlorobenzene		400	U	UG/KG	2.00E-02	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 40-7  
ECOLOGICAL SCREENING OF SOIL RESULTS FROM AUS-0107**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Background (SOIL)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ) (SOIL)	Retained as Potential Bioaccumulator
95-95-4	2,4,5-Trichlorophenol		2000	U	UG/KG	5.00E-01	
88-06-2	2,4,6-Trichlorophenol		400	U	UG/KG	4.00E-02	
120-83-2	2,4-Dichlorophenol		400	U	UG/KG	4.57E-03	
105-67-9	2,4-Dimethylphenol		400	U	UG/KG	4.00E+01	
51-28-5	2,4-Dinitrophenol		2000	U	UG/KG	1.00E-01	
91-58-7	2-Chloronaphthalene		400	U	UG/KG	3.28E+01	
95-57-8	2-Chlorophenol		400	U	UG/KG	1.65E+00	
91-57-6	2-Methylnaphthalene		400	U	UG/KG	1.23E-01	
95-48-7	2-Methylphenol		400	U	UG/KG	9.90E-03	
88-74-4	2-Nitroaniline		2000	U	UG/KG	2.70E-02	
88-75-5	2-Nitrophenol		400	U	UG/KG	2.50E-01	
91-94-1	3,3'-Dichlorobenzidine		400	U	UG/KG	6.19E-01	
99-09-2	3-Nitroaniline		2000	U	UG/KG	6.33E-01	
534-52-1	4,6-Dinitro-2-methylphenol		2000	U	UG/KG		
101-55-3	4-Bromophenyl phenyl ether		400	U	UG/KG		
59-50-7	4-Chloro-3-methylphenol		400	U	UG/KG	5.03E-02	
106-47-8	4-Chloroaniline		790	U	UG/KG	7.18E-01	
7005-72-3	4-Chlorophenyl phenyl ether		400	U	UG/KG		
106-44-5	4-Methylphenol		400	U	UG/KG	2.45E-03	
100-01-6	4-Nitroaniline		2000	U	UG/KG	9.13E-02	
100-02-7	4-Nitrophenol		2000	U	UG/KG	2.86E-01	
83-32-9	Acenaphthene		400	U	UG/KG	5.86E-04	
208-96-8	Acenaphthylene		400	U	UG/KG	5.86E-04	
120-12-7	Anthracene		400	U	UG/KG	2.70E-04	
56-55-3	Benzo(a)anthracene		400	U	UG/KG	7.68E-02	
50-32-8	Benzo(a)pyrene		400	U	UG/KG	9.09E-05	
205-99-2	Benzo(b)fluoranthene		400	U	UG/KG	6.69E-03	
191-24-2	Benzo(g,h,i)perylene		400	U	UG/KG	3.36E-03	
207-08-9	Benzo(k)fluoranthene		400	U	UG/KG	6.69E-03	
111-91-1	bis(2-Chloroethoxy)methane		400	U	UG/KG	1.32E+00	
111-44-4	bis(2-Chloroethyl) ether		400	U	UG/KG	1.69E-02	
108-60-1	bis(2-Chloroisopropyl) ether		400	U	UG/KG		
117-81-7	bis(2-Ethylhexyl) phthalate (DEHP)		400	U	UG/KG	4.32E-01	
85-68-7	Butyl benzyl phthalate		400	U	UG/KG	1.67E+00	
86-74-8	Carbazole		400	U	UG/KG		
218-01-9	Chrysene		400	U	UG/KG	8.46E-02	
84-74-2	Di-n-butyl phthalate		400	U	UG/KG	2.00E-03	
117-84-0	Di-n-octyl phthalate		400	U	UG/KG	5.64E-04	
53-70-3	Dibenz(a,h)anthracene		400	U	UG/KG	2.17E-02	
132-64-9	Dibenzofuran		400	U	UG/KG		
84-66-2	Diethyl phthalate		400	U	UG/KG	4.00E-03	
131-11-3	Dimethyl phthalate		400	U	UG/KG	2.00E-03	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 40-7  
ECOLOGICAL SCREENING OF SOIL RESULTS FROM AUS-0107**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Background (SOIL)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ) (SOIL)	Retained as Potential Bioaccumulator
206-44-0	Fluoranthene		400	U	UG/KG	3.28E-03	
86-73-7	Fluorene		400	U	UG/KG	1.33E-02	
118-74-1	Hexachlorobenzene		400	U	UG/KG	4.00E-04	
87-68-3	Hexachlorobutadiene		400	U	UG/KG	1.01E+01	
77-47-4	Hexachlorocyclopentadiene		400	U	UG/KG	4.00E-02	
67-72-1	Hexachloroethane		400	U	UG/KG	6.71E-01	
193-39-5	Indeno(1,2,3-c,d)pyrene		400	U	UG/KG	3.67E-03	
78-59-1	Isophorone		400	U	UG/KG	2.88E-03	
621-64-7	N-Nitroso-di-n-propylamine		400	U	UG/KG	7.36E-01	
86-30-6	N-Nitrosodiphenylamine		400	U	UG/KG	2.00E-02	
91-20-3	Naphthalene		400	U	UG/KG	1.61E-03	
87-86-5	Pentachlorophenol		2000	U	UG/KG	3.33E-01	
85-01-8	Phenanthrene		400	U	UG/KG	8.75E-03	
108-95-2	Phenol		400	U	UG/KG	1.00E-02	
129-00-0	Pyrene		400	U	UG/KG	5.10E-03	
<b>Explosives</b>							
99-35-4	1,3,5-Trinitrobenzene		300	UJ	UG/KG	7.98E-01	
99-65-0	1,3-Dinitrobenzene		300	UJ	UG/KG	4.58E-01	
118-96-7	2,4,6-Trinitrotoluene (TNT)		590	UJ	UG/KG	1.97E-02	
121-14-2	2,4-Dinitrotoluene		300	UJ	UG/KG	2.34E-01	
606-20-2	2,6-Dinitrotoluene		400	U	UG/KG	1.22E+01	
35572-78-2	2-Amino-4,6-Dinitrotoluene		590	UJ	UG/KG	7.38E-03	
88-72-2	2-Nitrotoluene (ONT)		590	UJ	UG/KG		
99-08-1	3-Nitrotoluene		590	UJ	UG/KG		
19406-51-0	4-Amino-2,6-Dinitrotoluene		590	UJ	UG/KG		
99-99-0	4-Nitrotoluene (PNT)		590	UJ	UG/KG		
2691-41-0	HMX		590	UJ	UG/KG	2.36E-02	
98-95-3	Nitrobenzene		300	UJ	UG/KG	7.50E-03	
121-82-4	RDX		590	UJ	UG/KG	5.90E-03	
479-45-8	Tetryl		890	UJ	UG/KG		
<b>Metals</b>							
7429-90-5	Aluminum	28800	7680		MG/KG		
7440-36-0	Antimony	0.83	0.26	J	MG/KG	5.20E-02	
7440-38-2	Arsenic	13.5	6.2		MG/KG	6.89E-01	
7440-39-3	Barium	195	68.1		MG/KG	1.36E-01	
7440-41-7	Beryllium	0.76	0.59	U	MG/KG	5.90E-02	
7440-42-8	Boron	5.3	12	U	MG/KG	2.40E+01	
7440-43-9	Cadmium	0.19	0.28	J	MG/KG	9.66E-03	
7440-70-2	Calcium	2497	96500		MG/KG		
7440-47-3	Chromium	25.2	11.5		MG/KG	2.30E+00	
7440-48-4	Cobalt	21.7	1.5	J	MG/KG	7.50E-02	
7440-50-8	Copper	11.3	7.9		MG/KG	2.55E-01	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 40-7  
ECOLOGICAL SCREENING OF SOIL RESULTS FROM AUS-0107**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Background (SOIL)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ) (SOIL)	Retained as Potential Bioaccumulator
7439-89-6	Iron	19306	9720		MG/KG	4.86E+01	
7439-92-1	Lead	23.4	14		MG/KG	3.23E-02	
7439-95-4	Magnesium	1552	56300		MG/KG		
7439-96-5	Manganese	3640	592		MG/KG	5.92E+00	
7439-97-6	Mercury	0.06	0.07	J	MG/KG	1.00E-02	YES
7440-02-0	Nickel	18.9	6.7		MG/KG	2.23E-01	
2023695	Potassium	625	296		MG/KG		
7782-49-2	Selenium	2.34	0.52	J	MG/KG	5.20E-01	YES
7440-22-4	Silver	0.58	1.2	U	MG/KG	6.00E-01	
7440-23-5	Sodium	170	180	U	MG/KG		
7440-28-0	Thallium	0.41	1.2	U	MG/KG	1.20E+00	
7440-62-2	Vanadium	47.2	20.1		MG/KG	4.37E-01	
7440-66-6	Zinc	51.4	199	J	MG/KG	1.66E+00	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

TABLE 40-8, AUS-0107  
SUMMARY OF HUMAN HEALTH COPC EVALUATION

AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Chemical	Surface Water		Trench Water		Sediment		Soil	
	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale
<b>Volatile Organic Compounds</b>								
1,1,1-Trichloroethane	NA	NA	No	A	NA	NA	No	A
1,1,2,2-Tetrachloroethane	NA	NA	Uncertainty	B	NA	NA	Uncertainty	B
1,1,2-Trichloroethane	NA	NA	Uncertainty	B	NA	NA	Uncertainty	B
1,1-Dichloroethane	NA	NA	No	A	NA	NA	No	A
1,1-Dichloroethene	NA	NA	Uncertainty	B	NA	NA	Uncertainty	B
1,2-Dichloroethane (EDC)	NA	NA	Uncertainty	B	NA	NA	Uncertainty	B
1,2-Dichloroethene (total)	NA	NA	NA	NA	NA	NA	No	A
1,2-Dichloropropane	NA	NA	Uncertainty	B	NA	NA	Uncertainty	B
2-Butanone (MEK)	NA	NA	No	A	NA	NA	No	A
2-Hexanone	NA	NA	No	C	NA	NA	No	C
4-Methyl-2-pentanone (MIBK)	NA	NA	No	A	NA	NA	No	A
Acetone	NA	NA	No	A	NA	NA	No	A
Benzene	NA	NA	Uncertainty	B	NA	NA	Uncertainty	B
Bromodichloromethane	NA	NA	Uncertainty	B	NA	NA	No	A
Bromoform	NA	NA	No	A	NA	NA	No	A
Bromomethane	NA	NA	No	A	NA	NA	No	A
Carbon disulfide	NA	NA	No	A	NA	NA	No	A
Carbon tetrachloride	NA	NA	Uncertainty	B	NA	NA	Uncertainty	B
Chlorobenzene	NA	NA	No	A	NA	NA	No	A
Chloroethane	NA	NA	No	A	NA	NA	No	A
Chloroform	NA	NA	Uncertainty	B	NA	NA	No	A
Chloromethane	NA	NA	No	A	NA	NA	No	A
cis-1,2-Dichloroethene	NA	NA	No	A	NA	NA	No	A
cis-1,3-Dichloropropene	NA	NA	Uncertainty	B	NA	NA	No	A
Dibromochloromethane	NA	NA	Uncertainty	B	NA	NA	No	A
Ethylbenzene	NA	NA	No	A	NA	NA	No	A
Methylene chloride	NA	NA	No	A	NA	NA	Uncertainty	B
N-Hexane	NA	NA	No	A	NA	NA	No	A
Styrene	NA	NA	No	A	NA	NA	No	A
Tetrachloroethylene (PCE)	NA	NA	No	A	NA	NA	Uncertainty	B
Toluene	NA	NA	No	A	NA	NA	No	A
total Xylenes	NA	NA	No	A	NA	NA	No	A
trans-1,2-Dichloroethene	NA	NA	No	A	NA	NA	No	A
trans-1,3-Dichloropropene	NA	NA	Uncertainty	B	NA	NA	No	A
Trichloroethylene (TCE)	NA	NA	No	A	NA	NA	Uncertainty	B
Vinyl chloride	NA	NA	Uncertainty	B	NA	NA	Uncertainty	B
<b>Semivolatile Organic Compounds</b>								
1,2,4-Trichlorobenzene	NA	NA	No	A	NA	NA	Uncertainty	B
1,2-Dichlorobenzene	NA	NA	No	A	NA	NA	No	A
1,3-Dichlorobenzene	NA	NA	Uncertainty	B	NA	NA	No	A
1,4-Dichlorobenzene	NA	NA	Uncertainty	B	NA	NA	Uncertainty	B
2,4,5-Trichlorophenol	NA	NA	No	A	NA	NA	No	A

TABLE 40-8, AUS-0107  
SUMMARY OF HUMAN HEALTH COPC EVALUATION

AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Chemical	Surface Water		Trench Water		Sediment		Soil	
	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale
2,4,6-Trichlorophenol	NA	NA	Uncertainty	B	NA	NA	Uncertainty	B
2,4-Dichlorophenol	NA	NA	No	A	NA	NA	Uncertainty	B
2,4-Dimethylphenol	NA	NA	No	A	NA	NA	Uncertainty	B
2,4-Dinitrophenol	NA	NA	No	A	NA	NA	Uncertainty	B
2-Chloronaphthalene	NA	NA	No	A	NA	NA	No	A
2-Chlorophenol	NA	NA	No	A	NA	NA	Uncertainty	B
1-Methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	NA	NA	No	A	NA	NA	No	A
2-Methylphenol	NA	NA	No	A	NA	NA	No	A
2-Nitroaniline	NA	NA	Uncertainty	B	NA	NA	No	A
2-Nitrophenol	NA	NA	No	A	NA	NA	No	A
3,3'-Dichlorobenzidine	NA	NA	Uncertainty	B	NA	NA	Uncertainty	B
3-Nitroaniline	NA	NA	Uncertainty	B	NA	NA	No	A
4,6-Dinitro-2-methylphenol	NA	NA	No	C	NA	NA	No	C
4-Bromophenyl phenyl ether	NA	NA	No	C	NA	NA	No	C
4-Chloro-3-methylphenol	NA	NA	No	A	NA	NA	No	A
4-Chloroaniline	NA	NA	No	A	NA	NA	Uncertainty	B
4-Chlorophenyl phenyl ether	NA	NA	No	C	NA	NA	No	C
4-Methylphenol	NA	NA	No	A	NA	NA	No	A
4-Nitroaniline	NA	NA	Uncertainty	B	NA	NA	No	A
4-Nitrophenol	NA	NA	No	A	NA	NA	No	A
Acenaphthene	NA	NA	No	A	NA	NA	No	A
Acenaphthylene	NA	NA	No	A	NA	NA	No	A
Anthracene	NA	NA	No	A	NA	NA	No	A
Benzo(a)anthracene	NA	NA	Uncertainty	B	NA	NA	Uncertainty	B
Benzo(a)pyrene	NA	NA	Uncertainty	B	NA	NA	Uncertainty	B
Benzo(b)fluoranthene	NA	NA	Uncertainty	B	NA	NA	Uncertainty	B
Benzo(g,h,i)perylene	NA	NA	No	A	NA	NA	No	A
Benzo(k)fluoranthene	NA	NA	Uncertainty	B	NA	NA	No	A
bis(2-Chloroethoxy)methane	NA	NA	No	C	NA	NA	No	C
bis(2-Chloroethyl) ether	NA	NA	Uncertainty	B	NA	NA	Uncertainty	B
bis(2-Chloroisopropyl) ether	NA	NA	Uncertainty	B	NA	NA	No	A
bis(2-Ethylhexyl) phthalate	NA	NA	Uncertainty	B	NA	NA	No	A
Butyl benzyl phthalate	NA	NA	No	A	NA	NA	No	A
Carbazole	NA	NA	Uncertainty	B	NA	NA	Uncertainty	B
Chrysene	NA	NA	Uncertainty	B	NA	NA	No	A
Di-n-butyl phthalate	NA	NA	No	A	NA	NA	No	A
Di-n-octyl phthalate	NA	NA	No	A	NA	NA	No	A
Dibenz(a,h)anthracene	NA	NA	Uncertainty	B	NA	NA	Uncertainty	B
Dibenzofuran	NA	NA	No	A	NA	NA	No	A
Diethyl phthalate	NA	NA	No	A	NA	NA	No	A
Dimethyl phthalate	NA	NA	No	A	NA	NA	No	A
Fluoranthene	NA	NA	No	A	NA	NA	No	A

TABLE 40-8, AUS-0107  
SUMMARY OF HUMAN HEALTH COPC EVALUATION

AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Chemical	Surface Water		Trench Water		Sediment		Soil	
	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale
Fluorene	NA	NA	No	A	NA	NA	No	A
Hexachlorobenzene	NA	NA	Uncertainty	B	NA	NA	Uncertainty	B
Hexachlorobutadiene	NA	NA	Uncertainty	B	NA	NA	Uncertainty	B
Hexachlorocyclopentadiene	NA	NA	No	A	NA	NA	No	A
Hexachloroethane	NA	NA	Uncertainty	B	NA	NA	Uncertainty	B
Indeno(1,2,3-c,d)pyrene	NA	NA	Uncertainty	B	NA	NA	No	A
Isophorone	NA	NA	No	A	NA	NA	Uncertainty	B
N-Nitroso-di-n-propylamine	NA	NA	Uncertainty	B	NA	NA	Uncertainty	B
N-Nitrosodiphenylamine	NA	NA	No	A	NA	NA	Uncertainty	B
Naphthalene	NA	NA	Uncertainty	B	NA	NA	No	A
Pentachlorophenol	NA	NA	Uncertainty	B	NA	NA	Uncertainty	B
Phenanthrene	NA	NA	No	A	NA	NA	No	A
Phenol	NA	NA	No	A	NA	NA	No	A
Pyrene	NA	NA	No	A	NA	NA	No	A
<b>Metals and Inorganics</b>								
Aluminum	NA	NA	No	F	NA	NA	No	F
Antimony	NA	NA	No	A	NA	NA	No	F
Arsenic	NA	NA	Yes	E	NA	NA	Yes	D
Barium	NA	NA	No	F	NA	NA	No	F
Beryllium	NA	NA	Uncertainty	B	NA	NA	No	A
Boron	NA	NA	No	A	NA	NA	No	A
Cadmium	NA	NA	Uncertainty	B	NA	NA	No	F
Calcium	NA	NA	No	H	NA	NA	No	H
Chromium	NA	NA	No	F	NA	NA	Yes	D
Cobalt	NA	NA	No	A	NA	NA	No	F
Copper	NA	NA	No	A	NA	NA	No	F
Cyanide, Total	NA	NA	NA	NA	NA	NA	NA	NA
Iron	NA	NA	Yes	E	NA	NA	No	F
Lead	NA	NA	Yes	E	NA	NA	No	F
Magnesium	NA	NA	No	H	NA	NA	No	H
Manganese	NA	NA	Yes	E	NA	NA	No	F
Mercury	NA	NA	No	F	NA	NA	No	F
Nickel	NA	NA	No	F	NA	NA	No	F
Potassium	NA	NA	No	H	NA	NA	No	H
Selenium	NA	NA	No	A	NA	NA	Yes	D
Silver	NA	NA	No	A	NA	NA	No	A
Sodium	NA	NA	No	H	NA	NA	No	C
Thallium	NA	NA	Uncertainty	B	NA	NA	No	A
Vanadium	NA	NA	No	F	NA	NA	No	F
Zinc	NA	NA	No	F	NA	NA	No	F
<b>Explosives</b>								
1,3,5-Trinitrobenzene	NA	NA	No	A	NA	NA	No	A
1,3-Dinitrobenzene	NA	NA	No	A	NA	NA	No	A



**TABLE 40-8, AUS-0107  
SUMMARY OF HUMAN HEALTH COPC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Trench Water		Sediment		Soil	
	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale
2,4,6-Trinitrotoluene (TNT)	NA	NA	No	A	NA	NA	No	A
2,4-Dinitrotoluene	NA	NA	No	A	NA	NA	Uncertainty	B
2,6-Dinitrotoluene	NA	NA	No	A	NA	NA	Uncertainty	B
2-Amino-4,6-Dinitrotoluene	NA	NA	No	C	NA	NA	No	C
2-Nitrotoluene (ONT)	NA	NA	No	C	NA	NA	No	C
3-Nitrotoluene	NA	NA	No	A	NA	NA	No	A
4-Amino-2,6-Dinitrotoluene	NA	NA	No	C	NA	NA	No	C
4-Nitrotoluene (PNT)	NA	NA	No	A	NA	NA	No	A
HMX	NA	NA	No	A	NA	NA	No	A
Nitrobenzene	NA	NA	No	A	NA	NA	Uncertainty	B
Nitroglycerin	NA	NA	NA	NA	NA	NA	NA	NA
Pentaerythritol tetranitrate (PETN)	NA	NA	NA	NA	NA	NA	NA	NA
Perchloric Acid	NA	NA	NA	NA	NA	NA	NA	NA
RDX	NA	NA	No	A	NA	NA	No	A
Tetryl	NA	NA	No	A	NA	NA	No	A
<b>Other Parameters</b>								
Nitrogen, Nitrate-Nitrite	NA	NA	NA	NA	NA	NA	NA	NA
Phosphorus, Total (as P)	NA	NA	NA	NA	NA	NA	NA	NA

- A - Chemical was not detected and the reporting limit does not exceed the screening concentration.
- B - Chemical was not detected, but reporting limit was equal to or exceeded screening concentration.
- C - Chemical was not detected and there is no screening concentration.
- D - Chemical was detected and was equal to or exceeded screening concentration, but did not exceed background.
- E - Chemical was detected and was equal to or exceeded screening concentration and background, if applicable.
- F - Chemical was detected and did not exceed screening concentration.
- G - Chemical was detected, but no screening value was available.
- H - Chemical was detected, but it is an essential nutrient.
- J - Chemical was classified as a COPC based on USEPA 1998 data but was not a COPC based on SI data.
- NA - Not Analyzed or not applicable.

**TABLE 40-9, AUS-0107  
SUMMARY OF ECOLOGICAL COPEC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Sediment		Soil	
	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale
<b>Volatile Organic Compounds</b>						
1,1,1-Trichloroethane	NA	NA	NA	NA	No	A
1,1,2,2-Tetrachloroethane	NA	NA	NA	NA	No	A
1,1,2-Trichloroethane	NA	NA	NA	NA	No	A
1,1-Dichloroethane	NA	NA	NA	NA	No	A
1,1-Dichloroethene	NA	NA	NA	NA	No	A
1,2-Dichloroethane (EDC)	NA	NA	NA	NA	No	A
1,2-Dichloroethene (total)	NA	NA	NA	NA	No	A
1,2-Dichloropropane	NA	NA	NA	NA	No	A
2-Butanone (MEK)	NA	NA	NA	NA	No	A
2-Hexanone	NA	NA	NA	NA	No	A
4-Methyl-2-pentanone (MIBK)	NA	NA	NA	NA	No	A
Acetone	NA	NA	NA	NA	No	A
Benzene	NA	NA	NA	NA	No	A
Bromodichloromethane	NA	NA	NA	NA	No	A
Bromoform	NA	NA	NA	NA	No	A
Bromomethane	NA	NA	NA	NA	No	A
Carbon disulfide	NA	NA	NA	NA	No	A
Carbon tetrachloride	NA	NA	NA	NA	No	A
Chlorobenzene	NA	NA	NA	NA	No	A
Chloroethane	NA	NA	NA	NA	No	C
Chloroform	NA	NA	NA	NA	No	A
Chloromethane	NA	NA	NA	NA	No	A
cis-1,2-Dichloroethene	NA	NA	NA	NA	No	A
cis-1,3-Dichloropropene	NA	NA	NA	NA	No	A
Dibromochloromethane	NA	NA	NA	NA	No	A
Ethylbenzene	NA	NA	NA	NA	No	A
Methylene chloride	NA	NA	NA	NA	No	A
N-Hexane	NA	NA	NA	NA	No	C
Styrene	NA	NA	NA	NA	No	A
Tetrachloroethylene (PCE)	NA	NA	NA	NA	No	A
Toluene	NA	NA	NA	NA	No	A
total Xylenes	NA	NA	NA	NA	No	A
trans-1,2-Dichloroethene	NA	NA	NA	NA	No	A
trans-1,3-Dichloropropene	NA	NA	NA	NA	No	A
Trichloroethylene (TCE)	NA	NA	NA	NA	No	A
Vinyl chloride	NA	NA	NA	NA	No	A
<b>Semivolatile Organic Compounds</b>						
1,2,4-Trichlorobenzene	NA	NA	NA	NA	No	A
1,2-Dichlorobenzene	NA	NA	NA	NA	No	A
1,3-Dichlorobenzene	NA	NA	NA	NA	No	A
1,4-Dichlorobenzene	NA	NA	NA	NA	No	A
2,4,5-Trichlorophenol	NA	NA	NA	NA	No	A

TABLE 40-9, AUS-0107  
SUMMARY OF ECOLOGICAL COPEC EVALUATION

AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Chemical	Surface Water		Sediment		Soil	
	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale
2,4,6-Trichlorophenol	NA	NA	NA	NA	No	A
2,4-Dichlorophenol	NA	NA	NA	NA	No	A
2,4-Dimethylphenol	NA	NA	NA	NA	Uncertainty	B
2,4-Dinitrophenol	NA	NA	NA	NA	No	A
2-Chloronaphthalene	NA	NA	NA	NA	Uncertainty	B
2-Chlorophenol	NA	NA	NA	NA	Uncertainty	B
1-Methylnaphthalene	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	NA	NA	NA	NA	No	A
2-Methylphenol	NA	NA	NA	NA	No	A
2-Nitroaniline	NA	NA	NA	NA	No	A
2-Nitrophenol	NA	NA	NA	NA	No	A
3,3'-Dichlorobenzidine	NA	NA	NA	NA	No	A
3-Nitroaniline	NA	NA	NA	NA	No	A
4,6-Dinitro-2-methylphenol	NA	NA	NA	NA	No	C
4-Bromophenyl phenyl ether	NA	NA	NA	NA	No	C
4-Chloro-3-methylphenol	NA	NA	NA	NA	No	A
4-Chloroaniline	NA	NA	NA	NA	No	A
4-Chlorophenyl phenyl ether	NA	NA	NA	NA	No	C
4-Methylphenol	NA	NA	NA	NA	No	A
4-Nitroaniline	NA	NA	NA	NA	No	A
4-Nitrophenol	NA	NA	NA	NA	No	A
Acenaphthene	NA	NA	NA	NA	No	A
Acenaphthylene	NA	NA	NA	NA	No	A
Anthracene	NA	NA	NA	NA	No	A
Benzo(a)anthracene	NA	NA	NA	NA	No	A
Benzo(a)pyrene	NA	NA	NA	NA	No	A
Benzo(b)fluoranthene	NA	NA	NA	NA	No	A
Benzo(g,h,i)perylene	NA	NA	NA	NA	No	A
Benzo(k)fluoranthene	NA	NA	NA	NA	No	A
bis(2-Chloroethoxy)methane	NA	NA	NA	NA	Uncertainty	B
bis(2-Chloroethyl) ether	NA	NA	NA	NA	No	A
bis(2-Chloroisopropyl) ether	NA	NA	NA	NA	No	C
bis(2-Ethylhexyl) phthalate	NA	NA	NA	NA	No	A
Butyl benzyl phthalate	NA	NA	NA	NA	Uncertainty	B
Carbazole	NA	NA	NA	NA	No	C
Chrysene	NA	NA	NA	NA	No	A
Di-n-butyl phthalate	NA	NA	NA	NA	No	A
Di-n-octyl phthalate	NA	NA	NA	NA	No	A
Dibenz(a,h)anthracene	NA	NA	NA	NA	No	A
Dibenzofuran	NA	NA	NA	NA	No	C
Diethyl phthalate	NA	NA	NA	NA	No	A
Dimethyl phthalate	NA	NA	NA	NA	No	A
Fluoranthene	NA	NA	NA	NA	No	A

TABLE 40-9, AUS-0107  
SUMMARY OF ECOLOGICAL COPEC EVALUATION

AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Chemical	Surface Water		Sediment		Soil	
	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale
Fluorene	NA	NA	NA	NA	No	A
Hexachlorobenzene	NA	NA	NA	NA	No	A
Hexachlorobutadiene	NA	NA	NA	NA	Uncertainty	B
Hexachlorocyclopentadiene	NA	NA	NA	NA	No	A
Hexachloroethane	NA	NA	NA	NA	No	A
Indeno(1,2,3-c,d)pyrene	NA	NA	NA	NA	No	A
Isophorone	NA	NA	NA	NA	No	A
N-Nitroso-di-n-propylamine	NA	NA	NA	NA	No	A
N-Nitrosodiphenylamine	NA	NA	NA	NA	No	A
Naphthalene	NA	NA	NA	NA	No	A
Pentachlorophenol	NA	NA	NA	NA	No	A
Phenanthrene	NA	NA	NA	NA	No	A
Phenol	NA	NA	NA	NA	No	A
Pyrene	NA	NA	NA	NA	No	A
<b>Metals and Inorganics</b>						
Aluminum	NA	NA	NA	NA	Uncertainty	I
Antimony	NA	NA	NA	NA	No	F
Arsenic	NA	NA	NA	NA	No	F
Barium	NA	NA	NA	NA	No	F
Beryllium	NA	NA	NA	NA	No	A
Boron	NA	NA	NA	NA	Uncertainty	B
Cadmium	NA	NA	NA	NA	No	F
Calcium	NA	NA	NA	NA	Uncertainty	G,H
Chromium	NA	NA	NA	NA	Yes	D
Cobalt	NA	NA	NA	NA	No	F
Copper	NA	NA	NA	NA	No	F
Cyanide, Total	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	Yes	D
Lead	NA	NA	NA	NA	No	F
Magnesium	NA	NA	NA	NA	Uncertainty	G,H
Manganese	NA	NA	NA	NA	Yes	D
Mercury	NA	NA	NA	NA	Yes	E
Nickel	NA	NA	NA	NA	No	F
Potassium	NA	NA	NA	NA	Uncertainty	G,H
Selenium	NA	NA	NA	NA	Yes	D
Silver	NA	NA	NA	NA	No	A
Sodium	NA	NA	NA	NA	Uncertainty	G,H
Thallium	NA	NA	NA	NA	Uncertainty	B
Vanadium	NA	NA	NA	NA	No	F
Zinc	NA	NA	NA	NA	Yes	E
<b>Explosives</b>						
1,3,5-Trinitrobenzene	NA	NA	NA	NA	No	A
1,3-Dinitrobenzene	NA	NA	NA	NA	No	A

**TABLE 40-9, AUS-0107  
SUMMARY OF ECOLOGICAL COPEC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Sediment		Soil	
	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale
2,4,6-Trinitrotoluene (TNT)	NA	NA	NA	NA	No	A
2,4-Dinitrotoluene	NA	NA	NA	NA	No	A
2,6-Dinitrotoluene	NA	NA	NA	NA	Uncertainty	B
2-Amino-4,6-Dinitrotoluene	NA	NA	NA	NA	No	A
2-Nitrotoluene (ONT)	NA	NA	NA	NA	No	C
3-Nitrotoluene	NA	NA	NA	NA	No	C
4-Amino-2,6-Dinitrotoluene	NA	NA	NA	NA	No	C
4-Nitrotoluene (PNT)	NA	NA	NA	NA	No	C
HMX	NA	NA	NA	NA	No	A
Nitrobenzene	NA	NA	NA	NA	No	A
Nitroglycerin	NA	NA	NA	NA	NA	NA
Pentaerythritol tetranitrate (PETN)	NA	NA	NA	NA	NA	NA
Perchloric Acid	NA	NA	NA	NA	NA	NA
RDX	NA	NA	NA	NA	No	A
Tetryl	NA	NA	NA	NA	No	C


- A - Chemical was not detected and the reporting limit does not exceed the screening concentration.
- B - Chemical was not detected, but reporting limit was equal to or exceeded screening concentration.
- C - Chemical was not detected and there is no screening concentration.
- D - Chemical was detected and was equal to or exceeded screening concentration, but did not exceed background.
- E - Chemical was detected and was equal to or exceeded screening concentration and background, if applicable.
- F - Chemical was detected and did not exceed screening concentration.
- G - Chemical was detected, but no screening value was available.
- H - Chemical was detected, but it is an essential nutrient.
- I - If pH<5.5, Aluminum is a COPEC, otherwise it is not.
- J - Chemical was classified as a COPEC based on USEPA 1998 data but was not a COPEC based on SI data.
- NA - Not Analyzed or not applicable.

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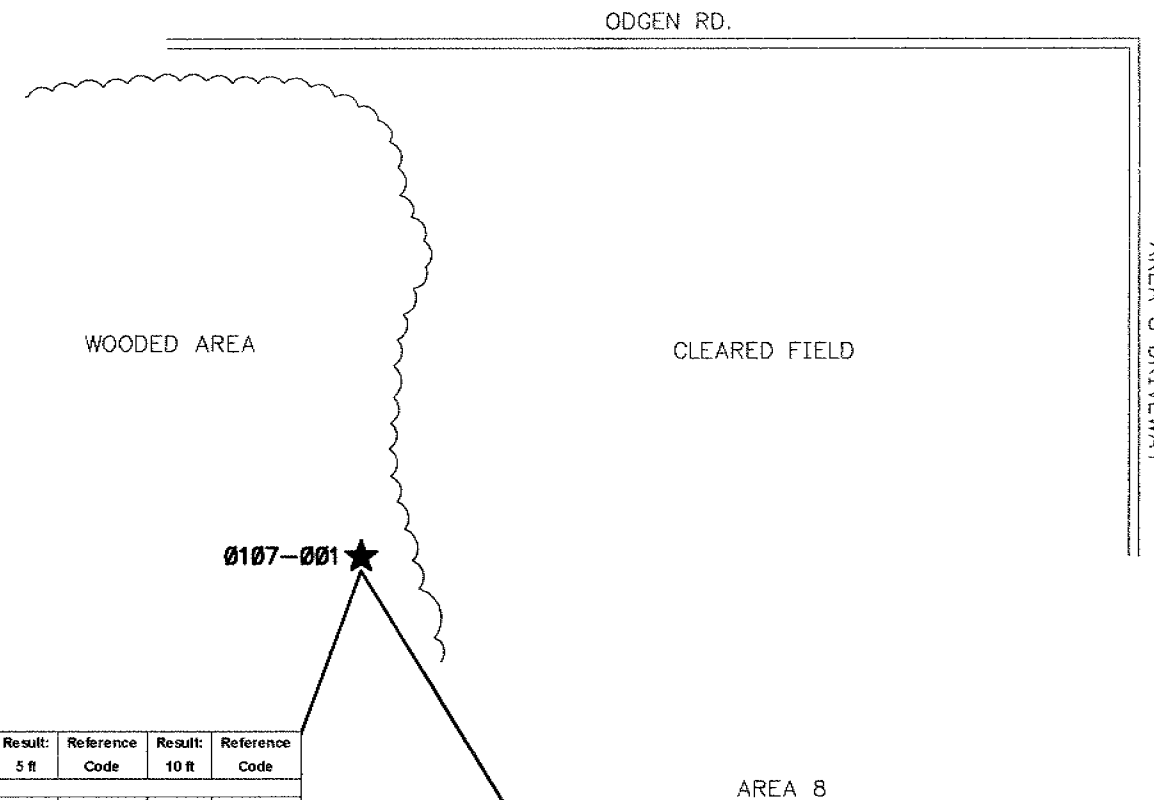
# AUS-0107-POSSIBLE FORMER DISPOSAL AREA

## LEGEND

- ★ TEST PIT LOCATION
- ~ TREELINE

APPROXIMATE  
  
 NOT TO SCALE

AUS-0107-001	Units	Result:	Reference	Result:	Reference	Result:	Reference	Result:	Reference
		0 - 6 in	Code	2 ft	Code	5 ft	Code	10 ft	Code
<b>Volatile Organic Compounds</b>									
All VOCs	UG/KG	NA		ND		ND		NA	
<b>Semivolatile Organic Compounds</b>									
All SVOCs	UG/KG	ND		NA		NA		ND	
<b>Explosives</b>									
All Explosives	UG/KG	ND		NA		NA		ND	
<b>Metals</b>									
All Metals	MG/KG			NA		NA			
Aluminum	MG/KG	2880						7680	
Antimony (duplicate)	MG/KG	0.26						NA	
Arsenic	MG/KG	6.2	h1,h5,h7					2.4	h5
Barium	MG/KG	40.5						68.1	
Cadmium	MG/KG	0.2	b1					ND	
Calcium	MG/KG	93200	b1					2390	
Chromium	MG/KG	5.2	e1,h5					11.5	e1,h5
Cobalt	MG/KG	ND						1.5	
Copper	MG/KG	ND						7.9	
Iron	MG/KG	9280	e1					9720	e1
Lead	MG/KG	14						7.7	
Magnesium	MG/KG	53800	b1					1920	b1
Manganese	MG/KG	592	e1					94.1	
Mercury (duplicate)	MG/KG	0.07	b1,h5					NA	
Nickel	MG/KG	3.9						6.7	
Potassium	MG/KG	218						296	
Selenium	MG/KG	0.52	e5,h5					ND	
Vanadium	MG/KG	12.8						20.1	
Zinc (duplicate)	MG/KG	199	b1,e1					22.1	



AUS-0107-001-GW-00 (Trench Water)	Units	Result	Screening Codes
<b>Volatile Organic Compounds</b>			
All VOCs	UG/L	ND	
<b>Semivolatile Organic Compounds</b>			
All SVOCs	UG/L	ND	
<b>Explosives</b>			
All Explosives	UG/L	ND	
<b>Metals</b>			
Aluminum	UG/L	23800	
Arsenic	UG/L	13.5	h3,h4
Barium	UG/L	355	
Calcium	UG/L	127000	
Chromium	UG/L	30.8	
Iron	UG/L	27200	h4,h5
Lead	UG/L	24.5	h5
Magnesium	UG/L	70400	
Manganese	UG/L	840	h5
Mercury	UG/L	0.13	
Nickel	UG/L	23	
Potassium	UG/L	1790	
Sodium	UG/L	39400	
Vanadium	UG/L	48.3	
Zinc	UG/L	90.3	

Screening Reference	Reference Code
AUS Background Soil UTL	b1
Little Grassy Background Sediment UTL	b2
Little Grassy Background Surface Water UTL	b3
Ecological Direct Exposure Pathway TRV - Soil	e1
Ecological Direct Exposure Pathway TRV - Sediment	e2
Ecological Direct Exposure Pathway TRV - Surface Water	e3
IEPA General Use Surface Water Quality Aquatic Life Toxicity	e4
Superfund Chemical Data Matrix Kow values (potential bioaccumulator)	e5
USEPA Region IX Industrial Soil PRG - cancerous	h1
USEPA Region IX Industrial Soil PRG - noncancerous	h2
USEPA Region IX Tap Water PRG - cancerous	h3
USEPA Region IX Tap Water PRG - noncancerous	h4
USEPA Region IX Migration to Groundwater PRG (DAF=1)	h5
USEPA MCL Drinking Water Standards	h6
IEPA TACO Industrial/Commercial Soil Ingestion	h7
IEPA TACO Construction Worker Soil Ingestion	h8
IEPA TACO Class I Soil Component of Groundwater	h9
IEPA General Use Surface Water Quality Human Health	h10

## NOTES:

- DRAWING TAKEN FROM FIELD SKETCH DRAWN ON 10/17/00.
- DATA QUALIFIERS FOR ANALYTICAL RESULTS ARE NOT INDICATED. REFER TO THE QCSR FOR DATA QUALIFIERS.
- THE FOLLOWING COMPOUNDS ARE INCLUDED IN THE ANALYTE LIST FOR BOTH SVOCs AND EXPLOSIVES: 2,4-DINITROTOLUENE, 2,6-DINITROTOLUENE, AND NITROBENZENE. THESE COMPOUNDS MAY BE REPORTED AS EITHER SVOCs OR EXPLOSIVES.

PA/SI REPORT-AUS OU CRAB ORCHARD NWR MARION, ILLINOIS	PROJECT NO. 2320000026.00
<b>URS</b>	
DRN. BY: djd 10/24/00 DSGN. BY: are CHKD. BY: mch/cmw	AUS-0107 Sample Locations and Detections in Soils and Trench Water
FIG. NO. 40-1	

**SECTION FORTY-ONE****Possible Disposal Area East of COC-10**

AUS-0108 is a possible surface disposal area that was identified from the historical aerial photograph interpretation done by Entech, Inc.<sup>1</sup> The general location of AUS-0108 is shown in Figure 30-1, and Figure 41-3 is a more detailed site map.

**AUS Original Site Designations**

AUS-0108 was not one of the original Additional and Uncharacterized Sites Operable Unit (AUS OU) sites designated in 1997-1999 by the United States Fish & Wildlife Service (USFWS).

**41.1 HISTORIC SEARCH INFORMATION****41.1.1 Site Description**

This site is located in a wooded area just east of a field that was being used for agricultural purposes at the time of this investigation. It is located north of Area 11, on the north side of Ogden Road. The site is approximately 0.7 miles west of the intersection of Route 148 and Ogden Road, and approximately 1,300 feet (ft) north of Ogden Road, just east of a field. AUS-0108 is located near the southeast corner of Site COC-10 of the Explosives/Munitions Manufacturing Area Operable Unit (EMMA OU) (Figure 41-1).

**41.1.2 Operational History and Waste Characteristics**

AUS-0108 was identified in the historical aerial photograph interpretation. The 1951 aerial photograph showed a "possible explosives demolition area containing numerous liquid-filled craters" (EMMA OU Site COC-10) and a "possible surface disposal site" with light-toned surface debris (AUS-0108).<sup>2</sup> Access roads to both locations are visible on the 1951 photograph. The "possible surface disposal site" was located near a former farmstead and there were two buildings previously located between COC-10 and AUS-0108 (to the west of AUS-0108) as first observed in the 1943 aerial photograph.<sup>3</sup> The use of these two buildings is unknown and it is not known how long they were present on site. By 1960, it appears that neither COC-10 nor AUS-0108 are still in use.<sup>4</sup>

<sup>1</sup> Entech, Inc., 1999, Historical Aerial Photographic Analysis – Inventory of Potential Disposal Sites: Additional and Uncharacterized Sites (AUS) Operable Unit, Crab Orchard National Wildlife Refuge, Marion, Illinois, Volume I (Text) Page 3-50, and Volume II (Maps) Page CC. The Entech reports analyze historic aerial overflight photographs of industrial areas at the Refuge, from 1943 to 1993. The photos were obtained from the National Archives and Records Administration (NARA) and the U.S. Department of Agriculture Agricultural Stabilization and Conservation Service (ASCS).

<sup>2</sup> Entech, Inc., 1999, Historical Aerial Photographic Analysis – Inventory of Potential Disposal Sites: Additional and Uncharacterized Sites (AUS) Operable Unit, Crab Orchard National Wildlife Refuge, Marion, Illinois, Volume I (Text) Page 3-50.

<sup>3</sup> Entech, Inc., 1999, Historical Aerial Photographic Analysis – Inventory of Potential Disposal Sites: Additional and Uncharacterized Sites (AUS) Operable Unit, Crab Orchard National Wildlife Refuge, Marion, Illinois, Volume I (Text) Page 3-50.

<sup>4</sup> Entech, Inc., 1999, Historical Aerial Photographic Analysis – Inventory of Potential Disposal Sites: Additional and Uncharacterized Sites (AUS) Operable Unit, Crab Orchard National Wildlife Refuge, Marion, Illinois, Volume I (Text) Page 3-50.

**SECTION FORTY-ONE****Possible Disposal Area East of COC-10**

There were no known industrial lessees of this property.

**41.1.3 AUS-0108 Previous Sampling Results**

Previous investigations have been done at former EMMA OU site COC-10, resulting in the recommendation of no further action at that site. Figure 4-1 shows the location of COC-10 and Figure 41-2 presents the previous sampling results for COC-10. There have been no previous investigations at AUS-0108.

**41.1.4 Observations During Site Visit**

Some concrete rubble was observed on the site. To the northeast of this site, there is a fenced area (approximately 125 ft by 125 ft) containing a pond, which has been identified as EMMA OU Site COC-10.

**41.1.5 Recommendations Based on Preliminary Assessment**

AUS-0108 was included in the Site Investigation (SI) because of the potential for surface disposal and because of its proximity to EMMA OU Site COC-10. Based on aerial photos, it appears to have been in use at the same time as COC-10. Since there was no other known relevant activity in this immediate area, it is assumed that the surface disposal area was associated with COC-10.

**41.2 SITE INVESTIGATION INFORMATION**

URS conducted a Site Investigation at AUS-0108 on May 9, 2000. The rationale for sample locations, media, and analytes is presented in the Field Sampling Plan (FSP)<sup>5</sup> for the AUS OU Preliminary Assessment/Site Investigation (PA/SI). Since the time the FSP was prepared, additional information has become available, and the historic discussion (Section 41.1) has been updated to include that information. The sampling locations discussed below are based on the information that was available at the time the FSP was developed, and may not address all areas of potential releases.

AUS OU SI sample locations are shown on Figure 41-3. Survey coordinates for all sample locations in AUS-0108 are listed in Table 41-1. Table 41-2 lists the sample locations and the matrix sampled at that location. All samples are soil samples.

**41.2.1 Field Investigation**

Sampling was done in accordance with the FSP, except as noted.

<sup>5</sup> U.S. Fish & Wildlife Service, Department of the Interior, March 2000, Draft Final Field Sampling Plan Site Inspection, Additional and Uncharacterized Sites Operable Unit, Crab Orchard National Wildlife Refuge Superfund Site, Marion, Illinois (Williamson County), prepared by URS Corporation.



**SECTION FORTY-ONE****Possible Disposal Area East of C0C-10****Possible Former Surface Disposal Area**

Two soil samples were collected. Sample 0108-001 was collected from an area of concrete rubble identified during the site reconnaissance and located in the field that is being used for agricultural purposes. Sample 0108-002 was collected from the possible former surface disposal area. Since there are no present-day features to indicate the area of potential surface disposal, the site was located by survey coordinates that were determined from aerial photographs<sup>6</sup>. These survey coordinates are shown in Table 41-1.

**41.2.2 Field Results****41.2.2.1 Site Conditions****41.2.2.1.1 *Geologic Conditions***

The only subsurface information from this site is from hand auger borings, which extended to a depth of one ft. The soil was described as silty clay fill.

**41.2.2.1.2 *Hydrogeologic Conditions***

No hydrogeological information is available for this site.

**41.2.2.1.3 *Hydrologic Conditions***

At the time of the field investigation, there was no evidence of surface water noted at the site, and no obvious drainageways.

**41.2.2.2 Chemical Results**

Table 41-3 lists the chemicals detected in AUS-0108 during this investigation, along with the frequency and range of detections.<sup>7</sup> Tabulated results of all analyses are included in the Quality Control Summary Report (QCSR). Figure 41-3 presents all sample results.

**41.3 SCREENING RISK ASSESSMENT**

Results of the screening are presented in Tables 41-4 and 41-5 as follows:

- Table 41-4--human health risk screening for soils, and
- Table 41-5--ecological risk screening for soils.

<sup>6</sup> At the beginning of the project, a test was conducted to estimate the accuracy of locating features from historic aerial photos. Using conventional methods, survey coordinates were obtained of a number of existing features at the Refuge that also appeared on a series of historic photos (for example, the corners of IOP buildings that are still existing). Entech independently obtained coordinates from the aerial photos. The coordinates obtained from the aerial photos were found to be in agreement with the coordinates obtained by conventional methods, within a few ft; acceptable for locating site features such as potential spills

<sup>7</sup> Duplicate results were not included in the range except when the maximum value detected was in a duplicate sample. Therefore there may be some duplicate samples with results below the low end of the range reported in the tables, that are not shown in the tables.

**SECTION FORTY-ONE****Possible Disposal Area East of COC-10**

Each table lists the maximum detected concentration for each constituent analyzed at AUS-0108. The screening results are presented in the tables in terms of hazard quotients (HQs). The HQ for any chemical detected, for any particular screening criterion is simply the ratio of the maximum detected concentration to the screening concentration. For human health for carcinogens, a screening level "cancer risk" is calculated instead of an HQ.

Chemicals that are shaded in the tables are those that exceeded the screening criteria, and are identified as chemicals of potential concern (COPCs) for human health risk, and chemicals of potential ecological concern (COPECs) for ecological risk. The only COPCs/COPECs not shaded in the table are those inorganic constituents that exceeded the screening criteria but were detected at levels below Refuge background.

In cases where the chemical was analyzed but not detected, the HQ is the ratio between the maximum reporting limit and the screening concentration. Chemicals not detected are identified with a "U" qualifier in the qualifier column. When these HQ values exceed one, they are not shaded. These constituents are not identified as COPCs/COPECs, but rather as uncertainties.

In Figure 41-3 the shading convention used is the same as for the tables discussed above. The particular screening criteria exceeded are indicated by the code in the analytical results labels. Duplicate results are shown only if the duplicate result for an analyte exceeded the screening criteria and the result from the original sample did not; or, if the analyte was detected in the duplicate and not in the original sample. Since in the screening process results which are qualified as estimated (coded with "J") are treated the same as unqualified results, data qualifiers are not included in the results shown in the figures. Refer to the QCSR for data qualifiers.

Tables 41-6 (human health risk) and 41-7 (ecological risk) list all the analytes and corresponding media sampled and indicate whether each is a COPC (or COPEC), not a COPC (or COPEC), or an uncertainty. The codes in the tables indicate the rationale for each classification. All COPCs (Table 41-6) and COPECs (Table 41-7) are shaded in the tables.

### 41.3.1 Human Health Risk

#### 41.3.1.1 Soil

Human health screening results for soil and samples are presented in Table 41-4. For carcinogens, a cancer risk was calculated using the United States Environmental Protection Agency (USEPA) Region 9 Industrial Soil Preliminary Remediation Goals (PRGs) as screening values. The cancer risk was derived by calculating a ratio of the maximum detected concentrations, or the maximum reporting limits, to their appropriate screening values. These ratios were then multiplied by  $1 \times 10^{-6}$ . In addition, ratios were calculated using the USEPA Region 9 Industrial Soil PRG for Toxins, the USEPA Region 9 Migration to Groundwater Criteria (Dilution Attenuation Factor (DAF)=1), the Illinois Tiered Approach to Corrective Action Objectives (TACO) Industrial/Commercial Soil Ingestion Criteria, the Illinois TACO Construction Worker Soil Ingestion Criteria, and the Illinois TACO Class I Soil Component of Groundwater Criteria.

**SECTION FORTY-ONE****Possible Disposal Area East of COC-10****41.3.2 Ecological Risk****41.3.2.1 Soil**

Ecological screening results for soil samples are presented in Table 41-5. Soil screening concentrations for direct exposures were developed using toxicity reference values (TRVs) derived from several sources, including the following:

- USEPA (2000)<sup>8</sup>
- Environment Canada (1995)<sup>9</sup>
- Talmage *et al.* (1999)<sup>10</sup>
- Efroymsen *et al.* (1997a, 1997b)<sup>11</sup>
- CCME (1999)<sup>12</sup>
- MHSPE (1994)<sup>13</sup>
- Other sources

A detailed discussion of the screening concentration selection is presented in Appendix G.

The screening approach for ingestion pathway exposures was based on the potential for a chemical to bioaccumulate. The potential for a chemical to bioaccumulate was based on the organic chemical-specific octanol-to-water partitioning coefficient ( $K_{ow}$ ), which provides an indication of the lipophilicity of an organic chemical, and its potential for sequestration in biological tissue. The document *Assessment and Control of Bioconcentratable Contaminants in Surface Waters* (USEPA 1991)<sup>14</sup> used a log  $K_{ow}$  of 3.5 as a target threshold value indicative of bioaccumulative chemicals to target organic chemicals of greatest concern. Using this as a guideline, organic chemicals with a log  $K_{ow}$  greater than 3.5 were considered potentially bioaccumulative chemicals. Among inorganics, mercury and selenium were considered as potentially bioaccumulative chemicals. Any potentially bioaccumulative chemical that is detected was retained as a COPEC.

<sup>8</sup> USEPA. 2000. Ecological Soil Screening Level Guidance (Draft). USEPA Office of Emergency and Remedial Response, Washington, DC.

<sup>9</sup> Environment Canada. 1995. Toxicity Testing of NCSRP Priority Substances for Development of Soil Quality Guidelines for Contaminated Sites. Guidelines Division, Evaluation and Interpretation Branch, Environmental Conservation Directorate, Environment Canada. Hull, Quebec.

<sup>10</sup> Talmage, S.S., D.M. Opresko, C.J. Maxwell, C.J.E. Welsh, F. M. Cretella, P.H. Reno, and F. B. Daniel. 1999. Nitroaromatic Munition Compounds: Environmental Effects and Screening Values. *Rev Environ. Contam. Toxicol* 161:1-156.

<sup>11</sup> Efroymsen, R.A., M.E. Will, G.W. Suter II, and A.C. Wooten. 1997a. *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision*. Oak Ridge National Laboratory, Oak Ridge, Tennessee. ES/ER/TM-85/R3.

Efroymsen, R.A., M.E. Will, and G.W. Suter II. 1997b. *Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision*. Oak Ridge National Laboratory, Oak Ridge, Tennessee. ES/ER/TM-126/R2.

<sup>12</sup> Canadian Council of Ministers of the Environment. 1999. Canadian Environmental Quality Guidelines.

<sup>13</sup> Ministry of Housing, Spatial Planning, and the Environment (MHSPE). 1994. *Intervention Values and Target Values – Soil Quality Standards*. Directorate General for Environmental Protection, Department of Soil Protection, The Hague, The Netherlands.

<sup>14</sup> USEPA 1991. *Assessment and Control of Bioconcentratable Contaminants in Surface Waters (Draft)*. US Environmental Protection Agency Office of Research and Development, Washington, D.C.

**SECTION FORTY-ONE****Possible Disposal Area East of COC-10****41.4 SCIENTIFIC MANAGEMENT DECISION POINT****41.4.1 Human Health Risk Evaluation**

Two soil samples were analyzed. No other media were sampled. This report recommends that inorganic constituents that exceeded project screening criteria but were within Refuge background levels not be retained as COPCs. These are the constituents coded with "D" on the COPC list, Table 41-6, and include antimony, arsenic, barium, chromium, nickel and selenium.

Only cadmium exceeded both the soil screening criteria and Refuge background values. The maximum cadmium concentration detected, 0.57J milligrams per kilogram (mg/kg), exceeded the calculated background value of 0.19 mg/kg for cadmium<sup>15</sup>. The Region 9 DAF 1 value for cadmium is 0.4 mg/kg. The screening value for the Illinois TACO soil component of the groundwater ingestion route for Class I groundwater was not exceeded. The Region 9 DAF 1 factor assumes that groundwater is at the surface, a somewhat conservative assumption for this site. The Region 9 screening value for DAF 20 (assuming a dilution/attenuation factor of 20) is 8 mg/kg, more than an order of magnitude greater than the maximum detected concentration. Based on these data and the magnitude of the detection, it is recommended that cadmium not be retained as a COPC based on potential groundwater impacts.

Several chemicals represent uncertainties for AUS-0108 because, while they were not detected, the reporting limit was equal to or exceeded the screening criteria. These are indicated as uncertainties on Table 41-6, and coded with a "B." The uncertainty associated with these chemicals is not considered to be significant.

In summary, results of the soil analyses at AUS-0108 indicate there are no chemicals present at levels of potential human health concern warranting further evaluation. It is recommended that none of the chemicals be retained as COPCs for this site.

**41.4.2 Ecological Risk Evaluation**

Among the organic compounds, an HQ of 6 was indicated for *carbon tetrachloride*. However, neither carbon tetrachloride, nor any other volatile organic compounds were detected in soils. The detection limit for carbon tetrachloride was 6 micrograms per kilogram (ug/kg). Because none were actually detected, the volatile organic compounds, including carbon tetrachloride, are not considered to be ecological concerns. Among the semivolatile organic compounds, HQs for several chemicals exceeded 1, ranging as high as 4.5. However, these were based entirely on the reporting limit, as none of these semivolatile organic compounds were detected at a reporting limit of 450 ug/kg. In fact, there were no volatile organic compounds, only one semivolatile organic compound was detected, and no explosives were detected, lending weight of evidence that organic chemicals are not of ecological concern at AUS-0108. The single organic detection was for bis(2-ethylhexyl)phthalate (0.83 J-qualified). Bis(2-ethylhexyl)phthalate was retained as a COPEC because it was detected and is a potential bioaccumulating constituent based on its Kow. Bis(2-ethylhexyl)phthalate is also a common laboratory contaminant and is often observed

<sup>15</sup> This the 95 percent upper tolerance limit (UTL), based on the 95 percent confidence level. See Section 2 for the development of background values.

**SECTION FORTY-ONE****Possible Disposal Area East of C0C-10**

in environmental samples. Though it was selected as a potential bioaccumulator based on its Kow, it is also readily metabolized, and thus is unlikely to biomagnify in food chains. Therefore, bis(2-ethylhexyl)phthalate is not considered a significant ecological concern at AUS-0108.

Among the inorganic compounds, HQs exceeded 1 for iron and thallium. Both mercury and selenium were also detected and are potentially bioaccumulative constituents. This report recommends that inorganic constituents which exceeded project screening criteria but were within Refuge background levels not be retained as COPECs for further evaluation. These are the constituents coded with "D" on Table 41-7 and include arsenic, boron, chromium, iron, manganese, mercury, and selenium.

*Thallium* - Though the HQ exceeded 1 (1.2), thallium was not detected. The hazard quotient is a function of the reporting limit in comparison with the ecological screening concentration. Because it was not detected, and the associated HQ is also low and based on a no-observed-effect concentration (NOEC), thallium is not considered a significant ecological concern.

Several inorganic chemicals represent uncertainties for AUS-0108 since they were detected but no screening concentrations were identified. These include calcium, magnesium, potassium, and sodium. Sodium was below background concentrations. Though calcium, magnesium and potassium were slightly above background levels, they are essential nutrients and are physiologically regulated. The uncertainty associated with these chemicals is not considered to be significant, and they are not believed to be ecological concerns.

In summary, results of the soil analyses at AUS-0108 indicate there are no chemicals present at levels of potential ecological concern that would warrant further evaluation of the site. It is recommended that none of the chemicals be retained as COPECs for AUS-0108.

**41.4.3 Summary of Recommendations**

Based on the above discussions, it is recommended that none of the constituents detected at Site AUS-0108 be retained for further evaluation. Site AUS-0108 is judged to require no further action.

**SECTION FORTY-ONE****Possible Disposal Area East of COC-10**

**TABLE 41-1**  
**SURVEY COORDINATES FOR SAMPLE LOCATIONS IN AUS-0108**

<b>Sample Location</b>	<b>Northing</b>	<b>Easting</b>	<b>Ground Surface Elevation</b>	<b>Top of Casing Elevation</b>	<b>Comments</b>
0108-001	370844.9	780323.7	NA	NA	Coordinates from aerial photos
0108-002	370585.0	781153.0	NA	NA	Coordinates from aerial photos

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NA = Not Applicable

**SECTION FORTY-ONE**

**Possible Disposal Area East of COC-10**

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**TABLE 41-2**  
**MATRICES SAMPLED AT EACH SAMPLE LOCATION AT AUS-0108**

Soil
AUS-0108-001
AUS-0108-002

Sheet 1 of 1

**SECTION FORTY-ONE****Possible Disposal Area East of COC-10**

**TABLE 41-3  
SOIL SAMPLE ANALYTICAL RESULTS SUMMARY**

Constituents	Number of Detections	Range of Detections
<b>Semivolatile Organic Compounds</b>		
Bis(2-Ethylhexyl) Phthalate	1/2	83 ug/kg
<b>Metals</b>		
Aluminum	2/2	8,670 mg/kg to 10,900 mg/kg
Antimony	1/2	0.35 mg/kg
Arsenic	2/2	5.2 mg/kg to 12.1 mg/kg
Barium	2/2	103 mg/kg to 109 mg/kg
Beryllium	2/2	0.5 mg/kg to 0.57 mg/kg
Boron	1/2	0.73 mg/kg
Cadmium	1/2	0.57 mg/kg
Calcium	2/2	3,550 mg/kg to 3,830 mg/kg
Chromium, Total	2/2	16.4 mg/kg to 17.9 mg/kg
Cobalt	2/2	7.9 mg/kg to 9.1 mg/kg
Copper	2/2	12.3 mg/kg to 14.5 mg/kg
Iron	2/2	16,100 mg/kg to 17,100 mg/kg
Lead	2/2	17.5 mg/kg to 68.9 mg/kg
Magnesium	2/2	2,370 mg/kg to 2,750 mg/kg
Manganese	2/2	401 mg/kg to 836 mg/kg
Mercury	2/2	0.016 mg/kg to 0.031 mg/kg
Nickel	2/2	12.8 mg/kg to 17 mg/kg
Potassium	2/2	528 mg/kg to 869 mg/kg
Selenium	1/2	0.49 mg/kg
Sodium	2/2	52.5 mg/kg to 66.2 mg/kg
Vanadium	2/2	27.4 mg/kg to 28.5 mg/kg
Zinc	2/2	55.9 mg/kg to 131 mg/kg

Sheet 1 of 1

mg/kg = milligrams per kilogram  
ug/kg = micrograms per kilogram

Notes: This table was derived from the figures that show the analytical results. As a result, duplicates are shown only if the duplicate result for an analyte exceeded the screening criteria and the result from the original sample did not; or, if the analyte was detected in the duplicate and not in the original sample. There may be some duplicate results, not shown in the table, that are outside the range shown. In addition, the frequency and range of detections is based on the number of sample locations, not the total number of samples (the total number of samples includes originals plus duplicates).

Checked by: MMF 7/20/01



**TABLE 41-4  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0108**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
<b>Volatile Organic Compounds</b>								
71-55-6	1,1,1-Trichloroethane	6	U	UG/KG			1.80E-06	6.00E-02
79-34-5	1,1,2,2-Tetrachloroethane	6	U	UG/KG		6.68E-09	1.54E-06	3.00E+01
79-00-5	1,1,2-Trichloroethane	6	U	UG/KG		3.16E-09	3.94E-05	6.67E+00
75-34-3	1,1-Dichloroethane	6	U	UG/KG			2.91E-06	6.00E-03
75-35-4	1,1-Dichloroethene	6	U	UG/KG		5.05E-08	8.91E-05	2.00E+00
107-06-2	1,2-Dichloroethane (EDC)	6	U	UG/KG		7.85E-09	1.70E-04	6.00E+00
540-59-0	1,2-Dichloroethene (total)	6	U	UG/KG			4.07E-05	3.00E-01
78-87-5	1,2-Dichloropropane	6	U	UG/KG		7.81E-09	2.82E-04	6.00E+00
78-93-3	2-Butanone (MEK)	12	U	UG/KG			4.33E-07	
591-78-6	2-Hexanone	12	U	UG/KG				
108-10-1	4-Methyl-2-pentanone (MIBK)	12	U	UG/KG			4.16E-06	
67-64-1	Acetone	27	U	UG/KG			4.34E-06	3.38E-02
71-43-2	Benzene	6	U	UG/KG		4.10E-09	2.48E-04	3.00E+00
75-27-4	Bromodichloromethane	6	U	UG/KG		2.55E-09	5.75E-06	2.00E-01
75-25-2	Bromoform	6	U	UG/KG		1.92E-11	3.41E-07	1.50E-01
74-83-9	Bromomethane	6	U	UG/KG			4.57E-04	6.00E-01
75-15-0	Carbon disulfide	6	U	UG/KG			4.96E-06	3.00E-03
56-23-5	Carbon tetrachloride	6	U	UG/KG		1.13E-08	8.58E-04	2.00E+00
108-90-7	Chlorobenzene	6	U	UG/KG			1.11E-05	8.57E-02
75-00-3	Chloroethane	6	U	UG/KG		9.22E-10	3.18E-07	
67-66-3	Chloroform	6	U	UG/KG		1.15E-08	4.66E-03	2.00E-01
74-87-3	Chloromethane	6	U	UG/KG		2.25E-09		
156-59-2	cis-1,2-Dichloroethene	6	U	UG/KG			4.07E-05	3.00E-01

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
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**TABLE 41-4  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0108**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
10061-01-5	cis-1,3-Dichloropropene	6	U	UG/KG		3.37E-08	1.36E-04	
124-48-1	Dibromochloromethane	6	U	UG/KG		2.26E-09	3.77E-06	3.00E-01
100-41-4	Ethylbenzene	6	U	UG/KG			1.00E-06	8.57E-03
75-09-2	Methylene chloride	6	U	UG/KG		2.92E-10	6.14E-07	6.00E+00
110-54-3	N-Hexane	6	U	UG/KG			1.49E-05	
100-42-5	Styrene	6	U	UG/KG			2.94E-07	3.00E-02
127-18-4	Tetrachloroethylene (PCE)	6	U	UG/KG		3.21E-10	3.52E-06	2.00E+00
108-88-3	Toluene	6	U	UG/KG			3.02E-06	1.00E-02
1330-20-7	total Xylenes	6	U	UG/KG			1.35E-06	6.00E-04
156-60-5	trans-1,2-Dichloroethene	6	U	UG/KG			2.80E-05	2.00E-01
10061-02-6	trans-1,3-Dichloropropene	6	U	UG/KG		3.37E-08	1.36E-04	
79-01-6	Trichloroethylene (TCE)	6	U	UG/KG		9.81E-10	7.59E-05	2.00E+00
75-01-4	Vinyl chloride	6	U	UG/KG		1.23E-07		8.57E+00
<b>Semivolatile Organic Compounds</b>								
120-82-1	1,2,4-Trichlorobenzene	450	U	UG/KG			5.91E-05	1.50E+00
95-50-1	1,2-Dichlorobenzene	450	U	UG/KG			1.36E-04	5.00E-01
541-73-1	1,3-Dichlorobenzene	450	U	UG/KG			8.69E-03	
106-46-7	1,4-Dichlorobenzene	450	U	UG/KG		5.54E-08	2.34E-04	4.50E+00
95-95-4	2,4,5-Trichlorophenol	2300	U	UG/KG			2.61E-05	2.30E-01
88-06-2	2,4,6-Trichlorophenol	450	U	UG/KG		2.01E-09		5.63E+01
120-83-2	2,4-Dichlorophenol	450	U	UG/KG			1.70E-04	9.00E+00
105-67-9	2,4-Dimethylphenol	450	U	UG/KG			2.55E-05	1.13E+00
51-28-5	2,4-Dinitrophenol	2300	U	UG/KG			1.31E-03	2.30E+02
91-58-7	2-Chloronaphthalene	450	U	UG/KG			1.65E-05	

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**TABLE 41-4  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0108**

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CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
95-57-8	2-Chlorophenol	450	U	UG/KG			1.86E-03	2.25E+00
91-57-6	2-Methylnaphthalene	450	U	UG/KG			8.30E-06	2.25E-03
95-48-7	2-Methylphenol	450	U	UG/KG			1.02E-05	5.63E-01
88-74-4	2-Nitroaniline	2300	U	UG/KG			4.57E-02	
88-75-5	2-Nitrophenol	450	U	UG/KG			6.39E-05	
91-94-1	3,3'-Dichlorobenzidine	450	U	UG/KG		8.21E-08		1.50E+03
99-09-2	3-Nitroaniline	2300	U	UG/KG			4.57E-02	
534-52-1	4,6-Dinitro-2-methylphenol	2300	U	UG/KG				
101-55-3	4-Bromophenyl phenyl ether	450	U	UG/KG				
59-50-7	4-Chloro-3-methylphenol	450	U	UG/KG			1.02E-05	
106-47-8	4-Chloroaniline	900	U	UG/KG			2.55E-04	3.00E+01
7005-72-3	4-Chlorophenyl phenyl ether	450	U	UG/KG				
106-44-5	4-Methylphenol	450	U	UG/KG			1.02E-04	
100-01-6	4-Nitroaniline	2300	U	UG/KG			4.57E-02	
100-02-7	4-Nitrophenol	2300	U	UG/KG			3.26E-04	
83-32-9	Acenaphthene	450	U	UG/KG			1.17E-05	1.50E-02
208-96-8	Acenaphthylene	450	U	UG/KG			8.30E-06	2.25E-03
120-12-7	Anthracene	450	U	UG/KG			1.15E-06	7.50E-04
56-55-3	Benzo(a)anthracene	450	U	UG/KG		1.56E-07		5.63E+00
50-32-8	Benzo(a)pyrene	450	U	UG/KG		1.56E-06		1.13E+00
205-99-2	Benzo(b)fluoranthene	450	U	UG/KG		1.56E-07		2.25E+00
191-24-2	Benzo(g,h,i)perylene	450	U	UG/KG			8.30E-06	2.25E-03
207-08-9	Benzo(k)fluoranthene	450	U	UG/KG		1.56E-08		2.25E-01
111-91-1	bis(2-Chloroethoxy)methane	450	U	UG/KG				

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**TABLE 41-4  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0108**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
111-44-4	bis(2-Chloroethyl) ether	450	U	UG/KG		7.26E-07		2.25E+04
108-60-1	bis(2-Chloroisopropyl) ether	450	U	UG/KG		5.57E-08	1.06E-04	
117-81-7	bis(2-Ethylhexyl) phthalate (DEHP)	83	J	UG/KG		4.71E-10	4.71E-06	
85-68-7	Butyl benzyl phthalate	450	U	UG/KG			2.55E-06	5.63E-04
86-74-8	Carbazole	450	U	UG/KG		3.65E-09		1.50E+01
218-01-9	Chrysene	450	U	UG/KG		1.56E-09		5.63E-02
84-74-2	Di-n-butyl phthalate	450	U	UG/KG			5.11E-06	1.50E-03
117-84-0	Di-n-octyl phthalate	450	U	UG/KG			2.55E-05	4.50E-05
53-70-3	Dibenz(a,h)anthracene	450	U	UG/KG		1.56E-06		5.63E+00
132-64-9	Dibenzofuran	450	U	UG/KG			8.89E-05	
84-66-2	Diethyl phthalate	450	U	UG/KG			6.39E-07	
131-11-3	Dimethyl phthalate	450	U	UG/KG			5.11E-08	
206-44-0	Fluoranthene	450	U	UG/KG			1.50E-05	2.25E-03
86-73-7	Fluorene	450	U	UG/KG			1.36E-05	1.50E-02
118-74-1	Hexachlorobenzene	450	U	UG/KG		2.92E-07	6.39E-04	4.50E+00
87-68-3	Hexachlorobutadiene	450	U	UG/KG		1.42E-08	2.55E-03	4.50E+00
77-47-4	Hexachlorocyclopentadiene	450	U	UG/KG			7.63E-05	2.25E-02
67-72-1	Hexachloroethane	450	U	UG/KG		2.55E-09	5.11E-04	2.25E+01
193-39-5	Indeno(1,2,3-c,d)pyrene	450	U	UG/KG		1.56E-07		6.43E-01
78-59-1	Isophorone	450	U	UG/KG		1.73E-10	2.55E-06	1.50E+01
621-64-7	N-Nitroso-di-n-propylamine	450	UJ	UG/KG		1.28E-06		2.25E+05
86-30-6	N-Nitrosodiphenylamine	450	U	UG/KG		8.94E-10		7.50E+00
91-20-3	Naphthalene	450	U	UG/KG			2.39E-03	1.13E-01
87-86-5	Pentachlorophenol	2300	U	UG/KG		2.07E-07	1.61E-04	2.30E+03

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**TABLE 41-4  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0108**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
85-01-8	Phenanthrene	450	U	UG/KG			8.30E-06	2.25E-03
108-95-2	Phenol	450	U	UG/KG			8.51E-07	9.00E-02
129-00-0	Pyrene	450	U	UG/KG			8.30E-06	2.25E-03
<b>Explosives</b>								
99-35-4	1,3,5-Trinitrobenzene	340	U	UG/KG			1.29E-05	
99-65-0	1,3-Dinitrobenzene	340	U	UG/KG			3.86E-03	
118-96-7	2,4,6-Trinitrotoluene (TNT)	680	U	UG/KG		8.27E-09	1.54E-03	
121-14-2	2,4-Dinitrotoluene	340	U	UG/KG			1.93E-04	8.50E+03
606-20-2	2,6-Dinitrotoluene	450	U	UG/KG			5.11E-04	1.50E+04
35572-78-2	2-Amino-4,6-Dinitrotoluene	680	U	UG/KG				
88-72-2	2-Nitrotoluene (ONT)	680	U	UG/KG				
99-08-1	3-Nitrotoluene	680	U	UG/KG			3.35E-04	
19406-51-0	4-Amino-2,6-Dinitrotoluene	680	U	UG/KG				
99-99-0	4-Nitrotoluene (PNT)	680	U	UG/KG			3.35E-04	
2691-41-0	HMX	680	U	UG/KG			1.54E-05	
98-95-3	Nitrobenzene	340	U	UG/KG			2.97E-03	
121-82-4	RDX	680	U	UG/KG		3.03E-08	2.57E-04	
479-45-8	Tetryl	1000	U	UG/KG			1.14E-04	
<b>Metals</b>								
7429-90-5	Aluminum	10900		MG/KG	3.78E-01		6.50E-03	
7440-36-0	Antimony	0.35	J	MG/KG	4.22E-01		4.28E-04	1.17E+00
7440-38-2	Arsenic	12.1		MG/KG	8.96E-01	4.44E-06	2.75E-02	1.21E+01
7440-39-3	Barium	109		MG/KG	5.59E-01		8.75E-04	1.36E+00
7440-41-7	Beryllium	0.57	J	MG/KG	7.50E-01	2.54E-10	1.54E-04	1.90E-01

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**TABLE 41-4  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0108**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to Background (SOIL)	Cancer Risk Based on USEPA Region 9 Industrial Soil PRG for Carcinogens	Hazard Quotient (HQ) Based on USEPA Region 9 Industrial Soil PRG for Toxins	Ratio of Max Concentration (or Max RL) to Migration to Groundwater Criteria (DAF-1)
7440-42-8	Boron	0.73	J	MG/KG	1.38E-01		9.23E-06	
7440-43-9	Cadmium	0.57	J	MG/KG	3.00E+00	1.91E-10	7.04E-04	1.43E+00
7440-70-2	Calcium	3830		MG/KG	1.53E+00			
7440-47-3	Chromium	17.9	J	MG/KG	7.10E-01	3.99E-08		8.95E+00
7440-48-4	Cobalt	9.1		MG/KG	4.19E-01		7.42E-05	
7440-50-8	Copper	14.5		MG/KG	1.28E+00		1.91E-04	
7439-89-6	Iron	17100		MG/KG	8.86E-01		2.79E-02	
7439-92-1	Lead	68.9	J	MG/KG	2.94E+00			
7439-95-4	Magnesium	2750		MG/KG	1.77E+00			
7439-96-5	Manganese	836		MG/KG	2.30E-01		2.59E-02	
7439-97-6	Mercury	0.031	J	MG/KG	5.17E-01			
7440-02-0	Nickel	17		MG/KG	8.99E-01		4.16E-04	2.43E+00
2023695	Potassium	869		MG/KG	1.39E+00			
7782-49-2	Selenium	0.49	J	MG/KG	2.09E-01		4.79E-05	1.63E+00
7440-22-4	Silver	1.3	U	MG/KG	2.24E+00		1.27E-04	6.50E-01
7440-23-5	Sodium	66.2	J	MG/KG	3.89E-01			
7440-28-0	Thallium	1.3	U	MG/KG	3.17E+00		9.09E-06	
7440-62-2	Vanadium	28.5		MG/KG	6.04E-01		1.99E-03	9.50E-02
7440-66-6	Zinc	131	J	MG/KG	2.55E+00		2.14E-04	2.18E-01

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HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0108**

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CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
<b>Volatile Organic Compounds</b>							
71-55-6	1,1,1-Trichloroethane	6	U	UG/KG			3.00E-03
79-34-5	1,1,2,2-Tetrachloroethane	6	U	UG/KG			
79-00-5	1,1,2-Trichloroethane	6	U	UG/KG	7.32E-07	7.32E-07	3.00E-01
75-34-3	1,1-Dichloroethane	6	U	UG/KG	3.00E-08	3.00E-08	2.61E-04
75-35-4	1,1-Dichloroethene	6	U	UG/KG	3.33E-07	3.33E-06	1.00E-01
107-06-2	1,2-Dichloroethane (EDC)	6	U	UG/KG	9.52E-05	4.29E-06	3.00E-01
540-59-0	1,2-Dichloroethene (total)	6	U	UG/KG	3.00E-07	3.00E-07	1.50E-02
78-87-5	1,2-Dichloropropane	6	U	UG/KG	7.14E-05	3.33E-06	2.00E-01
78-93-3	2-Butanone (MEK)	12	U	UG/KG			
591-78-6	2-Hexanone	12	U	UG/KG			
108-10-1	4-Methyl-2-pentanone (MIBK)	12	U	UG/KG			
67-64-1	Acetone	27	U	UG/KG	1.35E-07	1.35E-07	1.69E-03
71-43-2	Benzene	6	U	UG/KG	3.00E-05	1.40E-06	2.00E-01
75-27-4	Bromodichloromethane	6	U	UG/KG	6.52E-05	3.00E-06	1.00E-02
75-25-2	Bromoform	6	U	UG/KG	8.33E-06	3.75E-07	7.50E-03
74-83-9	Bromomethane	6	U	UG/KG	2.07E-06	6.00E-06	3.00E-02
75-15-0	Carbon disulfide	6	U	UG/KG	3.00E-08	3.00E-07	1.88E-04
56-23-5	Carbon tetrachloride	6	U	UG/KG	1.36E-04	1.46E-05	8.57E-02
108-90-7	Chlorobenzene	6	U	UG/KG	1.46E-07	1.46E-06	6.00E-03
75-00-3	Chloroethane	6	U	UG/KG			
67-66-3	Chloroform	6	U	UG/KG	6.38E-06	3.00E-06	1.00E-02
74-87-3	Chloromethane	6	U	UG/KG			
156-59-2	cis-1,2-Dichloroethene	6	U	UG/KG	3.00E-07	3.00E-07	1.50E-02

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CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

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10061-01-5	cis-1,3-Dichloropropene	6	U	UG/KG			
124-48-1	Dibromochloromethane	6	U	UG/KG	1.46E-07	1.46E-07	1.50E-02
100-41-4	Ethylbenzene	6	U	UG/KG	3.00E-08	3.00E-07	4.62E-04
75-09-2	Methylene chloride	6	U	UG/KG	7.89E-06	5.00E-07	3.00E-01
110-54-3	N-Hexane	6	U	UG/KG			
100-42-5	Styrene	6	U	UG/KG	1.46E-08	1.46E-07	1.50E-03
127-18-4	Tetrachloroethylene (PCE)	6	U	UG/KG	5.45E-05	2.50E-06	1.00E-01
108-88-3	Toluene	6	U	UG/KG	1.46E-08	1.46E-08	5.00E-04
1330-20-7	total Xylenes	6	U	UG/KG	6.00E-09	1.46E-08	4.00E-05
156-60-5	trans-1,2-Dichloroethene	6	U	UG/KG	1.46E-07	1.46E-07	8.57E-03
10061-02-6	trans-1,3-Dichloropropene	6	U	UG/KG			
79-01-6	Trichloroethylene (TCE)	6	U	UG/KG	1.15E-05	5.00E-06	1.00E-01
75-01-4	Vinyl chloride	6	U	UG/KG	2.00E-03	9.23E-05	6.00E-01
<b>Semivolatile Organic Compounds</b>							
120-82-1	1,2,4-Trichlorobenzene	450	U	UG/KG	2.25E-05	2.25E-04	9.00E-02
95-50-1	1,2-Dichlorobenzene	450	U	UG/KG	2.50E-06	2.50E-05	2.65E-02
541-73-1	1,3-Dichlorobenzene	450	U	UG/KG			
106-46-7	1,4-Dichlorobenzene	450	U	UG/KG			2.25E-01
95-95-4	2,4,5-Trichlorophenol	2300	U	UG/KG	1.15E-05	1.15E-05	8.52E-03
88-06-2	2,4,6-Trichlorophenol	450	U	UG/KG	8.65E-04	4.09E-05	2.25E+00
120-83-2	2,4-Dichlorophenol	450	U	UG/KG	7.38E-05	7.38E-04	4.50E-01
105-67-9	2,4-Dimethylphenol	450	U	UG/KG	1.10E-05	1.10E-05	5.00E-02
51-28-5	2,4-Dinitrophenol	2300	U	UG/KG	5.61E-04	5.61E-03	1.15E+01
91-58-7	2-Chloronaphthalene	450	U	UG/KG			

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95-57-8	2-Chlorophenol	450	U	UG/KG	4.50E-05	4.50E-05	1.13E-01
91-57-6	2-Methylnaphthalene	450	U	UG/KG	7.38E-06	7.38E-06	1.07E-04
95-48-7	2-Methylphenol	450	U	UG/KG	4.50E-06	4.50E-06	3.00E-02
88-74-4	2-Nitroaniline	2300	U	UG/KG			
88-75-5	2-Nitrophenol	450	U	UG/KG			
91-94-1	3,3'-Dichlorobenzidine	450	U	UG/KG	3.46E-02	1.61E-03	6.43E+01
99-09-2	3-Nitroaniline	2300	U	UG/KG			
534-52-1	4,6-Dinitro-2-methylphenol	2300	U	UG/KG			
101-55-3	4-Bromophenyl phenyl ether	450	U	UG/KG			
59-50-7	4-Chloro-3-methylphenol	450	U	UG/KG			
106-47-8	4-Chloroaniline	900	U	UG/KG	1.10E-04	1.10E-03	1.29E+00
7005-72-3	4-Chlorophenyl phenyl ether	450	U	UG/KG			
106-44-5	4-Methylphenol	450	U	UG/KG			
100-01-6	4-Nitroaniline	2300	U	UG/KG			
100-02-7	4-Nitrophenol	2300	U	UG/KG			
83-32-9	Acenaphthene	450	U	UG/KG	3.75E-06	3.75E-06	7.89E-04
208-96-8	Acenaphthylene	450	U	UG/KG	7.38E-06	7.38E-06	1.07E-04
120-12-7	Anthracene	450	U	UG/KG	7.38E-07	7.38E-07	3.75E-05
56-55-3	Benzo(a)anthracene	450	U	UG/KG	5.63E-02	2.65E-03	2.25E-01
50-32-8	Benzo(a)pyrene	450	U	UG/KG	5.63E-01	2.65E-02	5.63E-02
205-99-2	Benzo(b)fluoranthene	450	U	UG/KG	5.63E-02	2.65E-03	9.00E-02
191-24-2	Benzo(g,h,i)perylene	450	U	UG/KG	7.38E-06	7.38E-06	1.07E-04
207-08-9	Benzo(k)fluoranthene	450	U	UG/KG	5.77E-03	2.65E-04	9.18E-03
111-91-1	bis(2-Chloroethoxy)methane	450	U	UG/KG			

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 41-4  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0108**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
111-44-4	bis(2-Chloroethyl) ether	450	U	UG/KG	9.00E-02	6.00E-03	1.13E+03
108-60-1	bis(2-Chloroisopropyl) ether	450	U	UG/KG			
117-81-7	bis(2-Ethylhexyl) phthalate (DEHP)	83	J	UG/KG	2.02E-04	2.02E-05	2.31E-05
85-68-7	Butyl benzyl phthalate	450	U	UG/KG	1.10E-06	1.10E-06	4.84E-04
86-74-8	Carbazole	450	U	UG/KG	1.55E-03	7.26E-05	7.50E-01
218-01-9	Chrysene	450	U	UG/KG	5.77E-04	2.65E-05	2.81E-03
84-74-2	Di-n-butyl phthalate	450	U	UG/KG	2.25E-06	2.25E-06	1.96E-04
117-84-0	Di-n-octyl phthalate	450	U	UG/KG	1.10E-05	1.10E-04	4.50E-05
53-70-3	Dibenz(a,h)anthracene	450	U	UG/KG	5.63E-01	2.65E-02	2.25E-01
132-64-9	Dibenzofuran	450	U	UG/KG			
84-66-2	Diethyl phthalate	450	U	UG/KG	4.50E-07	4.50E-07	9.57E-04
131-11-3	Dimethyl phthalate	450	U	UG/KG			
206-44-0	Fluoranthene	450	U	UG/KG	5.49E-06	5.49E-06	1.05E-04
86-73-7	Fluorene	450	U	UG/KG	5.49E-06	5.49E-06	8.04E-04
118-74-1	Hexachlorobenzene	450	U	UG/KG	1.13E-01	5.77E-03	2.25E-01
87-68-3	Hexachlorobutadiene	450	U	UG/KG			
77-47-4	Hexachlorocyclopentadiene	450	U	UG/KG	3.21E-05	3.21E-05	1.13E-03
67-72-1	Hexachloroethane	450	U	UG/KG	2.25E-04	2.25E-04	9.00E-01
193-39-5	Indeno(1,2,3-c,d)pyrene	450	U	UG/KG	5.63E-02	2.65E-03	3.21E-02
78-59-1	Isophorone	450	U	UG/KG	1.10E-06	1.10E-06	5.63E-02
621-64-7	N-Nitroso-di-n-propylamine	450	UJ	UG/KG	5.63E-01	2.50E-02	9.00E+03
86-30-6	N-Nitrosodiphenylamine	450	U	UG/KG	3.75E-04	1.80E-05	4.50E-01
91-20-3	Naphthalene	450	U	UG/KG	5.49E-06	5.49E-05	5.36E-03
87-86-5	Pentachlorophenol	2300	U	UG/KG	9.58E-02	4.42E-03	7.67E+01

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 41-4  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0108**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
85-01-8	Phenanthrene	450	U	UG/KG	7.38E-06	7.38E-06	1.07E-04
108-95-2	Phenol	450	U	UG/KG	4.50E-07	3.75E-06	4.50E-03
129-00-0	Pyrene	450	U	UG/KG	7.38E-06	7.38E-06	1.07E-04
<b>Explosives</b>							
99-35-4	1,3,5-Trinitrobenzene	340	U	UG/KG			
99-65-0	1,3-Dinitrobenzene	340	U	UG/KG			
118-96-7	2,4,6-Trinitrotoluene (TNT)	680	U	UG/KG			
121-14-2	2,4-Dinitrotoluene	340	U	UG/KG	4.05E-02	1.89E-03	4.25E+02
606-20-2	2,6-Dinitrotoluene	450	U	UG/KG	5.36E-02	2.50E-03	6.43E+02
35572-78-2	2-Amino-4,6-Dinitrotoluene	680	U	UG/KG			
88-72-2	2-Nitrotoluene (ONT)	680	U	UG/KG			
99-08-1	3-Nitrotoluene	680	U	UG/KG			
19406-51-0	4-Amino-2,6-Dinitrotoluene	680	U	UG/KG			
99-99-0	4-Nitrotoluene (PNT)	680	U	UG/KG			
2691-41-0	HMX	680	U	UG/KG			
98-95-3	Nitrobenzene	340	U	UG/KG	3.40E-04	3.40E-04	3.40E+00
121-82-4	RDX	680	U	UG/KG			
479-45-8	Tetryl	1000	U	UG/KG			
<b>Metals</b>							
7429-90-5	Aluminum	10900		MG/KG			
7440-36-0	Antimony	0.35	J	MG/KG	4.27E-04	4.27E-03	7.00E-02
7440-38-2	Arsenic	12.1		MG/KG	4.03E+00	1.98E-01	4.32E-01
7440-39-3	Barium	109		MG/KG	7.79E-04	7.79E-03	9.08E-02
7440-41-7	Beryllium	0.57	J	MG/KG	5.70E-01	1.97E-02	8.64E-02

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 41-4  
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AUS-0108**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Ratio of Max Concentration (or Max RL) to IEPA Industrial/Commercial Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Construction Worker Soil Ingestion Criteria	Ratio of Max Concentration (or Max RL) to IEPA Class I Soil Component of Groundwater Criteria
7440-42-8	Boron	0.73	J	MG/KG	4.06E-06	4.06E-05	
7440-43-9	Cadmium	0.57	J	MG/KG	2.85E-04	2.85E-03	1.54E-01
7440-70-2	Calcium	3830		MG/KG			
7440-47-3	Chromium	17.9	J	MG/KG	1.79E-03	4.37E-03	6.39E-01
7440-48-4	Cobalt	9.1		MG/KG	7.58E-05	7.58E-04	
7440-50-8	Copper	14.5		MG/KG	1.77E-04	1.77E-03	1.32E-03
7439-89-6	Iron	17100		MG/KG			
7439-92-1	Lead	68.9	J	MG/KG	1.72E-01	1.72E-01	
7439-95-4	Magnesium	2750		MG/KG			
7439-96-5	Manganese	836		MG/KG	8.71E-03	8.71E-02	
7439-97-6	Mercury	0.031	J	MG/KG	5.08E-05	5.08E-04	2.07E-01
7440-02-0	Nickel	17		MG/KG	4.15E-04	4.15E-03	2.24E-01
2023695	Potassium	869		MG/KG			
7782-49-2	Selenium	0.49	J	MG/KG	4.90E-05	4.90E-04	2.04E-01
7440-22-4	Silver	1.3	U	MG/KG	1.30E-04	1.30E-03	8.67E-01
7440-23-5	Sodium	66.2	J	MG/KG			
7440-28-0	Thallium	1.3	U	MG/KG	8.13E-03	8.13E-03	5.42E-01
7440-62-2	Vanadium	28.5		MG/KG	2.04E-03	2.04E-02	2.91E-02
7440-66-6	Zinc	131	J	MG/KG	2.15E-04	2.15E-03	3.64E-02

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 41-5  
ECOLOGICAL SCREENING OF SOIL RESULTS FROM AUS-0108**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Background (SOIL)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ) (SOIL)	Retained as Potential Bioaccumulator
<b>Volatile Organic Compounds</b>							
71-55-6	1,1,1-Trichloroethane		6	U	UG/KG	2.01E-04	
79-34-5	1,1,2,2-Tetrachloroethane		6	U	UG/KG	4.72E-02	
79-00-5	1,1,2-Trichloroethane		6	U	UG/KG	2.10E-04	
75-34-3	1,1-Dichloroethane		6	U	UG/KG	2.99E-04	
75-35-4	1,1-Dichloroethene		6	U	UG/KG	7.25E-04	
107-06-2	1,2-Dichloroethane (EDC)		6	U	UG/KG	2.83E-04	
540-59-0	1,2-Dichloroethene (total)		6	U	UG/KG	7.62E-03	
78-87-5	1,2-Dichloropropane		6	U	UG/KG	8.57E-06	
78-93-3	2-Butanone (MEK)		12	U	UG/KG	1.34E-04	
591-78-6	2-Hexanone		12	U	UG/KG	9.52E-04	
108-10-1	4-Methyl-2-pentanone (MIBK)		12	U	UG/KG	2.71E-05	
67-64-1	Acetone		27	U	UG/KG	1.08E-02	
71-43-2	Benzene		6	U	UG/KG	3.75E-04	
75-27-4	Bromodichloromethane		6	U	UG/KG	1.11E-02	
75-25-2	Bromoform		6	U	UG/KG	3.77E-04	
74-83-9	Bromomethane		6	U	UG/KG	2.55E-02	
75-15-0	Carbon disulfide		6	U	UG/KG	6.37E-02	
56-23-5	Carbon tetrachloride		6	U	UG/KG	6.00E-06	
108-90-7	Chlorobenzene		6	U	UG/KG	1.50E-04	
75-00-3	Chloroethane		6	U	UG/KG		
67-66-3	Chloroform		6	U	UG/KG	5.04E-03	
74-87-3	Chloromethane		6	U	UG/KG	5.77E-04	
156-59-2	cis-1,2-Dichloroethene		6	U	UG/KG	7.62E-03	
10061-01-5	cis-1,3-Dichloropropene		6	U	UG/KG	1.51E-02	
124-48-1	Dibromochloromethane		6	U	UG/KG	2.93E-03	
100-41-4	Ethylbenzene		6	U	UG/KG	1.20E-03	
75-09-2	Methylene chloride		6	U	UG/KG	1.48E-03	
110-54-3	N-Hexane		6	U	UG/KG		
100-42-5	Styrene		6	U	UG/KG	2.00E-05	
127-18-4	Tetrachloroethylene (PCE)		6	U	UG/KG	4.62E-04	
108-88-3	Toluene		6	U	UG/KG	2.00E-03	
1330-20-7	total Xylenes		6	U	UG/KG	1.00E-02	
156-60-5	trans-1,2-Dichloroethene		6	U	UG/KG	7.62E-03	
10061-02-6	trans-1,3-Dichloropropene		6	U	UG/KG	1.51E-02	
79-01-6	Trichloroethylene (TCE)		6	U	UG/KG	6.67E-04	
75-01-4	Vinyl chloride		6	U	UG/KG	9.29E-03	
<b>Semivolatile Organic Compounds</b>							
120-82-1	1,2,4-Trichlorobenzene		450	U	UG/KG	2.25E-02	
95-50-1	1,2-Dichlorobenzene		450	U	UG/KG	1.52E-01	
541-73-1	1,3-Dichlorobenzene		450	U	UG/KG	1.19E-02	
106-46-7	1,4-Dichlorobenzene		450	U	UG/KG	2.25E-02	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 41-5  
ECOLOGICAL SCREENING OF SOIL RESULTS FROM AUS-0108**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Background (SOIL)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ) (SOIL)	Retained as Potential Bioaccumulator
95-95-4	2,4,5-Trichlorophenol		2300	U	UG/KG	5.75E-01	
88-06-2	2,4,6-Trichlorophenol		450	U	UG/KG	4.50E-02	
120-83-2	2,4-Dichlorophenol		450	U	UG/KG	5.14E-03	
105-67-9	2,4-Dimethylphenol		450	U	UG/KG	4.50E+01	
51-28-5	2,4-Dinitrophenol		2300	U	UG/KG	1.15E-01	
91-58-7	2-Chloronaphthalene		450	U	UG/KG	3.69E+01	
95-57-8	2-Chlorophenol		450	U	UG/KG	1.85E+00	
91-57-6	2-Methylnaphthalene		450	U	UG/KG	1.39E-01	
95-48-7	2-Methylphenol		450	U	UG/KG	1.11E-02	
88-74-4	2-Nitroaniline		2300	U	UG/KG	3.10E-02	
88-75-5	2-Nitrophenol		450	U	UG/KG	2.81E-01	
91-94-1	3,3'-Dichlorobenzidine		450	U	UG/KG	6.96E-01	
99-09-2	3-Nitroaniline		2300	U	UG/KG	7.28E-01	
534-52-1	4,6-Dinitro-2-methylphenol		2300	U	UG/KG		
101-55-3	4-Bromophenyl phenyl ether		450	U	UG/KG		
59-50-7	4-Chloro-3-methylphenol		450	U	UG/KG	5.66E-02	
106-47-8	4-Chloroaniline		900	U	UG/KG	8.18E-01	
7005-72-3	4-Chlorophenyl phenyl ether		450	U	UG/KG		
106-44-5	4-Methylphenol		450	U	UG/KG	2.76E-03	
100-01-6	4-Nitroaniline		2300	U	UG/KG	1.05E-01	
100-02-7	4-Nitrophenol		2300	U	UG/KG	3.29E-01	
83-32-9	Acenaphthene		450	U	UG/KG	6.59E-04	
208-96-8	Acenaphthylene		450	U	UG/KG	6.59E-04	
120-12-7	Anthracene		450	U	UG/KG	3.04E-04	
56-55-3	Benzo(a)anthracene		450	U	UG/KG	8.64E-02	
50-32-8	Benzo(a)pyrene		450	U	UG/KG	1.02E-04	
205-99-2	Benzo(b)fluoranthene		450	U	UG/KG	7.53E-03	
191-24-2	Benzo(g,h,i)perylene		450	U	UG/KG	3.78E-03	
207-08-9	Benzo(k)fluoranthene		450	U	UG/KG	7.53E-03	
111-91-1	bis(2-Chloroethoxy)methane		450	U	UG/KG	1.49E+00	
111-44-4	bis(2-Chloroethyl) ether		450	U	UG/KG	1.90E-02	
108-60-1	bis(2-Chloroisopropyl) ether		450	U	UG/KG		
117-81-7	bis(2-Ethylhexyl) phthalate (DEHP)		83	J	UG/KG	8.96E-02	YES
85-68-7	Butyl benzyl phthalate		450	U	UG/KG	1.88E+00	
86-74-8	Carbazole		450	U	UG/KG		
218-01-9	Chrysene		450	U	UG/KG	9.51E-02	
84-74-2	Di-n-butyl phthalate		450	U	UG/KG	2.25E-03	
117-84-0	Di-n-octyl phthalate		450	U	UG/KG	6.35E-04	
53-70-3	Dibenz(a,h)anthracene		450	U	UG/KG	2.45E-02	
132-64-9	Dibenzofuran		450	U	UG/KG		
84-66-2	Diethyl phthalate		450	U	UG/KG	4.50E-03	
131-11-3	Dimethyl phthalate		450	U	UG/KG	2.25E-03	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 41-5  
ECOLOGICAL SCREENING OF SOIL RESULTS FROM AUS-0108**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Background (SOIL)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ) (SOIL)	Retained as Potential Bioaccumulator
206-44-0	Fluoranthene		450	U	UG/KG	3.69E-03	
86-73-7	Fluorene		450	U	UG/KG	1.50E-02	
118-74-1	Hexachlorobenzene		450	U	UG/KG	4.50E-04	
87-68-3	Hexachlorobutadiene		450	U	UG/KG	1.13E+01	
77-47-4	Hexachlorocyclopentadiene		450	U	UG/KG	4.50E-02	
67-72-1	Hexachloroethane		450	U	UG/KG	7.55E-01	
193-39-5	Indeno(1,2,3-c,d)pyrene		450	U	UG/KG	4.13E-03	
78-59-1	Isophorone		450	U	UG/KG	3.24E-03	
621-64-7	N-Nitroso-di-n-propylamine		450	UJ	UG/KG	8.28E-01	
86-30-6	N-Nitrosodiphenylamine		450	U	UG/KG	2.25E-02	
91-20-3	Naphthalene		450	U	UG/KG	1.81E-03	
87-86-5	Pentachlorophenol		2300	U	UG/KG	3.83E-01	
85-01-8	Phenanthrene		450	U	UG/KG	9.85E-03	
108-95-2	Phenol		450	U	UG/KG	1.13E-02	
129-00-0	Pyrene		450	U	UG/KG	5.73E-03	
<b>Explosives</b>							
99-35-4	1,3,5-Trinitrobenzene		340	U	UG/KG	9.04E-01	
99-65-0	1,3-Dinitrobenzene		340	U	UG/KG	5.19E-01	
118-96-7	2,4,6-Trinitrotoluene (TNT)		680	U	UG/KG	2.27E-02	
121-14-2	2,4-Dinitrotoluene		340	U	UG/KG	2.66E-01	
606-20-2	2,6-Dinitrotoluene		450	U	UG/KG	1.37E+01	
35572-78-2	2-Amino-4,6-Dinitrotoluene		680	U	UG/KG	8.50E-03	
88-72-2	2-Nitrotoluene (ONT)		680	U	UG/KG		
99-08-1	3-Nitrotoluene		680	U	UG/KG		
19406-51-0	4-Amino-2,6-Dinitrotoluene		680	U	UG/KG		
99-99-0	4-Nitrotoluene (PNT)		680	U	UG/KG		
2691-41-0	HMX		680	U	UG/KG	2.72E-02	
98-95-3	Nitrobenzene		340	U	UG/KG	8.50E-03	
121-82-4	RDX		680	U	UG/KG	6.80E-03	
479-45-8	Tetryl		1000	U	UG/KG		
<b>Metals</b>							
7429-90-5	Aluminum	28800	10900		MG/KG		
7440-36-0	Antimony	0.83	0.35	J	MG/KG	7.00E-02	
7440-38-2	Arsenic	13.5	12.1		MG/KG	1.34E+00	
7440-39-3	Barium	195	109		MG/KG	2.18E-01	
7440-41-7	Beryllium	0.76	0.57	J	MG/KG	5.70E-02	
7440-42-8	Boron	5.3	0.73	J	MG/KG	1.46E+00	
7440-43-9	Cadmium	0.19	0.57	J	MG/KG	1.97E-02	
7440-70-2	Calcium	2497	3830		MG/KG		
7440-47-3	Chromium	25.2	17.9	J	MG/KG	3.58E+00	
7440-48-4	Cobalt	21.7	9.1		MG/KG	4.55E-01	
7440-50-8	Copper	11.3	14.5		MG/KG	4.68E-01	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect

**TABLE 41-5  
ECOLOGICAL SCREENING OF SOIL RESULTS FROM AUS-0108**

**ADDITIONAL AND UNCHARACTERIZED SITES OU  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

CAS Number	Chemical	Background (SOIL)	Max Result or Max Reporting Limit (RL)	Qualifier	Units	Direct Exposure Hazard Quotient (HQ) (SOIL)	Retained as Potential Bioaccumulator
7439-89-6	Iron	19306	17100		MG/KG	8.55E+01	
7439-92-1	Lead	23.4	68.9	J	MG/KG	1.59E-01	
7439-95-4	Magnesium	1552	2750		MG/KG		
7439-96-5	Manganese	3640	836		MG/KG	8.36E+00	
7439-97-6	Mercury	0.06	0.031	J	MG/KG	4.43E-03	YES
7440-02-0	Nickel	18.9	17		MG/KG	5.67E-01	
2023695	Potassium	625	869		MG/KG		
7782-49-2	Selenium	2.34	0.49	J	MG/KG	4.90E-01	YES
7440-22-4	Silver	0.58	1.3	U	MG/KG	6.50E-01	
7440-23-5	Sodium	170	66.2	J	MG/KG		
7440-28-0	Thallium	0.41	1.3	U	MG/KG	1.30E+00	
7440-62-2	Vanadium	47.2	28.5		MG/KG	6.20E-01	
7440-66-6	Zinc	51.4	131	J	MG/KG	1.09E+00	

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect  
J = Estimated U = Nondetect



TABLE 41-6, AUS-0108  
SUMMARY OF HUMAN HEALTH COPC EVALUATION

AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Chemical	Surface Water		Groundwater		Sediment		Soil	
	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale
<b>Volatile Organic Compounds</b>								
1,1,1-Trichloroethane	NA	NA	NA	NA	NA	NA	No	A
1,1,2,2-Tetrachloroethane	NA	NA	NA	NA	NA	NA	Uncertainty	B
1,1,2-Trichloroethane	NA	NA	NA	NA	NA	NA	Uncertainty	B
1,1-Dichloroethane	NA	NA	NA	NA	NA	NA	No	A
1,1-Dichloroethene	NA	NA	NA	NA	NA	NA	Uncertainty	B
1,2-Dichloroethane (EDC)	NA	NA	NA	NA	NA	NA	Uncertainty	B
1,2-Dichloroethene (total)	NA	NA	NA	NA	NA	NA	No	A
1,2-Dichloropropane	NA	NA	NA	NA	NA	NA	Uncertainty	B
2-Butanone (MEK)	NA	NA	NA	NA	NA	NA	No	A
2-Hexanone	NA	NA	NA	NA	NA	NA	No	C
4-Methyl-2-pentanone (MIBK)	NA	NA	NA	NA	NA	NA	No	A
Acetone	NA	NA	NA	NA	NA	NA	No	A
Benzene	NA	NA	NA	NA	NA	NA	Uncertainty	B
Bromodichloromethane	NA	NA	NA	NA	NA	NA	No	A
Bromoform	NA	NA	NA	NA	NA	NA	No	A
Bromomethane	NA	NA	NA	NA	NA	NA	No	A
Carbon disulfide	NA	NA	NA	NA	NA	NA	No	A
Carbon tetrachloride	NA	NA	NA	NA	NA	NA	Uncertainty	B
Chlorobenzene	NA	NA	NA	NA	NA	NA	No	A
Chloroethane	NA	NA	NA	NA	NA	NA	No	A
Chloroform	NA	NA	NA	NA	NA	NA	No	A
Chloromethane	NA	NA	NA	NA	NA	NA	No	A
cis-1,2-Dichloroethene	NA	NA	NA	NA	NA	NA	No	A
cis-1,3-Dichloropropene	NA	NA	NA	NA	NA	NA	No	A
Dibromochloromethane	NA	NA	NA	NA	NA	NA	No	A
Ethylbenzene	NA	NA	NA	NA	NA	NA	No	A
Methylene chloride	NA	NA	NA	NA	NA	NA	Uncertainty	B
N-Hexane	NA	NA	NA	NA	NA	NA	No	A
Styrene	NA	NA	NA	NA	NA	NA	No	A
Tetrachloroethylene (PCE)	NA	NA	NA	NA	NA	NA	Uncertainty	B
Toluene	NA	NA	NA	NA	NA	NA	No	A
total Xylenes	NA	NA	NA	NA	NA	NA	No	A
trans-1,2-Dichloroethene	NA	NA	NA	NA	NA	NA	No	A
trans-1,3-Dichloropropene	NA	NA	NA	NA	NA	NA	No	A
Trichloroethylene (TCE)	NA	NA	NA	NA	NA	NA	Uncertainty	B
Vinyl chloride	NA	NA	NA	NA	NA	NA	Uncertainty	B
<b>Semivolatile Organic Compounds</b>								
1,2,4-Trichlorobenzene	NA	NA	NA	NA	NA	NA	Uncertainty	B
1,2-Dichlorobenzene	NA	NA	NA	NA	NA	NA	No	A
1,3-Dichlorobenzene	NA	NA	NA	NA	NA	NA	No	A
1,4-Dichlorobenzene	NA	NA	NA	NA	NA	NA	Uncertainty	B
2,4,5-Trichlorophenol	NA	NA	NA	NA	NA	NA	No	A

**TABLE 41-6, AUS-0108  
SUMMARY OF HUMAN HEALTH COPC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Groundwater		Sediment		Soil	
	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale
2,4,6-Trichlorophenol	NA	NA	NA	NA	NA	NA	Uncertainty	B
2,4-Dichlorophenol	NA	NA	NA	NA	NA	NA	Uncertainty	B
2,4-Dimethylphenol	NA	NA	NA	NA	NA	NA	Uncertainty	B
2,4-Dinitrophenol	NA	NA	NA	NA	NA	NA	Uncertainty	B
2-Chloronaphthalene	NA	NA	NA	NA	NA	NA	No	A
2-Chlorophenol	NA	NA	NA	NA	NA	NA	Uncertainty	B
1-Methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	NA	NA	NA	NA	NA	NA	No	A
2-Methylphenol	NA	NA	NA	NA	NA	NA	No	A
2-Nitroaniline	NA	NA	NA	NA	NA	NA	No	A
2-Nitrophenol	NA	NA	NA	NA	NA	NA	No	A
3,3'-Dichlorobenzidine	NA	NA	NA	NA	NA	NA	Uncertainty	B
3-Nitroaniline	NA	NA	NA	NA	NA	NA	No	A
4,6-Dinitro-2-methylphenol	NA	NA	NA	NA	NA	NA	No	C
4-Bromophenyl phenyl ether	NA	NA	NA	NA	NA	NA	No	C
4-Chloro-3-methylphenol	NA	NA	NA	NA	NA	NA	No	A
4-Chloroaniline	NA	NA	NA	NA	NA	NA	Uncertainty	B
4-Chlorophenyl phenyl ether	NA	NA	NA	NA	NA	NA	No	C
4-Methylphenol	NA	NA	NA	NA	NA	NA	No	A
4-Nitroaniline	NA	NA	NA	NA	NA	NA	No	A
4-Nitrophenol	NA	NA	NA	NA	NA	NA	No	A
Acenaphthene	NA	NA	NA	NA	NA	NA	No	A
Acenaphthylene	NA	NA	NA	NA	NA	NA	No	A
Anthracene	NA	NA	NA	NA	NA	NA	No	A
Benzo(a)anthracene	NA	NA	NA	NA	NA	NA	Uncertainty	B
Benzo(a)pyrene	NA	NA	NA	NA	NA	NA	Uncertainty	B
Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA	Uncertainty	B
Benzo(g,h,i)perylene	NA	NA	NA	NA	NA	NA	No	A
Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	No	A
bis(2-Chloroethoxy)methane	NA	NA	NA	NA	NA	NA	No	C
bis(2-Chloroethyl) ether	NA	NA	NA	NA	NA	NA	Uncertainty	B
bis(2-Chloroisopropyl) ether	NA	NA	NA	NA	NA	NA	No	A
bis(2-Ethylhexyl) phthalate	NA	NA	NA	NA	NA	NA	No	F
Butyl benzyl phthalate	NA	NA	NA	NA	NA	NA	No	A
Carbazole	NA	NA	NA	NA	NA	NA	Uncertainty	B
Chrysene	NA	NA	NA	NA	NA	NA	No	A
Di-n-butyl phthalate	NA	NA	NA	NA	NA	NA	No	A
Di-n-octyl phthalate	NA	NA	NA	NA	NA	NA	No	A
Dibenz(a,h)anthracene	NA	NA	NA	NA	NA	NA	Uncertainty	B
Dibenzofuran	NA	NA	NA	NA	NA	NA	No	A
Diethyl phthalate	NA	NA	NA	NA	NA	NA	No	A
Dimethyl phthalate	NA	NA	NA	NA	NA	NA	No	A
Fluoranthene	NA	NA	NA	NA	NA	NA	No	A

**TABLE 41-6, AUS-0108  
SUMMARY OF HUMAN HEALTH COPC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Groundwater		Sediment		Soil	
	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale
Fluorene	NA	NA	NA	NA	NA	NA	No	A
Hexachlorobenzene	NA	NA	NA	NA	NA	NA	Uncertainty	B
Hexachlorobutadiene	NA	NA	NA	NA	NA	NA	Uncertainty	B
Hexachlorocyclopentadiene	NA	NA	NA	NA	NA	NA	No	A
Hexachloroethane	NA	NA	NA	NA	NA	NA	Uncertainty	B
Indeno(1,2,3-c,d)pyrene	NA	NA	NA	NA	NA	NA	No	A
Isophorone	NA	NA	NA	NA	NA	NA	Uncertainty	B
N-Nitroso-di-n-propylamine	NA	NA	NA	NA	NA	NA	Uncertainty	B
N-Nitrosodiphenylamine	NA	NA	NA	NA	NA	NA	Uncertainty	B
Naphthalene	NA	NA	NA	NA	NA	NA	No	A
Pentachlorophenol	NA	NA	NA	NA	NA	NA	Uncertainty	B
Phenanthrene	NA	NA	NA	NA	NA	NA	No	A
Phenol	NA	NA	NA	NA	NA	NA	No	A
Pyrene	NA	NA	NA	NA	NA	NA	No	A
<b>Metals and Inorganics</b>								
Aluminum	NA	NA	NA	NA	NA	NA	No	F
Antimony	NA	NA	NA	NA	NA	NA	Yes	D
Arsenic	NA	NA	NA	NA	NA	NA	Yes	D
Barium	NA	NA	NA	NA	NA	NA	Yes	D
Beryllium	NA	NA	NA	NA	NA	NA	No	F
Boron	NA	NA	NA	NA	NA	NA	No	F
Cadmium	NA	NA	NA	NA	NA	NA	Yes	E
Calcium	NA	NA	NA	NA	NA	NA	No	H
Chromium	NA	NA	NA	NA	NA	NA	Yes	D
Cobalt	NA	NA	NA	NA	NA	NA	No	F
Copper	NA	NA	NA	NA	NA	NA	No	F
Cyanide, Total	NA	NA	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	NA	NA	No	F
Lead	NA	NA	NA	NA	NA	NA	No	F
Magnesium	NA	NA	NA	NA	NA	NA	No	H
Manganese	NA	NA	NA	NA	NA	NA	No	F
Mercury	NA	NA	NA	NA	NA	NA	No	F
Nickel	NA	NA	NA	NA	NA	NA	Yes	D
Potassium	NA	NA	NA	NA	NA	NA	No	H
Selenium	NA	NA	NA	NA	NA	NA	Yes	D
Silver	NA	NA	NA	NA	NA	NA	No	A
Sodium	NA	NA	NA	NA	NA	NA	No	H
Thallium	NA	NA	NA	NA	NA	NA	No	A
Vanadium	NA	NA	NA	NA	NA	NA	No	F
Zinc	NA	NA	NA	NA	NA	NA	No	F
<b>Explosives</b>								
1,3,5-Trinitrobenzene	NA	NA	NA	NA	NA	NA	No	A
1,3-Dinitrobenzene	NA	NA	NA	NA	NA	NA	No	A

**TABLE 41-6, AUS-0108  
SUMMARY OF HUMAN HEALTH COPC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Groundwater		Sediment		Soil	
	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale	COPC (yes/no)	Rationale
2,4,6-Trinitrotoluene (TNT)	NA	NA	NA	NA	NA	NA	No	A
2,4-Dinitrotoluene	NA	NA	NA	NA	NA	NA	Uncertainty	B
2,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA	Uncertainty	B
2-Amino-4,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA	No	C
2-Nitrotoluene (ONT)	NA	NA	NA	NA	NA	NA	No	C
3-Nitrotoluene	NA	NA	NA	NA	NA	NA	No	A
4-Amino-2,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA	No	C
4-Nitrotoluene (PNT)	NA	NA	NA	NA	NA	NA	No	A
HMX	NA	NA	NA	NA	NA	NA	No	A
Nitrobenzene	NA	NA	NA	NA	NA	NA	Uncertainty	B
Nitroglycerin	NA	NA	NA	NA	NA	NA	NA	NA
Pentaerythritol tetranitrate (PETN)	NA	NA	NA	NA	NA	NA	NA	NA
Perchloric Acid	NA	NA	NA	NA	NA	NA	NA	NA
RDX	NA	NA	NA	NA	NA	NA	No	A
Tetryl	NA	NA	NA	NA	NA	NA	No	A
<b>Other Parameters</b>								
Nitrogen, Nitrate-Nitrite	NA	NA	NA	NA	NA	NA	NA	NA
Phosphorus, Total (as P)	NA	NA	NA	NA	NA	NA	NA	NA

- A - Chemical was not detected and the reporting limit does not exceed the screening concentration.
- B - Chemical was not detected, but reporting limit was equal to or exceeded screening concentration.
- C - Chemical was not detected and there is no screening concentration.
- D - Chemical was detected and was equal to or exceeded screening concentration, but did not exceed background.
- E - Chemical was detected and was equal to or exceeded screening concentration and background, if applicable.
- F - Chemical was detected and did not exceed screening concentration.
- G - Chemical was detected, but no screening value was available.
- H - Chemical was detected, but it is an essential nutrient.
- J - Chemical was classified as a COPC based on USEPA 1998 data but was not a COPC based on SI data.
- NA - Not Analyzed or not applicable.

TABLE 41-7, AUS-0108  
SUMMARY OF ECOLOGICAL COPEC EVALUATION

AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Chemical	Surface Water		Sediment		Soil	
	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale
<b>Volatile Organic Compounds</b>						
1,1,1-Trichloroethane	NA	NA	NA	NA	No	A
1,1,2,2-Tetrachloroethane	NA	NA	NA	NA	No	A
1,1,2-Trichloroethane	NA	NA	NA	NA	No	A
1,1-Dichloroethane	NA	NA	NA	NA	No	A
1,1-Dichloroethene	NA	NA	NA	NA	No	A
1,2-Dichloroethane (EDC)	NA	NA	NA	NA	No	A
1,2-Dichloroethene (total)	NA	NA	NA	NA	No	A
1,2-Dichloropropane	NA	NA	NA	NA	No	A
2-Butanone (MEK)	NA	NA	NA	NA	No	A
2-Hexanone	NA	NA	NA	NA	No	A
4-Methyl-2-pentanone (MIBK)	NA	NA	NA	NA	No	A
Acetone	NA	NA	NA	NA	No	A
Benzene	NA	NA	NA	NA	No	A
Bromodichloromethane	NA	NA	NA	NA	No	A
Bromoform	NA	NA	NA	NA	No	A
Bromomethane	NA	NA	NA	NA	No	A
Carbon disulfide	NA	NA	NA	NA	No	A
Carbon tetrachloride	NA	NA	NA	NA	No	A
Chlorobenzene	NA	NA	NA	NA	No	A
Chloroethane	NA	NA	NA	NA	No	C
Chloroform	NA	NA	NA	NA	No	A
Chloromethane	NA	NA	NA	NA	No	A
cis-1,2-Dichloroethene	NA	NA	NA	NA	No	A
cis-1,3-Dichloropropene	NA	NA	NA	NA	No	A
Dibromochloromethane	NA	NA	NA	NA	No	A
Ethylbenzene	NA	NA	NA	NA	No	A
Methylene chloride	NA	NA	NA	NA	No	A
N-Hexane	NA	NA	NA	NA	No	C
Styrene	NA	NA	NA	NA	No	A
Tetrachloroethylene (PCE)	NA	NA	NA	NA	No	A
Toluene	NA	NA	NA	NA	No	A
total Xylenes	NA	NA	NA	NA	No	A
trans-1,2-Dichloroethene	NA	NA	NA	NA	No	A
trans-1,3-Dichloropropene	NA	NA	NA	NA	No	A
Trichloroethylene (TCE)	NA	NA	NA	NA	No	A
Vinyl chloride	NA	NA	NA	NA	No	A
<b>Semivolatile Organic Compounds</b>						
1,2,4-Trichlorobenzene	NA	NA	NA	NA	No	A
1,2-Dichlorobenzene	NA	NA	NA	NA	No	A
1,3-Dichlorobenzene	NA	NA	NA	NA	No	A
1,4-Dichlorobenzene	NA	NA	NA	NA	No	A
2,4,5-Trichlorophenol	NA	NA	NA	NA	No	A

TABLE 41-7, AUS-0108  
SUMMARY OF ECOLOGICAL COPEC EVALUATION

AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Chemical	Surface Water		Sediment		Soil	
	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale
2,4,6-Trichlorophenol	NA	NA	NA	NA	No	A
2,4-Dichlorophenol	NA	NA	NA	NA	No	A
2,4-Dimethylphenol	NA	NA	NA	NA	Uncertainty	B
2,4-Dinitrophenol	NA	NA	NA	NA	No	A
2-Chloronaphthalene	NA	NA	NA	NA	Uncertainty	B
2-Chlorophenol	NA	NA	NA	NA	Uncertainty	B
1-Methylnaphthalene	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	NA	NA	NA	NA	No	A
2-Methylphenol	NA	NA	NA	NA	No	A
2-Nitroaniline	NA	NA	NA	NA	No	A
2-Nitrophenol	NA	NA	NA	NA	No	A
3,3'-Dichlorobenzidine	NA	NA	NA	NA	No	A
3-Nitroaniline	NA	NA	NA	NA	No	A
4,6-Dinitro-2-methylphenol	NA	NA	NA	NA	No	C
4-Bromophenyl phenyl ether	NA	NA	NA	NA	No	C
4-Chloro-3-methylphenol	NA	NA	NA	NA	No	A
4-Chloroaniline	NA	NA	NA	NA	No	A
4-Chlorophenyl phenyl ether	NA	NA	NA	NA	No	C
4-Methylphenol	NA	NA	NA	NA	No	A
4-Nitroaniline	NA	NA	NA	NA	No	A
4-Nitrophenol	NA	NA	NA	NA	No	A
Acenaphthene	NA	NA	NA	NA	No	A
Acenaphthylene	NA	NA	NA	NA	No	A
Anthracene	NA	NA	NA	NA	No	A
Benzo(a)anthracene	NA	NA	NA	NA	No	A
Benzo(a)pyrene	NA	NA	NA	NA	No	A
Benzo(b)fluoranthene	NA	NA	NA	NA	No	A
Benzo(g,h,i)perylene	NA	NA	NA	NA	No	A
Benzo(k)fluoranthene	NA	NA	NA	NA	No	A
bis(2-Chloroethoxy)methane	NA	NA	NA	NA	Uncertainty	B
bis(2-Chloroethyl) ether	NA	NA	NA	NA	No	A
bis(2-Chloroisopropyl) ether	NA	NA	NA	NA	No	C
bis(2-Ethylhexyl) phthalate	NA	NA	NA	NA	Yes	E
Butyl benzyl phthalate	NA	NA	NA	NA	Uncertainty	B
Carbazole	NA	NA	NA	NA	No	C
Chrysene	NA	NA	NA	NA	No	A
Di-n-butyl phthalate	NA	NA	NA	NA	No	A
Di-n-octyl phthalate	NA	NA	NA	NA	No	A
Dibenz(a,h)anthracene	NA	NA	NA	NA	No	A
Dibenzofuran	NA	NA	NA	NA	No	C
Diethyl phthalate	NA	NA	NA	NA	No	A
Dimethyl phthalate	NA	NA	NA	NA	No	A
Fluoranthene	NA	NA	NA	NA	No	A

**TABLE 41-7, AUS-0108  
SUMMARY OF ECOLOGICAL COPEC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**

Chemical	Surface Water		Sediment		Soil	
	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale
Fluorene	NA	NA	NA	NA	No	A
Hexachlorobenzene	NA	NA	NA	NA	No	A
Hexachlorobutadiene	NA	NA	NA	NA	Uncertainty	B
Hexachlorocyclopentadiene	NA	NA	NA	NA	No	A
Hexachloroethane	NA	NA	NA	NA	No	A
Indeno(1,2,3-c,d)pyrene	NA	NA	NA	NA	No	A
Isophorone	NA	NA	NA	NA	No	A
N-Nitroso-di-n-propylamine	NA	NA	NA	NA	No	A
N-Nitrosodiphenylamine	NA	NA	NA	NA	No	A
Naphthalene	NA	NA	NA	NA	No	A
Pentachlorophenol	NA	NA	NA	NA	No	A
Phenanthrene	NA	NA	NA	NA	No	A
Phenol	NA	NA	NA	NA	No	A
Pyrene	NA	NA	NA	NA	No	A
<b>Metals and Inorganics</b>						
Aluminum	NA	NA	NA	NA	Uncertainty	I
Antimony	NA	NA	NA	NA	No	F
Arsenic	NA	NA	NA	NA	Yes	D
Barium	NA	NA	NA	NA	No	F
Beryllium	NA	NA	NA	NA	No	F
Boron	NA	NA	NA	NA	Yes	D
Cadmium	NA	NA	NA	NA	No	F
Calcium	NA	NA	NA	NA	Uncertainty	G,H
Chromium	NA	NA	NA	NA	Yes	D
Cobalt	NA	NA	NA	NA	No	F
Copper	NA	NA	NA	NA	No	F
Cyanide, Total	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	Yes	D
Lead	NA	NA	NA	NA	No	F
Magnesium	NA	NA	NA	NA	Uncertainty	G,H
Manganese	NA	NA	NA	NA	Yes	D
Mercury	NA	NA	NA	NA	Yes	D
Nickel	NA	NA	NA	NA	No	F
Potassium	NA	NA	NA	NA	Uncertainty	G,H
Selenium	NA	NA	NA	NA	Yes	D
Silver	NA	NA	NA	NA	No	A
Sodium	NA	NA	NA	NA	Uncertainty	G,H
Thallium	NA	NA	NA	NA	Uncertainty	B
Vanadium	NA	NA	NA	NA	No	F
Zinc	NA	NA	NA	NA	Yes	E
<b>Explosives</b>						
1,3,5-Trinitrobenzene	NA	NA	NA	NA	No	A
1,3-Dinitrobenzene	NA	NA	NA	NA	No	A

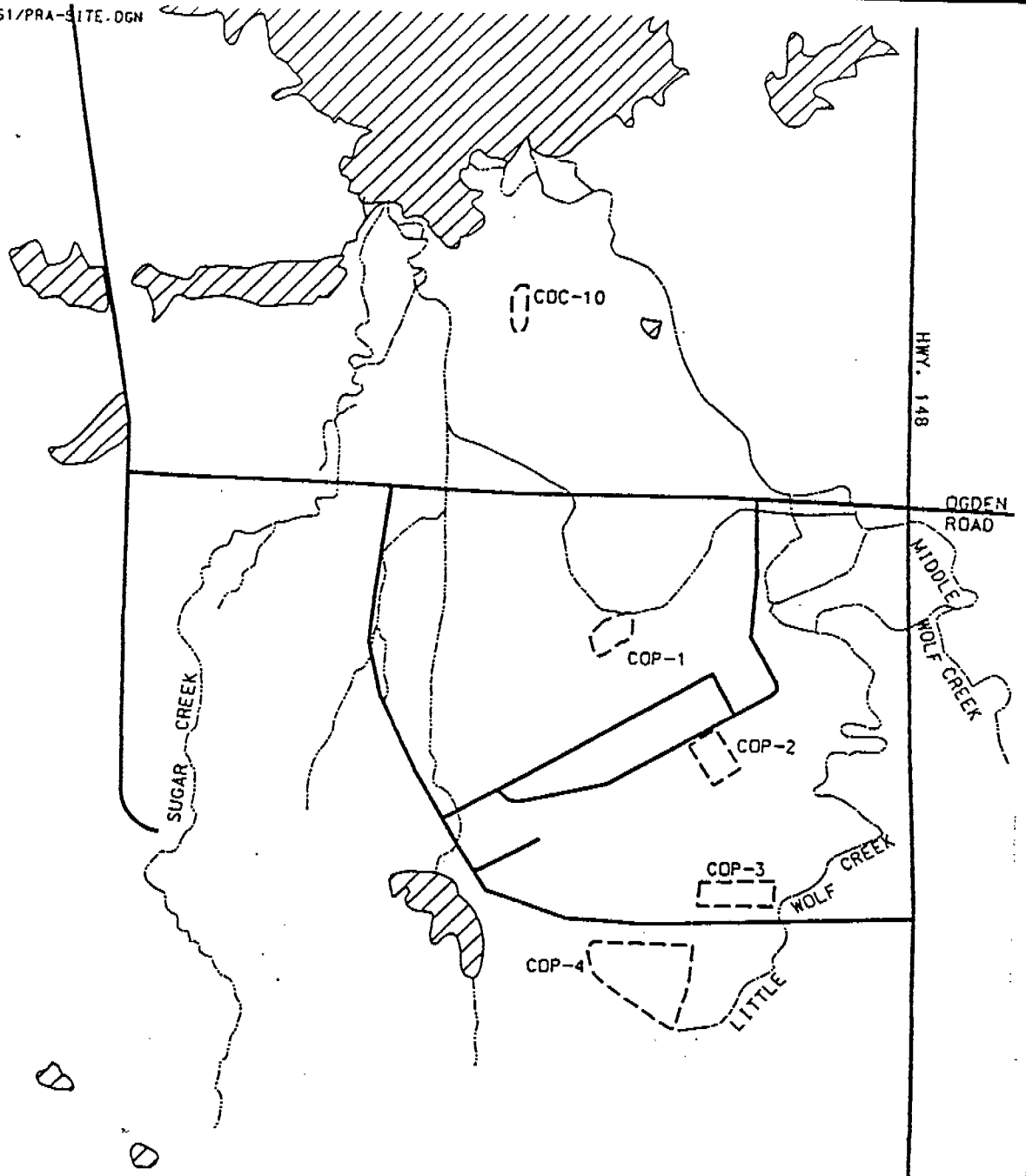
**TABLE 41-7, AUS-0108  
SUMMARY OF ECOLOGICAL COPEC EVALUATION**

**AUS OU PA/SI  
CRAB ORCHARD NATIONAL WILDLIFE REFUGE**



Chemical	Surface Water		Sediment		Soil	
	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale	COPEC (yes/no)	Rationale
2,4,6-Trinitrotoluene (TNT)	NA	NA	NA	NA	No	A
2,4-Dinitrotoluene	NA	NA	NA	NA	No	A
2,6-Dinitrotoluene	NA	NA	NA	NA	Uncertainty	B
2-Amino-4,6-Dinitrotoluene	NA	NA	NA	NA	No	A
2-Nitrotoluene (ONT)	NA	NA	NA	NA	No	C
3-Nitrotoluene	NA	NA	NA	NA	No	C
4-Amino-2,6-Dinitrotoluene	NA	NA	NA	NA	No	C
4-Nitrotoluene (PNT)	NA	NA	NA	NA	No	C
HMX	NA	NA	NA	NA	No	A
Nitrobenzene	NA	NA	NA	NA	No	A
Nitroglycerin	NA	NA	NA	NA	NA	NA
Pentaerythritol tetranitrate (PETN)	NA	NA	NA	NA	NA	NA
Perchloric Acid	NA	NA	NA	NA	NA	NA
RDX	NA	NA	NA	NA	No	A
Tetryl	NA	NA	NA	NA	No	C

- A - Chemical was not detected and the reporting limit does not exceed the screening concentration.
- B - Chemical was not detected, but reporting limit was equal to or exceeded screening concentration.
- C - Chemical was not detected and there is no screening concentration.
- D - Chemical was detected and was equal to or exceeded screening concentration, but did not exceed background.
- E - Chemical was detected and was equal to or exceeded screening concentration and background, if applicable.
- F - Chemical was detected and did not exceed screening concentration.
- G - Chemical was detected, but no screening value was available.
- H - Chemical was detected, but it is an essential nutrient.
- I - If pH<5.5, Aluminum is a COPEC, otherwise it is not.
- J - Chemical was classified as a COPEC based on USEPA 1998 data but was not a COPEC based on SI data.
- NA - Not Analyzed or not applicable.





LEGEND

-  OPEN WATER
-  COP-1 GENERAL SITE LOCATION & IDENTIFICATION

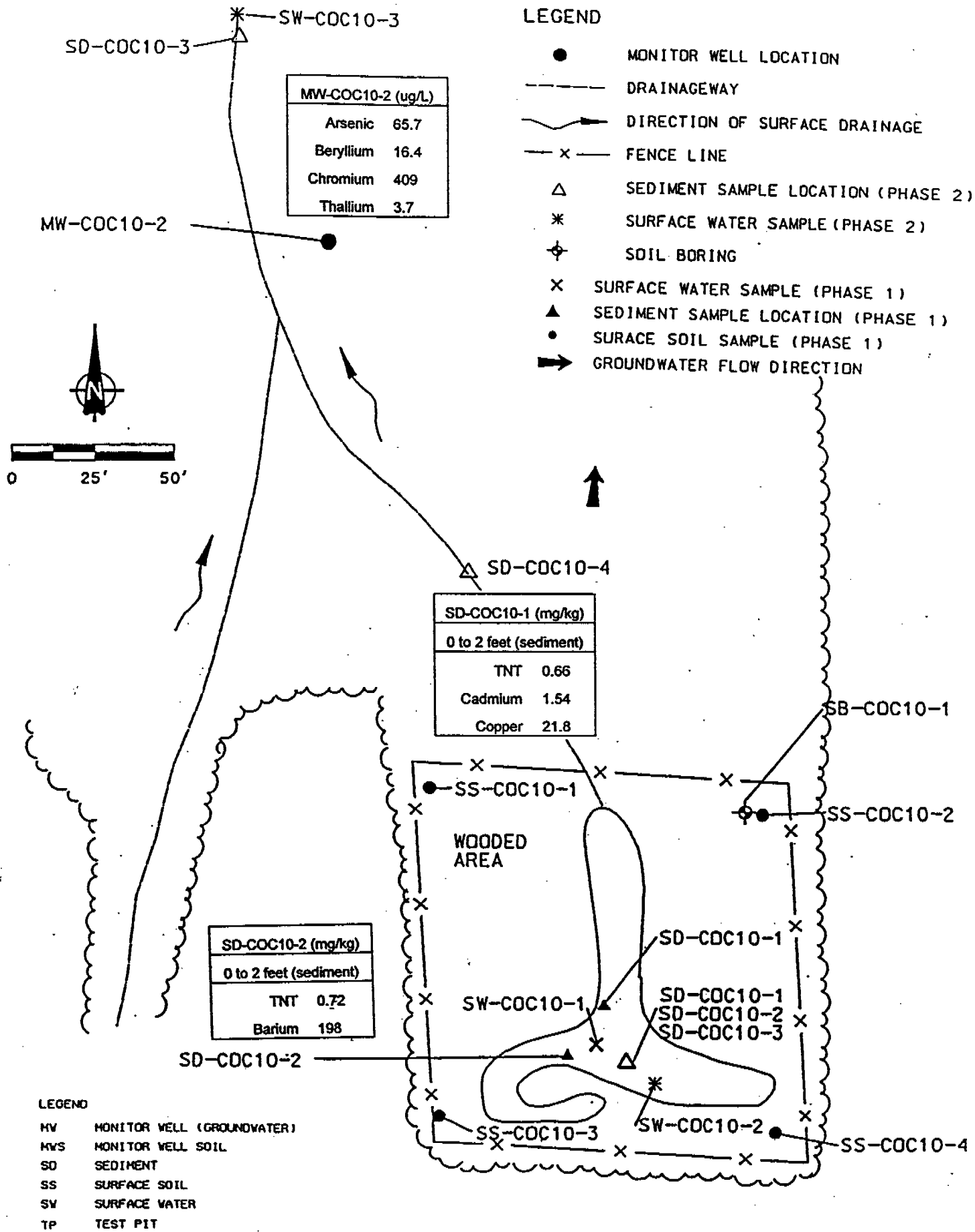


APPROXIMATE  
SCALE: 1" = 2700'

SOURCE: U.S. GEOLOGICAL SURVEY,  
PROJECT NAPP, MARCH 27, 1988

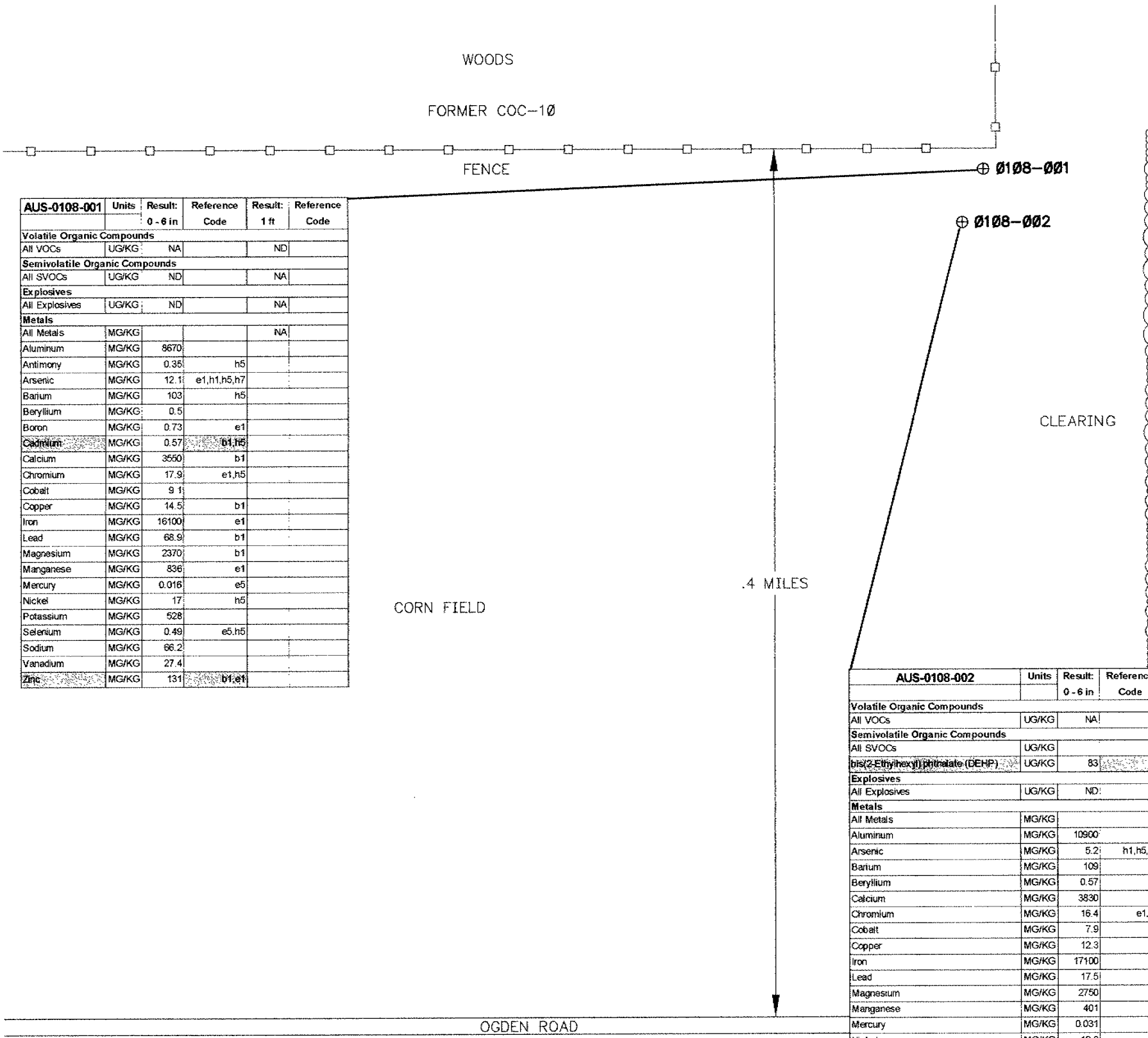
Note: This figure was obtained from the RI/BRA Report done by ESE, Inc. in September 1984 (Figure 1-5).

PA/SI REPORT-AUS OU CRAB ORCHARD NWR MARION, ILLINOIS		PROJECT NO. 2320000026.00
<b>URS</b>		
DRN. BY: djd 9/7/99 DSGN. BY: CHKD. BY:	Emma OU COC-10 Site Location	FIG. NO. 41-1



Note: The base map used for this figure is taken from Figure 4-11 of the ESE EMMA OU Draft Final RI Report, September 15, 1994. Data are from Tables 4-36 and 4-38 of the 1994 ESE Report, which list "Constituent Concentrations Above Background or Detection Limits." The background values used for the ESE report are referenced as being from a 1993 USACE-Omaha database (ESE report, page 4-8). The full reference for the database is not included in the ESE report. The background values are similar to those used for this Historic Search Report, which are from W-C, 1995.

**Figure 41-2**  
**Site COC-10**



AUS-0108-001	Units	Result:	Reference	Result:	Reference
		0 - 6 in	Code	1 ft	Code
<b>Volatile Organic Compounds</b>					
All VOCs	UG/KG	NA		ND	
<b>Semivolatile Organic Compounds</b>					
All SVOCs	UG/KG	ND		NA	
<b>Explosives</b>					
All Explosives	UG/KG	ND		NA	
<b>Metals</b>					
All Metals	MG/KG			NA	
Aluminum	MG/KG	8670			
Antimony	MG/KG	0.35		h5	
Arsenic	MG/KG	12.1	e1,h1,h5,h7		
Barium	MG/KG	103		h5	
Beryllium	MG/KG	0.5			
Boron	MG/KG	0.73		e1	
Cadmium	MG/KG	0.57		b1,h5	
Calcium	MG/KG	3550		b1	
Chromium	MG/KG	17.9		e1,h5	
Cobalt	MG/KG	9.1			
Copper	MG/KG	14.5		b1	
Iron	MG/KG	16100		e1	
Lead	MG/KG	68.9		b1	
Magnesium	MG/KG	2370		b1	
Manganese	MG/KG	836		e1	
Mercury	MG/KG	0.016		e5	
Nickel	MG/KG	17		h5	
Potassium	MG/KG	528			
Selenium	MG/KG	0.49		e5,h5	
Sodium	MG/KG	66.2			
Vanadium	MG/KG	27.4			
Zinc	MG/KG	131		b1,e1	

AUS-0108-002	Units	Result:	Reference	Result:	Reference
		0 - 6 in	Code	1 ft	Code
<b>Volatile Organic Compounds</b>					
All VOCs	UG/KG	NA		ND	
<b>Semivolatile Organic Compounds</b>					
All SVOCs	UG/KG			NA	
bis(2-Ethylhexyl)phthalate (DEHP)	UG/KG	83		e5	
<b>Explosives</b>					
All Explosives	UG/KG	ND		NA	
<b>Metals</b>					
All Metals	MG/KG			NA	
Aluminum	MG/KG	10900			
Arsenic	MG/KG	5.2		h1,h5,h7	
Barium	MG/KG	109		h5	
Beryllium	MG/KG	0.57			
Calcium	MG/KG	3830		b1	
Chromium	MG/KG	16.4		e1,h5	
Cobalt	MG/KG	7.9			
Copper	MG/KG	12.3		b1	
Iron	MG/KG	17100		e1	
Lead	MG/KG	17.5			
Magnesium	MG/KG	2750		b1	
Manganese	MG/KG	401		e1	
Mercury	MG/KG	0.031		e5	
Nickel	MG/KG	12.8		h5	
Potassium	MG/KG	889		b1	
Sodium	MG/KG	52.5			
Vanadium	MG/KG	28.5			
Zinc	MG/KG	55.9		b1	

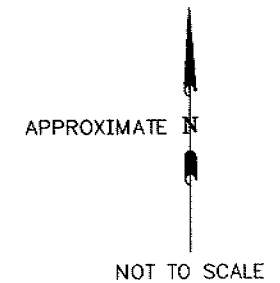
Screening Reference	Reference Code
AUS Background Soil UTL	b1
Little Grassy Background Sediment UTL	b2
Little Grassy Background Surface Water UTL	b3
Ecological Direct Exposure Pathway TRV - Soil	e1
Ecological Direct Exposure Pathway TRV - Sediment	e2
Ecological Direct Exposure Pathway TRV - Surface Water	e3
IEPA General Use Surface Water Quality Aquatic Life Toxicity	e4
Superfund Chemical Data Matrix Kow values (potential bioaccumulator)	e5
USEPA Region IX Industrial Soil PRG - cancerous	h1
USEPA Region IX Industrial Soil PRG - noncancerous	h2
USEPA Region IX Tap Water PRG - cancerous	h3
USEPA Region IX Tap Water PRG - noncancerous	h4
USEPA Region IX Migration to Groundwater PRG (DAF=1)	h5
USEPA MCL Drinking Water Standards	h6
IEPA TACO Industrial/Commercial Soil Ingestion	h7
IEPA TACO Construction Worker Soil Ingestion	h8
IEPA TACO Class I Soil Component of Groundwater	h9
IEPA General Use Surface Water Quality Human Health	h10

**LEGEND**

- ⊕ HAND AUGER LOCATION
- ~ TREELINE

**NOTES:**

1. DRAWING TAKEN FROM FIELD SKETCH DRAWN ON 10/17/00.
2. SAMPLE LOCATIONS ARE APPROXIMATE.
3. DATA QUALIFIERS FOR ANALYTICAL RESULTS ARE NOT INDICATED. REFER TO THE QCSR FOR DATA QUALIFIERS.
4. THE FOLLOWING COMPOUNDS ARE INCLUDED IN THE ANALYTE LIST FOR BOTH SVOCs AND SVOCs AND EXPLOSIVES: 2,4-DINITROTOLUENE, 2,6-DINITROTOLUENE, AND NITROBENZENE. THESE COMPOUNDS MAY BE REPORTED AS EITHER SVOCs OR EXPLOSIVES.



PA/SI REPORT-AUS OU  
CRAB ORCHARD NWR  
MARION, ILLINOIS

PROJECT NO.  
2320000026.00



DRN. BY:djd 10/24/00  
DSGN. BY:are  
CHKD. BY:mch/cmw

AUS-0108 Sample Locations  
and Detections in Soils

FIG. NO.  
41-3

**AUS-0108-POSSIBLE FORMER SURFACE DISPOSAL AREA**

## **SECTION FORTY-TWO**

This section presents the site summary sheets and site evaluations for sites within Additional and Uncharacterized Sites Operable Unit (AUS OU) which were eliminated after the historical record search. The sites are as follows:

- AUS-012 – Area 4 – Waste Oil Tank at Old Refuge Shop
- AUS-016 – Area 4 – Supreme Plating Co. – Concrete Pit At Old Refuge Shop
- AUS-025 – Area 8 – Load Line III Cleaning and Painting Building
- AUS-036 – Area 9 – Load Line I Cleaning and Painting Building
- AUS-041 – Area 10 – Firing Range (formerly COP-10)
- AUS-057 – Areas 11/12 – Dump East of Road From Area 11 to 12
- AUS-068 – COC Area – Pasture North of Hampton Cemetery
- AUS-070 – Dump Northeast of Bass Ponds
- AUS-071 – Route 148 Causeway – Former Mounds of Unknown Material
- AUS-072 – Route 148 Causeway – Marion Pump Station
- AUS-073 – Recreational Waste Dump (West End of Crab Orchard Lake Dam)
- AUS-074 – Homestead Dump
- AUS-075 – Homestead Dump on West Refuge Border
- AUS-076 – Open Burn Site at Route 13 Marina (Images Marina)
- AUS-077 – Homestead Dump Northwest of Devils Kitchen Lake
- AUS-078 – Treated Wood Posts East of Devils Kitchen Lake
- AUS-079 – Boy Scout Camp Dump
- AUS-080 – Girl Scout Camp Dump By Beach
- AUS-081 – Girl Scout Camp Dump By Camp Site
- AUS-082 – Area Between Water Tower 3 and PCB OU Remedial Action

**43.1 SITES IDENTIFIED IN THE AERIAL PHOTO INTERPRETATION**

As a part of the Preliminary Assessment/Site Investigation (PA/SI), Entech, Inc. was contracted to perform a historic aerial photographic search at the Refuge, with emphasis on several of the industrial areas. The following information was obtained from their document that was titled: "Historical Aerial Photographic Analysis – Inventory of Potential Disposal Sites: Additional and Uncharacterized Sites (AUS) Operable Unit, Crab Orchard National Wildlife Refuge (CONWR) Marion, Illinois". This was a draft report that was submitted to the United States Fish & Wildlife Service (USFWS) by Entech in August of 1999.

All of the sites identified by Entech, were reviewed, and the following sites are those sites that were determined to have potential for contamination. Each of the following sites has a brief description of the site, followed by a discussion of the recommendations for that site.

**T9S, R1E, SECTION 14**

#01 – Probable waste water treatment plant with four impoundments located west of the Administration Area (Area 1 of the Illinois Ordnance Plant (IOP)). Site Location is found in Figure 43-1.

This is the former IOP Waste Water Treatment Plant and it is already a part of the AUS investigation (AUS-0002).

**T9S, R1E, SECTION 13**

#01, 02, 04 & 05 – Railroad Yard with three spurs, evidence of open storage, disposal areas, a linear excavation and a horizontal tank; located northeast of Area 2D (AUS-0A2D). Also noted were nine buildings, several sheds, two rail spurs and one main line, and open storage of coal and crates/containers in Area 2R in 1943.<sup>1</sup> In the southwest corner of the site (south of Post Oak Road and west of Stringtown Road), a linear excavation with an access road leading to it was also observed in the 1943 aerial.<sup>2</sup> The excavation appeared to contain liquid, and there also appeared to be a horizontal tank just to the south of the excavation.<sup>3</sup> Along the main line at this time, were two buildings and an open storage area of dark-toned waste materials.<sup>4</sup> These

<sup>1</sup> Entech, Inc., 1999, Historical Aerial Photographic Analysis – Inventory of Potential Disposal Sites: Additional and Uncharacterized Sites (AUS) Operable Unit, Crab Orchard National Wildlife Refuge (CONWR) Marion, Illinois, Volume I: TEXT, Page 3-7, and Volume II: MAPS, Page B. The Entech reports analyze historic aerial overflight photographs of industrial areas at the Refuge, from 1943 to 1993 (except in Area 2, which was analyzed from 1960-1993). The photos were obtained from the National Archives and Records Administration (NARA) and the U.S. Department of Agriculture Agricultural Stabilization and Conservation Service (ASCS).

<sup>2</sup> Entech, Inc., 1999, Historical Aerial Photographic Analysis – Inventory of Potential Disposal Sites: Additional and Uncharacterized Sites (AUS) Operable Unit, Crab Orchard National Wildlife Refuge (CONWR) Marion, Illinois, Volume I: TEXT, Page 3-7.

<sup>3</sup> Entech, Inc., 1999, Historical Aerial Photographic Analysis – Inventory of Potential Disposal Sites: Additional and Uncharacterized Sites (AUS) Operable Unit, Crab Orchard National Wildlife Refuge (CONWR) Marion, Illinois, Volume I: TEXT, Page 3-7.

<sup>4</sup> Entech, Inc., 1999, Historical Aerial Photographic Analysis – Inventory of Potential Disposal Sites: Additional and Uncharacterized Sites (AUS) Operable Unit, Crab Orchard National Wildlife Refuge (CONWR) Marion, Illinois, Volume I: TEXT, Page 3-7.

materials and buildings were removed by 1951.<sup>5</sup> The remainder of this rail yard was also dismantled by 1951; however, the linear excavation was still present on site.<sup>6</sup> This excavation was gone and the area had re-vegetated by 1960.<sup>7</sup>

It appears that the Straitline Freight Co. may have occupied Area 2R in at least 1950, for trucking.<sup>8</sup> A Refuge map places them in the vicinity of Area 2R at that time.<sup>9</sup>

Also in 1960, there were several piles of earthen material present on this site.<sup>10</sup> By 1965, various stored materials covered the portion of the site between the easternmost and westernmost rail spurs.<sup>11</sup> These materials were still present in 1971, along with a new building on the southern portion of the site.<sup>12</sup> In 1976, E. T. Simonds occupied AUS-0A2R for storage.<sup>13,14</sup> The stored materials were removed from the site by 1980 and a string of rail cars were visible on the westernmost spur at this time.<sup>15</sup>

A possible disposal area containing various materials including light-toned earthen materials was noted in northernmost part of the area in the 1980 aerial photograph (just south of the convergence of the center and western rail lines). These materials were removed from the site by 1993.

Site location is found in Figure 43-2.

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<sup>5</sup> Entech, Inc., 1999, Historical Aerial Photographic Analysis – Inventory of Potential Disposal Sites: Additional and Uncharacterized Sites (AUS) Operable Unit, Crab Orchard National Wildlife Refuge (CONWR) Marion, Illinois, Volume I: TEXT, Page 3-7.

<sup>6</sup> Entech, Inc., 1999, Historical Aerial Photographic Analysis – Inventory of Potential Disposal Sites: Additional and Uncharacterized Sites (AUS) Operable Unit, Crab Orchard National Wildlife Refuge (CONWR) Marion, Illinois, Volume I: TEXT, Page 3-7.

<sup>7</sup> Entech, Inc., 1999, Historical Aerial Photographic Analysis – Inventory of Potential Disposal Sites: Additional and Uncharacterized Sites (AUS) Operable Unit, Crab Orchard National Wildlife Refuge (CONWR) Marion, Illinois, Volume I: TEXT, Page 3-7.

<sup>8</sup> CRO 000230. U.S. Department of the Interior, Fish and Wildlife Service, 1950, Map of Crab Orchard National Wildlife Refuge showing Recreational Facilities and Industrial Tenants.

<sup>9</sup> CRO 000230. U.S. Department of the Interior, Fish and Wildlife Service, 1950, Map of Crab Orchard National Wildlife Refuge showing Recreational Facilities and Industrial Tenants.

<sup>10</sup> Entech, Inc., 1999, Historical Aerial Photographic Analysis – Inventory of Potential Disposal Sites: Additional and Uncharacterized Sites (AUS) Operable Unit, Crab Orchard National Wildlife Refuge (CONWR) Marion, Illinois, Volume I: TEXT, Page 3-7.

<sup>11</sup> Entech, Inc., 1999, Historical Aerial Photographic Analysis – Inventory of Potential Disposal Sites: Additional and Uncharacterized Sites (AUS) Operable Unit, Crab Orchard National Wildlife Refuge (CONWR) Marion, Illinois, Volume I: TEXT, Page 3-7.

<sup>12</sup> Entech, Inc., 1999, Historical Aerial Photographic Analysis – Inventory of Potential Disposal Sites: Additional and Uncharacterized Sites (AUS) Operable Unit, Crab Orchard National Wildlife Refuge (CONWR) Marion, Illinois, Volume I: TEXT, Page 3-7, and Volume II: MAPS, Page B.

<sup>13</sup> DPRA Document No. 00006406. Attachment “C”, Land, Dated November 8, 1976. Identifies several companies at CONWR.

<sup>14</sup> DPRA Document No. 00006409. Special Area Designations Map associated with Attachment “C”, Land, Dated November 8, 1976. Identifies several companies at CONWR.

<sup>15</sup> Entech, Inc., 1999, Historical Aerial Photographic Analysis – Inventory of Potential Disposal Sites: Additional and Uncharacterized Sites (AUS) Operable Unit, Crab Orchard National Wildlife Refuge (CONWR) Marion, Illinois, Volume I: TEXT, Page 3-7.

This is the current loading dock used by Primex in Area 2. It is already a part of the AUS investigation (AUS-0A2R) and it has been included in the discussion with the rest of Area 2.

**T9S, R2E, SECTION 18**

#01 – Rectangular excavation next to roadway (just southeast of Old Route 13, near center of Section 18). Site Location is found in Figure 43-3.

There was no evidence of disposal in the excavation at this site, therefore no further investigation is recommended.

**T9S, R1E, SECTION 23**

#01 – Area containing 12-14 north-south trending trenches (located due west of Area 2D, west of Wolf Creek Road, midway between this road and Crab Orchard Lake). The trenches were filled with unidentifiable materials and were observed in the 1943 aerial photograph. By 1951, trenches are filled and some dumping has occurred at the site and the dumping continues until sometime between 1951 and 1960. Site Location is found in Figure 43-4.

A portion of this site is the Job Corps Landfill (PCB OU Site 17). It is very likely that the remediation done at the Job Corps Landfill did not include the trenches identified in the 1943 aerial photograph because the 1943 aerial photograph was not reviewed during the initial investigation done for the Job Corp Landfill. Specific remediation limits have not been identified at the Job Corps landfill site, however, a post-remediation contour map was found of the site and several of the trenches were located outside of the boundaries of the contour lines that were surveyed. It also appeared that remediation done in this area did not extend any deeper than three feet (ft). As a result, the former trenches may not have been discovered during remediation since the remediation did not go any deeper than three ft and the trenches would have been covered over with fill material after disposal activities were completed. Based on this information, it is believed that this site warrants further investigation and it should be included in the Remedial Investigation (RI). This site is located to the north of AUS OU site AUS-0061, and it will therefore be included as a part of AUS-0061 (and renamed the IOP Detonation/Disposal Area) during the RI.

**T9S, R1E, SECTION 24**

#02 – Containerized-materials storage and mound of probable earthen waste material located south of AUS-0A2B (Area 2B). Site Location is found in Figure 43-5.

This site was not originally investigated during the SI. It appears to have only been used by the IOP and it does not appear to have been used for production purposes since it is not included in any of the Area 2 Load Lines. It also does not have any interconnecting roads (other than Wolf Creek Road) with the production facilities for the four Load Lines in Area 2. Since contamination was found at the four Area 2 Load Lines during the SI, this site will be investigated as a part of the RI and it will be included with Area 2B (AUS-0A2B).

#03 – Four horizontal tanks located in area between AUS-0A2F (Area 2F) and AUS-0A2B (Area 2B), along with nine newly constructed buildings in 1965. Site Location is found in Figure 43-5.

Samples were collected from next to the four former horizontal ASTs as a part of the AUS-0A2F (Area 2F) investigation. Since trichloroethylene (TCE) and Tetrachloroethylene (PCE) were detected in the surface soils at this location during the SI, the areas around the nine buildings identified in the 1965 aerial photograph (along with further investigation of the aboveground storage tanks (ASTs)) will also be investigated as a part of the RI for Areas 2F (AUS-0A2F).

**T9S, R2E, SECTION 19**

#04 – Sewage Treatment Plant (located due east of Area 2F and due north of Area 3 – Finished Ammunition Group 1). Site Location is found in Figure 43-6.

This is IOP Sewage Treatment Plant. It has already been designated as a site (Site 36 of the Miscellaneous Operable Unit (MISCA OU)) and it is currently under investigation, therefore it is not included in AUS OU.

#05 – Probable disposal area located west of Area 4, with an access road leading to it from AUS-0A4W (Area 4 West). Site Location is found in Figure 43-6.

A sample was collected from this area as a part of the investigation for AUS-0A4W (Area 4 West) and no further investigation should be necessary in this portion of AUS-0A4W, based on SI sample results.

#06 & 08– Storage and surface disposal area located in Area 4 West (AUS-0A4W)

This is the former Wood Treatment Facility. It has already been designated as a site (Site 22A of the MISCA OU) and it has already been remediated for PCP and dioxins. Site Location is found in Figure 43-6.

#07 – Probable disposal area located southwest of the buildings located in Area 4 West. Site Location is found in Figure 43-6.

This area (seen already vegetating in 1960 aerial photograph) was not investigated since it appears to have just been an extension of the site #05 (above) which was seen in the 1951 aerial photograph and it was sampled as a part of AUS-0A4W (Area 4 West).

**T9S, R2E, SECTION 20**

#01 – Probable disposal area located due east of the Water Tower No. 4, that is located north of Area 4. This area was identified in the aerial photograph interpretation of Area 4, as having a foundation located next to a rail spur. There was an area of discolored soil located between this foundation and the rail spur. This area remained unvegetated for many years. Site Location is found in Figure 43-7.

This area was one of the original AUS sites (AUS-0019). A sample was collected from the area of the dark-toned (discolored) soil identified in the aerial photograph, and no further investigation was recommended at this site, based on the SI results.



**T9S, R2E, SECTION 21**

#01 – Surface disposal of various materials next to a creek, observed in the 1943 aerial photograph, north of Area 6. Site Location is found in Figure 43-8.

A visual site inspection was done at this site on May 11, 2000. There were a few 3 to 4 ft high mounds observed at the site as well as some pieces of concrete. The total area of the site is approximately 50 by 100 ft. A sample will be collected from at least one of these mounded areas during the RI and this area will be included with Area 6 (AUS-0A06) of the AUS OU.

**T9S, R2E, SECTION 22**

Site Location is found in figure 43-9.

No significant activity noted in this Section.

**T9S, R1E, SECTION 27**

#01 – Fenced compound located in the Crab Orchard Cemetery (COC) Area that was possibly used for explosives detonation activity. Site Location is found in Figure 43-10.

This area appears to be COC-5, which was previously designated as a site in the Explosives and Munitions Manufacturing Area Operable Unit (EMMA OU). This site has already undergone chemical and OEW investigations and no further action has been recommended for this site in the EMMA OU RI/Baseline Risk Assessment (BRA) done by Environmental Science & Engineering, Inc. (ESE) in 1994, so it was not included in the AUS OU with some of the other COC sites.

#02 – Ground scars in COC Area on a hillside just north of COC-11 (across road) in 1980 aerial photo. Site Location is found in Figure 43-10.

There is no apparent link between these two sites (no roadway is evident), however based on the proximity of this site and COC-11, it is likely that these two sites were related. COC-11 was a former landfill that was closed in 1974. It is expected that the materials disposed of in COC-11 would have been covered with fill material at that time. It is speculated that this scarred area was used as a borrow area for the landfill. The lack of an apparent link between the two sites could possibly be due to the time that the photo was taken. The photo was taken in 1980 and the landfill was closed six years before the photo was taken. It is likely that if a road existed between these two areas, it would have re-vegetated within the six-year time span. No further investigation is recommended at this location.

**T9S, R1E, SECTION 26**

#01 – Shallow trench-like depression located on west side of Wolf Creek Road, just north of Crab Orchard Lake (northwest of the former Water Treatment Plant). Site Location is found in Figure 43-11.

This was located next to a possible former farmstead in 1943 and there was no evidence of disposal activity in the trench. There were no obvious access roads leading to this trench. No further investigation is recommended at this location.

#03 – Trench-like feature cut into an embankment of a shallow drainage swale, that was identified in a 1943 aerial photograph northwest of a former farmstead and east of former EMMA Site COC-4. Site Location is found in Figure 43-11.

This trench was identified next to a former farmstead in the 1943 aerial photo. It did contain some unidentified material, however there was no evidence of recent activity in the trench. Since it did not appear to have been used recently in the 1943 aerial photo, it is assumed that this was a disposal area for the farmstead and it was not likely related to IOP operations. As a result, no further investigation was recommended for this location.

#04 – Two-sided bermed area containing a linear scar as seen in 1943 aerial photograph – similar to that typically associated with a backfilled trench. It is located north-northeast of Hampton Cemetery, near the southern shore of Crab Orchard Lake. Site Location is found in Figure 43-11.

There were vehicular tracks leading to this possible former trench location, therefore it was likely that there had been recent activity in this location and thus it was likely that the recent activity was IOP-related. This trench was not investigated during the SI; however, several other similar trenches were investigated. It was decided that if significant contamination were identified in the similar trenches, then this trench would be added for investigation during the RI. Since significant contamination was not identified in similar trenches (such as at AUS-0107), no further investigation is recommended at this site.

#05 – Surface and subsurface disposal area southwest of Hampton Cemetery. Likely location of EMMA OU Site COC-3. Site Location is found in Figure 43-11.

This area appears to be COC-3, which was previously designated as a site in the EMMA OU. This site has already undergone chemical and ordnance and explosive waste (OEW) investigations, and remediation is currently being done at this site so it was not included in the AUS OU with some of the other COC sites.

#06 – Scattered ground scars (craters that are indicative of explosives detonation activity). This site appears to be EMMA OU Site COC-4, which is located just east of EMMA OU Site COC-3. Site Location is found in Figure 43-11.

This area appears to be COC-4 based on the aerial photograph interpretation and EMMA OU documents. COC-4 was previously designated as a site in the EMMA OU. This site has already undergone chemical and OEW investigations and according to the USFWS, it has been eliminated from further investigation.

#07 – Open field pock-marked with water-filled craters. This site appears to be EMMA OU Site COC-6, which is located just west-northwest of Hampton Cemetery. Site Location is found in Figure 43-11.

This area appears to be COC-6, which was previously designated as a site in the EMMA OU. This site has already undergone chemical and OEW investigations and according to the USFWS, it has been eliminated from further investigation. This site was included in the AUS OU investigation as AUS-0068, however this site was eliminated when it was identified as COC-6 in the aerial photograph interpretations and in EMMA OU documents.

#08 – Surface disposal of solid materials on eastern shore of Crab Orchard Lake, west of the former IOP Water Treatment Plant. Site Location is found in Figure 43-11.

This site was identified in the 1971 aerial photographs and it is not present on leased property. It is located near a boat dock and near the former Water Treatment Plant which does not appear to be in service at this time. Based on its location and the time in which the site appeared, it is assumed that this area is related to USFWS operations (not related to production operations) and no further investigation was done at this site.

FS – One of the farmsteads in this area (located southwest of Hampton Cemetery at intersection of two un-named roads) has been included in the AUS OU SI as Site AUS-0065. Site Location is found in Figure 43-11. Recommendations for this site are included with the AUS-0065 discussion in Section 25 of this report.

FS – A second farmstead that was identified in this Section, northwest of COC-6 (designated as #07 in this Section) has been included in the AUS OU SI as Site AUS-0067. This site has a fenced area that is marked as a “contaminated area”. Site Location is found in Figure 43-11. Recommendations for this site are included with the AUS-0067 discussion in Section 27 of this report.

### **T9S, R1E, SECTION 25**

#02 – Two areas of possible surficial discoloration and scarring (possibly due to liquid release) were identified at this site. One was located adjacent to the west side of the building (boiler house) and it may have been associated with fuel loading activities. The other was located along the outer southeastern edge of the ring road that loops around the former Area 2P Boiler House. Site Location is found in Figure 43-12.

This is the location of the former Boiler House for AUS-0A2P (Area 2P). It was originally identified as AUS-0010, but has since been included in AUS-0A2P. Surficial samples were collected from the two main areas of scarring, as a part of the AUS OU SI. The Historic Search Report also identified underground storage tanks (USTs) that had been removed from near this building. The location of these are not known. These former USTs will be investigated during the RI, since no closure report could be found for their removal.

#04 – Probable debris and crates staged along roadway in 1943 (located south of AUS-0069, on south side of Crab Orchard Lake). Site Location is found in Figure 43-12.

All of the materials were removed from the site by 1951. Since all of the materials appear to have been removed and the site was re-vegetating in 1951, and also since there was no evidence of any disposal activity identified during the site reconnaissance in this area, no further action was recommended regarding this site.

#05 – Probable debris deposits and large numbers of possibly crated materials on a hill adjacent to Crab Orchard Lake. Site Location is found in Figure 43-12.

This is former EMMA OU Site COC-15 and current AUS OU Site AUS-0069. A looping access road serves the site in 1943 and the largest concentrations of debris are seen along the drainage swale and along the lakeshore. Ground scarring and mounded debris are still present in 1951 and were also identified during the site reconnaissance. This site was included in the AUS OU investigation as AUS-0069 and it was also a part of the EMMA OU (Site COC-15). It was included in the AUS OU because there has not been a chemical investigation of this site as a part of the EMMA OU. An OEW investigation was done at this site by Parsons in 1997. Further investigation (an RI) was recommended at this site based on the results of the SI, as discussed in Section 28 of this report.

#06 – Possible Water Treatment Plant (AUS-0084) located south of Area 2B on the east side of Wolf Creek Road, just north of Crab Orchard Lake. Site Location is found in Figure 43-12.

This was a former IOP Water Treatment Plant that appeared to have been abandoned by 1960. The site reconnaissance revealed no evidence of contamination at this site, and no contamination is expected to be associated with this facility, so no further investigation is recommended at this site.

### **T9S, R2E, SECTION 30**

Site Location is found in Figure 43-13.

No significant activity is noted within this Section.

### **T9S, R2E, SECTION 29**

Site Location is found in Figure 43-14.

No significant activity is noted within this Section.

### **T9S, R2E, SECTION 28**

#01 – Storage or surface disposal of various materials (crates and earthen materials), south of Area 6. Site Location is found in Figure 43-15.

This site was seen in the 1943 aerial photograph and was not seen in the 1951 aerial photograph. It is likely that this was a staging area for construction of IOP Area 6 and no further investigation was recommended in this area.

#02 – Deposition of earthen materials south of Area 6. Site Location is found in Figure 43-15.

*Possibly from nearby pond???* This site was seen in the 1943 aerial photograph and was not seen in the 1951 aerial photograph. It is likely that this site was related to construction of IOP Area 6, and no further investigation was recommended at this site.

**T9S, R2E, SECTION 27**

#01 – Excavation, grading and possible deposition of earthen materials on east side of railroad that runs along the east side of Area 6. Site Location is found in Figure 43-16.

It is likely that these activities which were noted in the 1943 aerial photographs, were related to IOP railroad construction, just to the west of this area. No further investigation was recommended at this location.

#02 – Deposition of different colored light to dark toned earthen materials that have been graded. This site is located south of an un-named lake that is located east of Area 6. Site Location is found in Figure 43-16.

This was identified in 1943 aerial photograph and it is likely a borrow area or stockpile area for construction of Area 6 (earth-covered bunkers). No further investigation was recommended at this location.

#03 – Deposition of medium toned earthen materials that have been graded. This site is located south of an un-named lake that is located east of Area 6. Site Location is found in Figure 43-16.

This was identified in 1943 aerial photograph and it is likely a borrow area or stockpile area for construction of Area 6 (earth-covered bunkers). No further investigation was recommended at this location.

#04 – Possible disposal area. Various materials/objects (such as vegetative debris) appear to be scattered on the slopes of the hill. This site is located south of an un-named lake that is located east of Area 6. Site Location is found in Figure 43-16.

It is likely based on the location of this area and since the materials appeared to be gone by the 1951 aerial photograph, that this area was also used in relation to the construction of Area 6, and no further investigation was recommended at this location.

**T9S, R2E, SECTION 26**

Site Location is found in Figure 43-17.

No significant activity is noted in this Section.

**T9S, R1E, SECTION 34**

#01 – Numerous craters present in an open pasture/field in 1951 aerial photograph. Cratering is centered in a north/south-oriented drainage swale and most of the craters appear to be filled with liquid. An access road is visible in this area. This appears to be former EMMA OU Site, COC-9. Site Location is found in Figure 43-18.

This area appears to be COC-9, which was previously designated as a site in the EMMA OU. This site has already undergone chemical and OEW investigations and no further action has been

recommended for this site in the EMMA OU RI/BRA done by ESE in 1994. As a result, it was not included in the AUS OU with some of the other COC sites.

#02 – Small area within a large open pasture/field containing several liquid-filled craters that may have been used for explosives detonation activity. There are two nearby access roads to this area. Site Location is found in Figure 43-18.

This is AUS-0109 and it is located south of AUS-0062 (a.k.a. COC-11). This site was identified in the 1951 aerial photograph is similar to several of the COC sites that have previously been identified. This site was added to the AUS OU and has been designated as AUS-0109. Samples were collected from this site in the AUS SI and no further action was recommended at this site.

#03 – Ground scars located in a field in the COC Area, south of AUS-0109. Possible former pitted/pockmarked area and possible former trench in the ground scarred areas. Site Location is found in Figure 43-18.

Scars appear in 1971 and are located next to a former farmstead. They were identified in a 1971 aerial photograph and by 1980, this site was incorporated into a plowed agricultural field. The use of this area is not known, however it is possible that it may have been used for some explosives activities since there appears to have been a pitted or pockmarked area and a possible former trench. The possible pitted or pockmarked area has since been plowed as it is in an agricultural field, therefore it is highly unlikely that any residual contamination from explosives activities would still be found in the former possible pitted/pockmarked areas. This site was not included in the RI, because a similar site (AUS-0109) was sampled during the AUS OU SI and no further investigation was recommended at that site, so no significant contamination is expected at this site either.

#04 – Roadside clearing and fill operation identified in 1974 aerial photographs, with mounds of unidentified material located at the western edge of the fill. This site appears to be AUS-0062 (former COC-11), which was identified by USFWS as a landfill that was closed in 1974. Site Location is found in Figure 43-18.

This site is AUS-0062 and it was investigated as a part of the AUS OU SI. A discussion of the history of this site is found in Section 22 of this report.

### **T9S, R1E, SECTION 35**

#03 – Open pasture/field scarred with numerous craters as seen in 1951 and 1960 aerial photographs. This site may have been used for explosives detonation activities. This site appears to be former EMMA OU Site, COC-7. Site Location is found in Figure 43-19.

This area appears to be COC-7, which was previously designated as a site in the EMMA OU. This site has already undergone chemical and OEW investigations and no further action has been recommended for this site in the EMMA OU RI/BRA done by ESE in 1994, so it was not included in the AUS OU with some of the other COC sites.

**T9S, R1E, SECTION 36**

#01 – Trench-like feature identified in 1943 aerial photographs, in a remote pasture area adjacent to western shore of Crab Orchard Lake, with an access road leading to this site. Site Location is found in Figure 43-20.

This site was not investigated as a part of the AUS OU SI because there was no evidence of disposal in this area. Similar trenches were investigated during the AUS OU SI (such as at AUS-0107) and it was decided that if significant contamination was identified in similar trenches, then this trench would be added for investigation during the RI. Since significant contamination was not identified in similar trenches (such as at AUS-0107), no further investigation is recommended at this site.

#03 – Trench cut into a hillside (south of site #04, T9S, R1E, Section 25 – discussed above), east of Wolf Creek Road on south side of Crab Orchard Lake and west of railroad tracks. Site Location is found in Figure 43-20.

The proximity of the trench to the above-mentioned site, would suggest that they might be related, however no access road was seen leading to the trench. There was also no visible debris in the area of the trench, or any other signs of recent activity. This trench will not be investigated as a part of the AUS SI since there is no visible debris present inside of it, nor any evidence of recent activity. Similar trenches, such as the one at AUS-0107, were investigated during the SI and significant contamination was not identified in these similar trenches, therefore no further investigation is recommended at this site.

**T9S, R2E, SECTION 31**

#02, 03 & 04 – Possible storage/disposal area of unidentified materials and objects, west of Area 9 on west side of Route 148. Site Location is found in Figure 43-21.

No investigation was done in this area (area is west of Area 9, across Route 148) since it was likely an IOP construction staging area for Area 9.

#05 – Possible surface disposal area located west of Area 9. Site Location is found in Figure 43-21.

This surface disposal area was already vegetating over in the 1943 aerial photographs, thus indicating that it has not been used for some period of time. Based on its proximity to a former farmstead and its access road, it is believed that this area was a former dumping grounds for this farmstead. It does not appear that IOP has used this disposal area and it was therefore not recommended for further investigation.

#06 – Unidentifiable light-toned materials dumped near shoreline of Crab Orchard Lake (west of Area 9) in 1943. Site Location is found in Figure 43-21.

There is no obvious access road to this site, thus indicating that vehicular traffic is not common to this area, if there is access at all. It appears that the lake may have engulfed the piles of material by 1951. No sampling was done at this site.

#08 – Small surface dump of earthen materials at end of forested track (area is west of Area 9, on west side of Route 148) as seen in 1971 aerial photos. Site Location is found in Figure 43-21.

There is no evidence of man-made materials in this dump – only earthen materials. As a result, no sampling was done at this site. The site was overgrown by 1980.

**T9S, R2E, SECTION 32**

#01 – Fill area/open dump located east of Area 9. Site Location is found in Figure 43-22.

This is the former Sangamo Dump (Site 32 of the PCB OU). This area has previously been remediated for PCBs; however, there is still volatile organic compound (VOC) (i.e. TCE) contamination that exists in the subsurface and in the groundwater at this site. The subsurface VOC contamination is still undergoing investigation at this site.

#02 – Two extremely large trench-like excavations located north of Area 9 on a peninsula into Crab Orchard Lake as seen in the 1943 aerial photographs. Site Location is found in Figure 43-22.

It is likely that both of these excavations were created as a result of soil borrow operations for the construction of Area 9, therefore, no further investigation was recommended at this site.

**T9S, R2E, SECTION 33**

#03 – Disposal area identified in 1943 aerial photographs, located next to shoreline of Crab Orchard Lake (north of Area 7 and west of Chamnesstown Road) that shows evidence of surficial disposal, two east-west oriented trenches, and evidence of filling activities. There is a heavily traveled access road that loops through this area. There does not appear to be any on-going disposal activities in this area in subsequent aerial photographs; however, there is still some evidence in subsequent aerial photographs that the disposed materials were not removed from the site. Site Location is found in Figure 43-23.

Surficial disposal appeared to be restricted to earthen materials in the 1943 aerial photographs. There was no evidence of man-made materials in the aerial photograph in either the surficial disposal area or in the trenches. A visual site inspection was done at this site on May 11, 2000. This site was an open treeless area with rock along the shoreline. There was no other debris noted in this area. Since no significant contamination was identified during the SI in trenches similar to those found at this site (such as at AUS-0107), no further investigation is recommended at this site.

**T9S, R2E, SECTION 34**

#01 – Trench situated on a hillside, next to a possible farmstead. Identified in the 1943 aerial photograph near the eastern Refuge border. Its location is now underneath Interstate 57. Site Location is found in Figure 43-24.

This trench is likely a farmstead disposal site. There is no evidence of any material present in the trench however there are vehicular tracks in the vicinity of the trench. This trench appears to



be located underneath current Interstate 57, which was being built in 1960, and as a result, no further investigation is recommended at this site.

**T9S, R2E, SECTION 35**

Site Location is found in Figure 43-25.

No significant activity is noted within this Section.

**T10S, R1E, SECTION 3**

Site Location is found in Figure 43-26.

No significant activity is noted within this Section.

**T10S, R1E, SECTION 2**

Site Location is found in Figure 43-27.

No significant activity is noted within this Section.

**T10S, R1E, SECTION 1**

#02 – Shallow excavation and ground scars located south of Area 10 (on south side of Ogden Road), as identified in the 1943 aerial photo. Site Location is found in Figure 43-28.

There does not appear to be any disposal in this area, therefore it is likely that this area was used as a borrow area for the construction of Area 10. As a result, no further investigation was recommended at this site.

#03 – Mounded material surrounded by ground scarring that was located south of Ogden Rd and east of Area 13. Site Location is found in Figure 43-28.

Based on the location of this mound of material, it is likely that this site was associated with construction of the railroad since the mound was seen only in the 1943 aerial photograph and it was gone by 1951. As a result, no further investigation was recommended at this site.

#06 – Possible surface disposal site (pile of unidentifiable materials) seen in the 1960 aerial photographs along a former vehicle track that was located south of Ogden Rd and east of Area 13. Site Location is found in Figure 43-28.

The pile of material is no longer evident by 1965 (thus suggesting that it was removed). The vehicle track still appears to be in use. Since all of the material appears to have been removed, no further investigation was done in this area.

**T10S, R2E, SECTION 6**

#02 – Possible surface disposal site located east of COC-10 (north of Ogden Road) near an old farmstead access road as seen in the 1951 aerial photographs. This site was added to the AUS OU SI and it was numbered AUS-0108. Site Location is found in Figure 43-29.

Based in the year that this disposal site was observed (1951) and the time that the former farmstead was observed (1943), it is possible that this disposal site was not associated with the former farmstead. This possibility is strengthened by the fact that COC-10 appeared just west of this disposal site in the same aerial photograph, near the beginning of the access road to COC-10, so it is possible that this surficial disposal site was related to activities at COC-10. This site was named AUS-0108 and it was investigated as a part of the AUS OU SI. Based on the results of the SI, no further investigation was recommended in this site.

#03 – Possible explosives demolition area containing numerous small, liquid-filled craters as seen in the 1951 aerial photograph. This site corresponds with the fenced area that was identified in the field by USFWS as the EMMA OU Site, COC-10. Site Location is found in Figure 43-29.

This area appears to be COC-10, which was previously designated as a site in the EMMA OU. This site has already undergone chemical and OEW investigations and no further action has been recommended for this site in the EMMA OU RI/BRA done by ESE in 1994. As a result, it was not included in the AUS OU with some of the other COC sites.

**T10S, R2E, SECTION 5**

#02 – Ground scarred area (located northwest of Area 8) with a possible disposal trench and with mounding of dark-toned materials, as identified in the 1943 aerial photograph. This site was added to the AUS OU SI and it was numbered AUS-0107. The trench scar seen in the 1951 aerial photographs was approximately 100 ft long and 2 to 5 ft wide. Site Location is found in Figure 43-30.

The possible disposal trench at this site was investigated as a part of the AUS OU SI and the site was named AUS-0107. Results from this possible disposal trench were used in part, to determine if other possible trench sites will require investigation as a part of the RI. No further investigation was recommended at this site.

#03 – Small military-related facility located at the end of a well-maintained access road, just southwest of Area 9. There appear to be three side-by-side trenches (each approx. 4ft wide by 12 ft long), located north of the largest structure in this area. None of the trenches appear to contain any type of material at this time. The trenches may still be present on site. Site Location is found in Figure 43-30.

This site will be included in Area 9 (AUS-0A09) and will be further investigated during the RI. A visual site inspection of this site was done on May 11, 2000. After reviewing the current aerial photograph, it appears that the wrong area was inspected since the topographic map obtained from Entech, located the site in the wrong place. Another visual site inspection will be done prior to conducting the RI for Area 9, to determine if this area needs further investigation.

#07 & 08 – Probable staging and stockpiling area for three rail spurs that are also located in this area (south of Area 9) as seen in the 1943 aerial photographs. The rail spurs appear to have been removed from the site by 1951 and there was no evidence of any spillage of materials in this area. Site Location is found in Figure 43-30.

Since the rail spurs appeared to have been in operation only during the IOP and since there was no evidence of spillage identified in the aerial photographs for this area (as was seen along other railroad lines in other parts of the Refuge at this time), no sampling was conducted in this area.

#### **T10S, R2E, SECTION 4**

#02 – Large ground scar/fill area south of the eastern portion of Area 7, identified in 1943 aerial photographs. Scarred area identified behind former Fire Station (AUS OU SI site AUS-0021), as identified in 1951 aerial photograph. Site Location is found in Figure 43-31.

It is expected that the large ground scar/fill area that was identified south of Area 7, possibly resulted from the construction activities of Area 7. The scarred area behind the former Fire Station will be investigated as a part of the AUS OU SI (Site AUS-0021) and this site was recommended for inclusion with Area 7 (AUS-0A07) of the AUS OU.

#04 – Three unusual ground scarred areas (identified in 1951 aerial photographs) that are present just southwest of buildings located in Area 7 (included in Area 7 – AUS-0A07). These three areas are reminiscent of capped landfill cells, although this is speculation. Site Location is found in Figure 43-31.

The speculated “capped landfill cells” were sampled as a part of the AUS OU SI for site AUS-0A07 and no evidence of any landfill activities were found in this area.

#10 – Faint linear scars and a possible trench located northeast of the water tower that is located north of Ogden Road, as seen in the 1951 aerial photograph. By 1960, it appears that disposal operations are being conducted in this area and they continue through 1965. By 1971, it appears that this disposal area has been abandoned. Site Location is found in Figure 43-31.

This is Site 28 of the PCB OU and it is referred to as the Water Tower Landfill. This site has previously been remediated and is therefore not included in the AUS OU SI.

#11 – Small oval lagoon located just south of Area 7. This is Site 15 of the MAOU and it is referred to as a Plating Pond. Site Location is found in Figure 43-31.

This is Site 15 of the MAOU has been remediated and it requires no further investigation. Therefore, it was not included in the AUS OU SI.

#### **T10S, R2E, SECTION 3**

#01 – Probable small arms training range located just north of the Federal Penitentiary boundary. This is believed to be AUS OU Site AUS-0022. Site Location is found in Figure 43-32.

This site was identified in the 1943 aerial photographs and it was abandoned by 1951. This is assumed to be Site AUS-0022 and it has been included in the AUS OU SI.

**T10S, R1E, SECTION 10**

Site Location is found in Figure 43-33.

No significant activity is noted within this Section.

**T10S, R1E, SECTION 11**

Site Location is found in Figure 43-34.

No significant activity is noted within this Section.

**T10S, R1E, SECTION 12**

Site Location is found in Figure 43-35.

No significant activity is noted within this Section.

**T10S, R2E, SECTION 7**

#04 – Possible disposal area identified in the 1943 aerial photographs in between what has currently been identified as the Nitroglycerin Area (AUS-A11N) and the High Explosives Area (AUS-A11H) of Area 11. Site Location is found in Figure 43-36.

This area was developed between 1951 and 1960 (regraded and constructed upon), therefore removing any possible materials that may have been disposed of in this location. No further investigation was recommended at this site.

#05 – Shallow trench-like feature located on the west side of a pile of earthen materials as identified in the 1943 aerial photographs. This site is located southwest of the explosives manufacturing area in the High Explosives Area (AUS-A11H) of Area 11. Site Location is found in Figure 43-36.

There does not appear to be anything inside of the trench. The aerial photo interpretation also did not identify an access road leading to this trench. As a result, this trench was not included in the AUS OU SI. It was decided that if significant contamination was identified in the similar trenches, then this trench would be added for investigation during the RI. Since significant contamination was not identified in similar trenches (such as at AUS-0107), no further investigation is recommended at this site.

#08 – Roadside fill/possible disposal site identified in the 1951 aerial photograph. This site is located east of the Nitroglycerin Area in Area 11. This site appears to coincide with the AUS OU Site AUS-106A. Site Location is found in Figure 43-36.

This site was inspected during the site reconnaissance and it was found to contain anywhere from 50 to 100 buried or partially buried drums not far from a nearby creek. This site was added to

the AUS OU SI during the site reconnaissance and it was numbered AUS-106A. The site no longer appears to be in use by 1960. Based on the results of the SI, further investigation will be required at this area as discussed in Section 41 of this report.

#09 – Scarred area with vehicular scars and mounding present in different areas, at different times from 1960 through at least 1980. A north/south oriented trench was identified on the site in the 1980 aerial photograph, with an access road circling this trench. The site was abandoned by 1993. This site was located next to an un-named lake that is approximately 300 yards west of Area 12 and it was included in Area 12 (AUS-0A12) in the AUS OU SI. Site Location is found in Figure 43-36.

This site was investigated with Area 12 (AUS-0A12) in the AUS OU SI and it was referred to as the “Area West of Area 12”. It was possibly the location of a Component Storage Magazine and Shooting House, during Olin and CSC’s tenure at the site. This site is located near the banks of an un-named lake from which a sample was also collected. An RI is recommended for Area 12.

#10 – Eight parallel, liquid-filled trenches located just north of the northeast corner of Area 12 that were first identified in the 1965 aerial photograph. Former Powder Storage Ponds (EMMA OU Site COP-3). Site Location is found in Figure 43-36.

These were the “Powder Storage Ponds” that were built by Olin and were continued to be used by CSC. These ponds were previously investigated as a part of the EMMA OU and they were referred to as COP-3. After reviewing the EMMA OU investigation, it was decided that the ponds needed further investigation. The ponds were reported to have been flashed or “decontaminated for explosives”, after the explosive materials that they had been storing were removed. There were numerous samples collected from this location during the EMMA OU investigation, however there had been no previous samples collected from shallow soils in the location of the ponds, nor from the creek that appeared to receive drainage from the area of the Powder Storage Ponds. These areas were investigated during the AUS OU SI as a part of Area 12 (AUS-0A12). Further investigation is not likely in the area of the former powder storage ponds.

#11 – A series of earthen ridges and shallow trenches identified in the Area 11 Nitroglycerin Area (AUS-A11N) to the southwest of the actual nitroglycerin production area. There was scarring from vehicular traffic all around these trenches. The trenches appeared to be liquid filled. The use of the trenches is not known. Site Location is found in Figure 43-36.

These trenches appeared in the 1980 aerial photograph, several years after production in the nitroglycerin plant had ceased. These trenches were investigated as a part of Site AUS-A11N of the AUS OU SI. A discussion of this site is found in Section 17 of this report.

### **T10S, R2E, SECTION 8**

Site Location is found in Figure 43-37.

No significant activity was noted within this Section.

**T10S, R2E, SECTION 9**

#02 – Ground scarring and remnants of a possible trench adjacent to a well-maintained IOP service road as identified in the 1943 aerial photograph. Located on what was formerly the southwesternmost portion of the Refuge, prior to the existence of the Federal Penitentiary. Site Location is found in Figure 43-38.

This site is currently located on the Federal Penitentiary property (it was transferred to the Federal Corrections Program sometime between 1951 and 1960), and will therefore not be investigated.

**T10S, R2E, SECTION 10**

#01 – Trench located in a remote agricultural field in 1943. This trench was located southeast of the Federal Penitentiary on the east side of I-57. Site Location is found in Figure 43-39.

There was no debris (other than vegetative) identified in this area and there was no obvious access road leading up to the trench location, therefore no investigation was recommended for this trench.

#02 – Possible trench located in remote agricultural area in 1943. This possible trench was identified east of the Federal Penitentiary on the east side of I-57. Site location is found in Figure 43-39.

There was no obvious vehicular access and no evidence of disposal at this location so no investigation was recommended for this possible trench location.

# T9S-R1E-S14

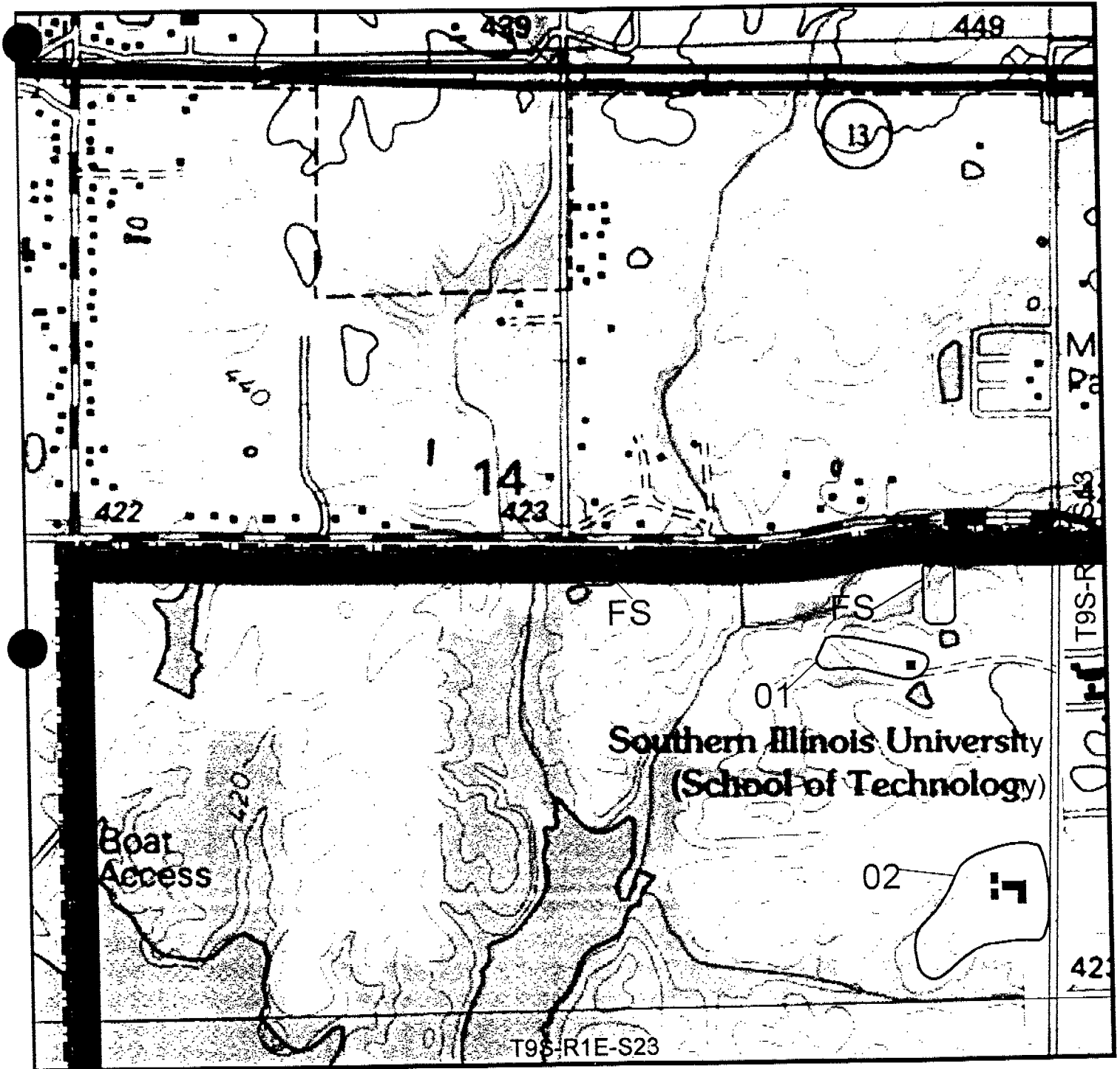


PHOTO LEGEND			
1943		1971	
1951		1980	
1960		1993	
1965			



LEGEND	
- Site	IOP Boundary
FS - Farmstead	Road/Lane
MS - Military Structures	Railroad
	Structure
	Fence

APPROX. SCALE 1 : 9,500

# T9S-R1E-S13

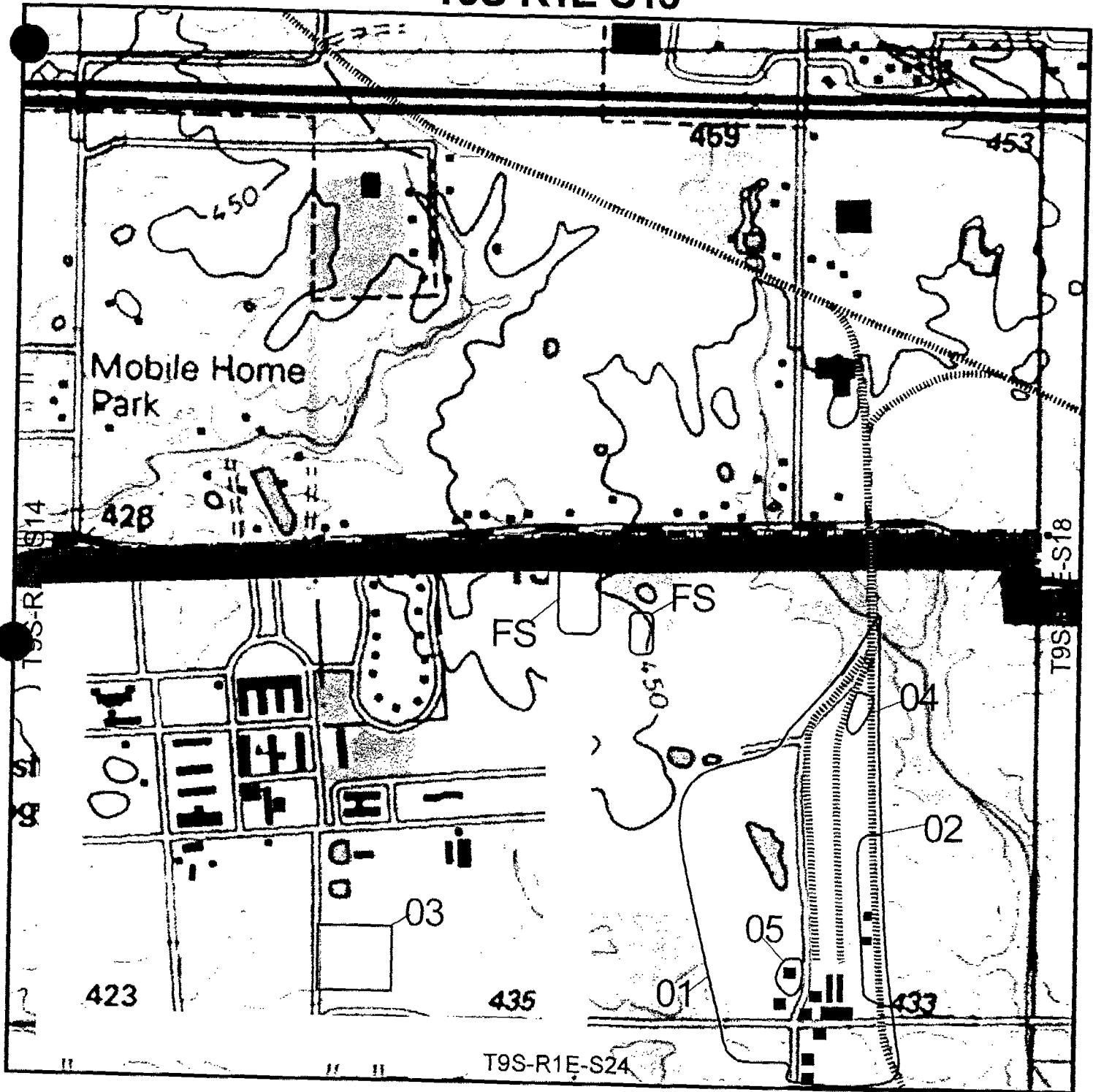


PHOTO LEGEND			
1943		1971	
1951		1980	
1960		1993	
1965			

LEGEND			
○01	- Site		IOP Boundary
FS	- Farmstead		Road/Lane
MS	- Military Structures		Railroad
			Structure
			Fence

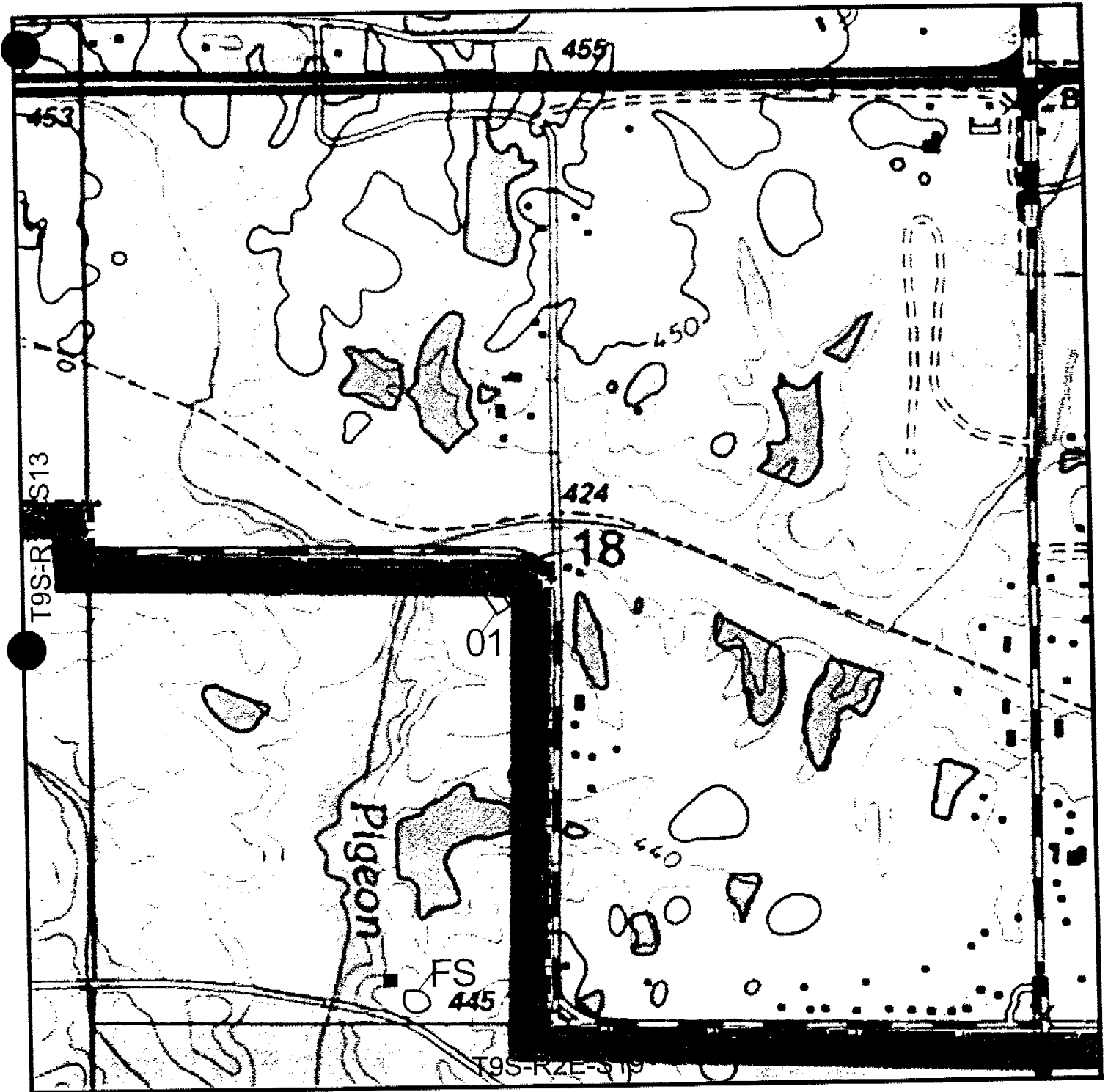


APPROX. SCALE 1 : 9,500

**FIGURE 43-2  
T9S-R1E-S13**



# T9S-R2E-S18



## PHOTO LEGEND

1943		1971	
1951		1980	
1960		1993	
1965			

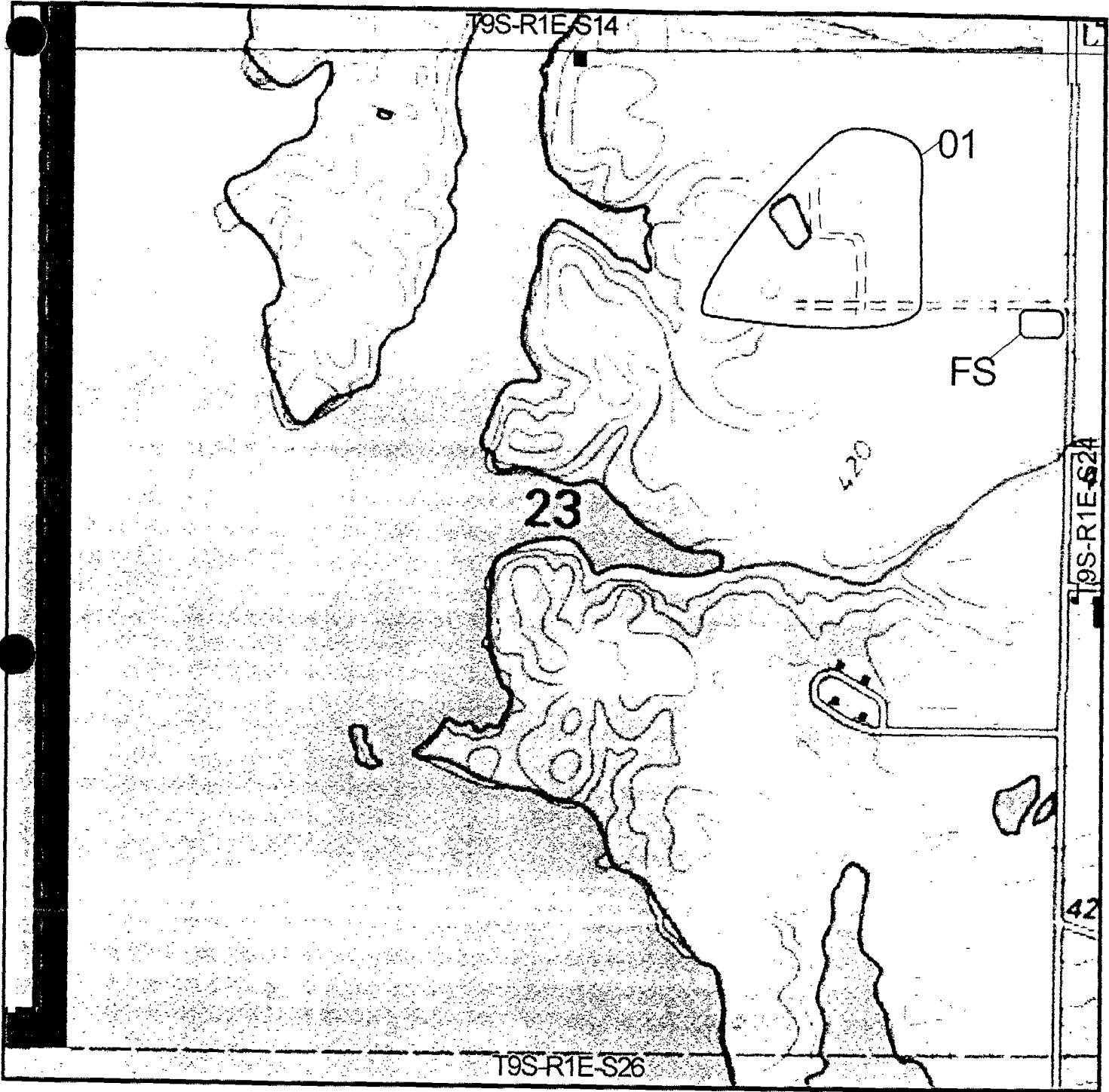


## LEGEND

- Site	IOP Boundary
FS - Farmstead	Road/Lane
MS - Military Structures	Railroad
	Structure
	Fence

APPROX. SCALE 1:9,500

# T9S-R1E-S23



## PHOTO LEGEND

1943	[Stippled Pattern]	1971	[Stippled Pattern]
1951	[Stippled Pattern]	1980	[Stippled Pattern]
1960	[Stippled Pattern]	1993	[Stippled Pattern]
1965	[Stippled Pattern]		

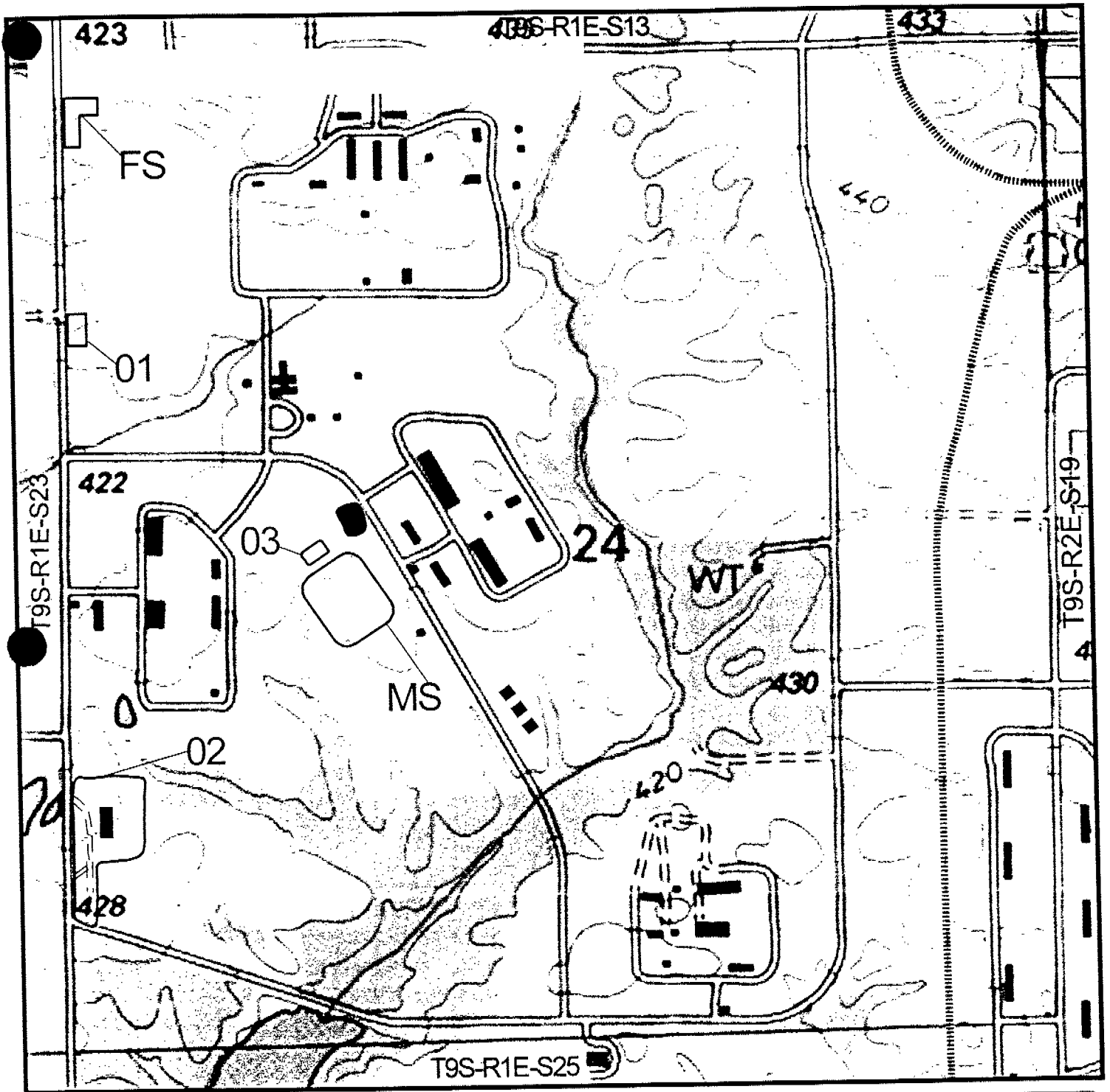


## LEGEND

(01) - Site	[Stippled Pattern] IOP Boundary
FS - Farmstead	== Road/Lane
MS - Military Structures	----- Railroad
	■ Structure
	-x-x- Fence

APPROX. SCALE 1 : 9,500

# T9S-R1E-S24



## PHOTO LEGEND

1943		1971	
1951		1980	
1960		1993	
1965			



## LEGEND

- Site	IOP Boundary
FS - Farmstead	Road/Lane
MS - Military Structures	Railroad
	Structure
	Fence

APPROX. SCALE 1 : 9,500

# T9S-R2E-S19

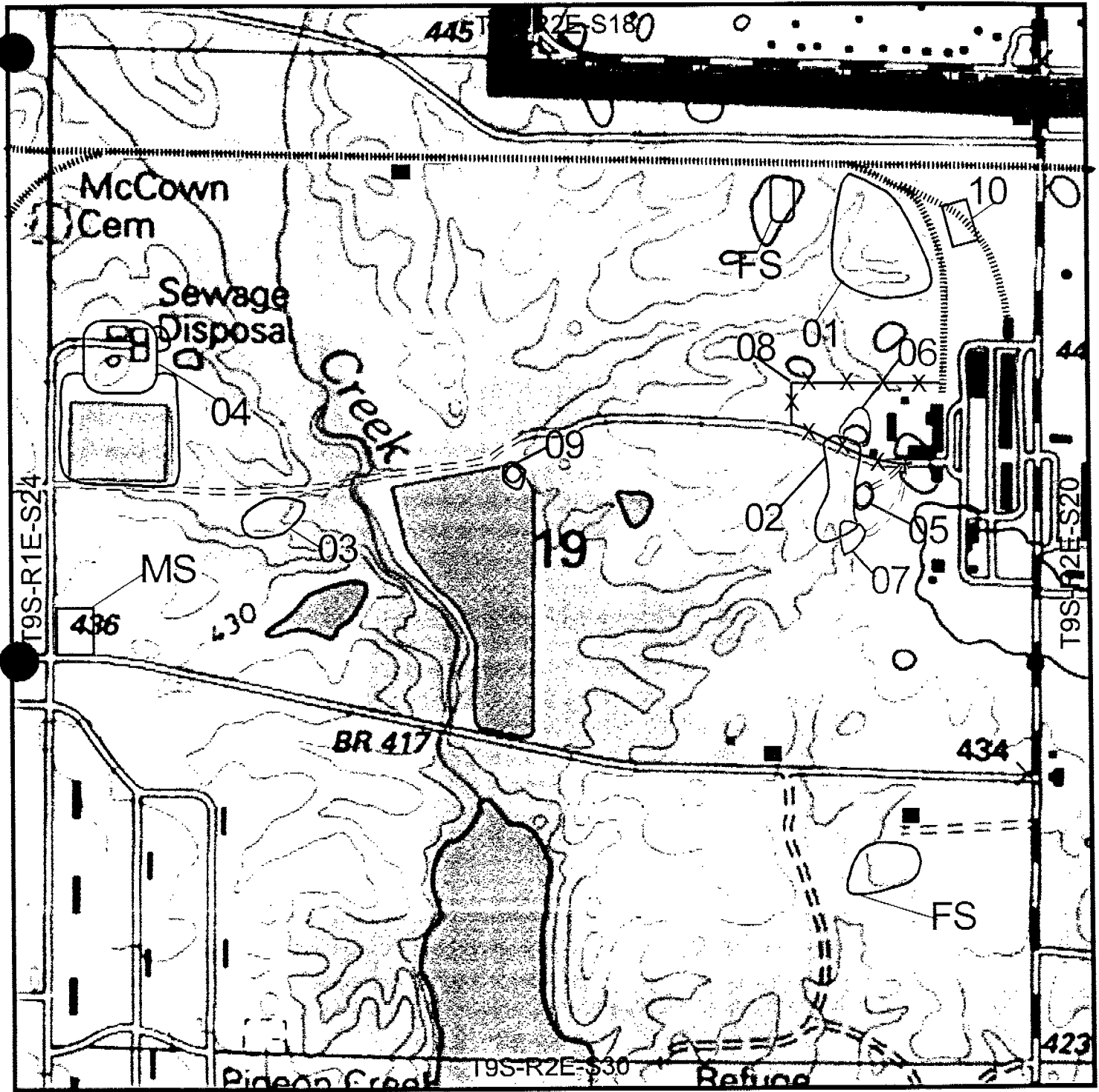


PHOTO LEGEND	
1943	[Solid Black Box]
1951	[Solid Black Box]
1960	[Solid Black Box]
1965	[Solid Black Box]
1971	[Solid Black Box]
1980	[Solid Black Box]
1993	[Solid Black Box]



LEGEND	
(01) - Site	[Thick Dashed Line] IOP Boundary
FS - Farmstead	[Double Dashed Line] Road/Lane
MS - Military Structures	[Dotted Line] Railroad
	[Small Black Square] Structure
	[X-X] Fence

APPROX. SCALE 1 : 9,500

**FIGURE 43-6  
T9S-R2E-S19**

# T9S-R2E-S20

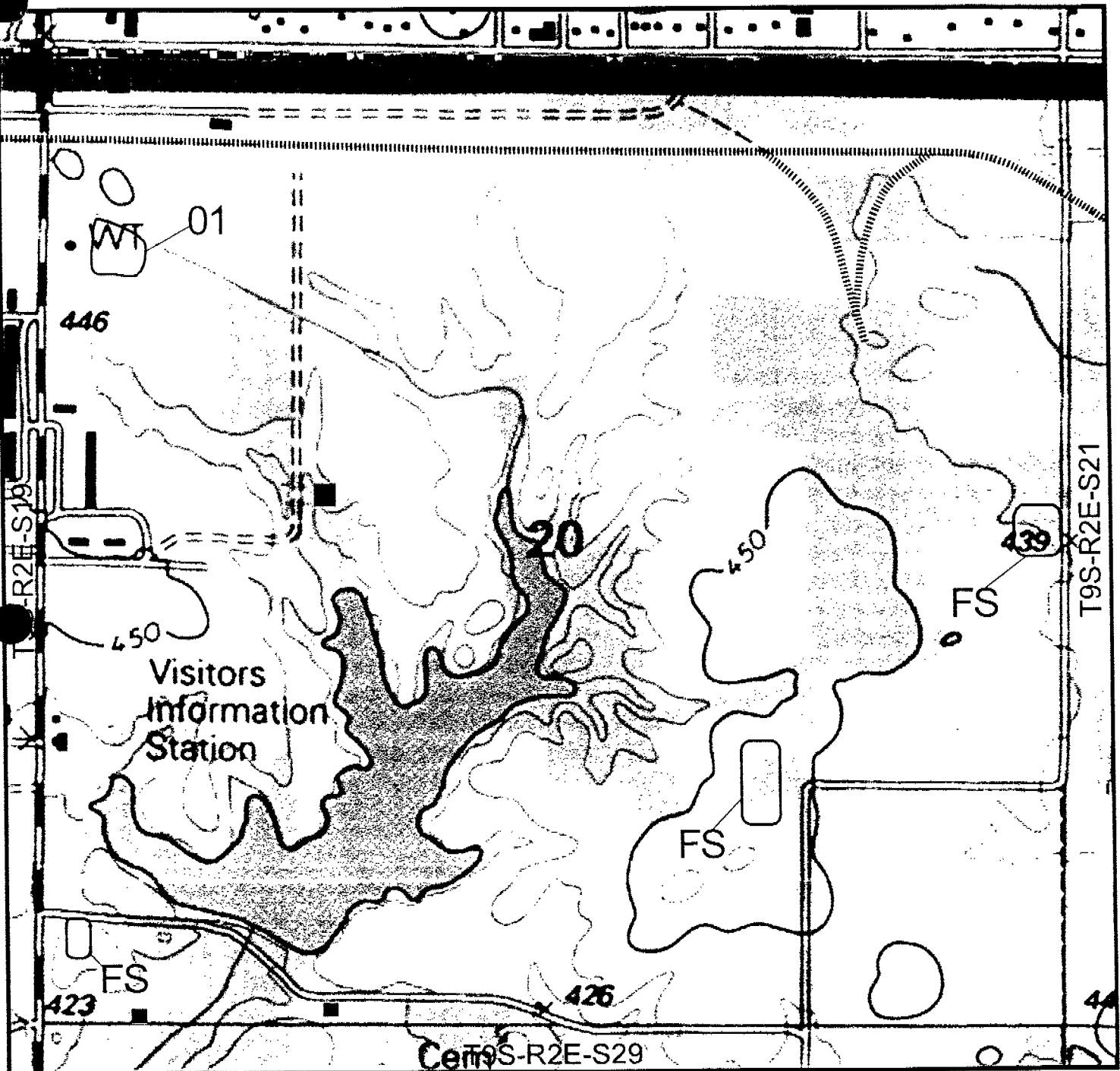


PHOTO LEGEND			
1943		1971	
1951		1980	
1960		1993	
1965			



LEGEND	
- Site	IOP Boundary
FS - Farmstead	Road/Lane
MS - Military Structures	Railroad
	Structure
	Fence

APPROX. SCALE 1 : 9,500

FIGURE 43-7  
T9S-R2E-S20

# T9S-R2E-S21

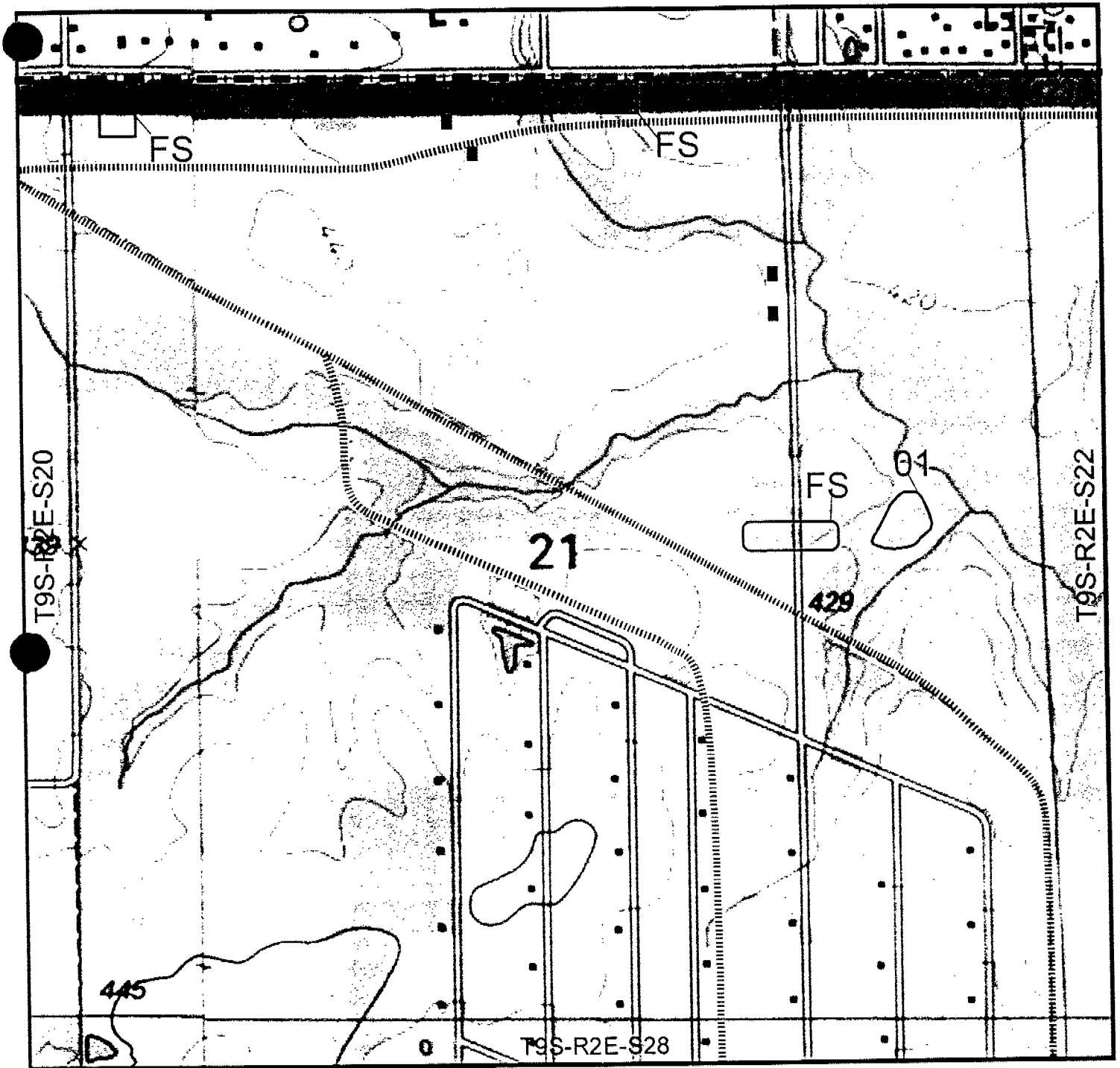


PHOTO LEGEND			
1943		1971	
1951		1980	
1960		1993	
1965			



LEGEND	
- Site	IOP Boundary
FS - Farmstead	Road/Lane
MS - Military Structures	Railroad
	Structure
	Fence

APPROX. SCALE 1 : 9,500

# T9S-R2E-S22

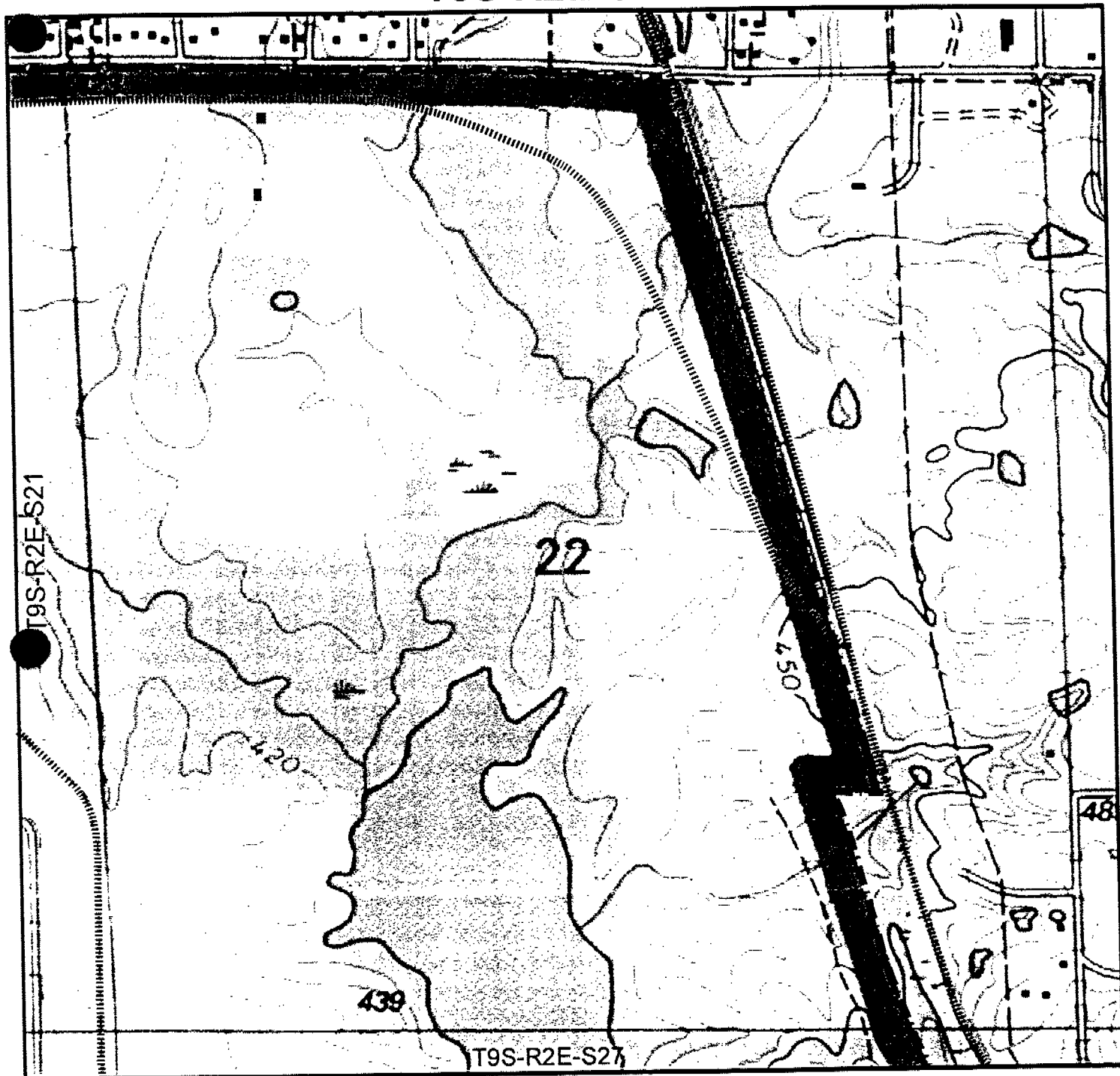


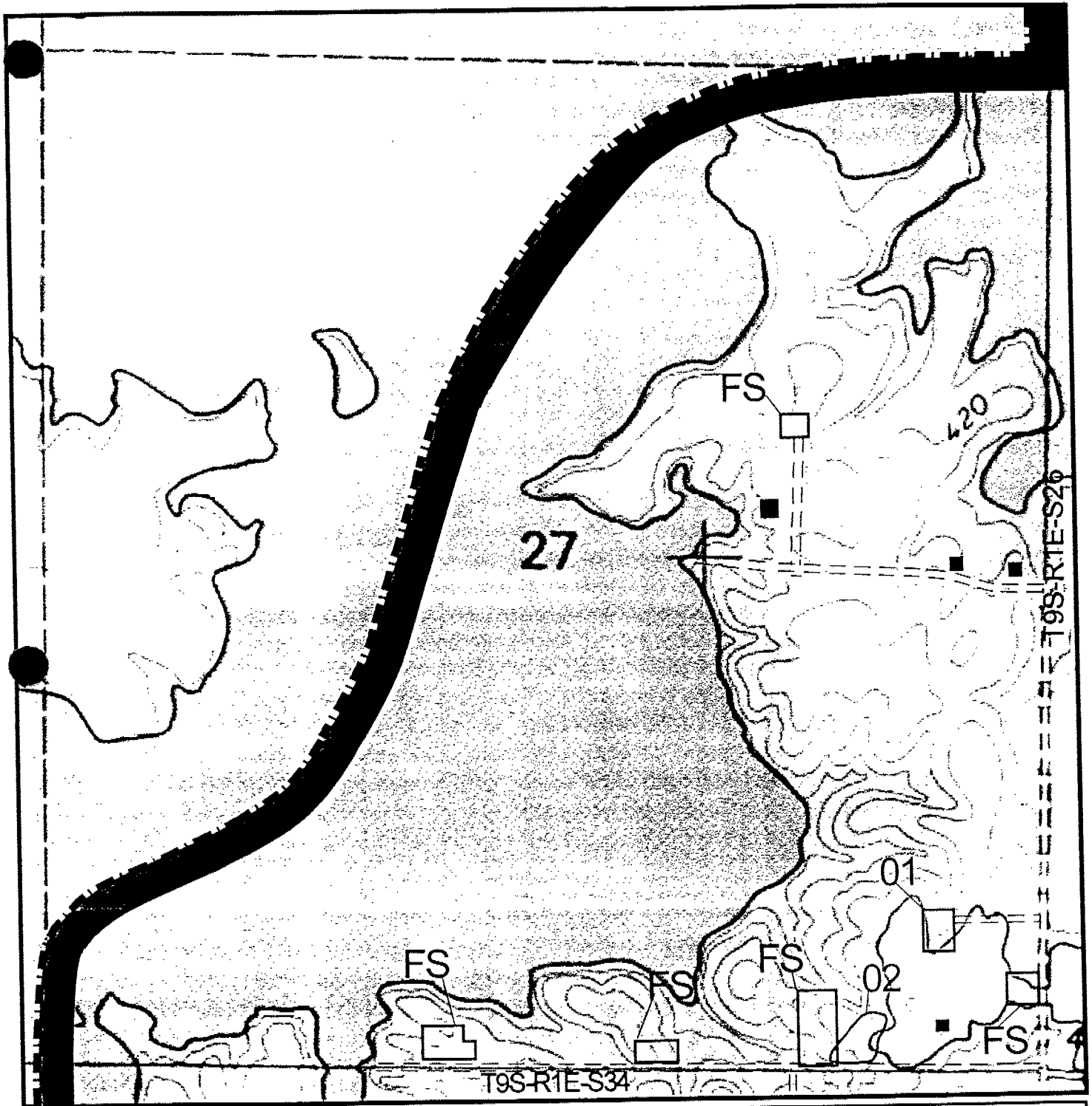
PHOTO LEGEND	
1943	
1951	
1960	
1965	
1971	
1980	
1993	



LEGEND	
- Site	IOP Boundary
FS - Farmstead	Road/Lane
MS - Military Structures	Railroad
	Structure
	Fence

APPROX. SCALE 1 : 9,500

# T9S-R1E-S27



## PHOTO LEGEND

1943		1971	
1951		1980	
1960		1993	
1965			



## LEGEND

- Site	IOP Boundary
FS - Farmstead	Road/Lane
MS - Military Structures	Railroad
	Structure
	Fence

APPROX. SCALE 1 : 9,500



# T9S-R1E-S26

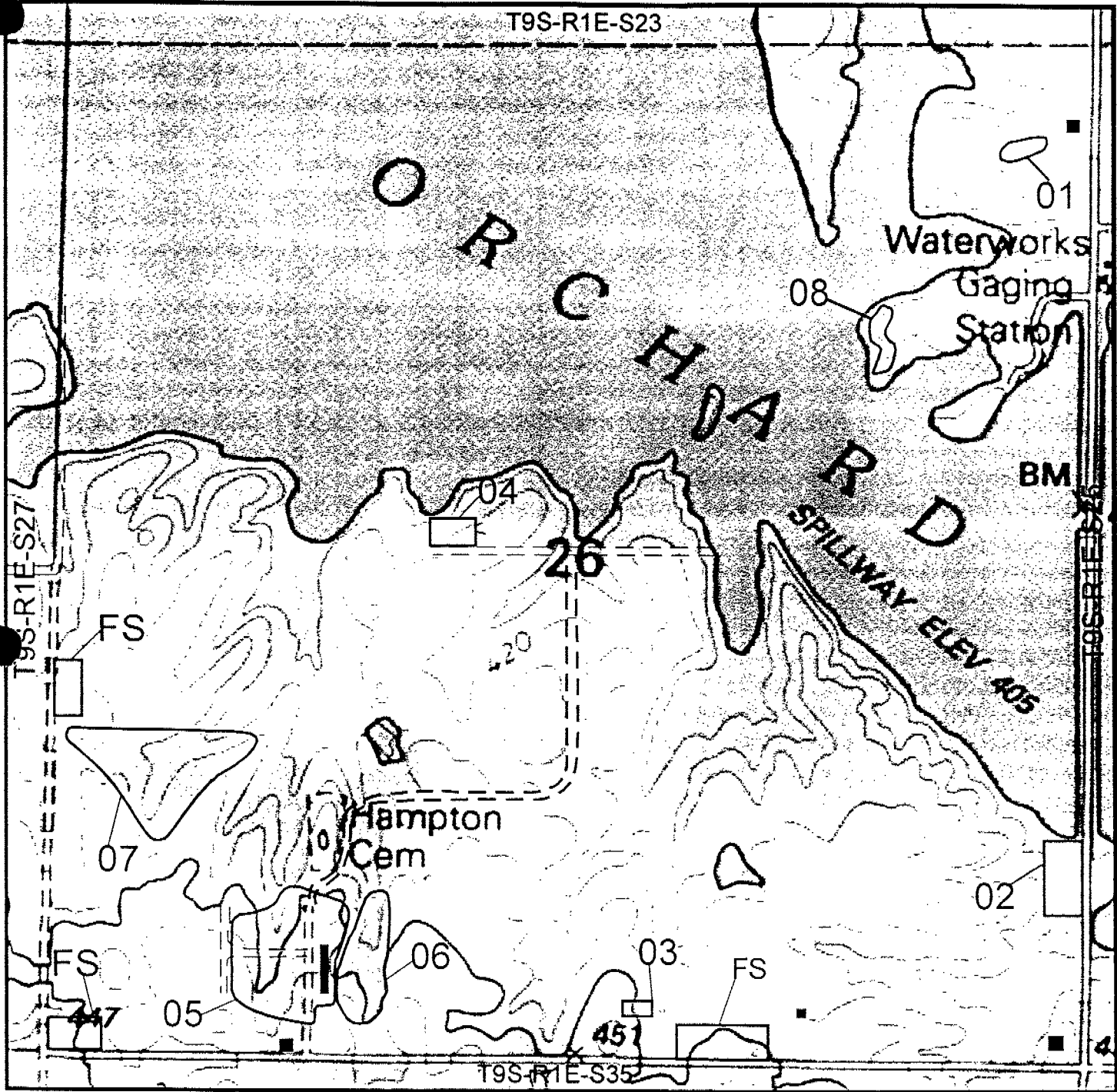


PHOTO LEGEND	
1943	[Solid black box]
1951	[Solid black box]
1960	[Solid black box]
1965	[Solid black box]
1971	[Solid black box]
1980	[Solid black box]
1993	[Solid black box]

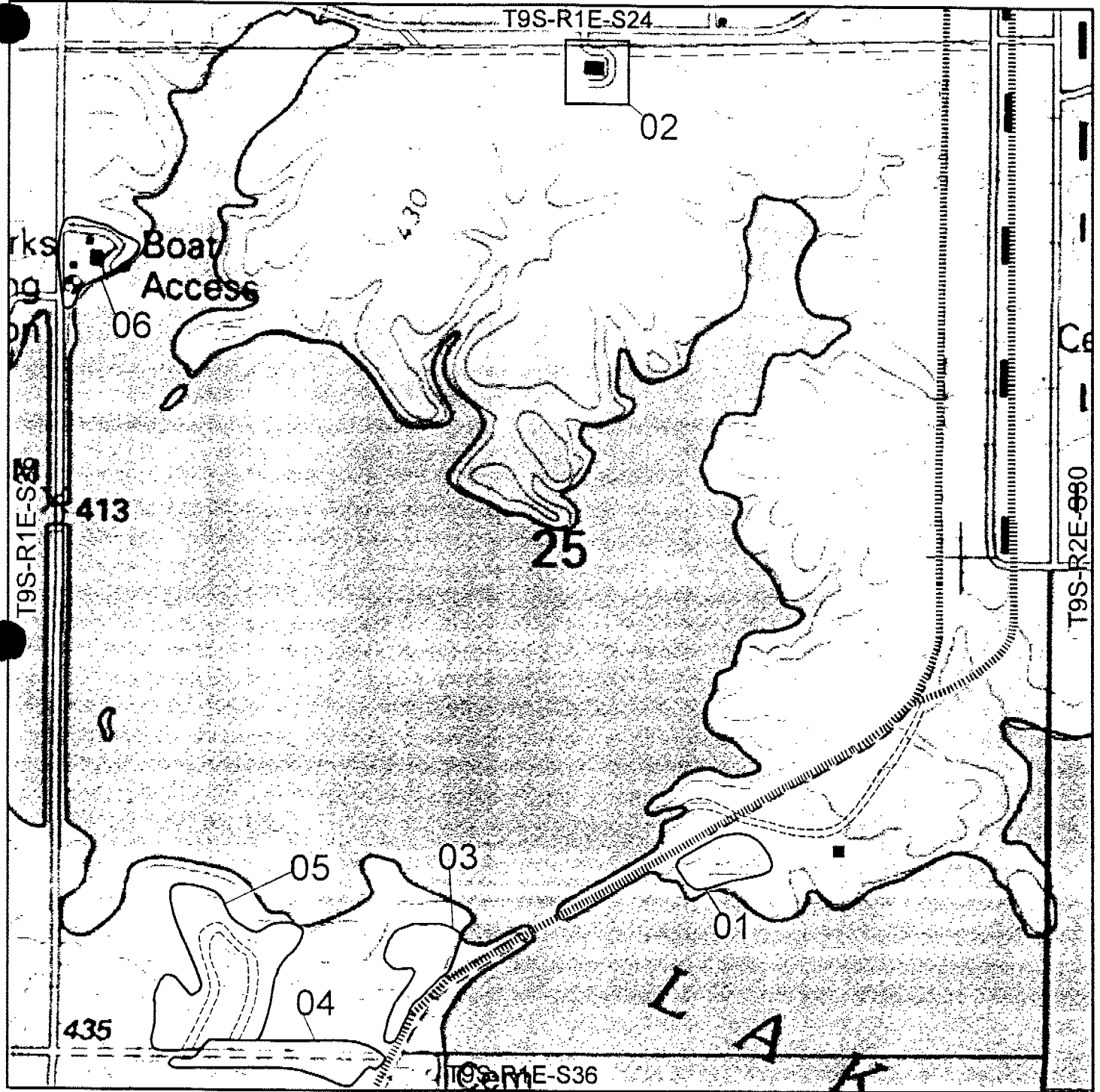


LEGEND	
(01) - Site	[Thick dashed line] IOP Boundary
FS - Farmstead	[Double line] Road/Lane
MS - Military Structures	[Dotted line] Railroad
	[Small square] Structure
	[X-X line] Fence

APPROX. SCALE 1:9,500

FIGURE 43-11  
T9S-R1E-S26

# T9S-R1E-S25



## PHOTO LEGEND

1943		1971	
1951		1980	
1960		1993	
1965			

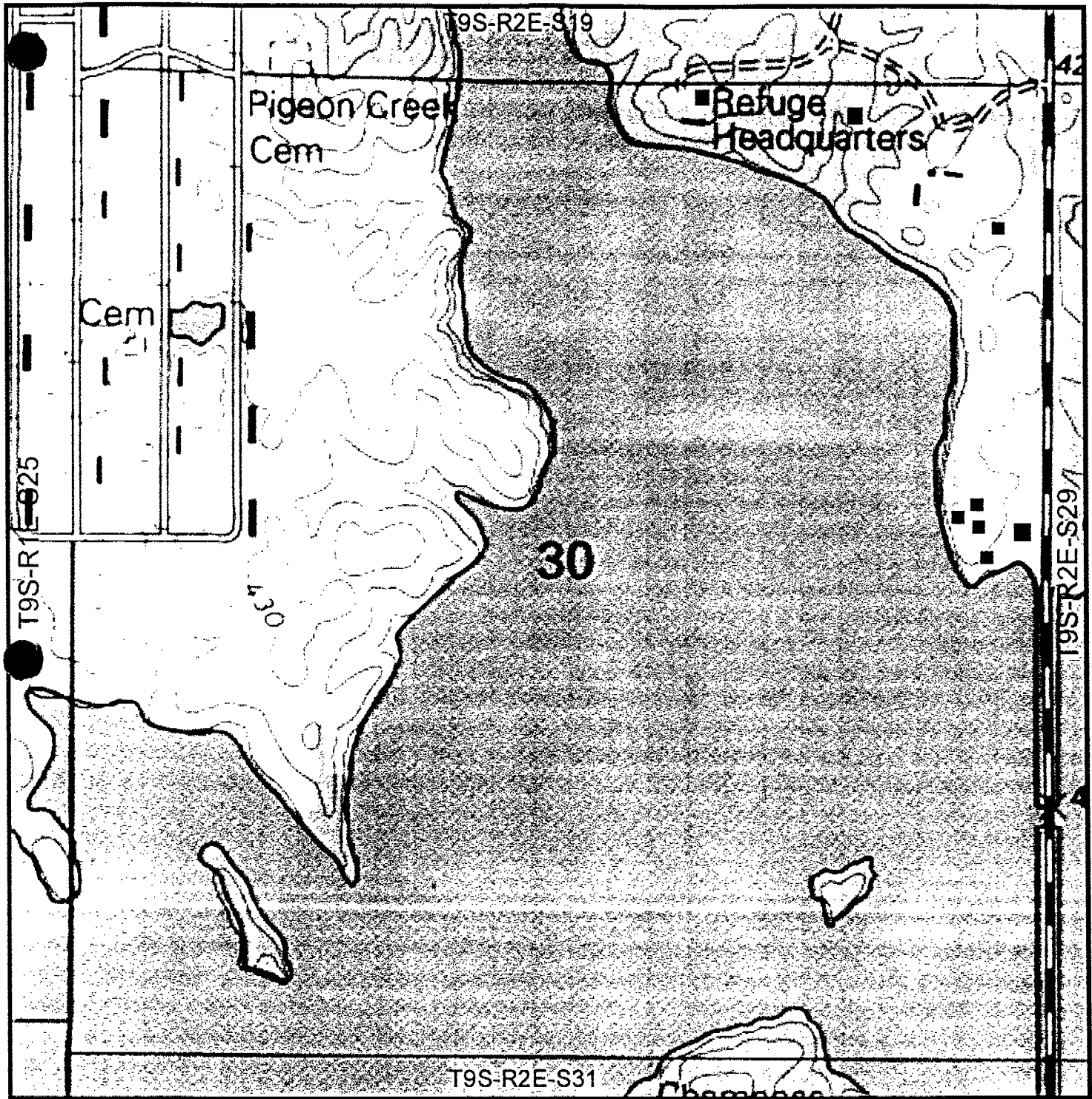


## LEGEND

- Site	IOP Boundary
FS - Farmstead	Road/Lane
MS - Military Structures	Railroad
	Structure
	Fence

APPROX. SCALE 1: 9,500

# T9S-R2E-S30



## PHOTO LEGEND

1943		1971	
1951		1980	
1960		1993	
1965			



## LEGEND

- Site	IOP Boundary
FS - Farmstead	Road/Lane
MS - Military Structures	Railroad
	Structure
	Fence

APPROX. SCALE 1 : 9,500

# T9S-R2E-S29

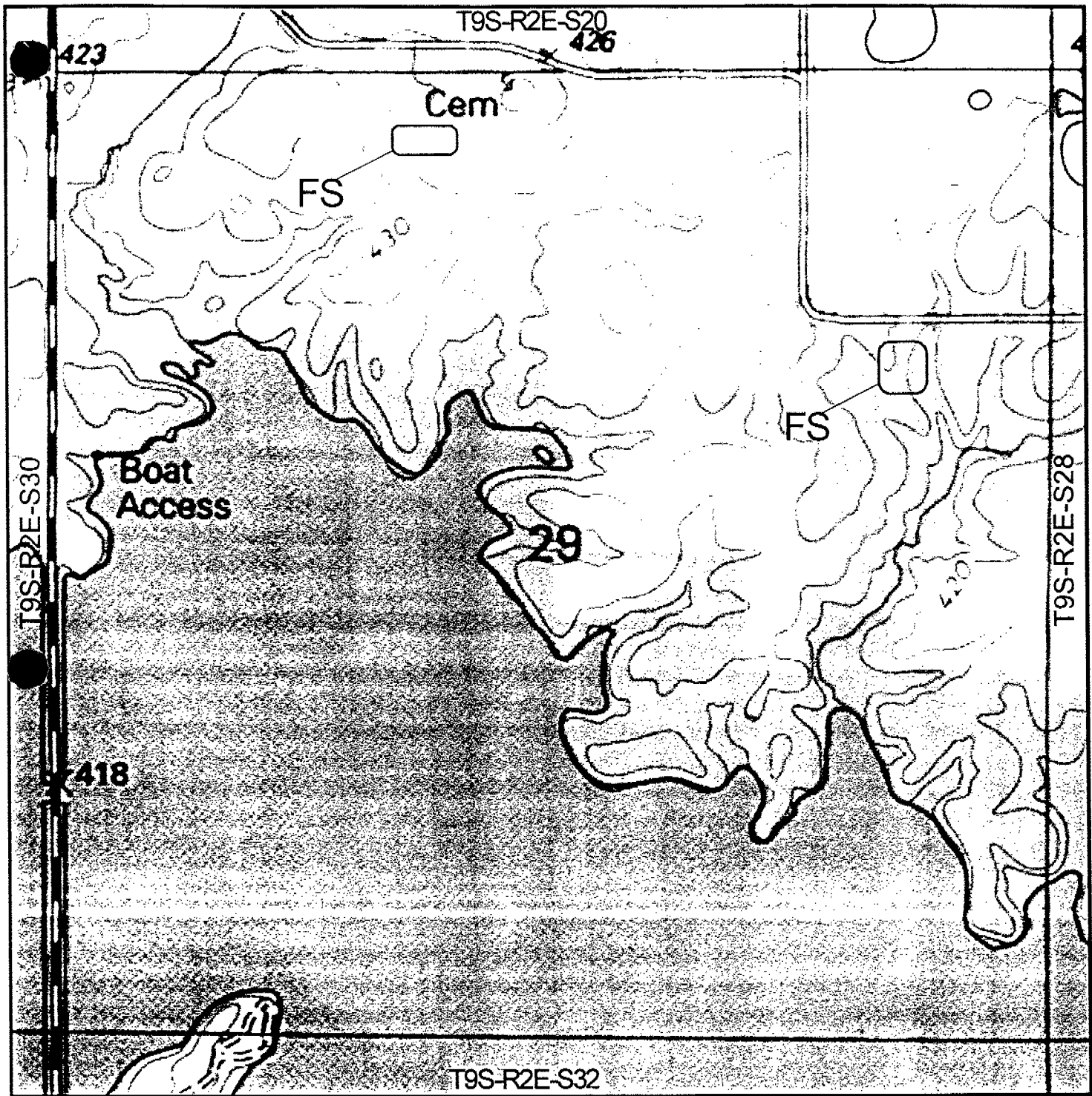


PHOTO LEGEND	
1943	1971
1951	1980
1960	1993
1965	



LEGEND	
⊙01 - Site	▬ IOP Boundary
FS - Famstead	== Road/Lane
MS - Military Structures	⋯ Railroad
	■ Structure
	-x-x- Fence

APPROX. SCALE 1 : 9,500

# T9S-R2E-S28

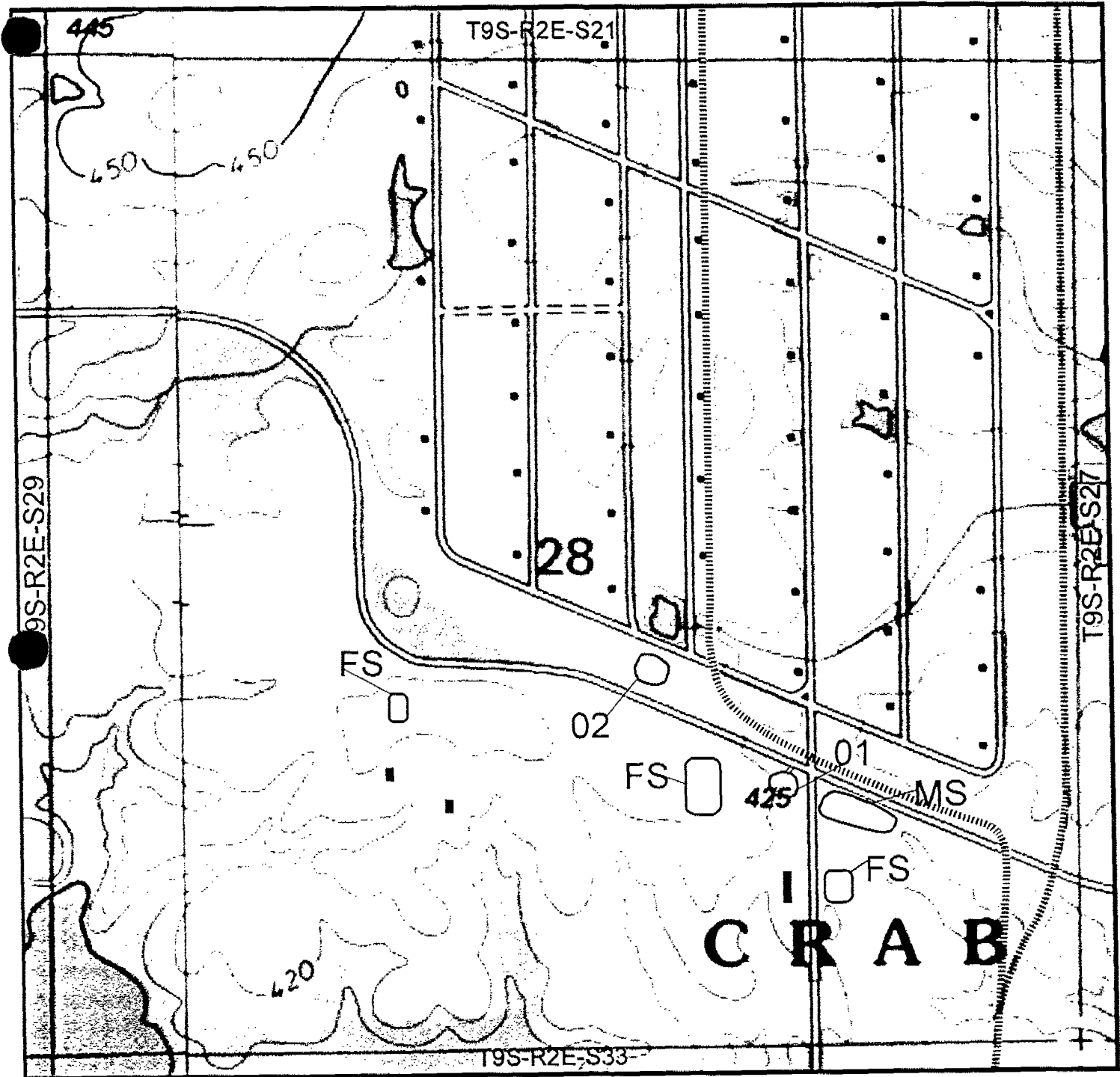


PHOTO LEGEND	
1943	
1951	
1960	
1965	
1971	
1980	
1993	



LEGEND	
- Site	IOP Boundary
FS - Farmstead	Road/Lane
MS - Military Structures	Railroad
	Structure
	Fence

APPROX. SCALE 1 : 9,500

# T9S-R2E-S27

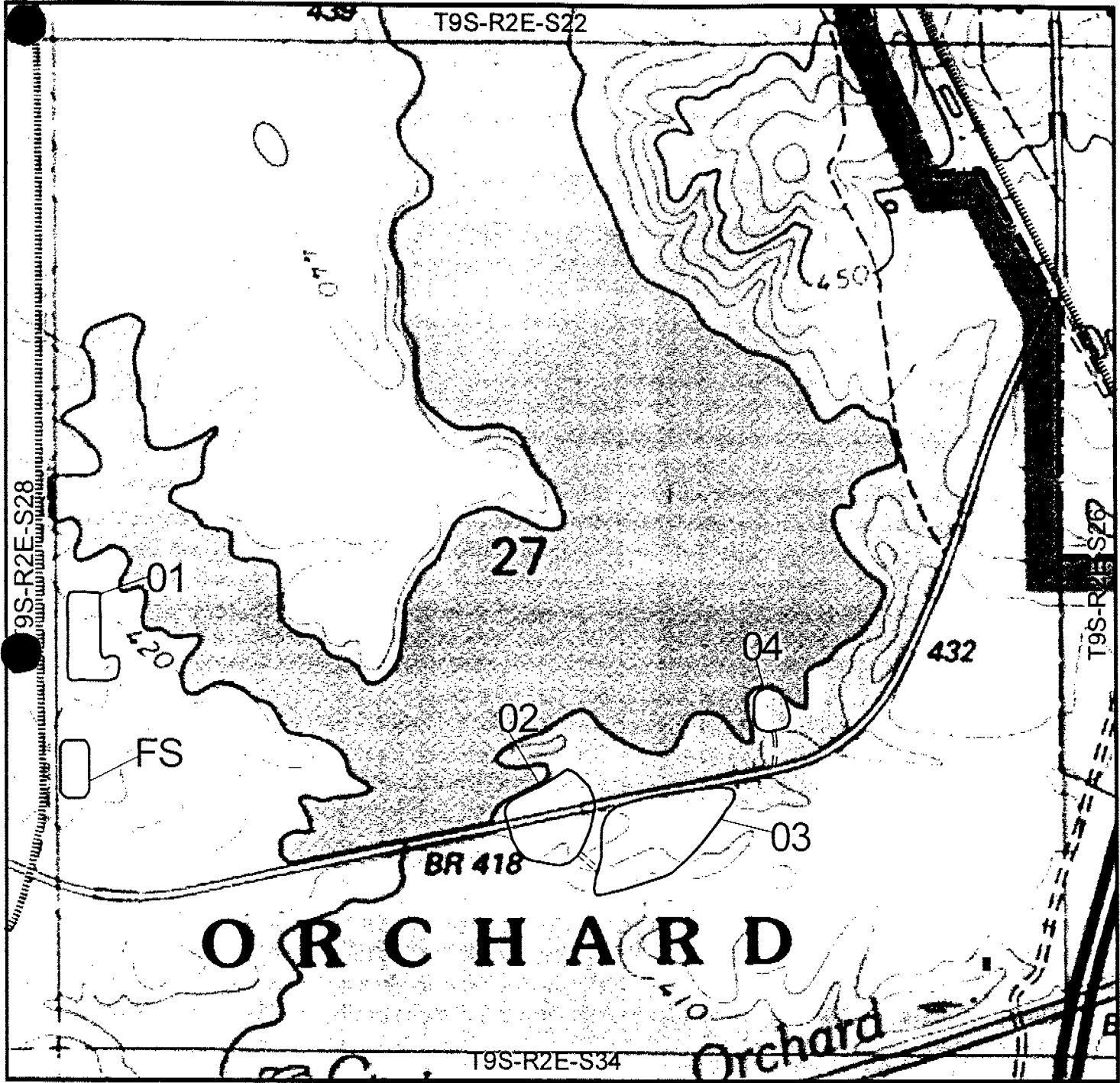


PHOTO LEGEND			
1943		1971	
1951		1980	
1960		1993	
1965			



LEGEND	
- Site	IOP Boundary
FS - Farmstead	Road/Lane
MS - Military Structures	Railroad
	Structure
	Fence

APPROX. SCALE 1 : 9,500

# T9S-R2E-S26

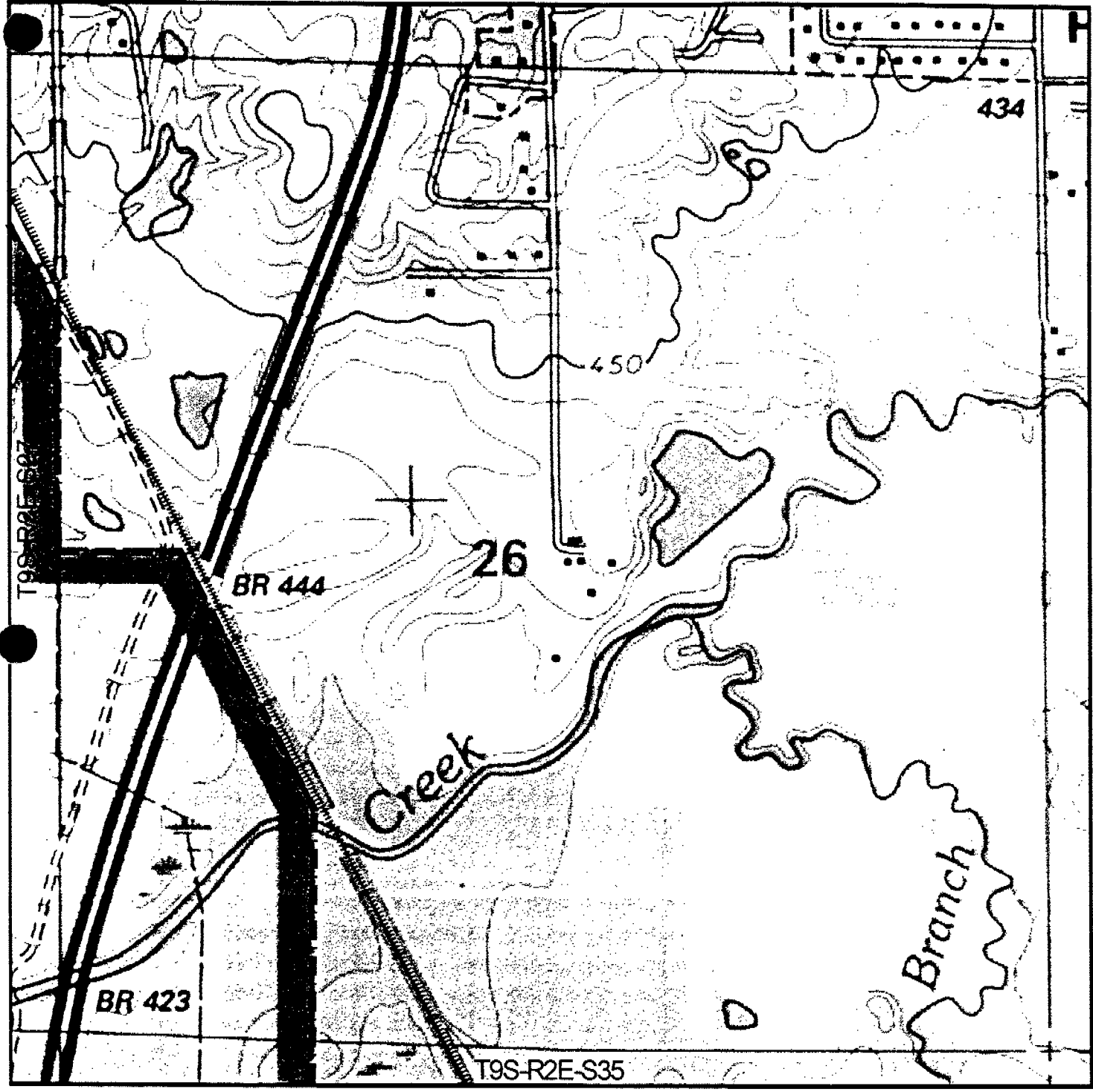


PHOTO LEGEND			
1943		1971	
1951		1980	
1960		1993	
1965			



LEGEND	
- Site	IOP Boundary
FS - Farmstead	Road/Lane
MS - Military Structures	Railroad
	Structure
	Fence

APPROX. SCALE 1 : 9,500

FIGURE 43-17  
 T9S-R2E-S26

# T9S-R1E-S34

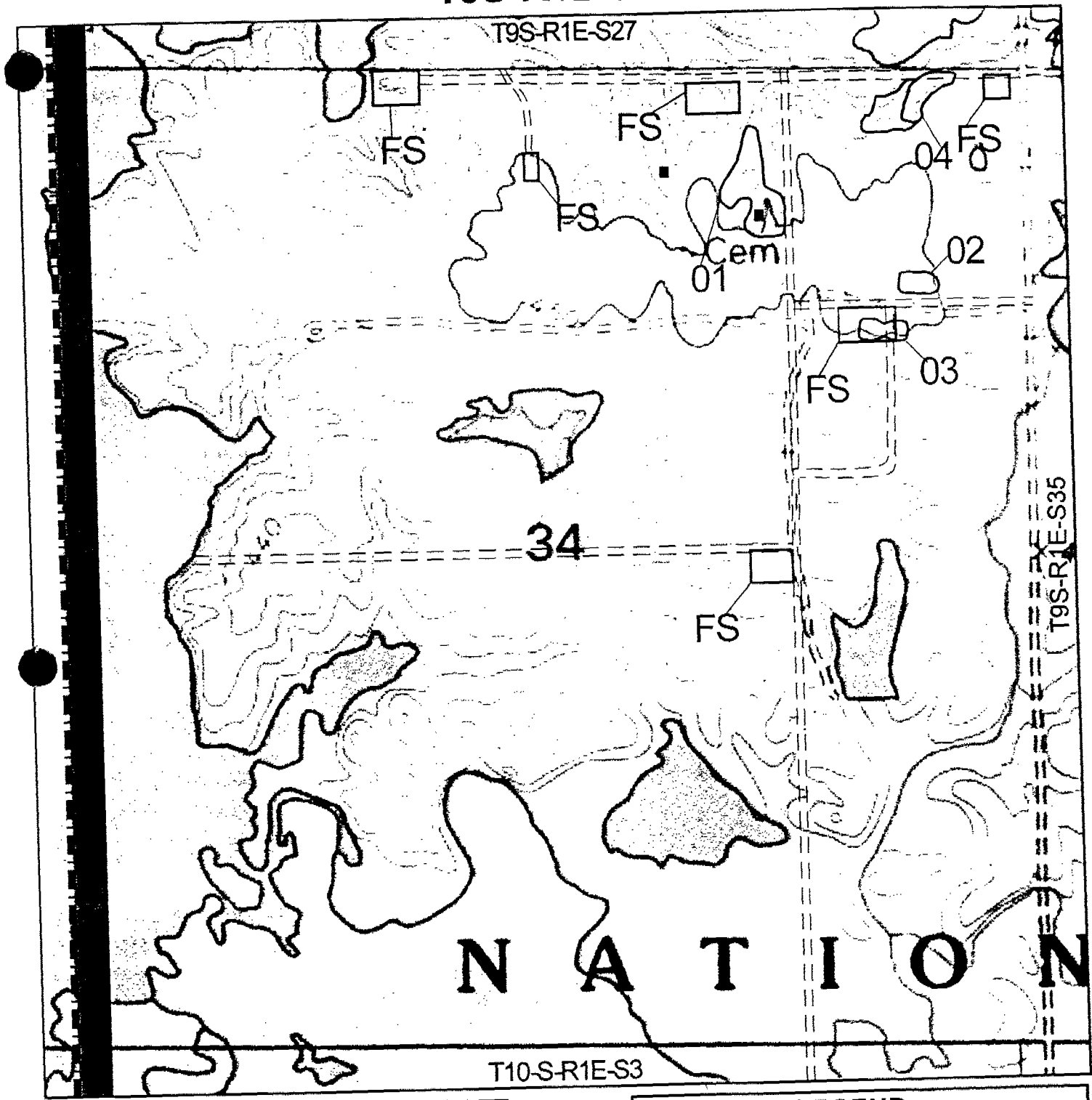


PHOTO LEGEND	
1943	
1951	
1960	
1965	
1971	
1980	
1993	



LEGEND	
- Site	IOP Boundary
FS - Farmstead	Road/Lane
MS - Military Structures	Railroad
	Structure
	Fence

APPROX. SCALE 1 : 9,500



# T9S-R1E-S35

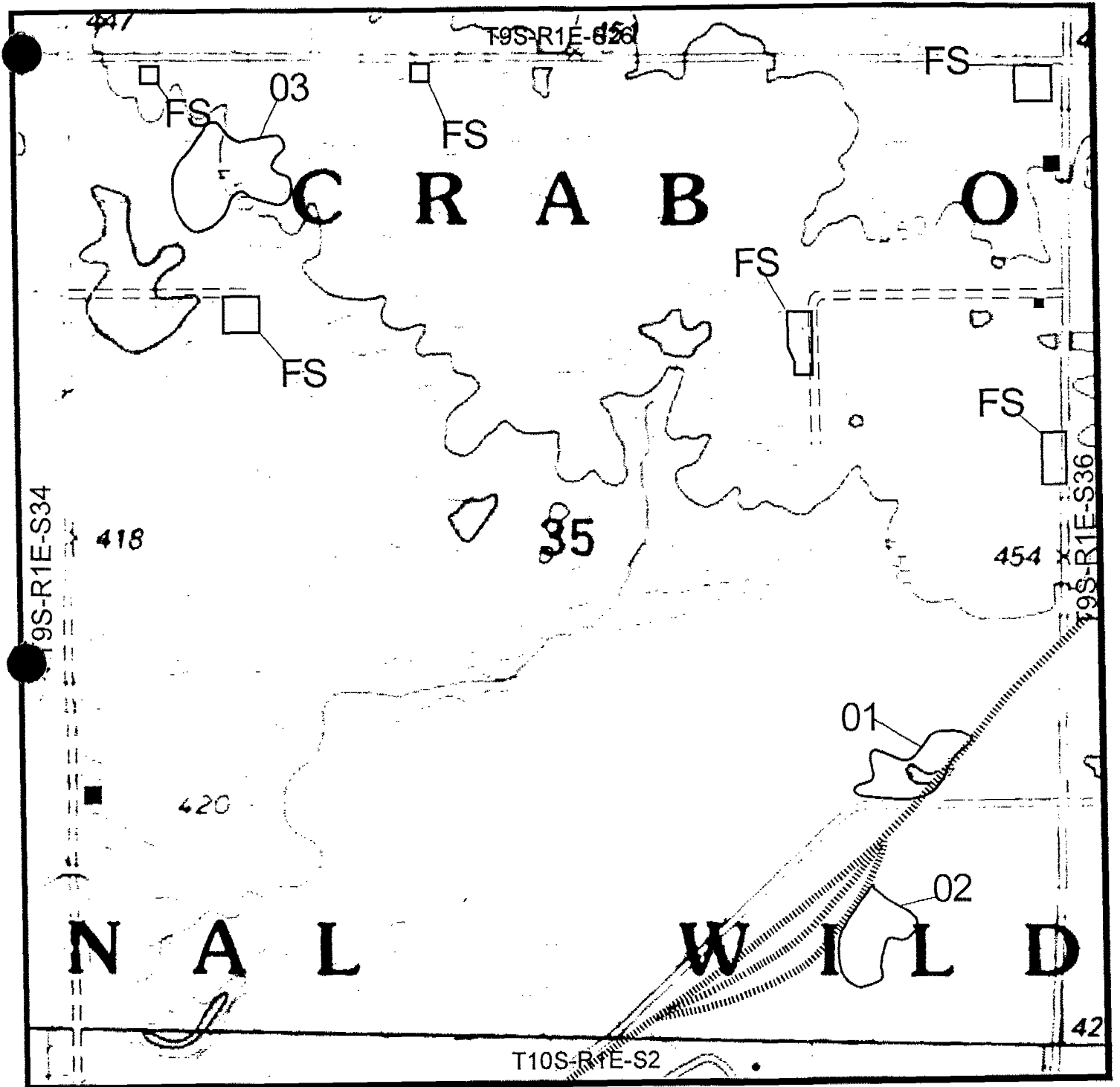


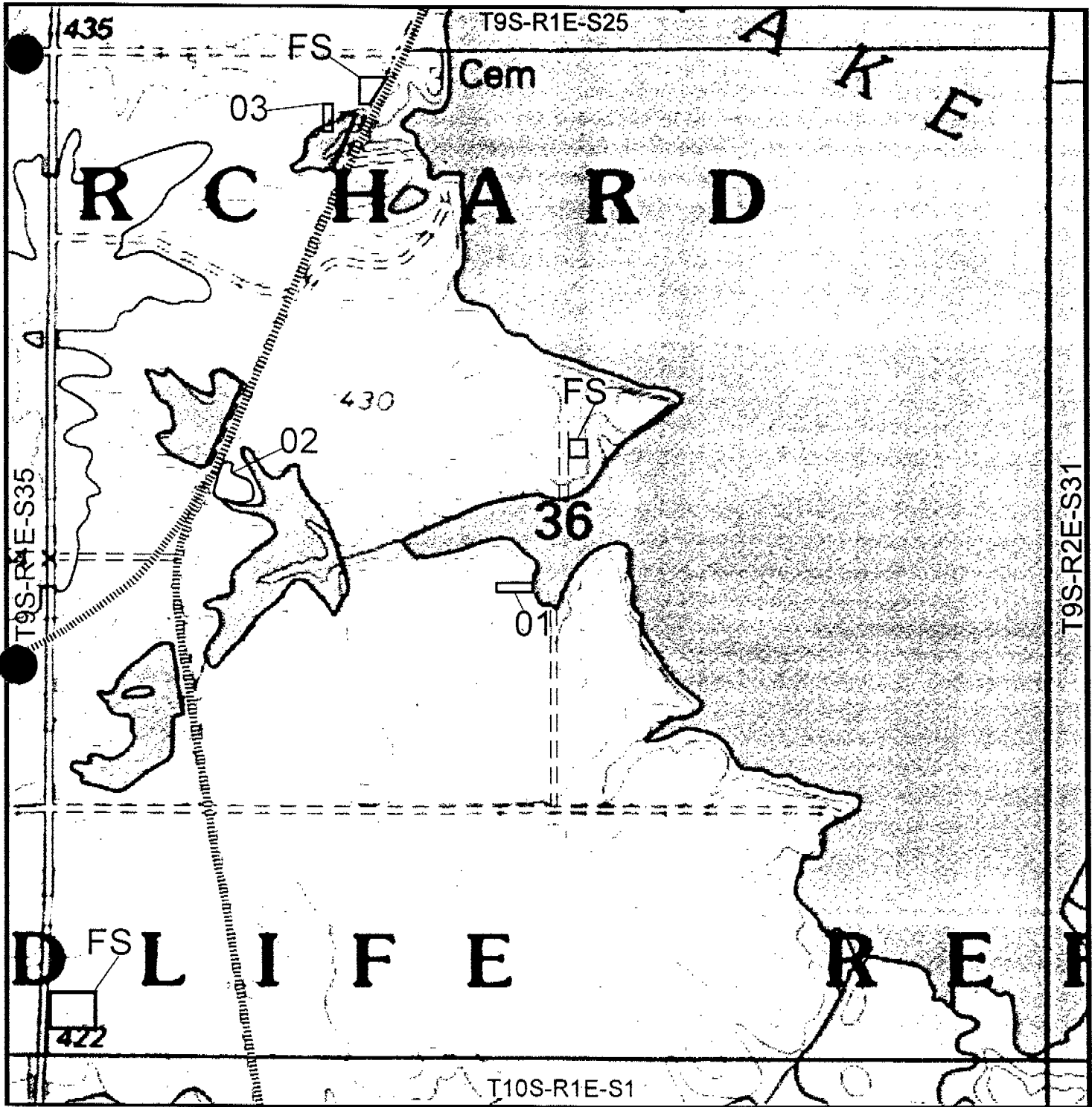
PHOTO LEGEND	
1943	
1951	
1960	
1965	
1971	
1980	
1993	



LEGEND	
	Site
FS	Farmstead
MS	Military Structures
	IOP Boundary
	Road/Lane
	Railroad
	Structure
	Fence

APPROX. SCALE 1 : 9,500

T9S-R1E-S36



**PHOTO LEGEND**

1943		1971	
1951		1980	
1960		1993	
1965			



**LEGEND**

- Site	IOP Boundary
FS - Farmstead	Road/Lane
MS - Military Structures	Railroad
	Structure
	Fence

APPROX. SCALE 1 : 9,500

# T9S-R2E-S31

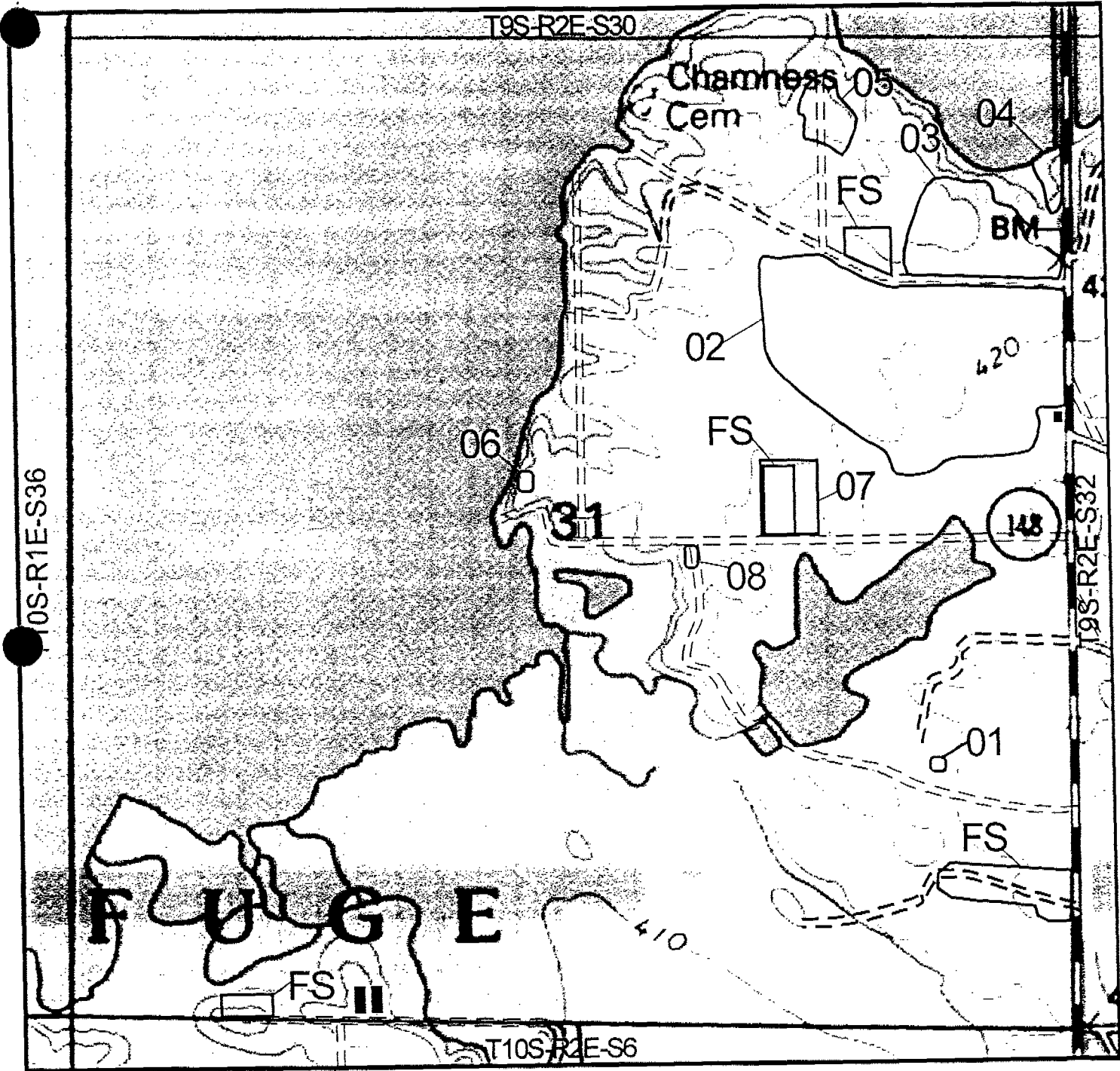


PHOTO LEGEND			
1943		1971	
1951		1980	
1960		1993	
1965			



LEGEND	
- Site	IOP Boundary
FS - Farmstead	Road/Lane
MS - Military Structures	Railroad
	Structure
	Fence

APPROX. SCALE 1:9,500

# T9S-R2E-S32

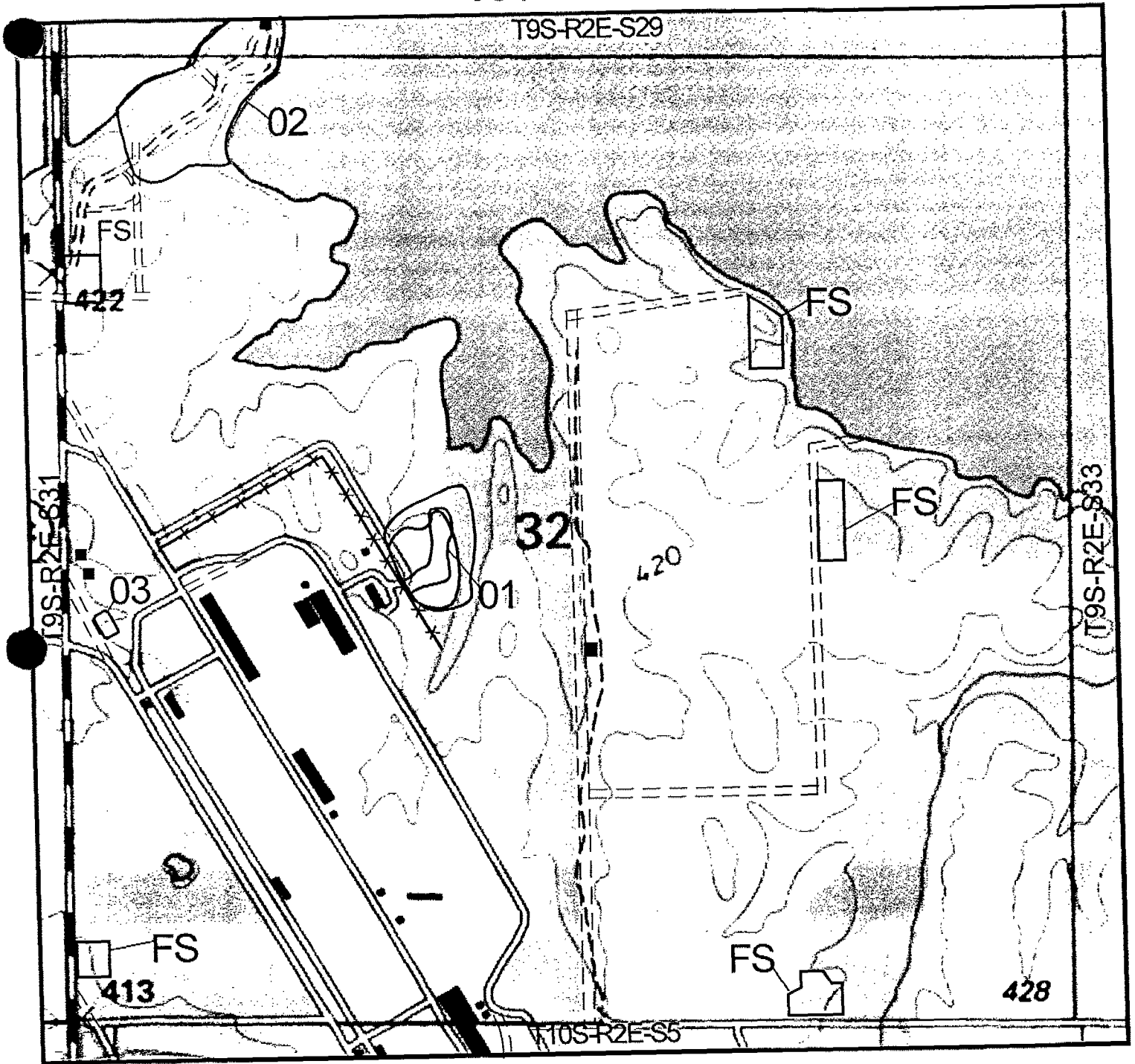


PHOTO LEGEND			
1943		1971	
1951		1980	
1960		1993	
1965			

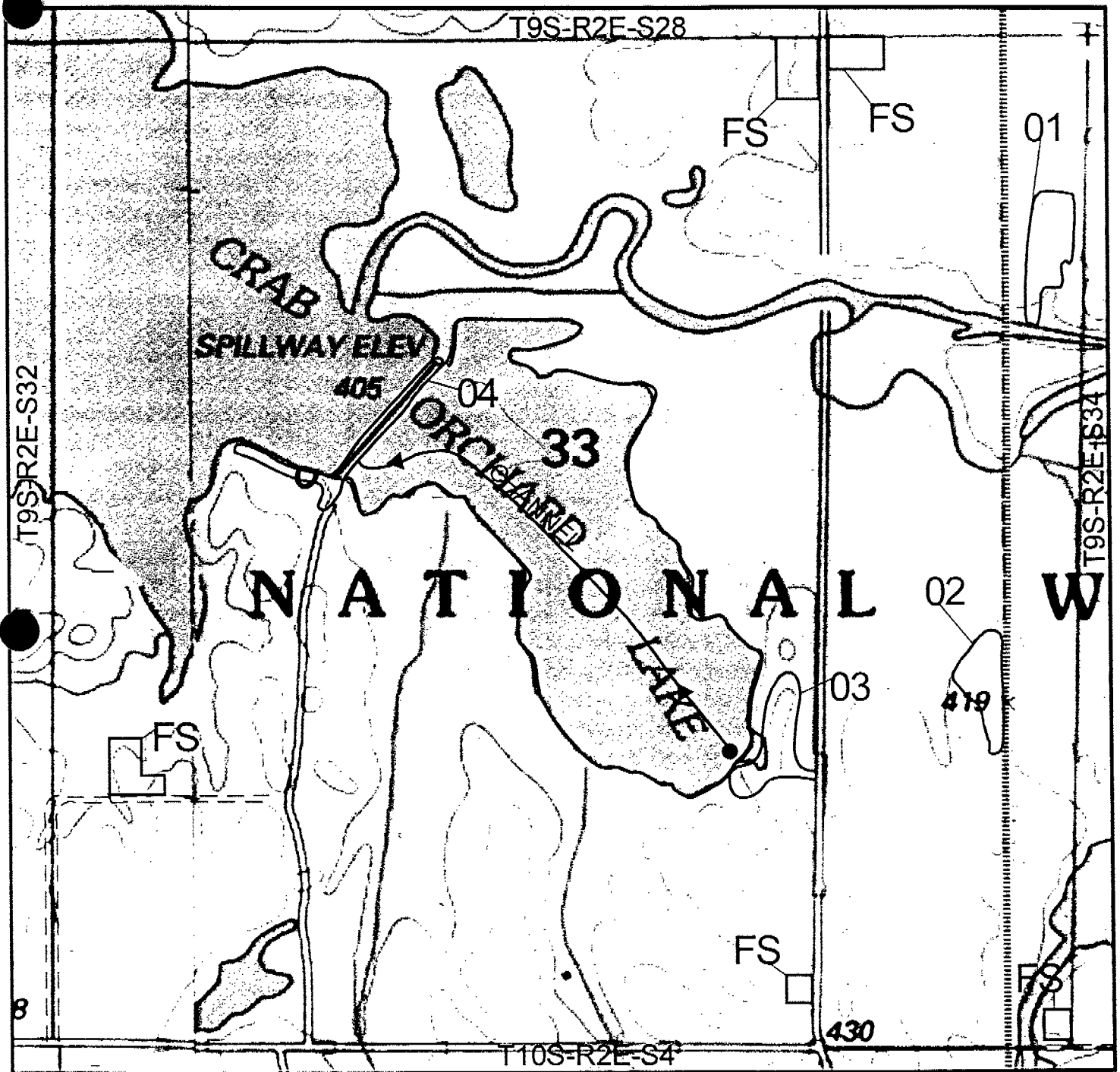


LEGEND	
- Site	IOP Boundary
FS - Farmstead	Road/Lane
MS - Military Structures	Railroad
	Structure
	Fence

APPROX. SCALE 1:9,500

FIGURE 43-22  
T9S-R2E-S32

# T9S-R2E-S33



## PHOTO LEGEND

1943		1971	
1951		1980	
1960		1993	
1965			



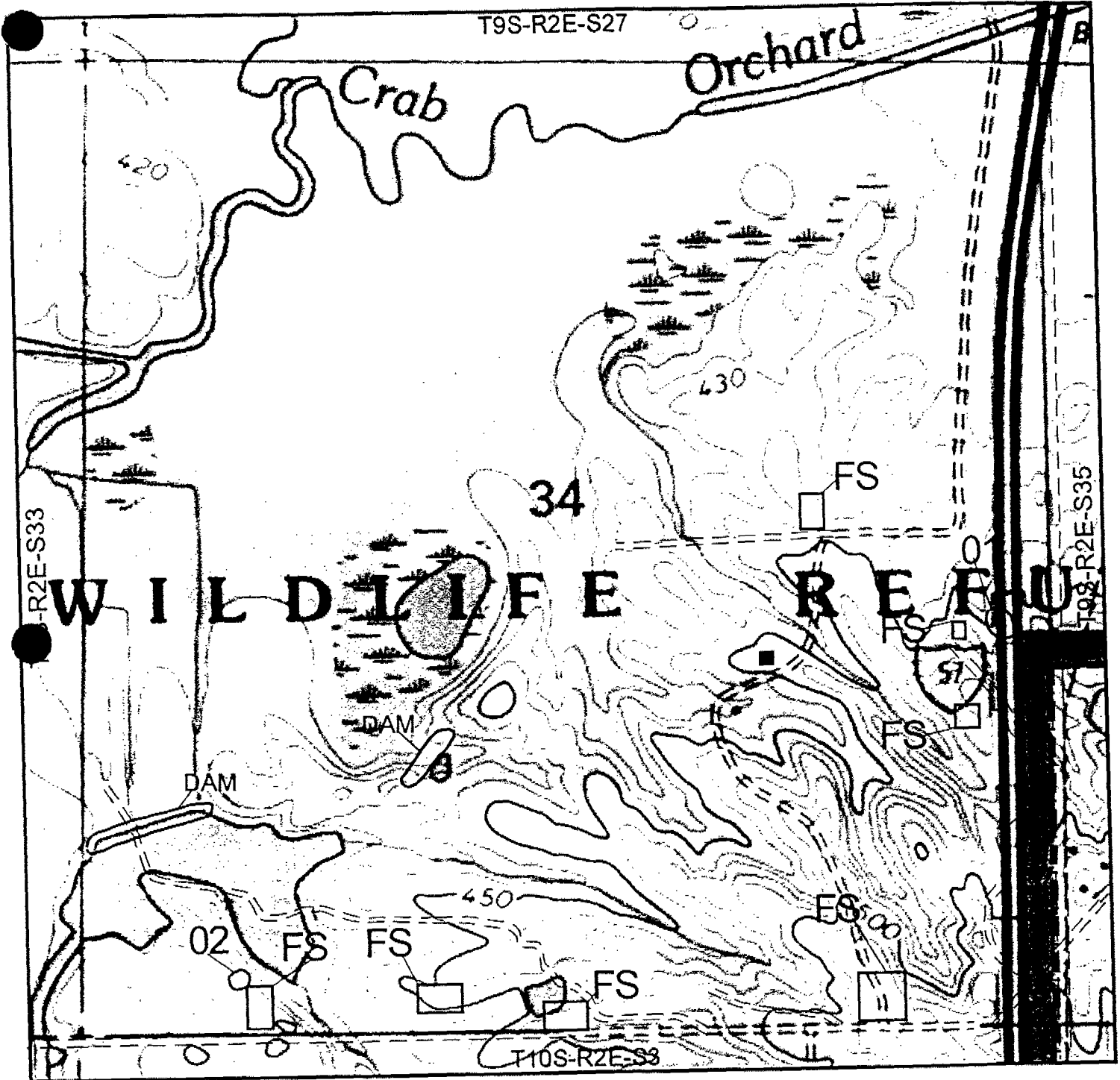
## LEGEND

- Site	IOP Boundary
FS - Farmstead	Road/Lane
MS - Military Structures	Railroad
	Structure
	Fence

APPROX. SCALE 1 : 9,500

# T9S-R2E-S34

T9S-R2E-S27



## PHOTO LEGEND

1943		1971	
1951		1980	
1960		1993	
1965			



## LEGEND

- Site	IOP Boundary
FS - Farmstead	Road/Lane
MS - Military Structures	Railroad
	Structure
	Fence

APPROX. SCALE 1:9,500

# T9S-R2E-S35

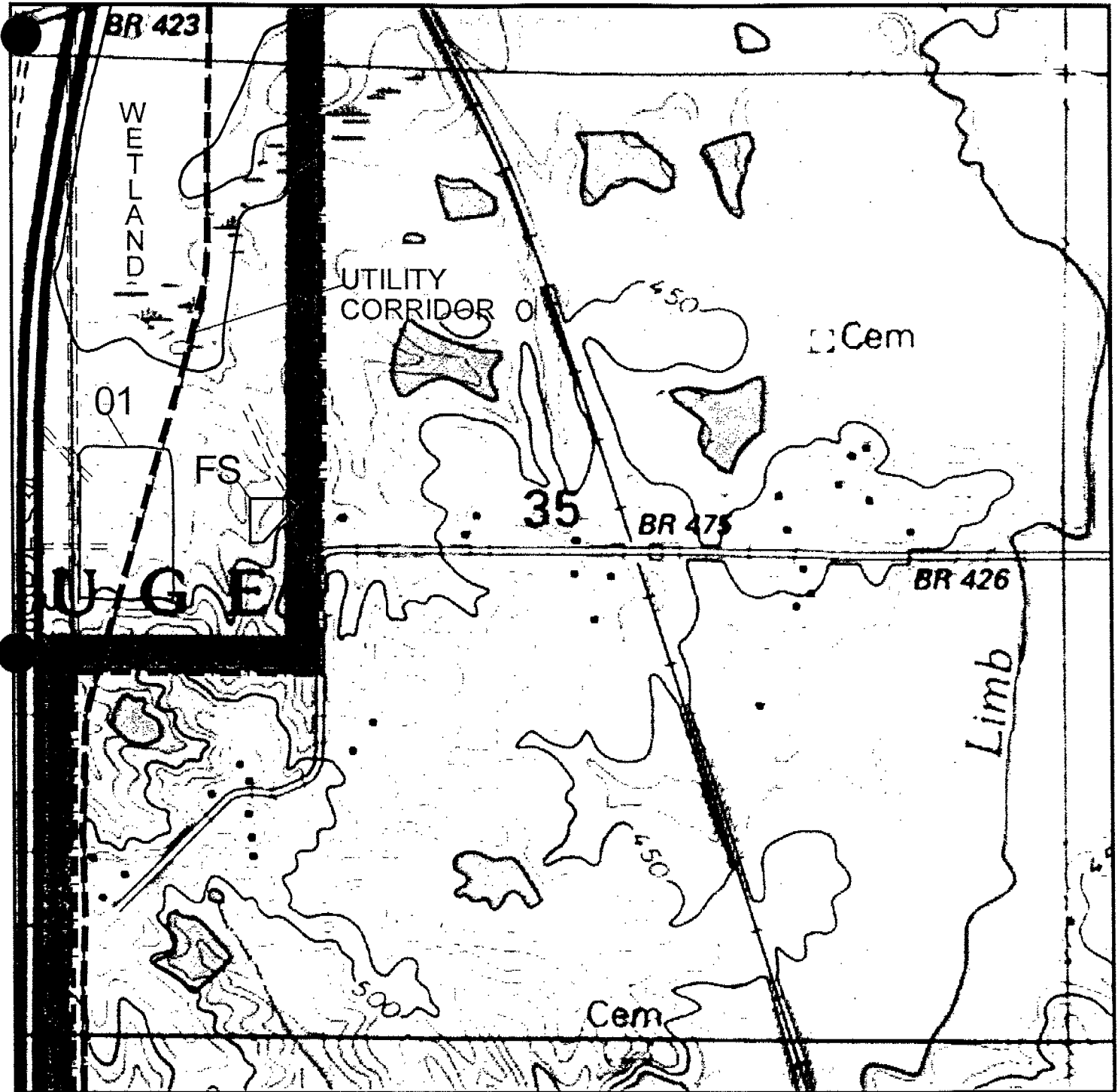


PHOTO LEGEND			
1943		1971	
1951		1980	
1960		1993	
1965			



LEGEND	
- Site	IOP Boundary
FS - Farmstead	Road/Lane
MS - Military Structures	Railroad
	Structure
	Fence

APPROX. SCALE 1 : 9,500

# T10S-R1E-S3

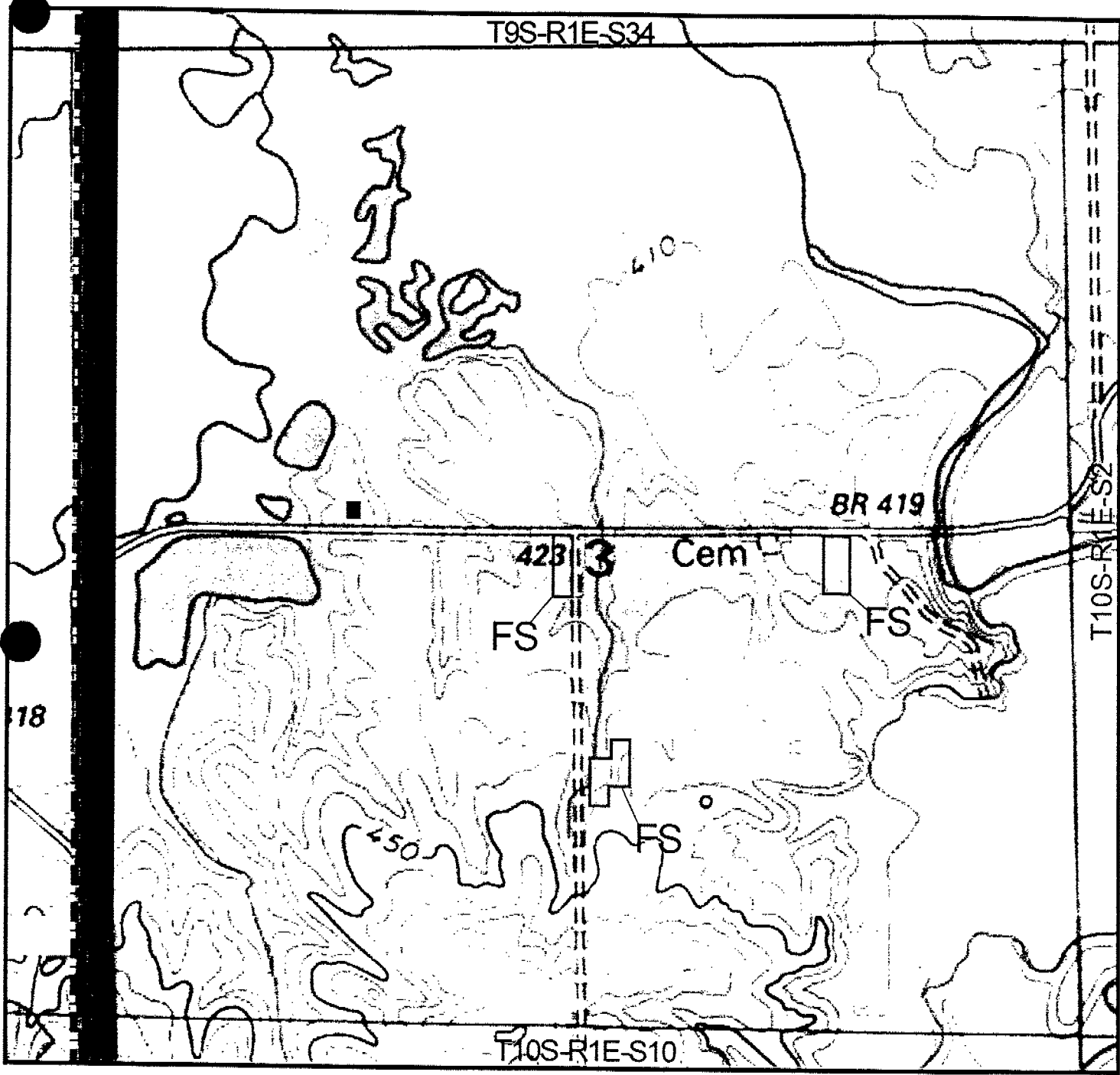


PHOTO LEGEND			
1943		1971	
1951		1980	
1960		1993	
1965			



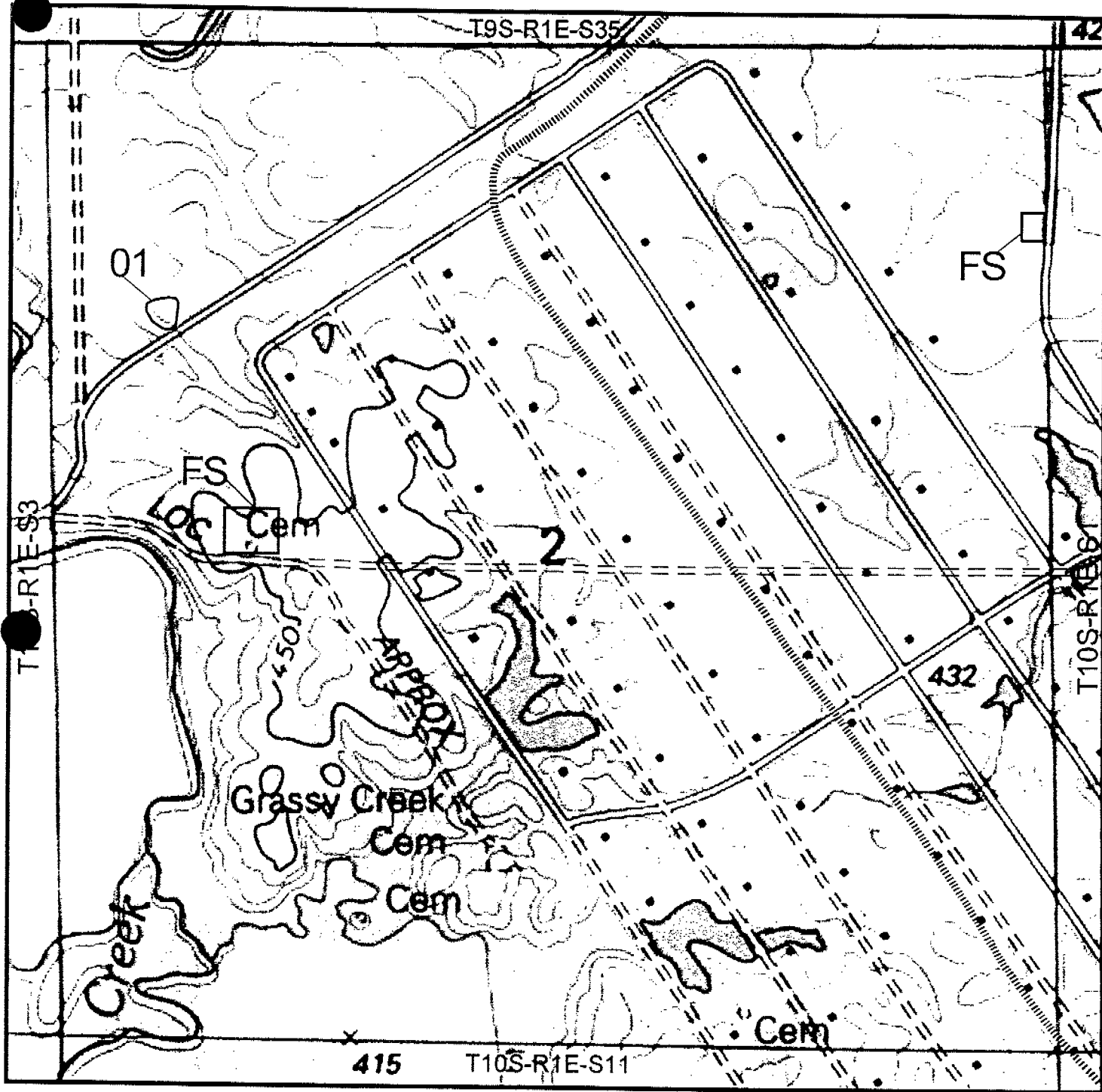
LEGEND	
- Site	IOP Boundary
FS - Farmstead	Road/Lane
MS - Military Structures	Railroad
	Structure
	Fence

APPROX. SCALE 1 : 9,500

FIGURE 43-26  
T10S-R1E-S3



# T10S-R1E-S2



## PHOTO LEGEND

1943		1971	
1951		1980	
1960		1993	
1965			



## LEGEND

- Site	IOP Boundary
FS - Farmstead	Road/Lane
MS - Military Structures	Railroad
	Structure
	Fence

APPROX. SCALE 1 : 9,500

# T10S-R1E-S1

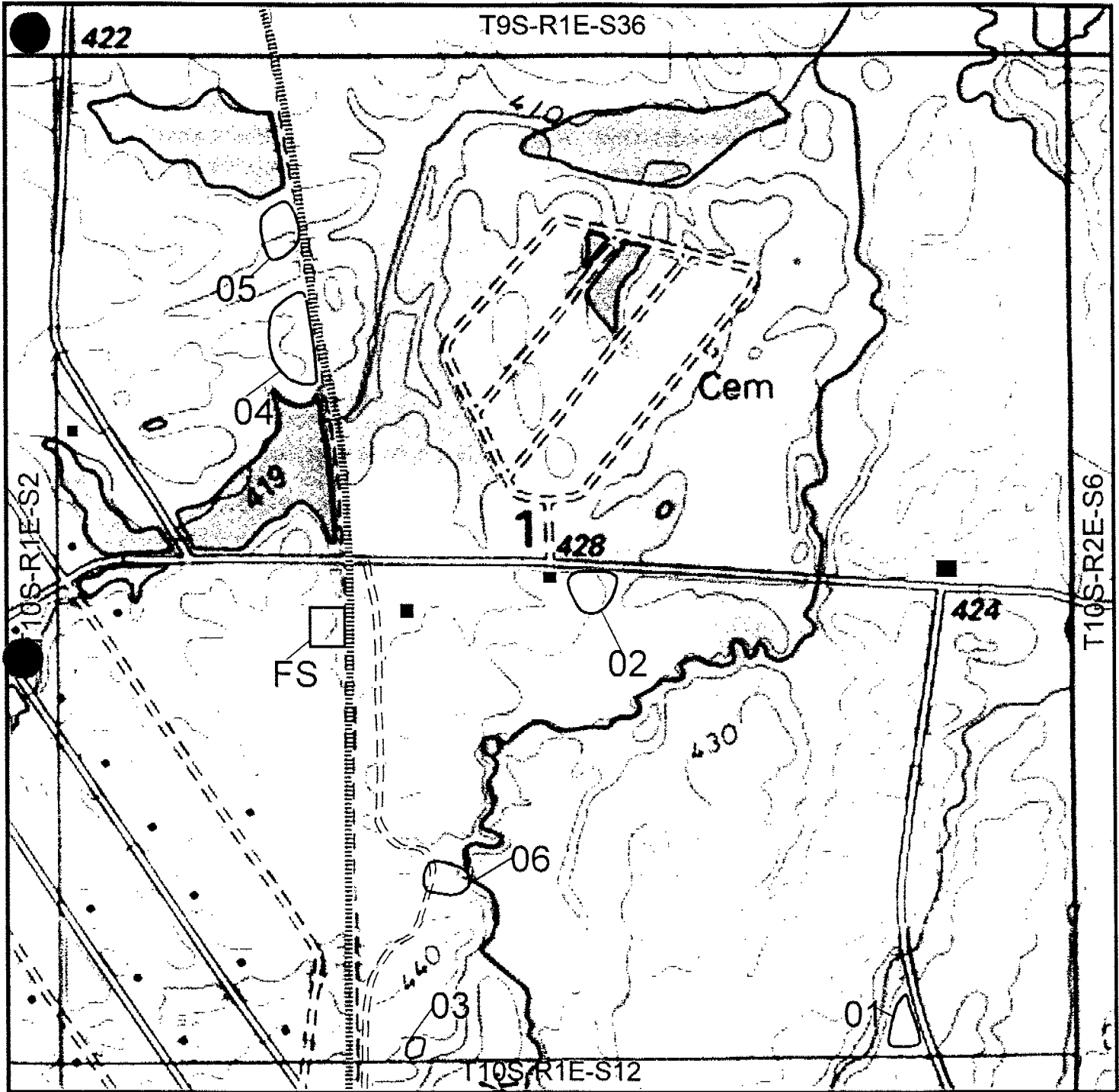


PHOTO LEGEND	
1943	1971
1951	1980
1960	1993
1965	

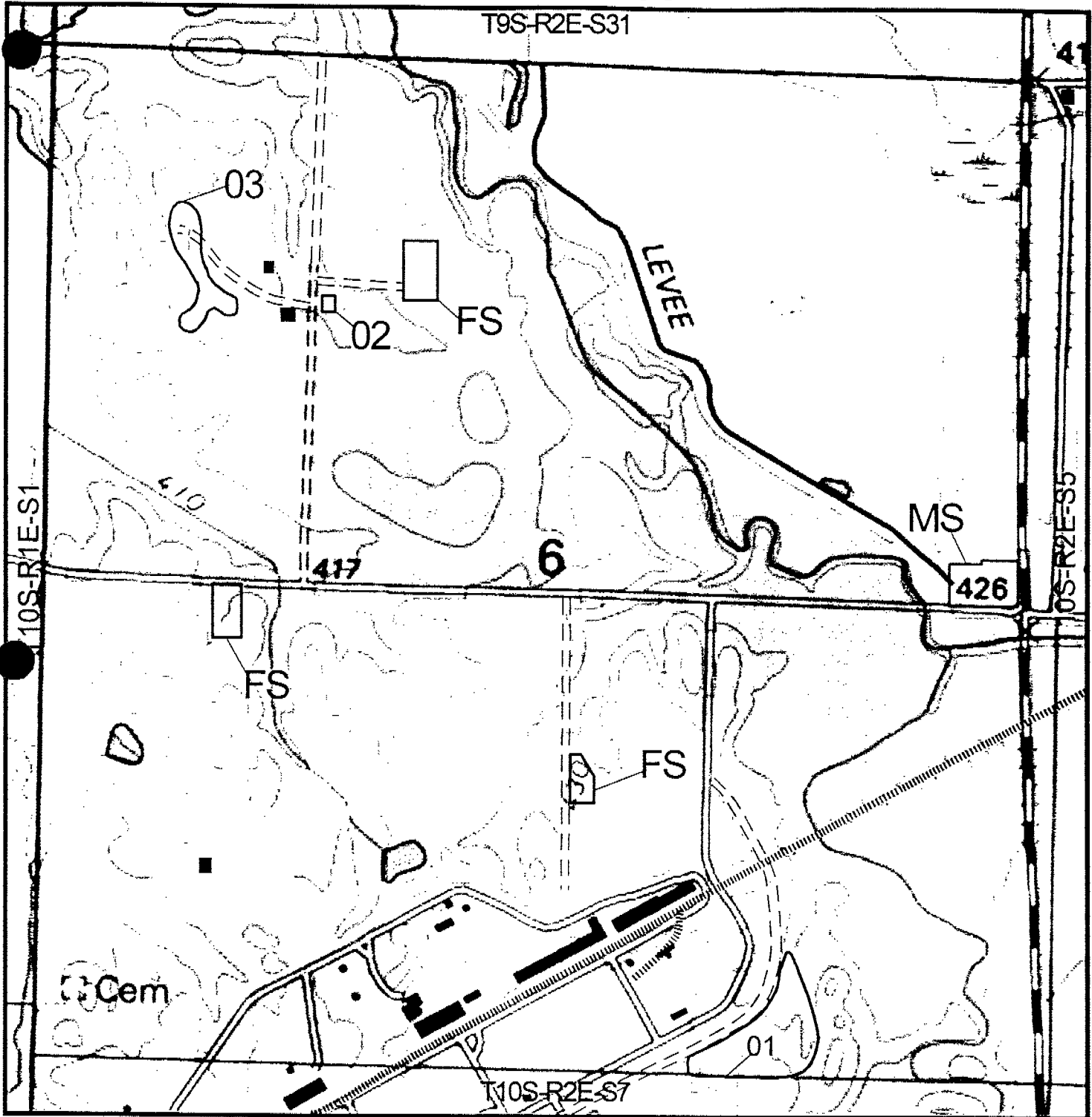


LEGEND	
(01) - Site	IOP Boundary
FS - Farmstead	== == Road/Lane
MS - Military Structures	..... Railroad
	■ Structure
	-x-x- Fence

APPROX. SCALE 1 : 9,500

# T10S-R2E-S6

T9S-R2E-S31



## PHOTO LEGEND

1943		1971	
1951		1980	
1960		1993	
1965			

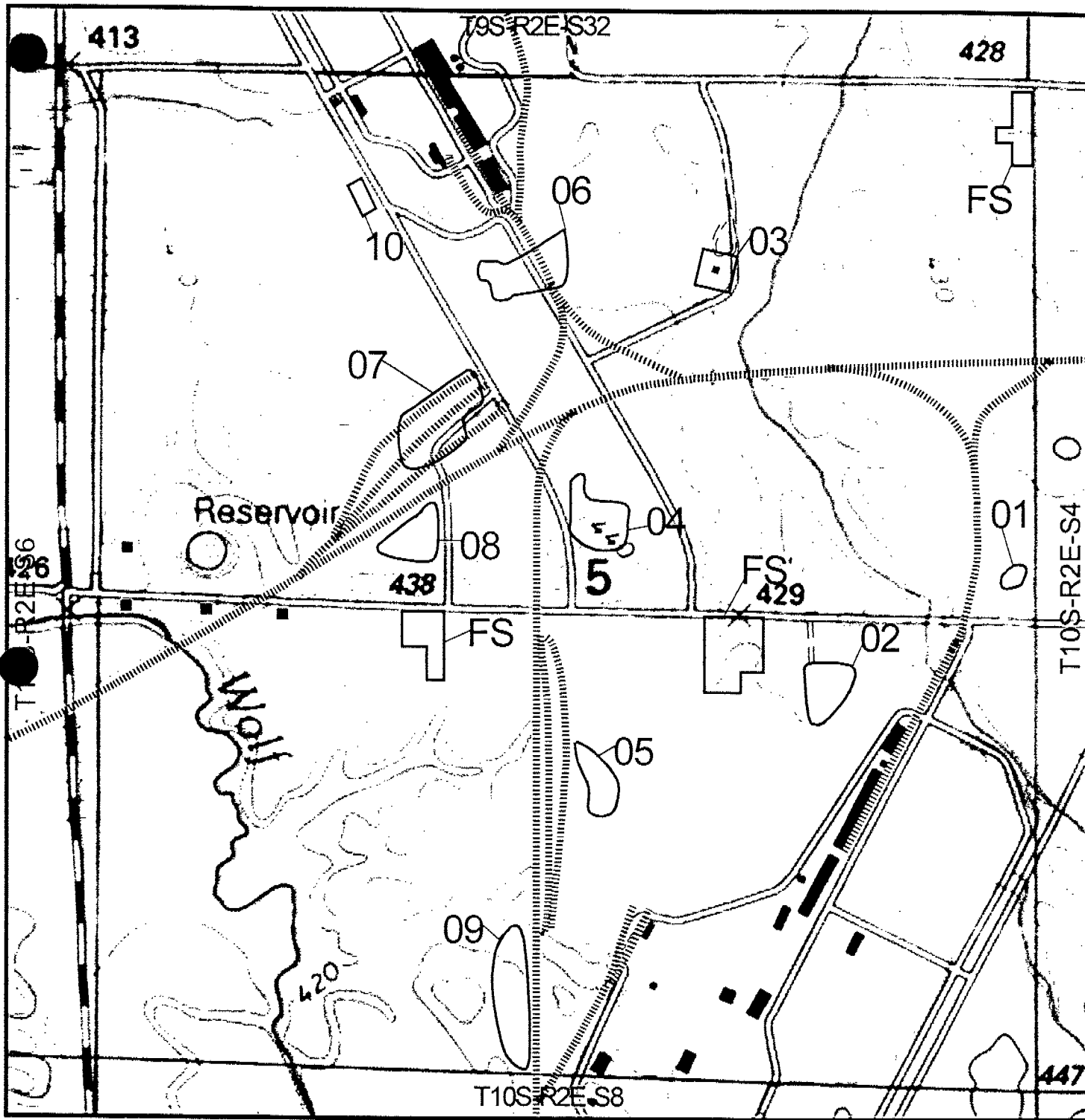


## LEGEND

- Site	IOP Boundary
FS - Farmstead	Road/Lane
MS - Military Structures	Railroad
	Structure
	Fence

APPROX. SCALE 1 : 9,500

# T10S-R2E-S5



## PHOTO LEGEND

1943		1971	
1951		1980	
1960		1993	
1965			

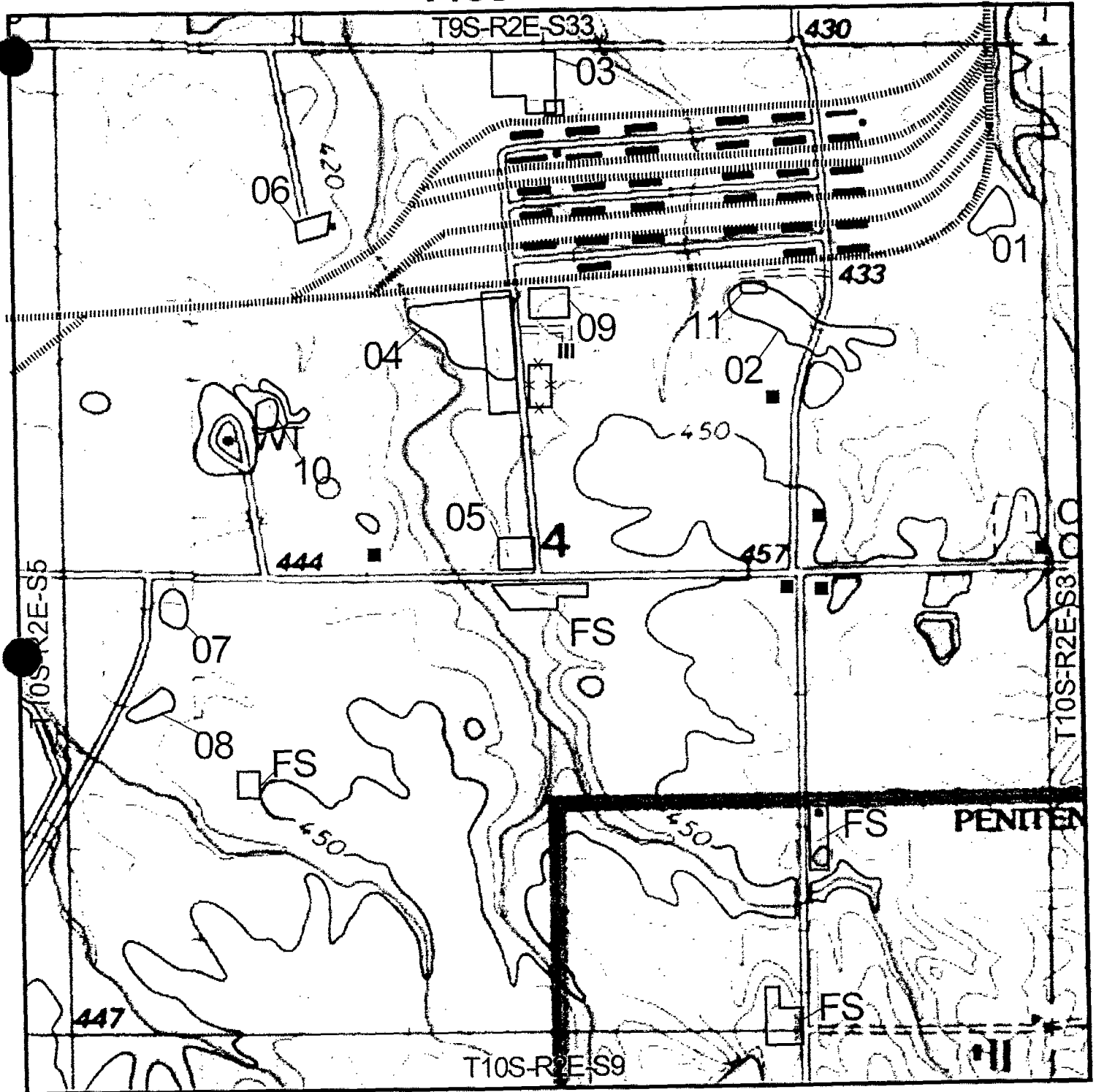


## LEGEND

- Site	IOP Boundary
FS - Farmstead	Road/Lane
MS - Military Structures	Railroad
	Structure
	Fence

APPROX. SCALE 1 : 9,500

# T10S-R2E-S4



## PHOTO LEGEND

1943		1971	
1951		1980	
1960		1993	
1965			

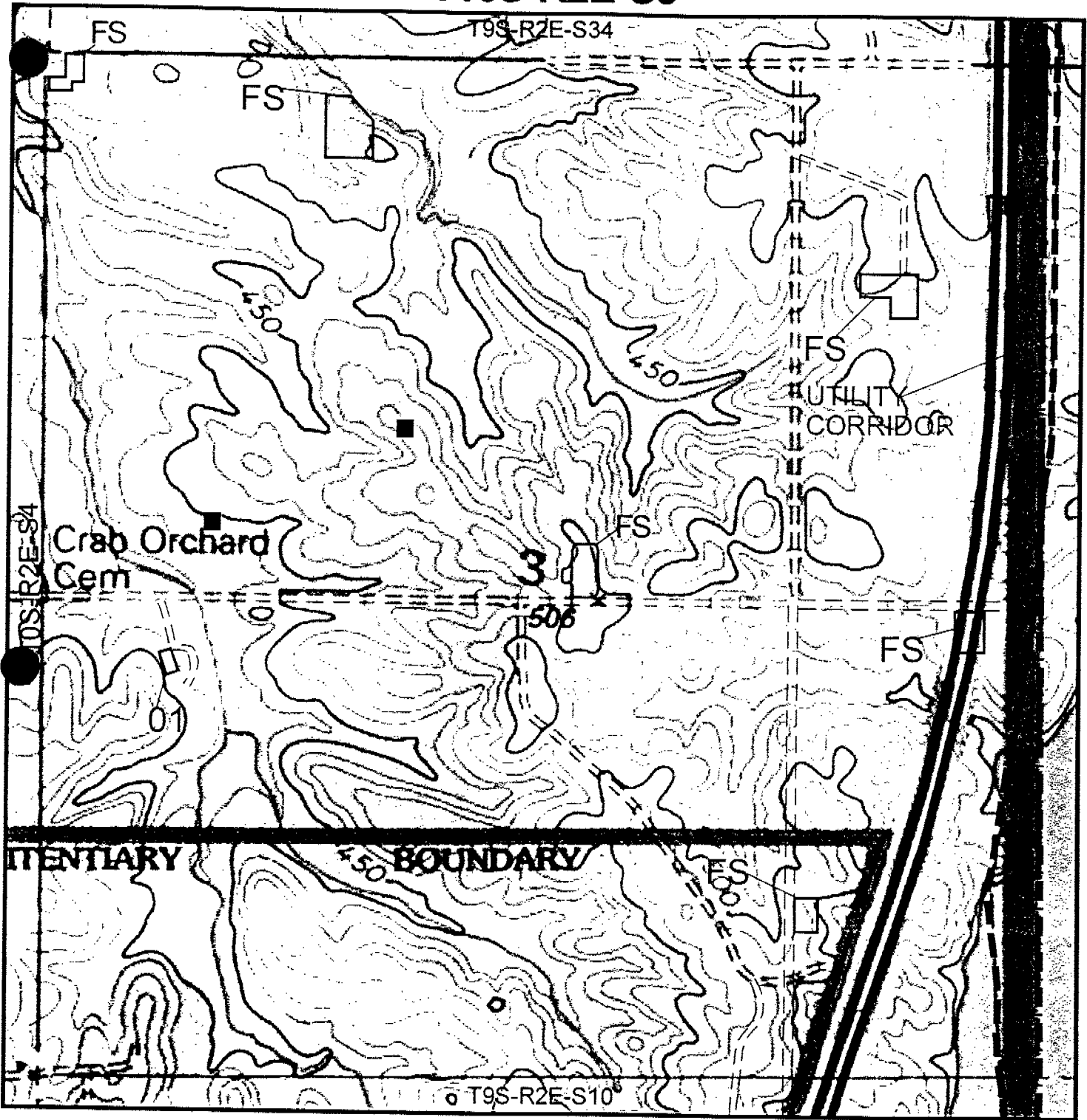


## LEGEND

- Site	IOP Boundary
FS - Farmstead	Road/Lane
MS - Military Structures	Railroad
	Structure
	Fence

APPROX. SCALE 1 : 9,500

# T10S-R2E-S3



## PHOTO LEGEND

1943		1971	
1951		1980	
1960		1993	
1965			

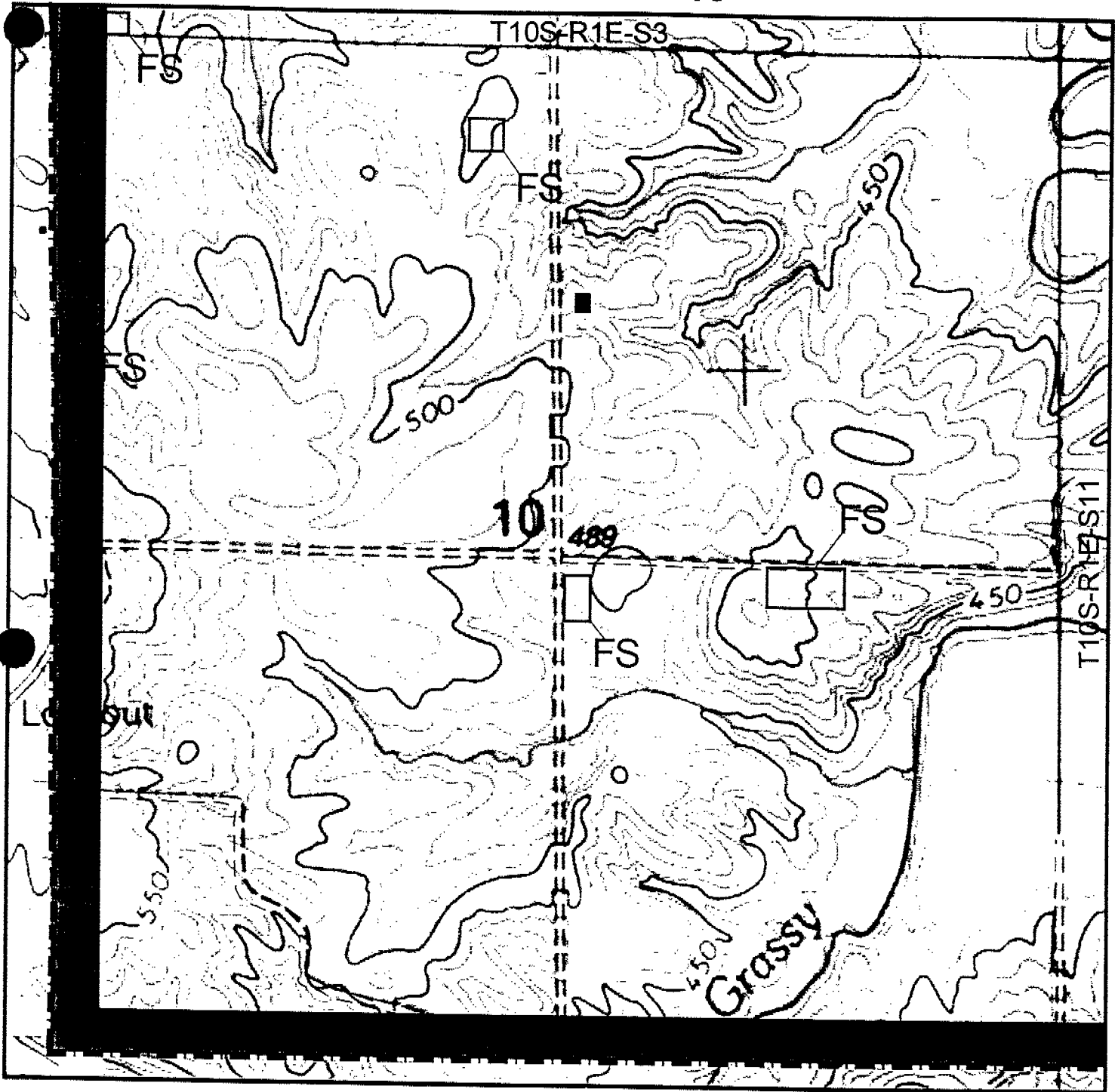


## LEGEND

- Site	IOP Boundary
FS - Farmstead	Road/Lane
MS - Military Structures	Railroad
	Structure
	Fence

APPROX. SCALE 1 : 9,500

# T10S-R1E-S10



## PHOTO LEGEND

1943		1971	
1951		1980	
1960		1993	
1965			



## LEGEND

- Site	IOP Boundary
FS - Farmstead	Road/Lane
MS - Military Structures	Railroad
	Structure
	Fence

APPROX. SCALE 1 : 9,500

# T10S-R1E-S11

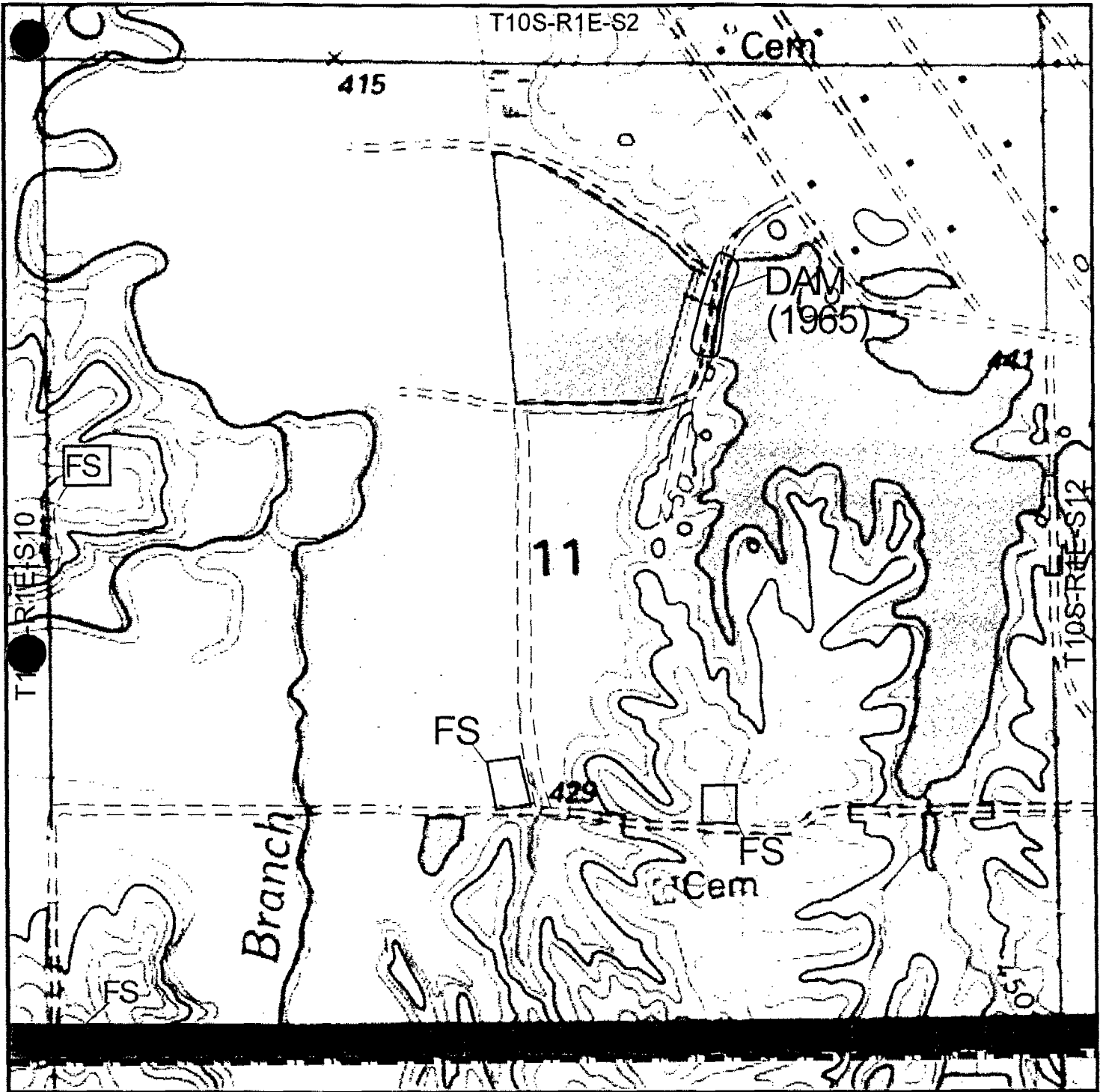


PHOTO LEGEND			
1943		1971	
1951		1980	
1960		1993	
1965			

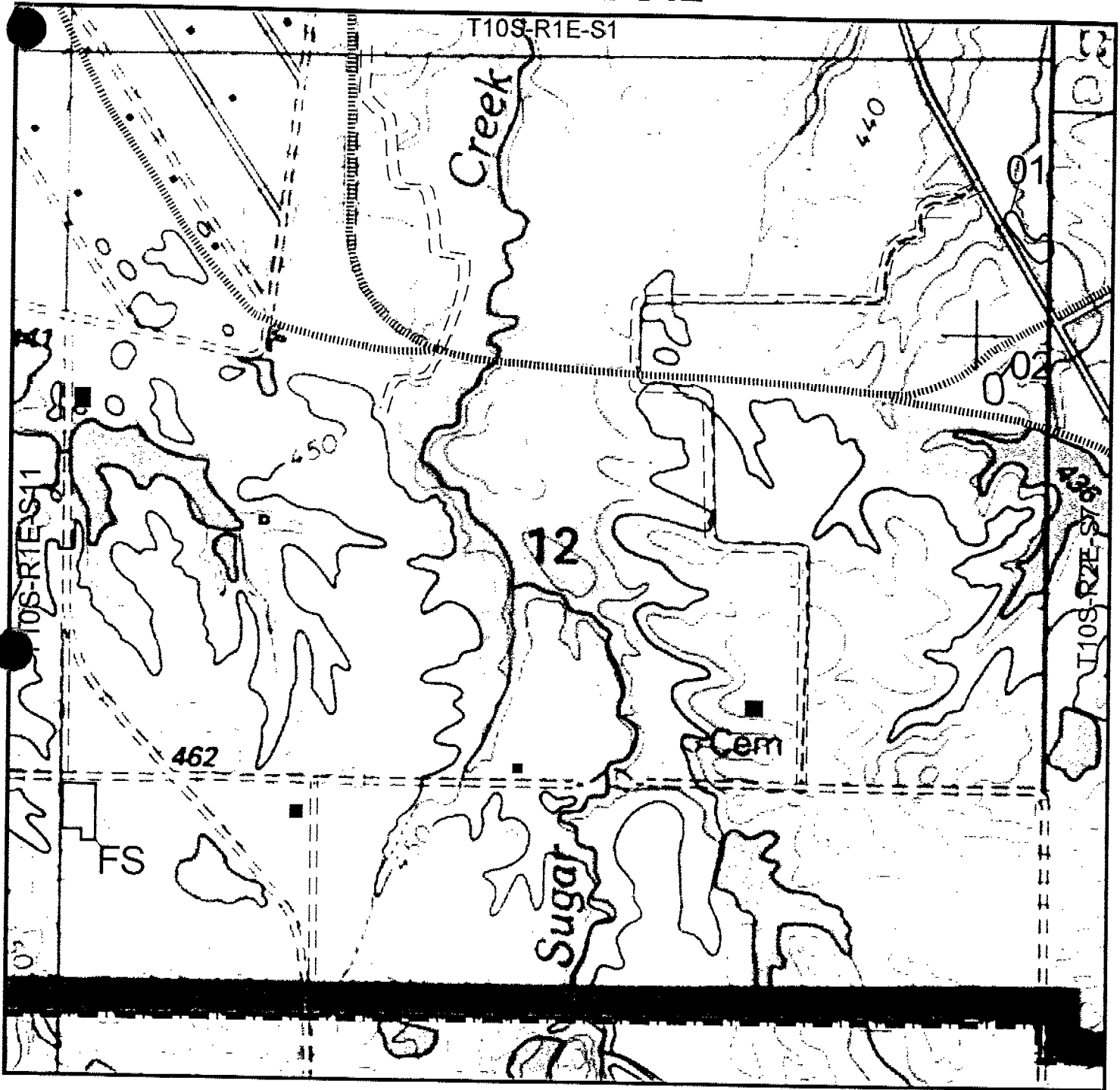


LEGEND	
- Site	IOP Boundary
FS - Farmstead	Road/Lane
MS - Military Structures	Railroad
	Structure
	Fence

APPROX. SCALE 1 : 9,500



# T10S-R1E-S12



## PHOTO LEGEND

1943		1971	
1951		1980	
1960		1993	
1965			



## LEGEND

- Site	IOP Boundary
FS - Farmstead	Road/Lane
MS - Military Structures	Railroad
	Structure
	Fence

# T10S-R2E-S7

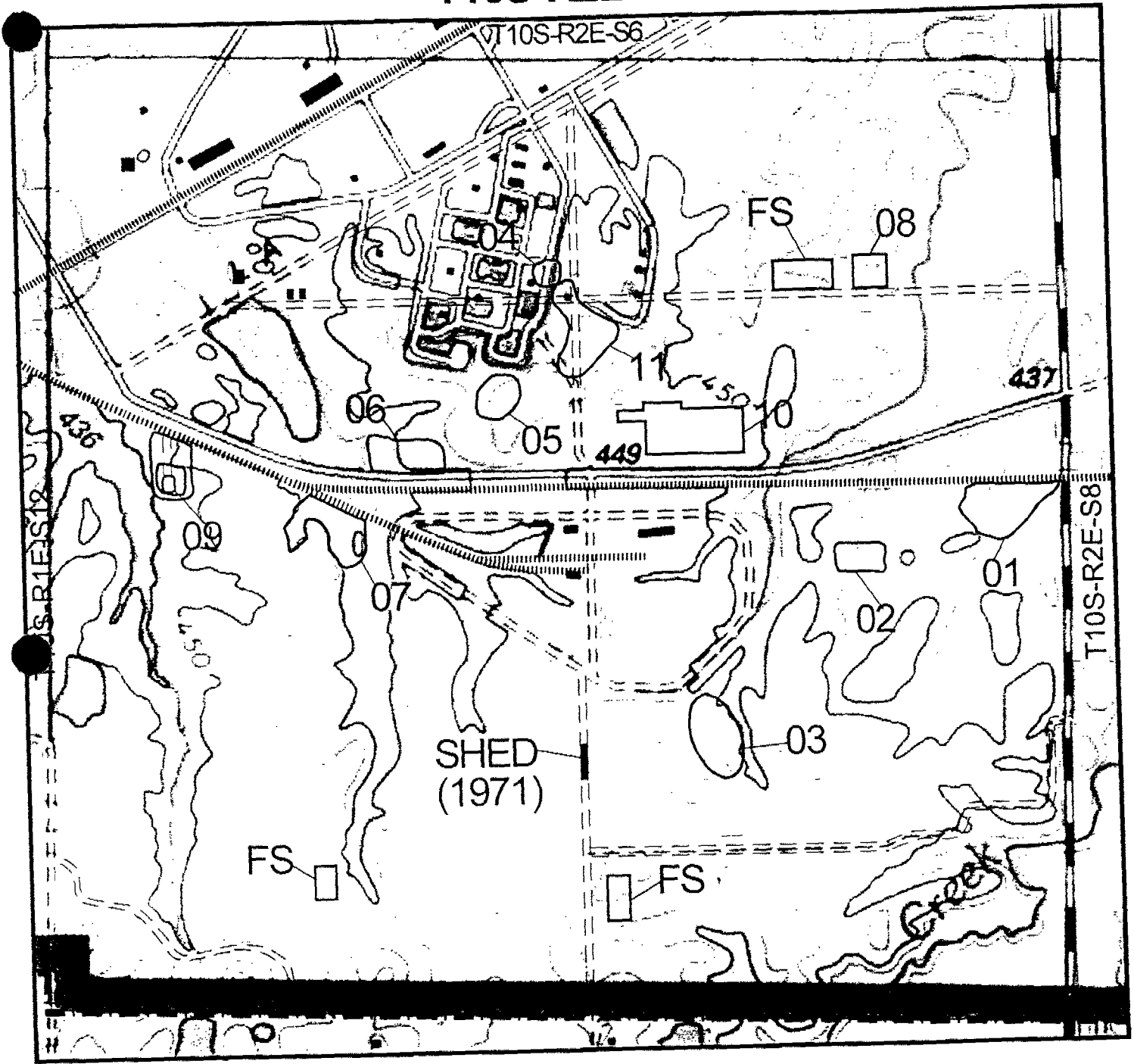


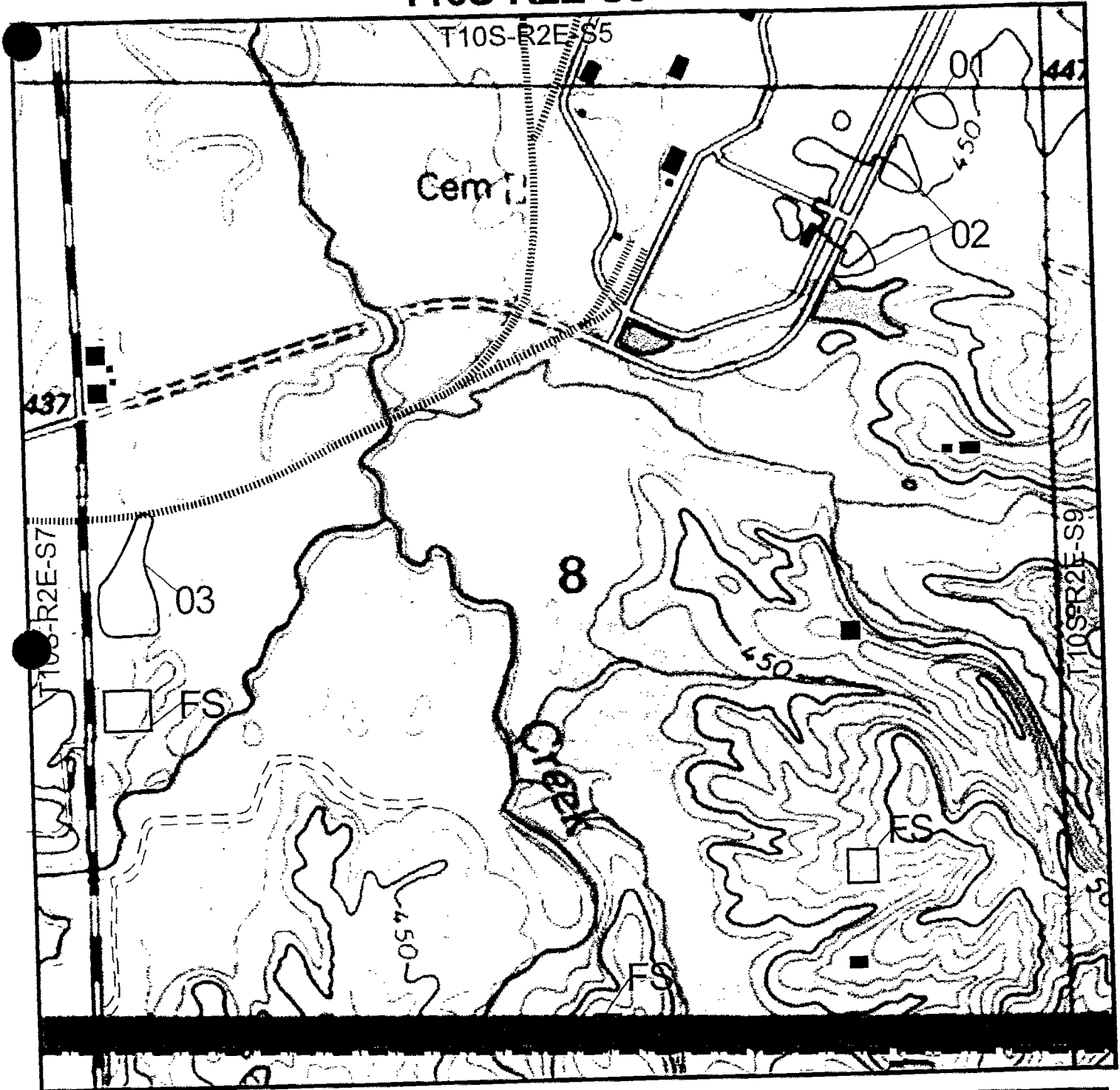
PHOTO LEGEND	
1943	
1951	
1960	
1965	
1971	
1980	
1993	



LEGEND	
- Site	IOP Boundary
FS - Famstead	Road/Lane
MS - Military Structures	Railroad
	Structure
	Fence

APPROX. SCALE 1 : 9,500

# T10S-R2E-S8



## PHOTO LEGEND

1943		1971	
1951		1980	
1960		1993	
1965			



## LEGEND

- Site	IOP Boundary
FS - Farmstead	Road/Lane
MS - Military Structures	Railroad
	Structure
	Fence

APPROX. SCALE 1 : 9,500

# T10S-R2E-S9

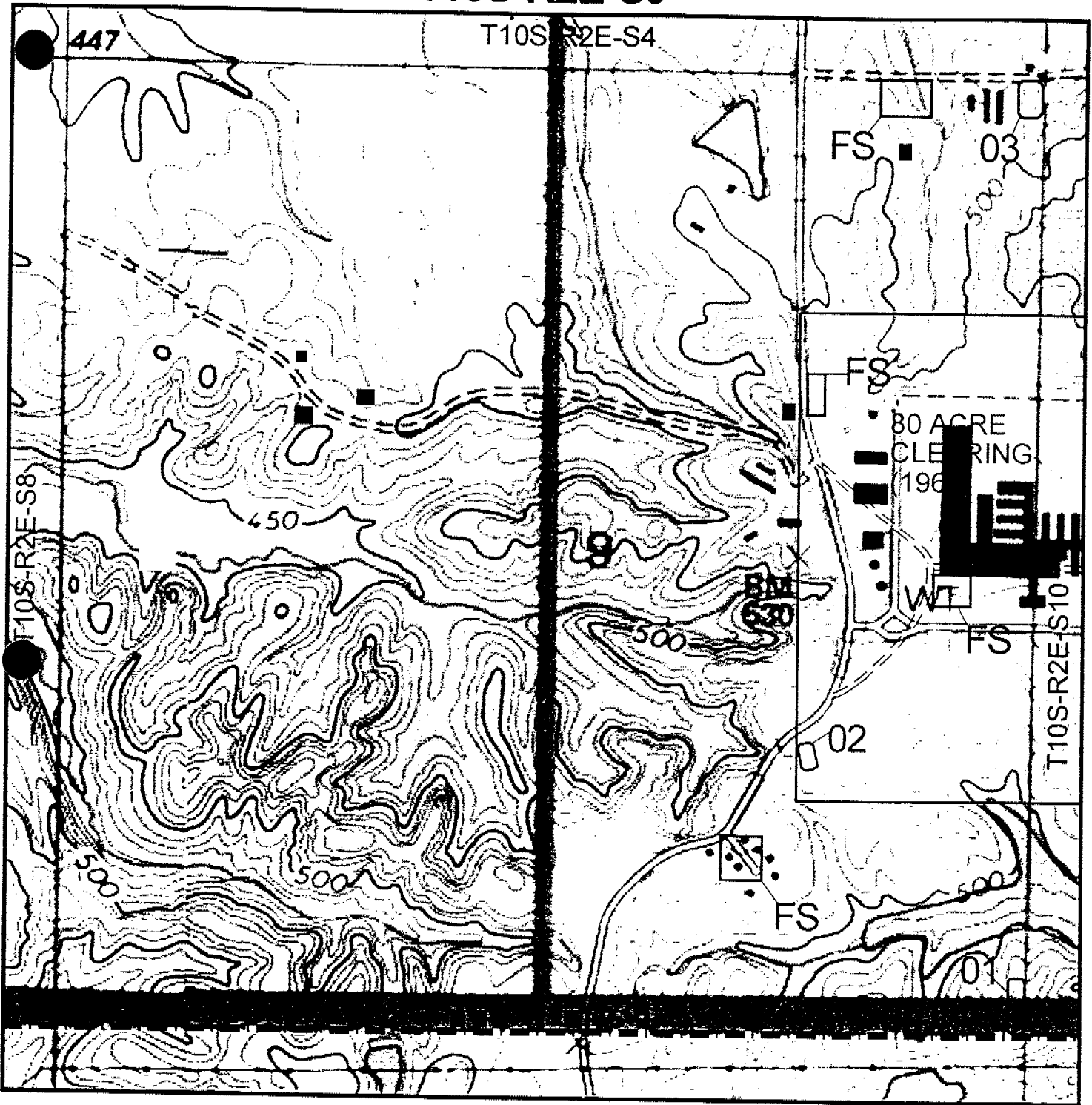


PHOTO LEGEND	
1943	
1951	
1960	
1965	
1971	
1980	
1993	



LEGEND	
- Site	IOP Boundary
FS - Farmstead	Road/Lane
MS - Military Structures	Railroad
	Structure
	Fence

APPROX. SCALE 1 : 9,500

# T10S-R2E-S10

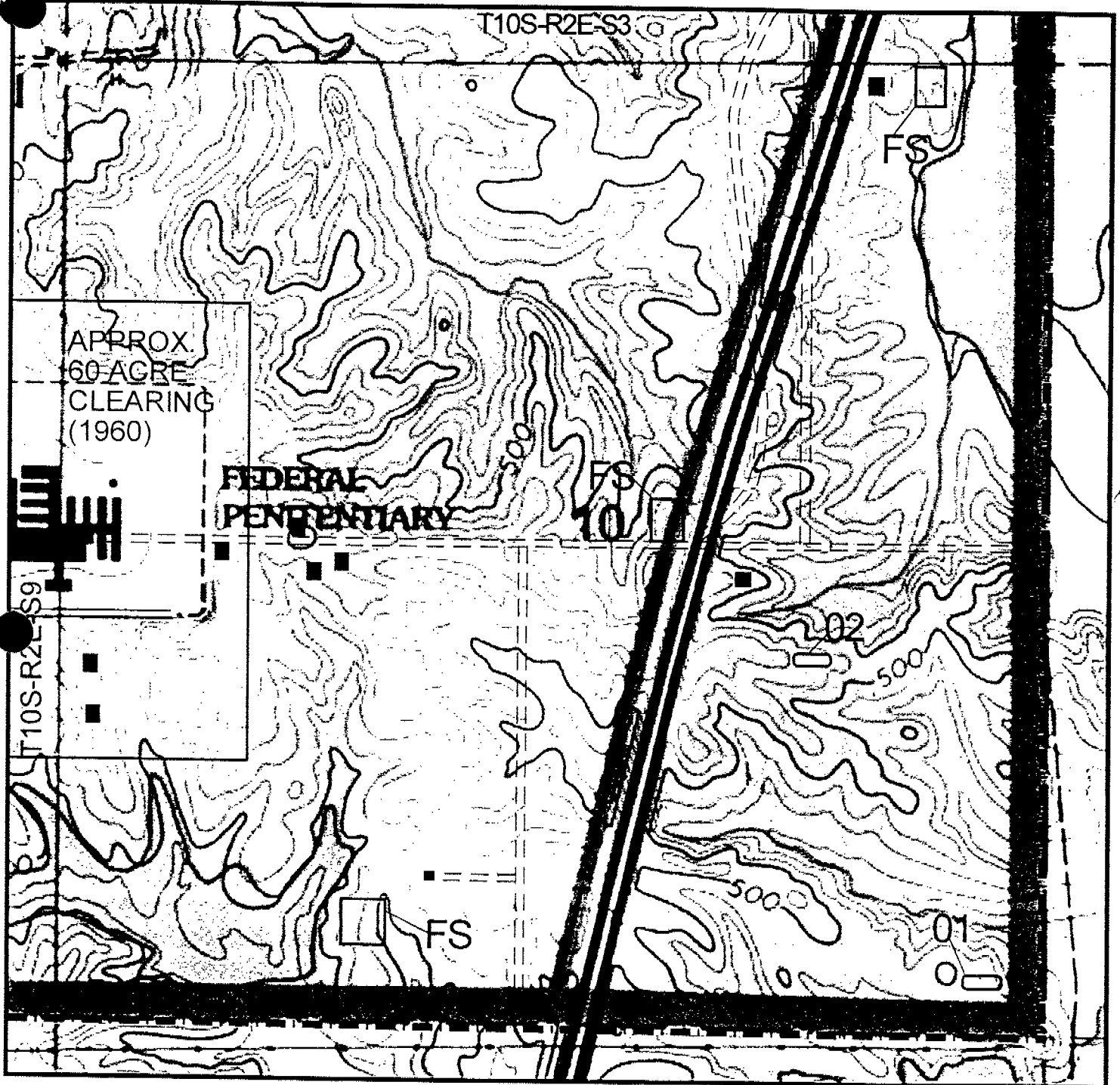


PHOTO LEGEND			
1943		1971	
1951		1980	
1960		1993	
1965			



LEGEND	
- Site	IOP Boundary
FS - Farmstead	Road/Lane
MS - Military Structures	Railroad
	Structure
	Fence

APPROX. SCALE 1 : 9,500

FIGURE 43-39  
T10S-R2E-S10