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 V

Section 11

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ACRONYM LIST
Crab Orchard AUS OU PA/SI Report

ACRONYM	DEFINITION
$3S_b$	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

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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_{ow}	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
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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

Area 7 (AUS-0A07), shown in Figure 11-1, is located approximately one and a half miles east of the intersection of Highway 148 and Ogden Road, and 0.5 miles north of Ogden Road on Chamnesstown Road.

AUS Original Site Designations

None of the sites originally designated in 1997-1999 as part of the Additional and Uncharacterized Sites Operable Unit (AUS OU) by the United States Fish & Wildlife Service (USFWS) are in Area 7. However, because of its past industrial use, Area 7 was identified as a potential source of contamination during the Preliminary Assessment (PA) and it was therefore included in the AUS OU.

11.1 HISTORIC SEARCH INFORMATION

11.1.1 Site Description

Area 7 was the Inert Storage Area for the Illinois Ordnance Plant (IOP), and was used for warehousing metal parts and other inert materials used in the production of artillery shells, tank mines and bombs.[1] The original configuration of Area 7 is shown in Figure 11-2. Figure 11-5 is the current site map.

Area 7 is made up of many warehouse buildings surrounded by grass and gravel roadways. The original building complex consisted of 6 rows of buildings (6 to 7 buildings per row originally) each of which were 51.3-feet (ft) wide by 200-ft long. All building numbers in this area were prefixed with "IN" (for Inert Storage). Figure 11-2 shows the numbering convention for the buildings.

11.1.2 Operational History and Waste Characteristics

During IOP operations, the Sherwin Williams Defense Corporation, under contract with the War Department (SWDC/War Department), occupied all of the buildings in Area 7. All the buildings were used as warehouses for inert storage, except for Buildings IN-3-4, which was used as a workshop, and IN-4-4, which was designated as the Shook Building.[2]. A low level aerial photo of Area 7 taken for the War Department 1944 Facilities Inventory shows most of the activity in these two buildings.[3]

There were many post-World War II industrial tenants in Area 7. A number of these tenants engaged in activities that could have resulted in contamination in the soil, sediment, groundwater and surface water at this site. Based on the information to date, however, the most significant areas of concern appear to be related to Great Lakes Terminal and Transport's pesticide storage operation in Buildings IN-1-4, IN-1-5, IN-1-6, and possibly IN-1-3; Olin's short-lived metal

[1] U.S. Army Corps of Engineers, 1944, War Department Facilities Inventory of the Illinois Ordnance Plant Carbondale, Illinois, Part I, Section 5. Page 5; and Part I, Section 9, Page 5.
[2] U.S. Army Corps of Engineers, 1944, War Department Facilities Inventory of the Illinois Ordnance Plant Carbondale, Illinois, Part II, Section 4, Sheet 16.
[3] U.S. Army Corps of Engineers, 1944, War Department Facilities Inventory of the Illinois Ordnance Plant Carbondale, Illinois, Part I, Section 7, Page 4.

fabrication operation in Buildings IN-5-2 and IN-5-3 and the related activities of Helical Bit/R.A. Wilkie Machine and Plating Co.

This section summarizes the available information about post-IOP lessees in Area 7, building by building. It should be noted that there are gaps in the available lease information, and often there is little or no information about a lessee's activities in the building. For each building, available lease information is tabulated and other relevant information is summarized following the table.

Building IN-1-1

Lessee	Dates	Building Use
Pickens, Roberts, and Mayor	1949 through 1954[4,5,6,7]	Chemical processing and packaging[8]
General Services Administration (GSA) for the Federal Civil Defense Administration[9,10]	1955 through 1968[11] (original lease was through 1970; however, Humitube began leasing IN-1-1 in 1968)[12,13]	Storage of medical, engineering, and engineering defense emergency supplies[14]
Humitube Packaging, Inc.	mid-1968 through mid-1972[15]	Manufacturing paper products[16]
Rend Lake Beverages, Inc.	1972 through 1973[17]	Based on USFWS records, this building was not used by this tenant.

[4] DPRA Document No. 00009075. Undated Refuge lease information document showing new leases up until 10/1/49, from CONWR files.
[5] DPRA Document No. 00009081. CONWR, Lease Data – Industrial Unit, Crab Orchard Refuge, dated August 31, 1949.
[6] CRO 000212. CONWR, Crab Orchard National Wildlife Refuge Industrial Unit, March 18, 1 955, Analysis of Industrial Tenants Employing Labor, Page 2.
[7] CRO 001575B. Herrin Daily Journal, Newspaper article about Pickens, Roberts and Mayor, dated March 30, 1949.
[8] 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. According to CRO 000212 CONWR, Crab Orchard National Wildlife Refuge Industrial Unit, March 18, 1955, Analysis of Industrial Tenants Employing Labor, Page 2, the lessee had a antifreeze contract with Sears Roebuck.
[9] ACO 002327. United States Department of the Interior, Fish and Wildlife Service, Crab Orchard National Wildlife Refuge, Narrative Report, September Thru December, 1955, Page 17.
[10] ACC 000057. Listing of Area 7 leasing information as obtained from leases.
[11] ACC 000057. Listing of Area 7 leasing information as obtained from leases.
[12] ACC 000057. Listing of Area 7 leasing information as obtained from leases.
[13] CRO 000417 – CRO 000418 and CRO 000422. Lease Contract No. 14-16-0008-12792 by and between U.S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife and Humitube Packaging, Incorporated, dated May 13, 1968; and CONWR, Cancellation of Lease Contract # 14-16-0003-12792, dated June 26, 1972.
[14] ACO 002327. United States Department of the Interior, Fish and Wildlife Service, Crab Orchard National Wildlife Refuge, Narrative Report, September Thru December, 1955, Page 17.
[15] CRO 000417 – CRO 000418 and CRO 000422. Lease Contract No. 14-16-0008-12792 by and between U.S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife and Humitube Packaging, Incorporated, dated May 13, 1968; and CONWR, Cancellation of Lease Contract # 14-16-0003-12792, dated June 26, 1972.
[16] CRO 000111. U.S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Narrative Report, 1968, Page 59.
[17] CRO 000519. Cancellation of Amendment No. 1 to Lease Contract No. 14-16-0003-13315, Rend Lake Beverages, Incorporated, dated January 23, 1973.

Lessee	Dates	Building Use
Southern Illinois Manufacturing Company, Inc.[18]	Beginning of 1973[19] through April of 1974[20]	Unknown
Pre-Hung Door Company, a manufacturer of wooden doors[21]	1974 through 1975[22,23]	Specifics unknown
Mental Health Services of Franklin and Williamson Counties, Inc.	1976 through 1980[24,25,26]	Workshop – assembly of parts by handicapped people
B.B. Robertson	1984 through 1988[27,28]	Unknown
Olin	1988[29] through 1995	Probable storage of equipment and materials[30]
American Trim	1996-1997	Warehouse storage
John L. Rosenberger/Rod Starkweather[31]	1998 - Current	Storage of equipment for lake concessions

[18] DPRA Document No. 00017966. U.S. Government Memorandum to USFWS Regional Director from USFWS CONWR Project Manager, regarding canceling Rend Lake Beverages lease and transferring Building IN-1-1 to Southern Illinois Manufacturing Company, dated January 16, 1973.
[19] DPRA Document No. 00027089. Amendment No. 1 to Lease Contract No. 14-16-0003-13737 and Southern Illinois Manufacturing Company, Inc., dated January 1, 1973.
[20] DPRA Document No. 00027092. Amendment No. 2 to Lease Contract No. 14-16-0003-13737 and Southern Illinois Manufacturing Company, Inc., dated April 25, 1974.
[21] ACO 002105. CONWR, Industrial Committee Report, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, August 1978 (Appendix J).
[22] CRO 000496. Lease Contract No. 14-16-0003-30,605 by and between U.S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife and Pre-Hung Door Company, dated May 1, 1974.
[23] DPRA Document No. 00018998. Amendment No. 1 to Lease Contract No. 14-16-0003-30,605, effective and dated August 1, 1975.
[24] ACC 000057. Listing of Area 7 leasing information as obtained from leases.
[25] CRO 001367. Amendment No. 2 to Lease Contract No. 14-16-0003-30,634, Mental Health Services of Franklin and Williamson Counties, Inc., effective date April 1, 1976.
[26] CRO 001371. Amendment No. 5 to Lease Contract No. 14-16-0003-30,634, Mental Health Services of Franklin and Williamson Counties, Inc., effective date April 30, 1980.
[27] CRO 000280 – CRO 000281. Building Lease Contract No. 14-16-0003-84-544 by and between U.S. Fish and Wildlife Service and B.B. Robertson Company, dated March 1, 1984, Pages 1-2.
[28] CRO 000292. Amendment No. 2 to Building Lease Contract No. 14-16-0003-84-544, B.B. Robertson Company, effective date February 1, 1988.
[29] DOI 001579. Amendment No. 2 to Building Lease Contract No. 14-16-0003-81-517, Olin Corporation, effective date March 1, 1988.
[30] ACO 002398. Olin Corporation's response to Section 104(e) request for information, Page 5.
[31] Industrial Tenant Roster – March 2001, Crab Orchard National Wildlife Refuge, Section 1, Table 1-3 of this report.

Possible Underground Storage Tank

The lease contract between the United States Fish & Wildlife Refuge (USFWS) and Humitube Packaging, Inc. allowed Humitube to install two No. 2 oil-fired furnaces and an associated 10,000-gallon capacity fuel oil underground storage tank (UST).[32] The exact location of this tank is not known. During the site reconnaissance on March 13, 2001, a pipe (approximately 3-4 inches in diameter) protruding from the ground was observed on the west side of this building. It is possible that this pipe was used as a vent pipe for the UST.

Southern Illinois Manufacturing Company

The insurance policy for the Southern Illinois Manufacturing Company[33] included them with the Pre-Hung Door Company (a subsidiary of Marion Metal and Roofing Company, Inc.), who leased this building from 1974 through 1975. The Pre-Hung Door Company manufactured wooden doors.

Building IN-1-2

Lessee	Dates	Building Use
USFWS[34]	1949	Grain storage
Hercules Powder[35,36]	1949 and 1950	Storage of linter for explosive powder production. Linter consisted of cotton fibers and fuzz escaping removal in the ginning operation.[37]
Allen Industries	1955 through 1956[38]	Warehousing and production of rug underlay samples and for warehousing of packing materials.[39,40]
Norge (later Magic Chef, 1979; later Maytag, 1986)	May 1957 to March 1965[41]	Warehousing washers and dryers[42]

[32] CRO 000421. Exhibit "B," Lease Contract – Humitube Packaging, Inc. – June 1, 1968, Personal Property and Installed Equipment.
[33] DPRA Document NO. 00027074. Great American Insurance Companies, Certificate of Insurance for Southern Illinois Manufacturing Co., Inc. and Pre-Hung Door Company.
[34] DPRA Document No. 00009059. CONWR, Lease Data and Income Pertaining to Industrial Unit, Crab Orchard National Wildlife Refuge, dated April 12, 1949.
[35] 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.
[36] DPRA Document No. 00009075. Undated Refuge lease information document showing new leases up until 10/1/49, from the CONWR files.
[37] CRO 001572A. Herrin Daily Journal, Newspaper article about Hercules Powder Company, dated February 16, 1949.
[38] ACC 000057. Listing of Area 7 leasing information as obtained from leases.
[39] U.S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Narrative Report, 1964, Page 48.
[40] ACO 002105. CONWR, Industrial Committee Report, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, August 1978 (Appendix J).
[41] ACC 000057. Listing of Area 7 leasing information as obtained from leases.
[42] ACO 002105. CONWR, Industrial Committee Report, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, August 1978 (Appendix J).

Lessee	Dates	Building Use
Allen Industries	1966 through 1972[43]	Probably same activities as first lease (warehousing and production of rug underlay samples and for warehousing of packing materials).[44,45]
Turco Manufacturing Company[46]	1973 to 1980	Storing finished, boxed gym sets; bar stools; and/or other finished, boxed toy products.[47]
Olin/Primex (see note below)	1980 through 1999[48,49,50]	Storage of inert materials and surplus equipment[51,52]
MDM (The Party Shop)[53]	Current (2001)	Storage of party supplies[54]

Olin/Primex Technologies, Inc./General Dynamics Ordnance and Tactical Systems, Inc.

At the end of 1996, Olin's ordnance manufacturing division was spun off to Primex Technologies, Inc. (Primex). General Dynamics Corporation (General Dynamics) acquired Primex in January 2001. Primex became a wholly owned subsidiary of General Dynamics and changed its name to General Dynamics Ordnance and Tactical Systems, Inc. (GDO&TS).[55,56]

[43] ACC 000057. Listing of Area 7 leasing information as obtained from leases.
[44] U.S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Narrative Report, 1964, Page 48.
[45] ACO 002105. CONWR, Industrial Committee Report, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, August 1978 (Appendix J).
[46] ACC 000057 – ACC 000068. Listing of Area 7 leasing information as obtained from leases.
[47] DOI 007939. Charmglow Industries, Inc., Letter to USDOI in response to a 104e request regarding Turco Manufacturing Company, dated June 15, 1989.
[48] DOI 001554 – DOI 001555. Building Lease Contract No. 14-16-0003-81-517 by and between U.S. Fish and Wildlife Service and Olin Corporation, dated October 1, 1980.
[49] DPRA Document No. 00007577. Amendment No. 8 to Building Lease Contract No. 14-16-0003-81-517, Olin Corporation, effective January 1, 1997.
[50] DPRA Document No. 00017640. Amendment No. 9 to Building and Igloo Lease Contract No. 14-16-0003-96-579, Primex Technologies, Inc., effective December 1, 1999, Pages 1 and 3.
[51] DPRA Document No. 00017640. "Environmental Site Closure Assessment" section of Amendment No. 9 to Building and Igloo Lease Contract No. 14-16-0003-96-579, Primex Technologies, Inc., amendment effective December 1, 1999, Environmental Site Closure Assessment dated December 3, 1993.
[52] ACO 002398. Olin Corporation's response to Section 104(e) request for information, Page 5.
[53] Industrial Tenant Roster – March 2001, Crab Orchard National Wildlife Refuge, Section 1, Table 1-3 of this report.
[54] Interview with MDM employees on site, on March 13, 2001.
[55] General Dynamics Ordnance and Tactical Systems, Letter to Crab Orchard National Wildlife Refuge regarding Building and Igloo Lease Contract No. 14-16-0003-96-579, changing Primex's name to General Dynamics Ordnance and Tactical Systems, Inc., dated January 29, 2001.
[56] Amendment No. 13 to Building and Igloo Lease Contract No. 14-16-0003-96-579, Primex Technologies, Inc., effective January 29, 2001; and, Crab Orchard National Wildlife Refuge, Letter to General Dynamics Ordnance and Tactical Systems, Inc. enclosing Amendment No. 13 regarding the Primex name change, dated March 13, 2001.

Building IN-1-3

Lessee	Dates	Building Use
Hercules Powder[57,58]	1949 and 1950	Storage of linter for explosive powder production.[59] Refer to Building IN-1-2 table.
Allen Industries	1956 to 1957[60]	Warehousing and production of rug underlay samples and for warehousing of packing materials.[61,62]
Great Lakes Terminal &Transport Corporation (see note below regarding date discrepancy with Norge)	1961 to 1966[63]	Storage of packaged agricultural chemicals (pesticides).[64]
Norge (later Magic Chef, 1979; later Maytag, 1986) (see note below regarding date discrepancy with Great Lakes Terminal & Transport)	1963 to 1964, and 1966 to 1967[65]	Warehousing washers and dryers[66]
Mark Twain Marine Industries	1970 to 1971[67]	Manufacturing boats and boat accessories[68]
Pennzoil Co.[69]	six months in 1971[70]	Warehousing motor oil, barrel washing operations, oil products distributorship.[71,72]

[57] 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.
[58] DPRA Document No. 00009075. Undated Refuge lease information document showing new leases up until 10/1/49, from the CONWR files.
[59] CRO 001572A. Herrin Daily Journal, Newspaper article about Hercules Powder Company, dated February 16, 1949.
[60] ACC 000058. Listing of Area 7 leasing information as obtained from leases.
[61] U.S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Narrative Report, 1964, Page 48.
[62] ACO 002105. CONWR, Industrial Committee Report, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, August 1978 (Appendix J).
[63] ACC 000058. Listing of Area 7 leasing information as obtained from leases.
[64] DOI 001069. Great Lakes Terminal and Transport Corporation's response to 104e request.
[65] ACC 000058. Listing of Area 7 leasing information as obtained from leases. Note that lease dates overlap with Great Lakes Terminal and Transport.
[66] ACO 002105. CONWR, Industrial Committee Report, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, August 1978 (Appendix J).
[67] ACC 000058. Listing of Area 7 leasing information as obtained from leases.
[68] CRO 000111. U.S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Narrative Report, 1968, Page 59.
[69] CRO 000482. Pennzoil Products Company, Letter to CONWR regarding consigning leases from Pennzoil to Pennzoil Products, dated October 14, 1986.
[70] ACC 000058. Listing of Area 7 leasing information as obtained from leases.
[71] ACO 002105. CONWR, Industrial Committee Report, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, August 1978 (Appendix J).

Lessee	Dates	Building Use
Federal Prison Industries – U.S. Department of Justice	1976 to 1981[73,74]	Warehousing of prison products[75]
Little Egypt Grain Co.	At least 1986 to 1990[76,77]	Storage of bushels of corn.[78]
Maytag Appliances	Current	Storage of service parts for equipment that is no longer manufactured.[79]

Date Discrepancy

Note, the source document[80] for Great Lakes Terminal and Transport and Norge's dates of occupancy in Building IN-1-3 indicates an overlap of time for these two tenants in 1963, 1964, and 1966.

Great Lakes Terminal and Transport

Great Lakes Terminal & Transport (Great Lakes) reported that they stored the following Shell Chemical products at the Refuge: technical aldrin, 94-97%; technical bidrin; ciodrin 2-3%; ciovap; technical dieldrin 100%; technical endrin 95-99%; technical nemagon; phosdrin; technical planavin; planavin 75%; rabon; vapona 1%; technical vapona; allyl alcohol; azordin; compound 4072; halbard; technical nethyl parathion; 10% parathion 1% telodrin; niran 10-G; SD-8447 2lb/gal solution XP-837; SD-8447 4lb/gal solution XP-783; SD-8447 75% wettable powder code 3-15-24-1; vapona smear XP-246; vapona in petrolatum XP-507; vapona 50% solution XP-465; vapona 90% solution XP-409; 20% vapona resin XP-555; vapona 0.5% dieldrin-0.5% spray solution; verdan senescence inhibitor. Various empty fibre and steel drums; cartons; glass bottles; polyethylene bottles and the like were also on the Great Lakes inventory list; celons and celoseals for jugs and bottles; caps for gallons and quarts; cartons.[81] Additional information is being sought about Great Lake's operations in Area 7.

[72] CRO 000181. U.S. Department of the Interior, , Fish and Wildlife Service, National Wildlife Refuge System, Narrative Report, 1968, Page 38.
[73] DPRA Database No. 00027050. Special Use Permit No. SUP-97-76, between Federal Prison Industries-U.S. Department of Justice and USFWS.
[74] ACC 000058. Listing of Area 7 leasing information as obtained from leases.
[75] ACO 002105. CONWR, Industrial Committee Report, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, August 1978 (Appendix J).
[76] DPRA Document No. 00006035. Building Lease Contract No. 14-16-0003-86-555 by and between U. S. Fish and Wildlife Service and Little Egypt Grain Company, Pages 1-2.
[77] CRO 000231. CONWR, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, October, 1990.
[78] CRO 000190. Department of the Interior, , Fish and Wildlife Service, National Wildlife Refuge System, Narrative Report, 1988, Page 58.
[79] Interview with Maytag employee, Laurel Johns, on March 13, 2001 during site visit.
[80] ACC 000058. Listing of Area 7 leasing information as obtained from leases.
[81] DOI 001069. Great Lakes Terminal and Transport Corporation's response to 104e request.

Some of these pesticides are highly toxic and/or probable carcinogens and have been banned. For example, USEPA banned all uses of aldrin and dieldrin in 1987[82].

Little Egypt Grain

In 1986, Cape-Kil Pest Control Co., on behalf of Little Egypt Grain Co., requested permission to apply herbicides and pesticides to Little Egypt's leased facilities.[83] USFWS approved the use of MSMA and malathion (57%) , but not some other requested pesticides.[84,85]. The herbicides and pesticides approved are in common use, and, based on available data, and are of less concern to human health and the environment than chemicals stored by Great Lakes Terminal and Transport, such as aldrin and dieldrin.[86] For example, the USEPA Region 9 preliminary remediation goal (PRG) for industrial soil for Malathion is more than 100,000 times higher than the PRGs for aldrin or dieldrin.

Building IN-1-4

Lessee	Dates	Building Use
Hercules Powder[87,88]	1949 and 1950	Storage of linter for explosive powder production.[89] Refer to Building IN-1-2 table.
Allen Industries	1956 through 1957[90]	Warehousing and production of rug underlay samples and for warehousing of packing materials.[91,92]

[82]U.S. Department of Health and Human Services, Agency for Toxic Substances and Disease Registry. Source: http://www.atsdr.cdc.gov/tfacts1.html

[83] FWM 000514-000516, DPRA document 00024861. Letter to Norrel Wallace, Project Manager, Crab Orchard Lake National Wild Life Refuge (sic) from Charles Knote, Cape-Kil Pest Control Co., dated 28 July 1986.

[84] DPRA documents 00005954-00005960. Letter to Roger Twenhafel, Little Egypt Grain Co., from Norrel Wallace, Project Manager, dated 12 November 1986, with attachments. MSMA is a herbicide, described as 6+, Glyphosate (Roundup), Bromacil & Diuron (mixed). It was to control grasses in a three-ft band around the building. Malathion is a pesticide which was to be applied to the walls, floor, and the grain.

[85] Cape-Kil Pest Control had also asked for permission to use Chlorphacinone, a rat poison Permission was apparently not granted; this compound was not included in the list approved by USFWS. Reference: FWM 000515. Page 2 of letter to Norrel Wallace, Project Manager, Crab Orchard Lake National Wild Life Refuge (sic) from Charles Knote, Cape-Kil Pest Control Co., dated 28 July 1986.

[86]See, for example, U.S. Department of Agriculture Fact Sheets for the listed pesticides/herbicides available at http://infoventures.com.

[87] 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.

[88] DPRA Document No. 00009075. Undated Refuge lease information document showing new leases up until 10/1/49, from the CONWR files.

[89] CRO 001572A. Herrin Daily Journal, Newspaper article about Hercules Powder Company, dated February 16, 1949.

[90] ACC 000058. Listing of Area 7 leasing information as obtained from leases.

[91] U.S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Narrative Report, 1964, Page 48.

[92] ACO 002105. CONWR, Industrial Committee Report, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, August 1978 (Appendix J).

Lessee	Dates	Building Use
Great Lakes Terminal & Transport	1951 or 1961 through 1971[93,94]	Pesticide storage. Refer to Building IN-1-3 table.
Pennzoil	Three months in 1971[95]	Warehousing motor oil, barrel washing operations, oil products distributorship.[96,97]
Olin	November 1971 through May 1976[98,99]	Storage of ordnance explosives and ordnance materials[100,101]
Royal Crown (R.C.) Bottling Company	1976 through at least 1990[102,103,104]	Storage of vehicles and other items[105]

Aboveground Storage Tanks

During the site reconnaissance on March 13, 2001, a horizontal aboveground storage tank (AST) was observed on the east end of the railroad loading dock on the north side of this building. This AST was approximately 6 ft long and 4 ft in diameter. It was rusted, and there was black staining on the loading dock beneath this tank that appeared to be from leakage from the tank. This black material has also stained some of the soils next to the loading dock.

Building IN-1-5

Lessee	Dates	Building Use
Hercules Powder[106,107]	1949 and 1950	Storage of linter for explosive powder production.[108] Refer to Building IN-1-2 table.

[93] DOI 001069. Great Lakes Terminal and Transport Corporation's response to 104e request.
[94] ACC 000058. Listing of Area 7 leasing information as obtained from leases.
[95] ACC 000058. Listing of Area 7 leasing information as obtained from leases.
[96] ACO 002105. CONWR, Industrial Committee Report, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, August 1978 (Appendix J).
[97] CRO 000181. U.S. Department of the Interior, , Fish and Wildlife Service, National Wildlife Refuge System, Narrative Report, 1968, Page 38.
[98] CRO 001518. Special Use Permit No. SUP-14-72, dated October 27, 1971.
[99] CRO 001534. Cancellation of Special Use Permit No. SUP-14-72, dated June 25, 1976.
[100] CRO 001518. Special Use Permit No. SUP-14-72, dated October 27, 1971.
[101] CRO 001533. Special Use Permit No. SUP-04-76, dated July 29, 1975.
[102] ACC 000058. Listing of Area 7 leasing information as obtained from leases.
[103] FWM 001249 – FWM 001250. Building Lease Contract No. 14-16-0003-84-545 by and between U. S. Fish and Wildlife Service and R. C. Beverage Company of Herrin, Illinois, Incorporated, Pages 1-2.
[104] CRO 000231. CONWR, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, October, 1990.
[105] ACO 002105. CONWR, Industrial Committee Report, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, August 1978 (Appendix J).
[106] 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.
[107] DPRA Document No. 00009075. Undated Refuge lease information document showing new leases up until 10/1/49, from the CONWR files.

Lessee	Dates	Building Use
Great Lakes Terminal & Transport	1951 through 1971.[109,110]	Pesticide storage. Refer to Building IN-1-3 table.
Central Fixtures Manufacturing Company later Cubicon Corporation[111]	1971 through 1983[112,113,114,115]	Woodworking[116,117]
Little Egypt Grain Co.	At least 1986 through 1990[118,119]	Grain storage. Refer to Building IN-1-3 table.

Building P-1-13, Moved from Area 2P

Sometime between 1943 and 1951,[120] Building P-1-13, a former solvent storage building in Area 2P, was moved to Area 7. Two separate documents indicate two different locations for P-1-13 in Area 7. In one document, it appears that it was added to the middle of the south side of Building IN-1-5.[121] In the other, it is located on the west side of Building IN-2-5.[122]

According to Great Lakes Terminal & Transport's Comprehensive Environmental Response Compensation and Liability Act (CERCLA) Section 104(e) response, they were present in Buildings IN-1-5, IN-1-6, and P-1-13 from 1951 through 1971.[123,124]

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[108] CRO 001572A. Herrin Daily Journal, Newspaper article about Hercules Powder Company, dated February 16, 1949.
[109] DOI 001069. Great Lakes Terminal and Transport Corporation's response to 104e request.
[110] DPRA Document No. 00009039. CONWR, Crab Orchard National Wildlife Refuge, Lease Data, Industrial Unit, dated June 1, 1951, Page 7.
[111] CRO 000309. Amendment No. 3 to Lease Contract No. 14-16-0003-12645 and Cubicon Corporation formerly Central Fixture Manufacturing Company, effective March 1, 1972, Page 1.
[112] CRO 000308. Amendment No. 2 to Lease Contract No. 14-16-0003-12645, Central Fixture Manufacturing Company, effective May 1, 1971, Pages 1-2.
[113] CRO 000309. Amendment No. 3 to Lease Contract No. 14-16-0003-12645 and Cubicon Corporation formerly Central Fixture Manufacturing Company, effective March 1, 1972, Page 1.
[114] FWM 000886. Lease Contract No. 14-16-0003-13,980 by and between Cubicon Corporation, effective January 1, 1974, Page 1.
[115] FWM 000892. Amendment No. 4 to Lease Contract No. 14-16-0003-13,980, Cubicon Corporation, effective December 31, 1983.
[116] CRO 000111. U.S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Narrative Report, 1968, Page 59.
[117] ACO 002105. CONWR, Industrial Committee Report, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, August 1978 (Appendix J).
[118] DPRA Document No. 00006035. Building Lease Contract No. 14-16-0003-86-555 by and between U. S. Fish and Wildlife Service and Little Egypt Grain Company, Pages 1-2.
[119] CRO 000231. CONWR, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, October, 1990.
[120] 1943 and 1951 aerial photographs from the National Archives and Records Administration, College Park, Maryland (of Area 2P) (same photographs used by Entech, Inc.).
[121] DPRA Document No. 00006449. From the Crab Orchard National Wildlife Refuge files, A handwritten annual cost calendar for fire control and the water plant, includes information for Area 7, dated April 20, 1976.
[122] Original IOP Plan No.6544-101.11, dated February 28, 1942 with later notations added by Refuge personnel. The notations recorded some information about leases, building uses, and buildings that were removed or destroyed.
[123] DOI 001069. Great Lakes Terminal and Transport Corporation's response to 104e request.

Central Fixtures/Cubicon's leases also included Building P-1-13.[125]

Sometime after 1983, it appears Building P-1-13 was moved to a location where it adjoined Building IN-2-6.[126, 127]

Aboveground Storage Tanks

A 1951 aerial photograph[128] obtained from USFWS shows what appears to be four aboveground storage tanks on the west side of Building IN-1-5. They are not visible on the 1960 photograph; however, ground scarring remains at the location of these structures.[129] There are also several patched holes, several inches in diameter, on the west exterior wall of the building.[130]

Building IN-1-6

Lessee	Dates	Building Use
Hercules Powder[131,132]	1949 and 1950	Storage of linter for explosive powder production.[133] Refer to Building IN-1-2 table.
Great Lakes Terminal & Transport	1951 to 1971[134,135]	Pesticide storage. Refer to Building IN-1-3 table.
Central Fixtures Manufacturing Company/Cubicon Corporation (name change in 1972)[136]	1971 to 1972[137,138,139] and again from 1980 to 1983[140,141]	Manufacturing interior display cases and shelves (woodworking) /building fixtures[142,143]

[124] DPRA Document No. 00009039. CONWR, Crab Orchard National Wildlife Refuge, Lease Data, Industrial Unit, dated June 1, 1951, Page 7.
[125] CRO 000308. Amendment No. 2 to Lease Contract No. 14-16-0003-12645, Central Fixture Manufacturing Company, effective May 1, 1971, Pages 1-2.
[126] DPRA Document No. 00024765. U.S. Department of the Interior, Fish & Wildlife Service, Management Plan Prints, Index, Page 9, date unknown.
[127] FWM 001022 – FWM 001023. Building Lease Contract No. 14-16-0003-84-542 by and between U.S. Fish and Wildlife Service and Midwest Woodworking and Fixture Corporation, dated January 1, 1984, Pages 1-2.
[128] 1951 aerial photograph from the National Archives and Records Administration, College Park, Maryland.
[129] 1960 aerial photograph from the U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service, Aerial Photography Field Office, Salt Lake City, Utah.
[130] Observed on a site visit in March 2001.
[131] 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.
[132] DPRA Document No. 00009075. Undated Refuge lease information document showing new leases up until 10/1/49, from the CONWR files.
[133] CRO 001572A. Herrin Daily Journal, Newspaper article about Hercules Powder Company, dated February 16, 1949.
[134] DOI 001069. Great Lakes Terminal and Transport Corporation's response to 104e request.
[135] DPRA Document No. 00009039. CONWR, Crab Orchard National Wildlife Refuge, Lease Data, Industrial Unit, dated June 1, 1951, Page 7.
[136] CRO 000309. Amendment No. 3 to Lease Contract No. 14-16-0003-12645 and Cubicon Corporation formerly Central Fixture Manufacturing Company, effective March 1, 1972, Page 1.
[137] CRO 000308. Amendment No. 2 to Lease Contract No. 14-16-0003-12645, Central Fixture Manufacturing Company, effective May 1, 1971, Pages 1-2.

Lessee	Dates	Building Use
Southern Illinois Manufacturing Company	1972 to 1974[144,145]	Unknown
Pre-Hung Door Company	1974 to 1980[146,147,148]	Manufacturing wooden doors.[149]
Midwest Woodworking & Fixture	1985[150]	Not specified
Little Egypt Grain Co.	At least 1986 through 1990[151,152]	Grain storage. Refer to Building IN-1-3 table.
MDM (The Party Shop)	1999 to Current[153]	Storage of party supplies. Also in Building IN-1-2.

[138] CRO 000309. Amendment No. 3 to Lease Contract No. 14-16-0003-12645 and Cubicon Corporation formerly Central Fixture Manufacturing Company, effective March 1, 1972, Page 1.
[139] CRO 000310. Amendment No. 4 to Lease Contract No. 14-16-0003-12645 and Cubicon Corporation formerly Central Fixture Manufacturing Company, effective June 1, 1972, Page 1.
[140] FWM 000890. Amendment No. 2 to Lease Contract No. 14-16-0003-13,980, Cubicon Corporation, effective June 15, 1980.
[141] FWM 000892. Amendment No. 4 to Lease Contract No. 14-16-0003-13,980, Cubicon Corporation, effective December 31, 1983.
[142] CRO 000111. U.S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Narrative Report, 1968, Page 59.
[143] ACO 002105. CONWR, Industrial Committee Report, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, August 1978 (Appendix J).
[144] DPRA Document No. 00027087. Lease Contract No. 14-16-0003-13737 by and between U.S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife and Southern Illinois Manufacturing Company, Incorporated, Page 1.
[145] DPRA Document No. 00027092. Amendment No. 2 to Lease Contract No. 14-16-0003-13737 and Southern Illinois Manufacturing Company, Inc., dated April 25, 1974.
[146] CRO 000496. Lease Contract No. 14-16-0003-30,605 by and between U.S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife and Pre-Hung Door Company, dated May 1, 1974, Page 1.
[147] DPRA Document Nos. 00019002 and 00019007. Amendment No. 2 to Lease Contract No. 14-16-0003-30,605, Pre-Hung Door, dated April 24, 1979 (re-submitted: July 30, 1979); and Amendment No. 3 to Lease Contract No. 14-16-0003-30,605, Pre-Hung Door Company, dated May 1, 1980.
[148] CRO 000498. Cancellation of Lease Contract No. 14-16-0003-30,650, Pre-Hung Door Company, Marion, Illinois dated June 13, 1980.
[149] ACO 002105. CONWR, Industrial Committee Report, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, August 1978 (Appendix J).
[150] FWM 001026. Amendment No. 1 to Building Lease Contract No. 14-16-0003-83-542, Midwest Woodworking & Fixture Corporation, effective date June 1, 1985.
[151] DPRA Document No. 00006035. Building Lease Contract No. 14-16-0003-86-555 by and between U. S. Fish and Wildlife Service and Little Egypt Grain Company, Pages 1-2.
[152] CRO 000231. CONWR, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, October, 1990.
[153] Industrial Tenant Roster – March 2001, Crab Orchard National Wildlife Refuge, Section 1, Table 1-3 of this report.

Southern Illinois Manufacturing Company

The insurance policy for the Southern Illinois Manufacturing Company[154] included them with the Pre-Hung Door Company (a subsidiary of Marion Metal and Roofing Company, Inc.), who leased this building from 1974 through 1975. The Pre-Hung Door Company manufactured wooden doors.

Building IN-2-1

Lessee	Dates	Building Use
Pickens, Roberts, and Mayor	1949 through 1954[155,156,157,158,159]	Chemical processing and packaging.[160] Also located in Building IN-1-1.
General Services Administration (GSA) for the Federal Civil Defense Administration)[161,162]	1955 through 1968[163]	Storage of medical, engineering, and defense emergency supplies[164]
Humitube Packaging, Inc.	mid-1968 through mid-1972[165]	Manufacturing paper products[166]
Southern Illinois Manufacturing Company, Inc.[167]	From 1972 through at least 1974[168,169]	Unknown. Also located in Building IN-1-1.

[154] DPRA Document NO. 00027074. Great American Insurance Companies, Certificate of Insurance for Southern Illinois Manufacturing Co., Inc. and Pre-Hung Door Company.
[155] 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.
[156] DPRA Document No. 00009075. Undated Refuge lease information document showing new leases up until 10/1/49, from the CONWR files.
[157] DPRA Document No. 00009081. CONWR, Lease Data – Industrial Unit, Crab Orchard Refuge, dated August 31, 1949.
[158] CRO 000212. CONWR, Crab Orchard National Wildlife Refuge Industrial Unit, March 18, 1 955, Analysis of Industrial Tenants Employing Labor, Page 2.
[159] CRO 001575B. Herrin Daily Journal, Newspaper article about Pickens, Roberts and Mayor, dated March 30, 1949.
[160] 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. According to CRO 000212 CONWR, Crab Orchard National Wildlife Refuge Industrial Unit, March 18, 1955, Analysis of Industrial Tenants Employing Labor, Page 2, the lessee had a antifreeze contract with Sears Roebuck.
[161] ACO 002327. United States Department of the Interior, Fish and Wildlife Service, Crab Orchard National Wildlife Refuge, Narrative Report, September Thru December, 1955, Page 17.
[162] ACC 000057. Listing of Area 7 leasing information as obtained from leases.
[163] ACC 000057. Listing of Area 7 leasing information as obtained from leases. GSA's lease was actually through 1970, which overlaps with Humitube's lease.
[164] ACO 002327. United States Department of the Interior, Fish and Wildlife Service, Crab Orchard National Wildlife Refuge, Narrative Report, September Thru December, 1955, Page 17.
[165] CRO 000417 – CRO 000418 and CRO 000422. Lease Contract No. 14-16-0008-12792 by and between U.S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife and Humitube Packaging, Incorporated, dated May 13, 1968; and CONWR, Cancellation of Lease Contract # 14-16-0003-12792, dated June 26, 1972.
[166] CRO 000111. U.S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Narrative Report, 1968, Page 59.

Lessee	Dates	Building Use
Mental Health Services of Franklin and Williamson Counties, Inc.	1976 through 1980[170,171,172]	Refer to discussion of Building IN-1-1.
McBrides Express	1981 through 1983[173]	Unknown
Hospital and Physicians Consulting Service, Inc. Also leased Quonset hut north of building (built sometime between 1960 and 1965[174])	1983 to present (2001) [175,176]	Listed as "medical manuals"[177]

Possible Oil-Fired Furnaces

Humitube's lease allowed them to install two No. 2 oil-fired furnaces; however, no evidence was found in the field investigation or historical search to indicate that that the furnaces were installed or that fuel oil storage tanks were installed next to this building.[178]

Building IN-2-2

Lessee	Dates	Building Use
Hercules Powder[179,180]	1949 and 1950	Storage of linter for explosive powder production.[181] Refer to Building IN-1-2 table.

[167] DPRA Document No. 00017966. U.S. Government Memorandum to USFWS Regional Director from USFWS CONWR Project Manager, regarding canceling Rend Lake Beverages lease and transferring Building IN-1-1 to Southern Illinois Manufacturing Company, dated January 16, 973.
[168] DPRA Document No. 00027087. Lease Contract No. 14-16-0003-13737 by and between U.S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife and Southern Illinois Manufacturing Company, Incorporated, dated August 23 1972, Page 1.
[169] ACC 000058. Listing of Area 7 leasing information as obtained from leases.
[170] ACC 000057. Listing of Area 7 leasing information as obtained from leases.
[171] CRO 001367. Amendment No. 2 to Lease Contract No. 14-16-0003-30,634, Mental Health Services of Franklin and Williamson Counties, Inc., effective date April 1, 1976.
[172] CRO 001371. Amendment No. 5 to Lease Contract No. 14-16-0003-30,634, Mental Health Services of Franklin and Williamson Counties, Inc., effective date April 30, 1980.
[173] ACC 000058. Listing of Area 7 leasing information as obtained from leases.
[174] 1960 and 1965 aerial photographs from the U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service, Aerial Photography Field Office, Salt Lake City, Utah.
[175] FWM 000993. Building Lease Contract No. 14-16-0003-83-540 by and between U. S. Fish and Wildlife Service and Hospital & Physician Consulting Service, Incorporated, dated April 15, 1983, Pages 1-2.
[176] Industrial Tenant Roster – March 2001, Crab Orchard National Wildlife Refuge, Section 1, Table 1-3 of this report.
[177] CRO 000231. CONWR, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, October, 1990.
[178] CRO 000421. Exhibit "B," Lease Contract – Humitube Packaging, Inc. – June 1, 1968, Personal Property and Installed Equipment.
[179] 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.
[180] DPRA Document No. 00009075. Undated Refuge lease information document showing new leases up until 10/1/49, from the CONWR files.
[181] CRO 001572A. Herrin Daily Journal, Newspaper article about Hercules Powder Company, dated February 16, 1949.

Lessee	Dates	Building Use
Allen Industries	1951 to 1952 then again from 1967 through 1972[182,183]	Warehousing and production of rug underlay samples and for warehousing of packing materials.[184,185]
Norge (later Magic Chef, 1979; later Maytag, 1986)	1958 to 1964 then again from 1972 possibly continuously until December of 2000.[186,187,188,189]	Warehousing washers and dryers, same as in Building IN-1-2.[190,191]

Building IN-2-3

Lessee	Dates	Building Use
Hercules Powder[192,193]	1949 and 1950	Storage of linter for explosive powder production.[194] Refer to Building IN-1-2 table.
Allen Industries	1955 to 1974[195]	Warehousing and production of rug underlay samples and for warehousing of packing materials.[196,197]
Turco Manufacturing Company[198]	1974 to 1981	Storing finished, boxed gym sets; bar stools; and/or other finished, boxed toy products.[199]

[182] DPRA Document No. 00009039. Crab Orchard National Wildlife Refuge, Lease Data, Industrial Unit, dated June 1, 1951, Page 2.
[183] ACC 000058 – ACC 000059. Listing of Area 7 leasing information as obtained from leases.
[184] U.S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Narrative Report, 1964, Page 48.
[185] ACO 002105. CONWR, Industrial Committee Report, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, August 1978 (Appendix J).
[186] ACC 000058. Listing of Area 7 leasing information as obtained from leases.
[187] FWM 001002 – FWM 001003. Building Lease Contract No. 14-16-0003-81-516 by and between U.S. Fish and Wildlife Service and Magic Chef, Inc. – Norge Division, dated October 1, 1980, Page 1 and Page 1 of Page 1A.
[188] ACC 000058 – ACC 000059. Listing of Area 7 leasing information as obtained from leases.
[189] Industrial Tenant Roster – March 2001, Crab Orchard National Wildlife Refuge, Section 1, Table 1-3 of this report.
[190] ACO 002105. CONWR, Industrial Committee Report, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, August 1978 (Appendix J).
[191] According to a current Maytag employee, they historically used this building for storage of spare parts for maintenance. Reference: Interview with Maytag employee, Laurel Johns, on March 13, 2001 during site visit.
[192] 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.
[193] DPRA Document No. 00009075. Undated Refuge lease information document showing new leases up until 10/1/49, from the CONWR files.
[194] CRO 001572A. Herrin Daily Journal, Newspaper article about Hercules Powder Company, dated February 16, 1949.
[195] ACC 000059. Listing of Area 7 leasing information as obtained from leases.
[196] U.S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Narrative Report, 1964, Page 48.
[197] ACO 002105. CONWR, Industrial Committee Report, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, August 1978 (Appendix J).

Lessee	Dates	Building Use
Norge (later Magic Chef, 1979; later Maytag, 1986)	1974, then again from 1984to December of 2000.[200,201]	Warehousing washers and dryers[202]

Building IN-2-4

Lessee	Dates	Building Use
Hercules Powder[203,204]	1949 and 1950	Storage of linter for explosive powder production.[205] Refer to Building IN-1-2 table.
Grinnel Sash and Door	1956 through 1967[206,207]	Manufacturing wooden sash and doorframes, and blinds[208]
Norge (later Magic Chef, 1979; later Maytag, 1986)	1974, then again from 1984 to December of 2000.[209,210]	Warehousing washers and dryers[211]
Central Fixtures Manufacturing Company/Cubicon Corporation	1969 to 1973[212,213]	Manufacturing interior display cases and shelves (woodworking) /building fixtures[214,215]

[198] ACC 000057 – ACC 000068. Listing of Area 7 leasing information as obtained from leases.
[199] DOI 007939. Charmglow Industries, Inc., Letter to USDOI in response to a 104e request regarding Turco Manufacturing Company, dated June 15, 1989.
[200] ACC 000059. Listing of Area 7 leasing information as obtained from leases.
[201] Industrial Tenant Roster – March 2001, Crab Orchard National Wildlife Refuge, Section 1, Table 1-3 of this report.
[202] ACO 002105. CONWR, Industrial Committee Report, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, August 1978 (Appendix J).
[203] 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.
[204] DPRA Document No. 00009075. Undated Refuge lease information document showing new leases up until 10/1/49, from the CONWR files.
[205] CRO 001572A. Herrin Daily Journal, Newspaper article about Hercules Powder Company, dated February 16, 1949.
[206] DPRA Document No. 00003311. Lease Contract No. 14-19-003-2646 by and between U. S. Fish and Wildlife Service and Grinnell Sash & Door Company, dated August 3, 1956, Page 1.
[207] FWM 000969. Lease Contract No. 14-16-0003-4754 by and between U.S. Fish and Wildlife Service and Grinnell Sash & Door Company, dated August 28, 1961, Page 1.
[208] CRO 001162. Demko, George Joseph, 1959, The Ordill Ordnance Industrial Cluster: A Study in Manufacturing Geography, Appendix B, Table 6 – The Fabricating Industries, Their Origins, Type of Plant, and Products, Page 62.
[209] ACC 000059. Listing of Area 7 leasing information as obtained from leases.
[210] Industrial Tenant Roster – March 2001, Crab Orchard National Wildlife Refuge, Section 1, Table 1-3 of this report.
[211] ACO 002105. CONWR, Industrial Committee Report, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, August 1978 (Appendix J).
[212] CRO 000307. Amendment No. 1 to Lease Contract No. 14-16-003-12645, Central Fixture Manufacturing Company, Dated March 5, 1969, Page 1.
[213] CRO-000311. Cancellation, Amendment No. 1, Lease ...Contract No. 14-16-0003-12645, Cubicon Corporation (formerly) Central Fixture Manufacturing Company, dated January 10, 1973.

Lessee	Dates	Building Use
Royal Crown (R.C.) Bottling Company	1976through at least 1990[216,217,218]	Cola sales/distribution[219]

This building was razed sometime between 1980 and 1993.[220]

Building IN-2-5

Lessee	Dates	Building Use
Hercules Powder[221,222]	1949 and 1950	Storage of linter for explosive powder production.[223] Refer to Building IN-1-2 table.
Grinnel Sash and Door	1956 through 1967[224,225]	Manufacturing wooden sash and doorframes, and blinds[226]
Central Fixtures Manufacturing Company/Cubicon Corporation	1968 to 1983[227,228,229]	Manufacturing interior display cases and shelves (woodworking) /building fixtures[230,231]

[214] CRO 000111. U.S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Narrative Report, 1968, Page 59.
[215] ACO 002105. CONWR, Industrial Committee Report, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, August 1978 (Appendix J).
[216] ACC 000058. Listing of Area 7 leasing information as obtained from leases.
[217] FWM 001249 – FWM 001250. Building Lease Contract No. 14-16-0003-84-545 by and between U. S. Fish and Wildlife Service and R. C. Beverage Company of Herrin, Illinois, Incorporated, Pages 1-2.
[218] CRO 000231. CONWR, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, October, 1990.
[219] ACO 002105. CONWR, Industrial Committee Report, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, August 1978 (Appendix J).
[220] 1980 and 1993 aerial photographs from the U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service, Aerial Photography Field Office, Salt Lake City, Utah.
[221] 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.
[222] DPRA Document No. 00009075. Undated Refuge lease information document showing new leases up until 10/1/49, from the CONWR files.
[223] CRO 001572A. Herrin Daily Journal, Newspaper article about Hercules Powder Company, dated February 16, 1949.
[224] DPRA Document No. 00003311. Lease Contract No. 14-19-003-2646 by and between U. S. Fish and Wildlife Service and Grinnell Sash & Door Company, dated August 3, 1956, Page 1.
[225] FWM 000969. Lease Contract No. 14-16-0003-4754 by and between U.S. Fish and Wildlife Service and Grinnell Sash & Door Company, dated August 28, 1961, Page 1.
[226] CRO 001162. Demko, George Joseph, 1959, The Ordill Ordnance Industrial Cluster: A Study in Manufacturing Geography, Appendix B, Table 6 – The Fabricating Industries, Their Origins, Type of Plant, and Products, Page 62.
[227] CRO 000304. Lease Contract No. 14-16-0003-12645 by and between U.S. Fish and Wildlife Service, Bureau of Sport Fisheries and Central Fixture Manufacturing Company, dated November 14, 1967, Page 1.
[228] FWM 000886. Lease Contract No. 14-16-0003-13,980 by and between Cubicon Corporation, December 10, 1973, Page 1.
[229] FWM 000892. Amendment No. 4 to Lease Contract No. 14-16-0003-13,980, Cubicon Corporation, dated December 31, 1983.
[230] CRO 000111. U.S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Narrative Report, 1968, Page 59.

Lessee	Dates	Building Use
Midwest Woodworking & Fixture	1984 to 1998 [232,233]	Not specified. Also leased Building IN-1-6 table.
Orpack Stone Corp.	Sometime after 1990 through 2000 [234,235]	Manufacturing, assembly, and storage of boxes [236]

During the site reconnaissance (which did not include the inside of these buildings), a structure, which appeared to be a cyclone,[237] was observed between Buildings IN-2-5 and IN-2-6.

Building D-1-9

Building D-1-9 was the IOP Detonator Line Office and was originally located in Area 2D.[238] Refuge documents indicate this building was relocated to Area 7.[239] According to a USFWS map of Area 2D containing notes by Refuge personnel, when Building D-1-9 was moved to Area 7, it was positioned slightly northwest of Building IN-2-5.[240] The map and the notes do not contain dates for this move; however, according to aerial photographs, this building appeared in Area 7 sometime prior to 1960.[241] It is assumed that this move took place prior to 1956 when Grinnell Sash & Door Company (Grinnell) began occupying Building D-1-9.[242,243,244] Grinnell

[231] ACO 002105. CONWR, Industrial Committee Report, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, August 1978 (Appendix J).
[232] FWM 001022 – FWM 001023. Building Lease Contract No. 14-16-0003-84-542 by and between U.S. Fish and Wildlife Service and Midwest Woodworking and Fixture Corporation, dated January 1, 1984, Pages 1-2.
[233] Industrial Tenant Roster – March 2001, Crab Orchard National Wildlife Refuge, Section 1, Table 1-3 of this report.
[234] CRO 000231. CONWR, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, October, 1990. Orpack Stone Corp. was not on this list, so it is assumed that they moved into these buildings after 1990.
[235] Industrial Tenant Roster – March 2001, Crab Orchard National Wildlife Refuge, Section 1, Table 1-3 of this report.
[236] Industrial Tenant Roster – March 2001, Crab Orchard National Wildlife Refuge, Section 1, Table 1-3 of this report.
[237] A cyclone is a air cleaning device designed to remove large particulates from the air and is normally associated with the metal working industries or industries which grind and lathe large parts.
[238] U.S. Army Corps of Engineers, 1944, War Department Facilities Inventory of the Illinois Ordnance Plant Carbondale, Illinois, Part I, Section 5, Page 7 (Plan No. 6544-101.13) and Part II, Section 4, Sheet 5.
[239] DPRA Document No. 00006467. CONWR, List of Buildings on the Refuge containing information such as FWS Building Numbers, Army Building Numbers, and Square Footage (date unknown), Pages 6 and 10. Building D-1-9 is also known as USFWS Building #130.
[240] Undated USFWS map of Area-IN with notations added by Refuge personnel. The notations recorded some information about leases, building uses, and buildings that were removed or destroyed.
[241] 1960 aerial photograph from the U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service, Aerial Photography Field Office, Salt Lake City, Utah (same photograph used by Entech, Inc.).
[242] CRO 001254. Lease Contract No. 14-19-003-2646 by and between U.S. Fish and Wildlife Service and Grinnell Sash & Door Company, dated August 1956.
[243] FWM 000968. Lease Contract No. 14-16-0003-4754 by and between U.S. Fish and Wildlife Service and Grinnell Sash & Door Company, dated August 28, 1961.
[244] FWM 000973. Cancellation, Lease No. 14-16-0003-4757, dated October 31, 1967.

leased several other buildings in Area 7. Other Area 7 tenants also occupied this building in Area 7, including Central Fixture Manufacturing and Cubicon Corporation.[245,246]

Building IN-2-6

Lessee	Dates	Building Use
Hercules Powder[247,248]	1949 and 1950	Storage of linter for explosive powder production.[249] Refer to Building IN-1-2 table.
Grinnel Sash and Door	1956 through 1967[250,251]	Manufacturing wooden sash and doorframes, and blinds[252]
Central Fixtures Manufacturing Company/Cubicon Corporation	1968 to 1983[253,254,255]	Manufacturing interior display cases and shelves (woodworking) /building fixtures[256,257]
Midwest Woodworking & Fixture	1984 to 1998[258,259]	Not specified. Also leased Buildings IN-1-6 and IN-2-5.
Orpack Stone Corp.	Sometime after 1990 through 2000[260,261]	Manufacturing, assembly, and storage of boxes[262]

[245] FWM 000886. Lease Contract No. 14-16-0003-13,980 by and between Cubicon Corporation, dated December 10, 1973.
[246] CRO 000304. Lease Contract No. 14-16-0003-12645 by and between U.S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife and Central Fixtures Manufacturing Company, dated November 1967.
[247] 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.
[248] DPRA Document No. 00009075. Undated Refuge lease information document showing new leases up until 10/1/49, from the CONWR files.
[249] CRO 001572A. Herrin Daily Journal, Newspaper article about Hercules Powder Company, dated February 16, 1949.
[250] DPRA Document No. 00003311. Lease Contract No. 14-19-003-2646 by and between U. S. Fish and Wildlife Service and Grinnell Sash & Door Company, dated August 3, 1956, Page 1.
[251] FWM 000969. Lease Contract No. 14-16-0003-4754 by and between U.S. Fish and Wildlife Service and Grinnell Sash & Door Company, dated August 28, 1961, Page 1.
[252] CRO 001162. Demko, George Joseph, 1959, The Ordill Ordnance Industrial Cluster: A Study in Manufacturing Geography, Appendix B, Table 6 – The Fabricating Industries, Their Origins, Type of Plant, and Products, Page 62.
[253] CRO 000304. Lease Contract No. 14-16-0003-12645 by and between U.S. Fish and Wildlife Service, Bureau of Sport Fisheries and Central Fixture Manufacturing Company, dated November 14, 1967, Page 1.
[254] FWM 000886. Lease Contract No. 14-16-0003-13,980 by and between Cubicon Corporation, December 10, 1973, Page 1.
[255] FWM 000892. Amendment No. 4 to Lease Contract No. 14-16-0003-13,980, Cubicon Corporation, dated December 31, 1983.
[256] CRO 000111. U.S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Narrative Report, 1968, Page 59.
[257] ACO 002105. CONWR, Industrial Committee Report, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, August 1978 (Appendix J).
[258] FWM 001022 – FWM 001023. Building Lease Contract No. 14-16-0003-84-542 by and between U.S. Fish and Wildlife Service and Midwest Woodworking and Fixture Corporation, dated January 1, 1984, Pages 1-2.
[259] Industrial Tenant Roster – March 2001, Crab Orchard National Wildlife Refuge, Section 1, Table 1-3 of this report.

The Midwest Woodworking & Fixture lease included Building P-1-13, which had been moved from a location adjacent to Building IN-1-5.[263,264]

Building IN-3-1

Lessee	Dates	Building Use
General Services Administration (GSA) for the Federal Civil Defense Administration)[265,266]	1955 through 1968[267]	Storage of medical, engineering, and defense emergency supplies[268]
Humitube Packaging, Inc.	Mid-1968 through mid-1972[269]	Manufacturing paper products[270]

In December of 1971, a fire destroyed one of the Buildings occupied by Brooks Paper Company[271] (also known as Humitube Packaging, Inc.).[272] It is assumed that the building that burned was Building IN-3-1 because this was the only building they leased that was no longer on site in 1980.[273]

[260] CRO 000231. CONWR, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, October, 1990. Orpack Stone Corp. was not on this list, so it is assumed that they moved into these buildings after 1990.
[261] Industrial Tenant Roster – March 2001, Crab Orchard National Wildlife Refuge, Section 1, Table 1-3 of this report.
[262] Industrial Tenant Roster – March 2001, Crab Orchard National Wildlife Refuge, Section 1, Table 1-3 of this report.
[263] FWM 001022 – FWM 001023. Building Lease Contract No. 14-16-0003-84-542 by and between U.S. Fish and Wildlife Service and Midwest Woodworking and Fixture Corporation, dated January 1, 1984, Pages 1-2.
[264] Industrial Tenant Roster – March 2001, Crab Orchard National Wildlife Refuge, Section 1, Table 1-3 of this report.
[265] ACO 002327. United States Department of the Interior, Fish and Wildlife Service, Crab Orchard National Wildlife Refuge, Narrative Report, September Thru December, 1955, Page 17.
[266] ACC 000057. Listing of Area 7 leasing information as obtained from leases.
[267] ACC 000057. Listing of Area 7 leasing information as obtained from leases.
[268] ACO 002327. United States Department of the Interior, Fish and Wildlife Service, Crab Orchard National Wildlife Refuge, Narrative Report, September Thru December, 1955, Page 17.
[269] CRO 000417 – CRO 000418 and CRO 000422. Lease Contract No. 14-16-0008-12792 by and between U.S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife and Humitube Packaging, Incorporated, dated May 13, 1968; and CONWR, Cancellation of Lease Contract # 14-16-0003-12792, dated June 26, 1972.
[270] CRO 000111. U.S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Narrative Report, 1968, Page 59.
[271] DPRA Document No. 00009377. U.S. Department of Interior, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Crab Orchard National Wildlife Refuge, Narrative Report 1971, Page 64.
[272] DPRA Document No. 00018947. Letter from Rosenblum and Goldenhersh (Attorneys at Law) to Bureau of Sport Fisheries and Wildlife regarding Humitube Packaging, Inc., dated February 1, 1972.
[273] 1980 Aerial photograph from the U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service, Aerial Photography Field Office, Salt Lake City, Utah.

Building IN-3-2

Lessee	Dates	Building Use
ACME Equipment Co.	At least 1948 through 1950[274,275]	Warehousing
Norge (later Magic Chef, 1979; later Maytag, 1986)	1958 to 1964[276]	Warehousing washers and dryers[277]
Commercial Solvents Corporation	October 1965 through September 1966[278]	Storage of bagged fertilizer
Allen Industries	1967 through 1972[279]	Warehousing and production of rug underlay samples and for warehousing of packing materials.[280,281]
Turco Manufacturing Company	1973 to 1981[282]	Storing finished, boxed gym sets; bar stools; and/or other finished, boxed toy products.[283]
Little Egypt Grain Co.	At least 1986 through 1990[284,285]	Grain storage. Refer to Building IN-1-3 table.
Orpack Stone Corp.	Sometime after 1990 through 2000[286,287]	Manufacturing, assembly, and storage of boxes[288]

[274] 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.
[275] DPRA Document No. 00009075. Undated Refuge lease information document showing new leases up until 10/1/49, from the CONWR files.
[276] ACC 000060. Listing of Area 7 leasing information as obtained from leases.
[277] ACO 002105. CONWR, Industrial Committee Report, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, August 1978 (Appendix J).
[278] DPRA Document No. 00008844. Special Use Permit No. SUP-12-66, dated September 15, 1965.
[279] ACC 000060. Listing of Area 7 leasing information as obtained from leases.
[280] U.S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Narrative Report, 1964, Page 48.
[281] ACO 002105. CONWR, Industrial Committee Report, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, August 1978 (Appendix J).
[282] ACC 000060. Listing of Area 7 leasing information as obtained from leases.
[283] DOI 007939. Charmglow Industries, Inc., Letter to USDOI in response to a 104e request regarding Turco Manufacturing Company, dated June 15, 1989.
[284] DPRA Document No. 00006035. Building Lease Contract No. 14-16-0003-86-555 by and between U. S. Fish and Wildlife Service and Little Egypt Grain Company, Pages 1-2.
[285] CRO 000231. CONWR, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, October, 1990.
[286] CRO 000231. CONWR, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, October, 1990. Orpack Stone Corp. was not on this list, so it is assumed that they moved into these buildings after 1990.
[287] Industrial Tenant Roster – March 2001, Crab Orchard National Wildlife Refuge, Section 1, Table 1-3 of this report.
[288] Industrial Tenant Roster – March 2001, Crab Orchard National Wildlife Refuge, Section 1, Table 1-3 of this report.

Building IN-3-3

Lessee	Dates	Building Use
Hercules Powder[289,290]	1949 and 1950	Storage of linter for explosive powder production.[291] Refer to Building IN-1-2 table.
Grinnel Sash and Door	1956 through 1967[292,293]	Manufacturing wooden sash and doorframes, and blinds[294]
Norge (later Magic Chef, 1979; later Maytag, 1986)	1957 to 1965 then again from 1973 to 1974[295,296]	Warehousing washers and dryers[297]
Allen Industries	1967 through 1972[298]	Warehousing and production of rug underlay samples and for warehousing of packing materials.[299,300]
Turco Manufacturing Company	1974 to 1980[301]	Storing finished, boxed gym sets; bar stools; and/or other finished, boxed toy products.[302]
Olin/Primex	1980 to 1999[303,304,305]	Storage of inert materials and surplus equipment[306,307]

[289] 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.
[290] DPRA Document No. 00009075. Undated Refuge lease information document showing new leases up until 10/1/49, from the CONWR files.
[291] CRO 001572A. Herrin Daily Journal, Newspaper article about Hercules Powder Company, dated February 16, 1949.
[292] DPRA Document No. 00003311. Lease Contract No. 14-19-003-2646 by and between U. S. Fish and Wildlife Service and Grinnell Sash & Door Company, dated August 3, 1956, Page 1.
[293] FWM 000969. Lease Contract No. 14-16-0003-4754 by and between U.S. Fish and Wildlife Service and Grinnell Sash & Door Company, dated August 28, 1961, Page 1.
[294] CRO 001162. Demko, George Joseph, 1959, The Ordill Ordnance Industrial Cluster: A Study in Manufacturing Geography, Appendix B, Table 6 – The Fabricating Industries, Their Origins, Type of Plant, and Products, Page 62.
[295] ACC 000061. Listing of Area 7 leasing information as obtained from leases.
[296] ACC 000061. Listing of Area 7 leasing information as obtained from leases.
[297] ACO 002105. CONWR, Industrial Committee Report, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, August 1978 (Appendix J).
[298] ACC 000060. Listing of Area 7 leasing information as obtained from leases.
[299] U.S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Narrative Report, 1964, Page 48.
[300] ACO 002105. CONWR, Industrial Committee Report, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, August 1978 (Appendix J).
[301] ACC 000061. Listing of Area 7 leasing information as obtained from leases.
[302] DOI 007939. Charmglow Industries, Inc., Letter to USDOI in response to a 104e request regarding Turco Manufacturing Company, dated June 15, 1989.
[303] DOI 001554 - DOI-00155. Building Lease Contract No. 14-16-0003-81-517 by and between U. S. Fish and Wildlife Service and Olin Corporation, dated October 1, 1980, Page1 and Page 1of Page 1A.
[304] DPRA Document No. 00007577. Amendment No. 8 to Building Lease Contract No. 14-16-0003-81-517, Olin Corporation, dated January 1, 1997, Page 1.

Lessee	Dates	Building Use
Orpack Stone Corp.	Sometime after 1990 through 2000[308,309]	Manufacturing, assembly, and storage of boxes[310]

Building IN-3-4

Lessee	Dates	Building Use
Radionic Products Inc./Supreme Transformer/Oxford Electric.[311]	1946[312] through at least 1951 and at least 1957 through 1959[313,314]	Specifics unknown.
Allen Industries	1964 through 1971[315]	Warehousing and production of rug underlay samples and for warehousing of packing materials.[316,317]
Pennzoil	1971 through 1986[318,319,320]	Warehousing motor oil, barrel washing operations, oil products distributorship.[321,322] (according to a hand-written list of Refuge tenants in April of 1976, Pennzoil used this building for refining)[323]

[305] DPRA Document No. 00017640. Amendment No. 9 to Building and Igloo Lease Contract No. 14-16-0003-96-579, Primex Technologies, Inc., effective December 1, 1999, Pages 1 and 3.
[306] DPRA Document No. 00017640. "Environmental Site Closure Assessment" section of Amendment No. 9 to Building and Igloo Lease Contract No. 14-16-0003-96-579, Primex Technologies, Inc., amendment effective December 1, 1999, Environmental Site Closure Assessment dated December 3, 1993.
[307] ACO 002398. Olin Corporation's response to Section 104(e) request for information, Page 5.
[308] CRO 000231. CONWR, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, October, 1990. Orpack Stone Corp. was not on this list, so it is assumed that they moved into these buildings after 1990.
[309] Industrial Tenant Roster – March 2001, Crab Orchard National Wildlife Refuge, Section 1, Table 1-3 of this report.
[310] Industrial Tenant Roster – March 2001, Crab Orchard National Wildlife Refuge, Section 1, Table 1-3 of this report.
[311] Supreme Transformer was Radionic Products Division of Radionic Controls, Inc. prior to 1956. Reference: DPRA Document No. 00009402. U.S. Department of the Interior, Fish and Wildlife Service, Crab Orchard National Wildlife Refuge, Narrative Report, January Thru April, 1956, Table VI.
[312] ACL 000706. Lease, dated September 1, 1946 (Radionic Products, Inc.), Page 1.
[313] DPRA Document No. 00009059. Lease Data and Income Pertaining to Industrial Unit, Crab Orchard National Wildlife Refuge, April 12, 1949, Page 12.
[314] DPRA Document No. 00009039. Crab Orchard National Wildlife Refuge, Lease Data, Industrial Unit, June 1, 1951, Page 15.
[315] ACC 000061. Listing of Area 7 leasing information as obtained from leases.
[316] U.S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Narrative Report, 1964, Page 48.
[317] ACO 002105. CONWR, Industrial Committee Report, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, August 1978 (Appendix J).
[318] ACC 000061. Listing of Area 7 leasing information as obtained from leases.
[319] CRO 000470 – CRO 471. Building Lease Contract No. 14-16-0003-82-531 by and between U. S. Fish and Wildlife Service and Pennzoil Company, dated September 1, 1982, Pages 1-2.

Lessee	Dates	Building Use
Little Egypt Grain Co.	1987 through 1988[324,325]	Grain storage. Refer to Building IN-1-3 table.

Radionic Products Inc./Supreme Transformer/Oxford Electric

Radionic was also a tenant in Area 4 in 1950 and was involved in radio component manufacturing.[326] Supreme Transformer (which was Radionic Products Division of Radionic Controls, Inc. prior to 1956)[327] occupied Building IN-3-4 in at least 1957, as reported in one of the 1957 Refuge Narrative Reports.[328] Since lease information for both Radionic Products and Supreme Transformer was incomplete, it is assumed that Radionic/Supreme Transformer occupied this building continuously from 1946 through 1959 when Supreme Transformer became Oxford Electric.[329] Oxford Electric likely continued to occupy this building (this is assumed since the amount of space that Oxford Electric occupied was slightly more than what was previously occupied by Supreme Transformer), through 1963.[330]

Building IN-3-5

Lessee	Dates	Building Use
Towal Manufacturing Company, Inc., manufacturer of ice vending machines.[331]	1950 through 1951[332,333,334]	Specifics unknown.

[320] CRO 000483. Amendment No. 2 to Building Lease No. 14-16-0003-82-531, Pennzoil Company, dated January 1, 1987.
[321] ACO 002105. CONWR, Industrial Committee Report, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, August 1978 (Appendix J).
[322] CRO 000181. U.S. Department of the Interior, , Fish and Wildlife Service, National Wildlife Refuge System, Narrative Report, 1968, Page 38.
[323] DPRA Document No. 00006449. CONWR, Annual Cost CY 1975, Fire Control-200 and Water Plant –300-1, dated April 20, 1976.
[324] DPRA Document No. 00012791. Little Egypt Grain Company, Letter to the USFWS regarding additional buildings that they would like to lease in Area 7, dated April 20, 1987.
[325] DPRA Document No. 00005953. Little Egypt Grain Company, Letter to the USFWS regarding termination of lease for Building IN-3-4, dated March 14, 1988.
[326] 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.
[327] DPRA Document No. 00009402. U.S. Department of the Interior, Fish and Wildlife Service, Crab Orchard National Wildlife Refuge, Narrative Report, January Thru April, 1956, Table VI.
[328] DPRA Document No. 00009410. U.S. Department of the Interior, Fish and Wildlife Service, Crab Orchard National Wildlife Refuge, Narrative Report, January Thru April, 1957, Page 3.
[329] CRO 000833. U.S. Department of the Interior, Bureau of Sport Fisheries & Wildlife, Fish and Wildlife Service, Crab Orchard National Wildlife Refuge, Narrative Report, May through August, 1959, Table V.
[330] DPRA Document No. 00009339. U.S. Department of the Interior, Bureau of Sport Fisheries & Wildlife, Fish and Wildlife Service, Narrative Report, 1964, Table 5.
[331] 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.
[332] DPRA Document No. 00009039. Crab Orchard National Wildlife Refuge, Lease Data, Industrial Unit, June 1, 1951, Page 18.

Lessee	Dates	Building Use
Allen Industries	1955 through 1956[335]	Warehousing and production of rug underlay samples and for warehousing of packing materials.[336,337]
Castellano Construction Co.	1956	Manufacturing pre-fabricated housing.[338]
Permanent Homes, prefabricated homebuilder.[339]	1961 through 1963 and again in 1964[340,341]	Specifics unknown
Whitby Brothers Pianos, Inc.,	1965[342] through 1966[343] (leased Building IN-3-5 from 1965 through 1966, when they went bankrupt after being in operation for only a few months)[344]	Piano manufacturing
Egyptian Woodcraft Co.		Piano manufacturing[345]
Seyer Buckner Tool & Machine Co./Belos Corporation	1967 through 1974[346,347,348]	Precision machining, stamping, welding and dies[349] or manufacturing pallets.[350]

[333] 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.
[334] CRO 000211. CONWR, Crab Orchard National Wildlife Refuge Industrial Unit, March 18, 955, Analysis of Industrial Tenants Employing Labor, Page 1.
[335] ACC 000061. Listing of Area 7 leasing information as obtained from leases.
[336] U.S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Narrative Report, 1964, Page 48.
[337] ACO 002105. CONWR, Industrial Committee Report, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, August 1978 (Appendix J).
[338] DPRA Document No. 00009402. U.S. Department of the Interior, Fish and Wildlife Service, Crab Orchard National Wildlife Refuge, Narrative Report, January Thru April, 1956, Pages 12 and 24.
[339] CRO 001162. Demko, George Joseph, 1959, The Ordill Ordnance Industrial Cluster: A Study in Manufacturing Geography, Appendix B, Table 6 – The Fabricating Industries, Their Origins, Type of Plant, and Products, Page 62.
[340] CRO 001181. Cancellation of Lease No. 14-16-0003-4788, dated June 5, 1984.
[341] CRO 001185. Lease Contract No. 14-16-0003-6237 by and between U. S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife and Philip A. Castellano Doing Business as Permanent Homes, dated January 1, 1964, Page 1.
[342] FWM 001331. Lease Contract No. <<*illegible*>> by and between U. S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife and Whitby Brothers Pianos, Incorporated, Page 1.
[343] CRO 000093. U. S. Department of the Interior , Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Narrative Report, 1966, Page 49.
[344] CRO 000093. U. S. Department of the Interior , Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Narrative Report, 1966, Page 49.
[345] CRO 000101. U. S. Department of the Interior , Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Narrative Report, 1967, Page 49.
[346] CRO 001384 – CRO 001385. Lease Contract No. 14-16-0003-12615 by and between U. S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife and Seyer-Buckner Tool and Machine Company, dated July 7, 1967, Pages 1-2.
[347] ACC 000061. Listing of Area 7 leasing information as obtained from leases.

Lessee	Dates	Building Use
Dura-Plex	1974[351] through 1977.[352]	Manufacture of fiberglass panel houses.[353]
Turco Manufacturing Company	1977 to 1980[354]	Storing finished, boxed gym sets; bar stools; and/or other finished, boxed toy products.[355]
Pennzoil	1981[356] through 1986[357,358]	Warehousing motor oil, barrel washing operations, oil products distributorship.[359,360]
Little Egypt Grain Co.	1987[361] through 1990.[362]	Grain storage. Refer to Building IN-1-3 table.

This building was razed sometime between 1980 and 1993.[363]

Building IN-3-6

Lessee	Dates	Building Use
Olin	1961 through 1963.[364]	Probable storage of equipment and

[348] DPRA Document No. 00017201. Lease Contract No. 17-16-0003-13,734 by and between U. S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife and Belos Corporation, dated July 3, 1972, Page 1.
[349] DOI 000069. DOJ, Crab Orchard National Wildlife Refuge, Narrative Profiles of Potential Information Request Recipients, Page 7.
[350] DOI 007792. Seyer Industries, Response of Seyer Industries, Inc. to a First Set of Information Requests Concerning Crab Orchard National Wildlife Refuge NPL Site, dated June 21, 1989, Page 1.
[351] CRO 000356. Lease Contract No. 14-16-0003-30.632 by and between U.S. Fish and Wildlife Service and Dura-Plex Industries, Inc., dated June 1, 1974, Page 1.
[352] DPRA Document No. 00020032. Amendment #1 to Lease Contract No. 14-16-0003-30,362, dated December 15, 1977.
[353] ACO 002105. CONWR, Industrial Committee Report, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, August 1978 (Appendix J).
[354] ACC 000061. Listing of Area 7 leasing information as obtained from leases.
[355] DOI 007939. Charmglow Industries, Inc., Letter to USDOI in response to a 104e request regarding Turco Manufacturing Company, dated June 15, 1989.
[356] ACC 000061. Listing of Area 7 leasing information as obtained from leases.
[357] CRO 000470 – CRO 471. Building Lease Contract No. 14-16-0003-82-531 by and between U. S. Fish and Wildlife Service and Pennzoil Company, dated September 1, 1982, Pages 1-2.
[358] CRO 000483. Amendment No. 2 to Building Lease No. 14-16-0003-82-531, Pennzoil Company, dated January 1, 1987.
[359] ACO 002105. CONWR, Industrial Committee Report, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, August 1978 (Appendix J).
[360] CRO 000181. U.S. Department of the Interior, , Fish and Wildlife Service, National Wildlife Refuge System, Narrative Report, 1968, Page 38.
[361] DPRA Document No. 00012791. Little Egypt Grain Company, Letter to the USFWS regarding additional buildings that they would like to lease in Area 7, dated April 20, 1987.
[362] CRO 000231. CONWR, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, October, 1990.
[363] 1980 and 1993 aerial photographs from the U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service, Aerial Photography Field Office, Salt Lake City, Utah.

Lessee	Dates	Building Use
		materials[365]
Norge (later Magic Chef, 1979; later Maytag, 1986)	1964[366]	Warehousing washers and dryers[367]
Whitby Brothers Pianos, Inc.,	1965[368] through 1966[369]	Piano manufacturing
Seyer Buckner Tool & Machine Co./Belos Corporation	1967 through 1974[370,371,372]	Precision machining, stamping, welding and dies[373] or manufacturing pallets.[374]
Dura-Plex	1974[375] through 1980.[376]	Manufacture of fiberglass panel houses.[377]
Castel Properties	1982[378] through 1992.[379]	Manufacturing.[380]
Little Egypt Grain Co.	1987[381] through 1990.[382]	Grain storage. Refer to Building IN-1-3 table.

[364] ACC 000061. Listing of Area 7 leasing information as obtained from leases.
[365] ACO 002398. Olin Corporation's response to Section 104(e) request for information, Page 5.
[366] ACC 000061. Listing of Area 7 leasing information as obtained from leases.
[367] ACO 002105. CONWR, Industrial Committee Report, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, August 1978 (Appendix J).
[368] FWM 001331. Lease Contract No. <<*illegible*>> by and between U. S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife and Whitby Brothers Pianos, Incorporated, Page 1.
[369] CRO 000093. U. S. Department of the Interior , Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Narrative Report, 1966, Page 49.
[370] CRO 001384 – CRO 001385. Lease Contract No. 14-16-0003-12615 by and between U. S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife and Seyer-Buckner Tool and Machine Company, dated July 7, 1967, Pages 1-2. The lease also included a boiler house.
[371] ACC 000061. Listing of Area 7 leasing information as obtained from leases.
[372] DPRA Document No. 00017201. Lease Contract No. 17-16-0003-13,734 by and between U. S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife and Belos Corporation, dated July 3, 1972, Page 1.
[373] DOI 000069. DOJ, Crab Orchard National Wildlife Refuge, Narrative Profiles of Potential Information Request Recipients, Page 7.
[374] DOI 007792. Seyer Industries, Response of Seyer Industries, Inc. to a First Set of Information Requests Concerning Crab Orchard National Wildlife Refuge NPL Site, dated June 21, 1989, Page 1.
[375] CRO 000356. Lease Contract No. 14-16-0003-30.632 by and between U.S. Fish and Wildlife Service and Dura-Plex Industries, Inc., dated June 1, 1974, Page 1.
[376] DPRA Document No. 00017998. Amendment #3 to Lease Contract No. 14-16-0003-30,632, dated April 4, 1980.
[377] ACO 002105. CONWR, Industrial Committee Report, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, August 1978 (Appendix J).
[378] FWM 000875 – FWM 000876. Building Lease Contract No. 14-16-0003-82-533 by and between U. S. Fish and Wildlife Service and Castel Properties, Ltd., dated April 1, 1982, Pages 1-2.
[379] DPRA Document No. 00016084. U. S. Department of the Interior, Fish and Wildlife Service, National Wildlife Refuge System, Crab Orchard National Wildlife Refuge, Cartersville, Illinois, Annual Narrative Report, Calendar Year 1992, Page 57. Castel Properties lease was terminated due to non-payment, failure to provide copy of required insurance and failure to maintain buildings properly.
[380] FWM 000876. Building Lease Contract No. 14-16-0003-82-533 by and between U. S. Fish and Wildlife Service and Castel Properties, Ltd., dated April 1, 1982, Page 2
[381] DPRA Document No. 00012791. Little Egypt Grain Company, Letter to the USFWS regarding additional buildings that they would like to lease in Area 7, dated April 20, 1987.
[382] CRO 000231. CONWR, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, October, 1990.

Building IN-4-1

Lessee	Dates	Building Use
GSA	1955 through 1968.[383]	Storage of medical, engineering, and defense emergency supplies[384]
Hercules Powder[385,386]	1949 and 1950	Storage of linter for explosive powder production.[387] Refer to Building IN-1-2 table.
Humitube Packaging, Inc.	mid-1968 through mid-1972[388]	Manufacturing paper products[389]
Olin	July 1972 through 1997[390,391,392,393]	Storage[394]
Olin (East Alton)	Current (2001)[395]	Specifics unknown

Building IN-4-2

Lessee	Dates	Building Use
ACME Equipment Co.	at least 1949 through at least 1951[396,397,398]	Warehousing

[383] ACC 000062. Listing of Area 7 leasing information as obtained from leases.
[384] ACO 002327. United States Department of the Interior, Fish and Wildlife Service, Crab Orchard National Wildlife Refuge, Narrative Report, September Thru December, 1955, Page 17.
[385] 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.
[386] DPRA Document No. 00009075. Undated Refuge lease information document showing new leases up until 10/1/49, from the CONWR files.
[387] CRO 001572A. Herrin Daily Journal, Newspaper article about Hercules Powder Company, dated February 16, 1949.
[388] CRO 000417 – CRO 000418 and CRO 000422. Lease Contract No. 14-16-0008-12792 by and between U.S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife and Humitube Packaging, Incorporated, dated May 13, 1968; and CONWR, Cancellation of Lease Contract # 14-16-0003-12792, dated June 26, 1972.
[389] CRO 000111. U.S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Narrative Report, 1968, Page 59.
[390] CRO 001524. Special Use Permit No. SUP-84-72, dated June 8, 1972.
[391] CRO 001539. Special Use Permit No. SUP-53-80, dated May 22, 1980.
[392] DOI 001554 - DOI-00155. Building Lease Contract No. 14-16-0003-81-517 by and between U. S. Fish and Wildlife Service and Olin Corporation, dated October 1, 1980, Page1 and Page 1of Page 1A.
[393] DPRA Document No. 00007577. Amendment No. 8 to Building Lease Contract No. 14-16-0003-81-517.
[394] DPRA Document No. 00006449. CONWR, Annual Cost CY 1975, Fire Control-200 and Water Plant –300-1, dated April 20, 1976.
[395] Industrial Tenant Roster – March 2001, Crab Orchard National Wildlife Refuge, Section 1, Table 1-3 of this report.
[396] 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.
[397] DPRA Document No. 00009059. CONWR, Lease Data and Income Pertaining to Industrial Unit, Crab Orchard National Wildlife Refuge, dated April 12, 1949, Page 1.
[398] DPRA Document No. 00009039. Crab Orchard National Wildlife Refuge, Lease Data, Industrial Unit, dated June 1, 1951, Page 1.

Lessee	Dates	Building Use
Allen Industries	1957[399] through 1986[400]	Warehousing and production of rug underlay samples and for warehousing of packing materials.[401,402]
Little Egypt Grain Co.	At least 1986 through 1990[403,404]	Grain storage. Refer to Building IN-1-3 table.
Orpack Stone Corp.	Sometime after 1990 through 2000[405,406]	Manufacturing, assembly, and storage of boxes[407]

Building IN-4-3

Lessee	Dates	Building Use
Hercules Powder[408,409]	1949 and 1950	Storage of linter for explosive powder production.[410] Refer to Building IN-1-2 table.
Allen Industries	1957[411] through 1986[412]	Warehousing and production of rug underlay samples and for warehousing of packing materials.[413,414]

[399] ACC 000062. Listing of Area 7 leasing information as obtained from leases.
[400] CRO 000241A. Amendment No. 2 to Building Lease Contract No. 14-16-0003-81-511, Allen Industries, Incorporated, dated February 28, 1986.
[401] U.S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Narrative Report, 1964, Page 48.
[402] ACO 002105. CONWR, Industrial Committee Report, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, August 1978 (Appendix J).
[403] DPRA Document No. 00006035. Building Lease Contract No. 14-16-0003-86-555 by and between U. S. Fish and Wildlife Service and Little Egypt Grain Company, Pages 1-2.
[404] CRO 000231. CONWR, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, October, 1990.
[405] CRO 000231. CONWR, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, October, 1990. Orpack Stone Corp. was not on this list, so it is assumed that they moved into these buildings after 1990.
[406] Industrial Tenant Roster – March 2001, Crab Orchard National Wildlife Refuge, Section 1, Table 1-3 of this report.
[407] Industrial Tenant Roster – March 2001, Crab Orchard National Wildlife Refuge, Section 1, Table 1-3 of this report.
[408] 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.
[409] DPRA Document No. 00009075. Undated Refuge lease information document showing new leases up until 10/1/49, from the CONWR files.
[410] CRO 001572A. Herrin Daily Journal, Newspaper article about Hercules Powder Company, dated February 16, 1949.
[411] ACC 000062. Listing of Area 7 leasing information as obtained from leases.
[412] CRO 000241A. Amendment No. 2 to Building Lease Contract No. 14-16-0003-81-511, Allen Industries, Incorporated, dated February 28, 1986.
[413] U.S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Narrative Report, 1964, Page 48.

Lessee	Dates	Building Use
Little Egypt Grain Co.	At least 1986 through 1990[415,416]	Grain storage. Refer to Building IN-1-3 table.
Orpack Stone Corp.	Sometime after 1990 through 2000[417,418]	Manufacturing, assembly, and storage of boxes[419]

Building IN-4-4

SWDC/War Department did not use Building IN-4-4 as a warehouse. IN-4-4 was designated as the Shook Building.[420]

Lessee	Dates	Building Use
Radionic Products Inc.	1949 through at least 1951. [421,422]	Specifics unknown. Refer to discussion under Building IN-3-4 table.
United Church Builders, Inc., manufacturers of pre-fabricated churches.[423]	1965[424] through 1966.[425]	Specifics unknown.
Pennzoil	1971through 1986[426,427,428]	Warehousing motor oil, barrel washing operations, oil products distributorship.[429,430]

[414] ACO 002105. CONWR, Industrial Committee Report, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, August 1978 (Appendix J).
[415] DPRA Document No. 00006035. Building Lease Contract No. 14-16-0003-86-555 by and between U. S. Fish and Wildlife Service and Little Egypt Grain Company, Pages 1-2.
[416] CRO 000231. CONWR, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, October, 1990.
[417] CRO 000231. CONWR, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, October, 1990. Orpack Stone Corp. was not on this list, so it is assumed that they moved into these buildings after 1990.
[418] Industrial Tenant Roster – March 2001, Crab Orchard National Wildlife Refuge, Section 1, Table 1-3 of this report.
[419] Industrial Tenant Roster – March 2001, Crab Orchard National Wildlife Refuge, Section 1, Table 1-3 of this report.
[420] U.S. Army Corps of Engineers, 1944, War Department Facilities Inventory of the Illinois Ordnance Plant Carbondale, Illinois, Part II, Section 4, Sheet 16.
[421] DPRA Document No. 00009059. CONWR, Lease Data and Income Pertaining to Industrial Unit, Crab Orchard National Wildlife Refuge, dated April 12, 1949, Page 12.
[422] DPRA Document No. 00009039. Crab Orchard National Wildlife Refuge, Lease Data, Industrial Unit, dated June 1, 1951, Page 15.
[423] DPRA Document No. 00016071. U. S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Crab Orchard National Wildlife Refuge, Narrative Report, 1965, Page 46.
[424] FWM 001311. Lease Contract No. 14-16-003-12093 by and between U. S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife and United Church Builders Incorporated, dated August 13, 1965, Page 1.
[425] DPRA Document No. 00009333. U. S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Narrative Report, 1966, Table No. 1., Page 2.
[426] ACC 000061. Listing of Area 7 leasing information as obtained from leases.
[427] CRO 000470 – CRO 471. Building Lease Contract No. 14-16-0003-82-531 by and between U. S. Fish and Wildlife Service and Pennzoil Company, dated September 1, 1982, Pages 1-2.

This building was razed sometime between 1980 and 1993.[431]

Building IN-4-5

Lessee	Dates	Building Use
GTE	1953[432,433] through 1958.[434]	Temporary storage of materials and supplies.[435,436]
Oxford Electric	1956 through 1963 (note overlap with GTE)	Electrical equipment and possibly for manufacturing transformers.[437,438,439]
Norge (later Magic Chef, 1979; later Maytag, 1986)	1963 to 1964,[440] then again from 1973 to 1974	Warehousing washers and dryers[441]
Commercial Solvents Corporation	April 1965 through April 1967[442,443]	Storage of bagged fertilizer
Southern Illinois Paper Co.	1968 through 1972.[444]	Sales of National Tape Co. Products,[445] also some manufacturing.[446]
Ram Fiber Glass	1972 through 1973.[447,448]	Storage of plastics (fabricated or molded products).[449]

[428] CRO 000483. Amendment No. 2 to Building Lease No. 14-16-0003-82-531, Pennzoil Company, dated January 1, 1987.
[429] ACO 002105. CONWR, Industrial Committee Report, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, August 1978 (Appendix J).
[430] CRO 000181. U.S. Department of the Interior, , Fish and Wildlife Service, National Wildlife Refuge System, Narrative Report, 1968, Page 38.
[431] 1980 and 1993 aerial photographs from the U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service, Aerial Photography Field Office, Salt Lake City, Utah.
[432] DPRA Document No. 00009176. Special Use Permit No. 20003, dated September 10, 1953.
[433] DPRA Document No. 00009177. Special Use Permit No. 21653, dated August 17, 1954.
[434] ACC 000063. Listing of Area 7 leasing information as obtained from leases.
[435] DPRA Document No. 00009176. Special Use Permit No. 20003, dated September 10, 1953.
[436] DPRA Document No. 00009177. Special Use Permit No. 21653, dated August 17, 1954.
[437] CONWR Narrative Reports for: September-December, 1955; January-April, 1956; January-April, 1963; and from 1964.
[438] DPRA Document No. 00009378. U. S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, Crab Orchard National Wildlife Refuge, Narrative Report, September Thru December, 1959, Page 34.
[439] LOC 000002. Moody's Industrial Manual, 1956, Page 1572.
[440] ACC 000063. Listing of Area 7 leasing information as obtained from leases.
[441] ACO 002105. CONWR, Industrial Committee Report, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, August 1978 (Appendix J).
[442] DPRA Document No. 00008837. Special Use Permit SUP-75-65, dated April 22, 1965.
[443] DPRA Document No. 00008831. Special Use Permit SUP-6-67, dated September 28, 1966.
[444] CRO 000545. Lease Contract No. 14-16-0003-12900 by and between U. S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife and Southern Illinois Paper Company, dated October 18, 1968, Page 1.
[445] CRO 000111. U.S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Narrative Report, 1968, Page 59.
[446] CRO 000111. U.S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Narrative Report, 1968, Page 59.

Lessee	Dates	Building Use
Dolan Machinery Co.	1975[450] through 1976.[451]	Rebuilding mining equipment.[452]
Turco Manufacturing Company	1976 to 1980[453]	Storing finished, boxed gym sets; bar stools; and/or other finished, boxed toy products.[454]
Olin/Primex/GDO&TS	1980[455] to Current[456,457]	Specifics not known for Olin. For Primex/GDO&TS - Storage of inert materials and surplus equipment[458]

Building IN-4-6

Lessee	Dates	Building Use
Olin	1961 through 1963.[459]	Specifics not known
Norge (later Magic Chef, 1979; later Maytag, 1986)	1966 to 1967[460]	Warehousing washers and dryers[461]
Mark Twain Marine Industries	1970 through 1971.[462]	Manufacturing boats and boat

[447] DPRA Document No. 00017856. Amendment No. 1 to Lease Contract No. 14-16-0003-13630 and Ram Fiber Glass, Incorporated, dated June 1, 1972.
[448] DPRA Document No. 00003891. CONWR, Letter to Ram Fiber-Glass, Inc. regarding cancellation notice for nonpayment of rent, dated June 27, 1973; and CRO 000502. Cancellation of Lease Contract No. 14-16-0003-13,630, Ram Fiber Glass, Incorporated, dated June 21, 1973.
[449] DPRA Document No. 00017860. Aetna Insurance Company, Special Multi-Peril Policy, Policy Number MP 48 58 61, General Schedule – Section H, dated March 24, 1972; and DPRA Document No. 00017862. Aetna Insurance Company, Change Endorsement, dated April 25, 1972.
[450] DPRA Document No. 00003812. Lease Contract No. 14-16-0003-30,729 by and between U. S. Fish and Wildlife Service and Dolan Machinery, Incorporated, July 17, 1975, Page 1.
[451] CRO 000354. Cancellation of Lease Contract No. 14-16-0003-30,729, Dolan Machinery, Incorporated, dated August 31, 1975.
[452] CRO 000143. U.S. Department of the Interior, U.S. Fish and Wildlife Service, Narrative Report, Fiscal Year 1975, Page 23.
[453] ACC 000057 - ACC 000063. Listing of Area 7 leasing information as obtained from leases.
[454] DOI 007939. Charmglow Industries, Inc., Letter to USDOI in response to a 104e request regarding Turco Manufacturing Company, dated June 15, 1989.
[455] DOI 001554 – DOI 001555. Building Lease Contract No. 14-16-0003-81-517 by and between U. S. Fish and Wildlife Service and Olin Corporation, dated October 1, 1980, Page 1 and Page 1 of 1A.
[456] DPRA Document No. 00007524. Building And Igloo Lease Contract No. 14-16-0003-96-579 by and between PRIMEX Technologies, Inc., dated January 1, 1997, Pages 1 and 6.
[457] Industrial Tenant Roster – March 2001, Crab Orchard National Wildlife Refuge, Section 1, Table 1-3 of this report.
[458] DPRA Document No. 00017640. "Environmental Site Closure Assessment" section of Amendment No. 9 to Building and Igloo Lease Contract No. 14-16-0003-96-579, Primex Technologies, Inc., amendment effective December 1, 1999, Environmental Site Closure Assessment dated December 3, 1993.
[459] ACC 000063. Listing of Area 7 leasing information as obtained from leases.
[460] ACC 000063. Listing of Area 7 leasing information as obtained from leases.
[461] ACO 002105. CONWR, Industrial Committee Report, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, August 1978 (Appendix J).

Lessee	Dates	Building Use
		accessories[463]
Olin (East Alton)	1972[464] through present (2001).[465]	Storage

Building IN-5-1

Lessee	Dates	Building Use
Hercules Powder[466,467]	1949 and 1950	Storage of linter for explosive powder production.[468] Refer to Building IN-1-2 table.
GSA	1955 to 1970[469]	Storage of medical, engineering, and engineering defense emergency supplies[470]
Turco Manufacturing Company	1970 to 1980[471]	Storing finished, boxed gym sets; bar stools; and/or other finished, boxed toy products.[472]
Diagraph	1980 to 1985[473,474]	Warehouse
Little Egypt Grain Co.	At least 1986 through 1990[475,476]	Grain storage. Refer to Building IN-1-3 table.

[462] ACC 000063. Listing of Area 7 leasing information as obtained from leases.
[463] CRO 000111. U.S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Narrative Report, 1968, Page 59.
[464] DOI 001491. Lease Contract No. 14-16-0003-13733 by and between U. S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife and Olin Corporation Energy Systems Division, dated May 1, 1972, Page 1.
[465] DPRA Document No. 00007577. Amendment No. 8 to Building Lease Contract No. 14-16-0003-81-517, Olin Corporation, dated January 1, 1997.
[466] 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.
[467] DPRA Document No. 00009075. Undated Refuge lease information document showing new leases up until 10/1/49, from the CONWR files.
[468] CRO 001572A. Herrin Daily Journal, Newspaper article about Hercules Powder Company, dated February 16, 1949.
[469] ACC 000064. Listing of Area 7 leasing information as obtained from leases.
[470] ACO 002327. United States Department of the Interior, Fish and Wildlife Service, Crab Orchard National Wildlife Refuge, Narrative Report, September Thru December, 1955, Page 17.
[471] ACC 000064. Listing of Area 7 leasing information as obtained from leases.
[472] DOI 007939. Charmglow Industries, Inc., Letter to USDOI in response to a 104e request regarding Turco Manufacturing Company, dated June 15, 1989.
[473] DO000571 – DOI 000572. Building Lease Contract No. 14-16-0003-82-534 by and between U. S. Fish and Wildlife Service and Diagraph Bradley Industries, Inc., dated April 1, 1982, Pages 1-2.
[474] DOI 000600. Amendment No. 5 to Building Lease Contract No. 14-16-0003-82-534, Diagraph Bradley Industries, Incorporated, dated October 1, 1985.
[475] DPRA Document No. 00006035. Building Lease Contract No. 14-16-0003-86-555 by and between U. S. Fish and Wildlife Service and Little Egypt Grain Company, Pages 1-2.
[476] CRO 000231. CONWR, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, October, 1990.

Lessee	Dates	Building Use
Primex Technologies, Inc.	1997 through 1999[477]	Cold storage of inert materials and surplus equipment[478]
U.S. Department of Justice, Federal Bureau of Prisons	Current[479]	Unknown

Building IN-5-2

Lessee	Dates	Building Use
ACME Equipment Co.	At least 1949 through at least 1951[480,481]	Warehousing
Norge (later Magic Chef, 1979; later Maytag, 1986)	1958 to 1964[482]	Warehousing washers and dryers[483]
Commercial Solvents Corporation	October 1965 through September 1966[484]	Storage of bagged fertilizer
Olin	1969 through 1971[485] and again from 1972[486] through 1973[487]	Manufacturing and other business concerns.[488] Refer to additional discussion below.
Helical Bit Company, Inc. (name	1973 through 1987[489,490,491]	Manufacturing and rebuilding

[477] DPRA Document No. 00017640. Amendment No. 9 to Building and Igloo Lease Contract No. 14-16-0003-96-579, Primex Technologies, Inc., effective December 1, 1999, Pages 1 and 3.
[478] DPRA Document No. 00017640. "Environmental Site Closure Assessment" section of Amendment No. 9 to Building and Igloo Lease Contract No. 14-16-0003-96-579, Primex Technologies, Inc., amendment effective December 1, 1999, Environmental Site Closure Assessment dated December 3, 1993.
[479] Industrial Tenant Roster – March 2001, Crab Orchard National Wildlife Refuge, Section 1, Table 1-3 of this report.
[480] 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.
[481] DPRA Document No. 00009059. CONWR, Lease Data and Income Pertaining to Industrial Unit, Crab Orchard National Wildlife Refuge, dated April 12, 1949, Page 1.
[482] ACC 000064. Listing of Area 7 leasing information as obtained from leases.
[483] ACO 002105. CONWR, Industrial Committee Report, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, August 1978 (Appendix J).
[484] DPRA Document No. 00008844. Special Use Permit No. SUP-12-66, dated September 15, 1965.
[485] ACC 000064. Listing of Area 7 leasing information as obtained from leases.
[486] DOI 001491. Lease Contract No. 14-16-0003-13733 by and between U. S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife and Olin Corporation Energy Systems Division, dated May 1, 1972, Page 1.
[487] DOI 001504. Amendment No. 1 to Lease Contract No. 14-16-0003-13733, Olin Corporation Energy Systems Division, dated September 30, 1973.
[488] CRO 001516. Special Use Permit No. SUP-44-70, dated March 13, 1970.
[489] CRO 000413. Lease Contract No. 14-16-0003-13,436 by and between U. S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife and Helical Bit Company, Incorporated, dated September 26, 1973.
[490] CRO 000507 – CRO 000508. Building Lease Contract No. 14-16-0003-81-523 by and between U. S. Fish and Wildlife Service and R.A. Wilkie Machine & Plating Company, dated October 1, 1980, Page1 and Page 1 of 1A.

Lessee	Dates	Building Use
changed to R.A.Wilkie Machine and Plating Company in 1976)		mining equipment. Refer to discussion below.
Little Egypt Grain Co.	1987[492] through 1988[493]	Grain storage. Refer to Building IN-1-3 table.

Olin Metal Fabrication Operation

Based on information from former employees and an Olin contractor, these buildings were used for a short-lived metal fabrication operation that took place partly in Area 7 and partly in Area 2F.

Charles Funk, a former Olin manager, worked in what he described as Olin's metal fabrication facility in Area 7.[494] [495] Mr. Frank Wilkie, employed by Supreme Plating who did contract work for Olin, described a similar operation. Mr. Herb Baines, a former Olin employee and foreman of metal fabrication, confirmed that for about a year and a half, Olin fabricated housings for the 105-mm shells. [496] The work involved fabrication of the shells for 105, 81, 60, 57, and 23-millimeter (mm) projectiles. During the time that Mr. Funk was involved (1971 to 1972 or 1973), the metal fabrication plant was divided into two parts: cold forming and phosphatizing, which was done in Area 7; and machining and assembly, which was done in Building F-2-2. Another former Olin employee, Rudy Okolski, reported that the F Area was used for manufacturing howitzer rounds. According to Mr. Okolski, the "press and dip operation" (cold forming and phosphatizing, presumably) for the howitzer rounds was in Area 7. Machining was done in Building F-2-2, after the rounds were "dipped" at Area 7.[497]

Mr. Funk said that there were "a couple of paint lines located in those buildings, and in addition...there were some other presses where we did some metal stamping." It is not clear whether Mr. Funk was referring to Area 7 or Area 2F when he mentioned the painting and metal stamping. Mr. Frank Wilkie reported that Olin had metal stampings for plating in Area 7,[498] and that Supreme Plating picked up aluminum stampings from Area 7 that were later used for the flares that Olin manufactured in Area 9.[499] Supreme Plating took the aluminum stampings for

[491] CRO 000413. Lease Contract No. 14-16-0003-13,436 by and between U. S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife and Helical Bit Company, Incorporated, dated September 26, 1973.
[492] DPRA Document No. 00012791. Little Egypt Grain Company, Letter to the USFWS regarding additional buildings that they would like to lease in Area 7, dated April 20, 1987.
[493] DPRA Document No. 00006002. USFWS Incident Report dated April 22, 1988, regarding fire at Buildings IN-5-2, IN-5-3 and Annex in between these two buildings.
[494] Deposition of Charles Funk, April 9, 1998, Pages 15-19.
[495] In an earlier interview Funk reported that the Olin's metal fabrication in Area 7 was located in "warehouses 1-2 and 1-3;" however, as discussed above, it is likely that these activities took place in Buildings IN-5-2 and IN-5-3. Note that other tenants occupied Building IN-1-2 during the time Funk says Olin used it; there were no recorded tenants for IN-1-3 during that time. Reference: Charles Funk, personal interview, September 29, 1997
[496] Herb Baines, personal interview, September 29, 1997.
[497] Rudy Okolski, personal interview, June 30, 1999.
[498] Deposition of Frank Wilkie, October 14, 1999, Page 52.
[499] Deposition of Frank Wilkie, October 14, 1999, Page 52.

anodizing at their plating facility in Area 4, and then returned the finished product to Olin in Area 9.[500]

According to Mr. Wilkie, as part of the 105-mm shell manufacturing process Olin had two "tremendous presses" located in an annex between Buildings IN-5-2 and IN-5-3 that they used to cold-press the "slugs" (metal pieces that were formed into shells by pressing).

Prior to pressing, Supreme Plating coated the slugs with a slick, soapy substance called Bondalube.[501] According to Mr. Funk, the tubing ("slugs" to Mr. Wilkie) for this process was received in Area 7 where it was first lubricated in "lube tanks."[502] This may be the Bondalube process described by Mr. Wilkie, although Mr. Wilkie reported that the lubrication was done in Area 4.[503] In any case, after lubrication the metal was cold formed, phosphatized, and heat treated, then moved to the F Area for machining and assembly. There was a concrete pit in this annex, which was used to collect hydraulic oil from the presses.[504 505]

According to Mr. Frank Wilkie, after pressing, Olin sent the shells back to Supreme Plating in Area 4 so that they could put the cadmium [plating] on the ring.[506] Wilkie also reported that the phosphatizing was done in Area 4.[507] Wilkie said the phosphatizing put a rust-preventative coating on the outside surface. [508] According to Mr. Funk, the phosphate coating was a "metal prep for painting."[509]

Mr. Funk was sure there were degreasers used for metal cleaning in Area 7, but he didn't know specifically what was used, probably solvents of some kind.[510]

Site 15 (the "Plating Pond") of the Metals Area Operable Unit (MAOU) was located just to the south of the Area 7 buildings. It was remediated as part of the MAOU. According to Roy Taylor (former Olin and USFWS employee) Olin had an acid vat in Area 7 that was used for cleaning metal. Sludge from the vat was reportedly pumped to a pond in the woods, south of the warehouse complex.[511] This pond was a part of a waste treatment system that was used for treatment of wastes resulting from cold extrusion of ordnance projectiles.[512] A letter from the USEPA to the USFWS, stated that this wastewater treatment system was approved for operation,

[500] Deposition of Frank Wilkie, October 14, 1999, Pages 52-54.
[501] Deposition of Frank Wilkie, October 14, 1999, Pages 52-53.
[502] Deposition of Charles Funk, April 9, 1998, Pages 15-19.
[503] Deposition of Frank Wilkie, October 14, 1999, Pages 114-115.
[504] Robert Andrew Wilkie, personal interview, July 28, 1999.
[505] Deposition of Charles Funk, April 9, 1998, Pages 15-19.
[506] Deposition of Frank Wilkie, October 14, 1999, Page 115.
[507] Deposition of Frank Wilkie, October 14, 1999, Page 116.
[508] Deposition of Frank Wilkie, October 14, 1999, Page 97.
[509] Deposition of Charles Funk, April 9, 1998, Pages 15-19.
[510] Deposition of Charles Funk, April 9, 1998, Pages 15-18.
[511] Roy Taylor, personal interview, September 25, 1997.
[512] PRI-00167/DPRA Document No. 00013788. EPA Form 7500-1, Plant Process and Discharge Description from Olin for cold extrusion of ordnance projectiles, dated November 15, 1971.

under the condition that the daily effluent sample results were satisfactory.[513] The effluent from this pond was to be released from the pond to the Refuge Treatment Plant.[514]

Aerial Photograph Interpretation

Aerial photographs show significant changes in the vicinity of Buildings IN-5-2 and IN-5-3 between 1965 and 1971.[515] A structure (the annex), approximately 100 ft by 50 ft in plan dimension, was built between the two buildings. On the aerial, this annex appears to join the two existing buildings, essentially creating one large building approximately 500 ft long and 50 ft wide. A rectangular structure at the west end of Building IN-5-3, possibly a loading dock, is visible on the 1971 photograph but not on the 1960 photograph. A new pond, most likely the pond referred to by Rob Taylor is visible on the 1971 photograph, in the woods south of the Area 7 complex. This pond is MAOU Site 15, which was remediated in 1996. Two linear scars extend from the west end of Building IN-5-3 to the pond. At least one of these is probably the burial trench for the discharge pipe leading from the building to the pond. A large number of vehicles (probably employee vehicles), are parked in front of Buildings IN-5-2, IN-5-3, and IN-6-2, just to the south. Since Olin was also leasing Building IN-6-2 in 1971, this suggests that the activities in Building IN-6-2 may also have been related to the metal fabrication operation.

(Note, in an undated, USFWS document, a handwritten note indicates Olin built this annex in 1968.)[516]

Helical Bit/R.A. Wilkie Machine and Plating Co.

Helical Bit Company, Inc., which changed its name to R.A.Wilkie Machine and Plating Company in 1976, leased Buildings IN-5-2 and IN-5-3 from 1973 through 1976,[517] after Olin left the building. According to Mr. Robert Wilkie, both the oil in the pit beneath the "tremendous presses" and the presses themselves were removed from the annex prior to Helical Bit taking possession of the building in 1973.[518] According to Mr. Frank Wilkie, the Helical Bit Company manufactured mining equipment (such as the Helical Mine bit – a continuous mining bit for coal mining), and also rebuilt mining equipment.[519] Helical Bit Company also leased "Annex No. 1" at this time.[520] It is probable that Annex No. 1 is the annex built by Olin in between Buildings IN-5-2 and IN-5-3.

[513] PRI-00423/DPRA Document No. 00013882. USEPA, Letter to USFWS regarding acceptance of wastewater treatment system in Area 7, dated December 16, 1971.
[514] DPRA Document No. 00007440. Telephone Record from regarding wastewater treatment in Area 7, dated October 26, 1971.
[515] 1965 and 1971 aerial photographs from the U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service, Aerial Photography Field Office, Salt Lake City, Utah.
[516] CRO 000685/DPRA Document No. 00024765. U.S. Department of the Interior, Fish & Wildlife Service, Management Plan Prints, Index, Page 9, date unknown.
[517] CRO 000413. Lease Contract No. 14-16-0003-13,436 by and between U. S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife and Helical Bit Company, Incorporated, dated September 26, 1973.
[518] Robert Andrew Wilkie, personal interview, July 28, 1999.
[519] Frank Wilkie, personal interview, July 28, 1999.
[520] CRO 000413. Lease Contract No. 14-16-0003-13,436 by and between U. S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife and Helical Bit Company, Incorporated, dated September 26, 1973.

R.A. Wilkie Machine and Plating Co. leased Buildings IN-5-2 and IN-5-3 from 1976 through 1987.[521,522] According to Mr. Robert Wilkie, R.A. Wilkie Machine Company had a machine shop. They did other machinery repair in these buildings, and they may have also done some mining machine repair.[523] They may have used water-soluble oil in these activities, which would dissolve in water thus eliminating the need to dispose of the oil.[524]

According to Mr. Robert Wilkie, R.A. Wilkie Machine Company machined components for some of the Olin flares. They made a cap that was filled with lead for the flares.[525,526] After the lead was melted and poured into forms the shapes of pie slices,[527] the excess lead was machined off and the tailings (filings) that fell to the ground were swept up and re-melted.[528]

They also refurbished 50mm ammunition (ammo) cans in Area 7 for Olin during this time.[529] They would blast the ammo cans with steel shot, the cans would then be sent through a small phosphatizing machine, and finally the cans would be painted in spray booths.[530] Mr. Frank Wilkie, Robert Wilkie's brother, believed that the phosphatizing machine and the spray booths were located in Building IN-5-3, and the machine shop was located in Building IN-5-2.[531] The paint was brought on site in 55-gallon drums and stored on site.[532] There might have been paint thinners on site, but he thought that they used paint straight out of the drums.[533] Frank Wilkie believed that the phosphatizing operation was present on site for about one and a half years.[534]

According to Mr. Frank Wilkie, the R.A. Wilkie Machine and Plating Company had a plating operation in Area 7 for a short period of time.[535]

Neither Mr. Robert Wilkie nor Mr. Frank Wilkie knew if there were any floor drains present in these two buildings; however, according to Mr. Frank Wilkie, there was a sewer lift station to the southwest of the Building IN-6-3 future location where the wastewater would go.[536] Review of IOP drawings shows that a sewer main does in fact traverse through Area 7 and part of that line is located southwest of building IN-6-3 (it actually runs between buildings IN-6-4 and IN-6-5).[537] However, a sewer lift is not located in this area although it is possible that a manhole is located

[521] CRO 000507 – CRO 000508. Building Lease Contract No. 14-16-0003-81-523 by and between U. S. Fish and Wildlife Service and R.A. Wilkie Machine & Plating Company, dated October 1, 1980, Page1 and Page 1 of 1A.
[522] CRO 000413. Lease Contract No. 14-16-0003-13,436 by and between U. S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife and Helical Bit Company, Incorporated, dated September 26, 1973.
[523] Robert Andrew Wilkie, personal interview, July 28, 1999.
[524] Robert Andrew Wilkie, personal interview, July 28, 1999.
[525] Deposition of Robert Andrew Wilkie, October 15, 1999, Page 80.
[526] PRI-019807-PRI-019808. This document is an Olin Shipping Request for 67 pigs of lead for use in leading end caps. 67 pigs would be approximately 4,060 pounds.
[527] Deposition of Robert Andrew Wilkie, October 15, 1999, Page 88.
[528] Deposition of Robert Andrew Wilkie, October 15, 1999, Page 91.
[529] Robert Andrew Wilkie, personal interview, July 28, 1999.
[530] Robert Andrew Wilkie, personal interview, July 28, 1999.
[531] Frank Wilkie, personal interview, July 28, 1999.
[532] Robert Andrew Wilkie, personal interview, July 28, 1999.
[533] Robert Andrew Wilkie, personal interview, July 28, 1999.
[534] Frank Wilkie, personal interview, July 28, 1999.
[535] Deposition of Frank Wilkie, October 14, 1999, Page 131.
[536] Frank Wilkie, personal interview, July 28, 1999.
[537] U.S. Army Corps of Engineers, 1944, War Department Facilities Inventory of the Illinois Ordnance Plant Carbondale, Illinois, Part I, Section 6, Sheet 3.

in this area into which liquid wastes were directed. According to Mr. Robert Wilkie, any waste materials (such as paint chips from sandblasting) would have been taken to either the Marion or Herrin landfills.[538] Any scrap metals that resulted from machining operations would have been taken to Gary's Metals in Cartersville, Illinois.[539]

In 1998, a fire destroyed Buildings IN-5-2, IN-5-3, and the annex in between them. There were empty Olin ammo cans stored in these buildings at the time of the fire.[540]

Building IN-5-3

Lessee	Dates	Building Use
ACME Equipment Co.	At least 1948 through at least 1952[541,542,543]	Warehousing
Olin	1961 through 1963[544]	Specifics not found.
Commercial Solvents Corporation	October 1963 through April 1969[545]	Storage of bagged fertilizer
Olin	1969 through 1971[546] and again from 1972[547] through 1973[548]	Refer to Building IN-3-2 table and discussion.
Helical Bit/R.A.Wilkie Machine and Plating Company	1973 through 1987[549,550,551]	Manufacturing and rebuilding mining equipment. Refer to Building IN-3-2 table and discussion.

[538] Robert Andrew Wilkie, personal interview, July 28, 1999.
[539] Robert Andrew Wilkie, personal interview, July 28, 1999.
[540] DPRA Document No. 00006669. Olin, Letter USFWS regarding ammo cans that were destroyed in Area 7 warehouse fire, dated November 9, 1988.
[541] 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.
[542] DPRA Document No. 00009059. CONWR, Lease Data and Income Pertaining to Industrial Unit, Crab Orchard National Wildlife Refuge, dated April 12, 1949, Page 1.
[543] DPRA Document No. 00009039. Crab Orchard National Wildlife Refuge, Lease Data, Industrial Unit, dated June 1, 1951, Page 1.
[544] ACC 000064. Listing of Area 7 leasing information as obtained from leases.
[545] DPRA Document Nos. 00008821, 00008823, 00008844, 00008831, 00008848, 00008856, and 00008891. Special Use Permit numbers SUP-14-64, SUP-15-65, SUP-12-66, SUP-6-67, SUP-10-68, SUP-10-69, and Cancellation of Special Use Permit No. 10-69, Commercial Solvents Corporation.
[546] ACC 000064. Listing of Area 7 leasing information as obtained from leases.
[547] DOI 001491. Lease Contract No. 14-16-0003-13733 by and between U. S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife and Olin Corporation Energy Systems Division, dated May 1, 1972, Page 1.
[548] DOI 001504. Amendment No. 1 to Lease Contract No. 14-16-0003-13733, Olin Corporation Energy Systems Division, dated September 30, 1973.
[549] CRO 000413. Lease Contract No. 14-16-0003-13,436 by and between U. S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife and Helical Bit Company, Incorporated, dated September 26, 1973.
[550] CRO 000507 – CRO 000508. Building Lease Contract No. 14-16-0003-81-523 by and between U. S. Fish and Wildlife Service and R.A. Wilkie Machine & Plating Company, dated October 1, 1980, Page1 and Page 1 of 1A.
[551] CRO 000413. Lease Contract No. 14-16-0003-13,436 by and between U. S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife and Helical Bit Company, Incorporated, dated September 26, 1973.

Lessee	Dates	Building Use
Little Egypt Grain Co.	1987[552] through 1988[553]	Grain storage. Refer to Building IN-1-3 table.

As discussed above, this building was destroyed by fire in 1988.

Building IN-5-4

Lessee	Dates	Building Use
Norge (later Magic Chef, 1979; later Maytag, 1986)	1964[554] and again from 1976[555,556] until likely 1984-1985[557]	Warehousing washers and dryers[558]
City Distributing Company, Inc.	Three months in 1970 and 1971[559]	Storage.
Rend Lake Beverages, Inc.	1971 through 1975[560,561]	Unknown
Little Egypt Grain Co.	At least 1986 through 1990.[562,563]	Grain storage. Refer to Building IN-1-3 table.
Primex Technologies, Inc.	1997 through 1999[564]	Cold storage of inert materials and surplus equipment[565]

[552] DPRA Document No. 00012791. Little Egypt Grain Company, Letter to the USFWS regarding additional buildings that they would like to lease in Area 7, dated April 20, 1987.
[553] DPRA Document No. 00006002. USFWS Incident Report dated April 22, 1988, regarding fire at Buildings IN-5-2, IN-5-3 and Annex in between these two buildings.
[554] ACC 000064. Listing of Area 7 leasing information as obtained from leases.
[555] ACC 000064. Listing of Area 7 leasing information as obtained from leases.
[556] FWM 001002. Building Lease Contract No. 14-16-0003-81-516 by and between U. S. Fish and Wildlife Service and Magic Chef, Inc. – Norge Division, dated October 1, 1980, Page 1 and Page 1 of 1A.
[557] Original IOP Plan No.6544-101.11, dated February 28, 1942 with later notations added by Refuge personnel. The notations recorded some information about leases, building uses, and buildings that were removed or destroyed.
[558] ACO 002105. CONWR, Industrial Committee Report, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, August 1978 (Appendix J).
[559] DPRA Document No. 00027094. Special Use Permit No. SUP-108-70, dated Nov. 17, 1970.
[560] CRO 000516. Lease Contract No. 14-16-0003-13315 by and between U. S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife and Rend Lake Beverages, Inc., dated January 15, 1971, Page 1.
[561] CRO 000520. Cancellation of Lease Contract No. 14-16-0003-13,315, Rend Lake Beverages, Inc., dated December 4, 1975.
[562] DPRA Document No. 00006035. Building Lease Contract No. 14-16-0003-86-555 by and between U. S. Fish and Wildlife Service and Little Egypt Grain Company, dated August 1, 1986, Pages 1-2.
[563] CRO 000231. CONWR, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, October, 1990.
[564] DPRA Document No. 00017640. Amendment No. 9 to Building and Igloo Lease Contract No. 14-16-0003-96-579, Primex Technologies, Inc., effective December 1, 1999, Pages 1 and 3.
[565] DPRA Document No. 00017640. "Environmental Site Closure Assessment" section of Amendment No. 9 to Building and Igloo Lease Contract No. 14-16-0003-96-579, Primex Technologies, Inc., amendment effective December 1, 1999, Environmental Site Closure Assessment dated December 3, 1993.

Building IN-5-5

Lessee	Dates	Building Use
Norge (later Magic Chef, 1979; later Maytag, 1986)	1964[566]	Warehousing washers and dryers[567]
Mark Twain Marine Industries	1970 through 1973[568]	Manufacturing boats and boat accessories [569]
The Federal Prison Industries – U.S. Department of Justice	October 1973[570] through September 1979[571]	Warehousing of prison products[572]
Turco Manufacturing Company	1979 to 1982[573]	Storing finished, boxed gym sets; bar stools; and/or other finished, boxed toy products.[574]
Castel Properties	1982 to 1987	Cold storage[575,576]
Little Egypt Grain Co.	1987[577] to 1990[578]	Grain storage. Refer to Building IN-1-3 table.

This building was razed sometime between 1980 and 1993.[579]

[566] ACC 000064. Listing of Area 7 leasing information as obtained from leases.
[567] ACO 002105. CONWR, Industrial Committee Report, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, August 1978 (Appendix J).
[568] ACC 000064. Listing of Area 7 leasing information as obtained from leases.
[569] CRO 000111. U.S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Narrative Report, 1968, Page 59.
[570] DPRA Document No. 00027032. Special Use Permit No. SUP-09-74, dated September 11, 1973.
[571] DPRA Document No. 00027046. Special Use Permit No. SUP-76-78, dated August 23, 1978.
[572] ACO 002105. CONWR, Industrial Committee Report, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, August 1978 (Appendix J).
[573] ACC 000064. Listing of Area 7 leasing information as obtained from leases.
[574] DOI 007939. Charmglow Industries, Inc., Letter to USDOI in response to a 104e request regarding Turco Manufacturing Company, dated June 15, 1989.
[575] FWM 000878. Amendment No. 1 to Building Lease Contract No. 14-16-0003-82-533, Castel Properties, Ltd, dated May 16, 1982.
[576] FWM 000880. Amendment No. 4 to Building Lease Contract No. 14-16-0003-82-533, Castel Properties, Ltd, dated January 1, 1987.
[577] DPRA Document No. 00012791. Little Egypt Grain Company, Letter to the USFWS regarding additional buildings that they would like to lease in Area 7, dated April 20, 1987.
[578] CRO 000231. CONWR, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, October, 1990.
[579] 1980 and 1993 aerial photographs from the U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service, Aerial Photography Field Office, Salt Lake City, Utah.

Building IN-5-6

Lessee	Dates	Building Use
Crab Orchard Field and Trial Club[580]	at least 1975[581] through 1976 (when Turco Manufacturing Company moved in - see below). Their lease did not expire until 1980[582]	Horse barn[583]
Turco Manufacturing Company	1976 to 1981[584]	Storing finished, boxed gym sets; bar stools; and/or other finished, boxed toy products.[585]
Mark Twain Marine Industries	1970 through 1973[586]	Manufacturing boats and boat accessories[587]
The Federal Prison Industries – U.S. Department of Justice	October 1973[588] through September 1979[589]	Warehousing of prison products[590]
Castel Properties	1982 through 1984[591,592]	Cold storage[593,594]
Little Egypt Grain Co.	1986 through 1990[595,596]	Gain storage. Refer to Building IN-1-3 table.

[580] DPRA Document No. 00006432. CONWR, List identifying areas, company Names, Lease/Permit, and Expiration Date for Businesses located at Crab Orchard National Wildlife Refuge.
[581] DPRA Document No. 00013537. CONWR, 1975, List of lessee building numbers, names, and telephone numbers.
[582] DPRA Document No. 00006432. CONWR, List identifying areas, company Names, Lease/Permit, and Expiration Date for Businesses located at Crab Orchard National Wildlife Refuge.
[583] DPRA Document No. 00006449. CONWR, Annual Cost CY 1975, Fire Control-200 and Water Plant –300-1, dated April 20, 1976.
[584] ACC 000057 - ACC 000065. Listing of Area 7 leasing information as obtained from leases.
[585] DOI 007939. Charmglow Industries, Inc., Letter to USDOI in response to a 104e request regarding Turco Manufacturing Company, dated June 15, 1989.
[586] ACC 000064. Listing of Area 7 leasing information as obtained from leases.
[587] CRO 000111. U.S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Narrative Report, 1968, Page 59.
[588] DPRA Document No. 00027032. Special Use Permit No. SUP-09-74, dated September 11, 1973.
[589] DPRA Document No. 00027046. Special Use Permit No. SUP-76-78, dated August 23, 1978.
[590] ACO 002105. CONWR, Industrial Committee Report, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, August 1978 (Appendix J).
[591] FWM 000875 – FWM 000876. Building Lease Contract No. 14-16-0003-82-533 by and between U. S. Fish and Wildlife Service and Castel Properties, Ltd, dated April 1, 1982, Pages 1-2.
[592] FWM 000879. Amendment No. 2 to Building Lease Contract No. 14-16-0003-82-533, Castel Properties, Ltd., dated February 1, 1984.
[593] FWM 000878. Amendment No. 1 to Building Lease Contract No. 14-16-0003-82-533, Castel Properties, Ltd, dated May 16, 1982.
[594] FWM 000880. Amendment No. 4 to Building Lease Contract No. 14-16-0003-82-533, Castel Properties, Ltd, dated January 1, 1987.
[595] DPRA Document No. 00006035. Building Lease Contract No. 14-16-0003-86-555 by and between U. S. Fish and Wildlife Service and Little Egypt Grain Company, dated August 1, 1986, Pages 1-2.
[596] CRO 000231. CONWR, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, October, 1990.

Lessee	Dates	Building Use
Operating Engineers Union Local 318	Current (2001)	Classroom storage[597]

Building IN-5-7

Lessee	Dates	Building Use
Crab Orchard Field and Trial Club[598]	1948 through possibly 1963[599,600,601]	Horse barn[602]

Fire destroyed this building in May of 1963.[603] As seen in the 1971 aerial photograph, it appears that this building foundation was used for open storage after the building was razed. It was not determined who was using this foundation for open storage in 1971; however, Olin Corporation used this pad for storage of materials (tube-steel) from June 1972 through May 1973).[604]

Building IN-6-1

Lessee	Dates	Building Use
Hercules Powder[605,606]	1949 and 1950	Storage of linter for explosive powder production.[607] Refer to Building IN-1-2 table.
GSA	1955 to 1970 [608]	Storage of medical, engineering, and engineering defense emergency supplies[609]

[597] Industrial Tenant Roster – March 2001, Crab Orchard National Wildlife Refuge, Section 1, Table 1-3 of this report.
[598] DPRA Document No. 00006432. CONWR, List identifying areas, company Names, Lease/Permit, and Expiration Date for Businesses located at Crab Orchard National Wildlife Refuge.
[599] DPRA Document No. 00008035. Special Use Permit No. 49-596, dated April 27, 1949.
[600] DPRA Document No. 00008020. Crab Orchard Field Trial Club, Letter to Fish and Wildlife Service requesting a their Special Use Permit be renewed for a ten year period, dated August 25, 1959.
[601] DPRA Document No. 00008090. Special Use Permit No. 30739, dated September 11, 1959.
[602] DPRA Document No. 00006449. CONWR, Annual Cost CY 1975, Fire Control-200 and Water Plant –300-1, dated April 20, 1976.
[603] DPRA Document No. 00016055. U. S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Crab Orchard National Wildlife Refuge, Narrative Report, May through August, 1963, Page 27.
[604] DPRA Document No. 00025362. Special Use Permit, dated May 16, 1972.
[605] 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.
[606] DPRA Document No. 00009075. Undated Refuge lease information document showing new leases up until 10/1/49, from the CONWR files.
[607] CRO 001572A. Herrin Daily Journal, Newspaper article about Hercules Powder Company, dated February 16, 1949.
[608] ACC 000065. Listing of Area 7 leasing information as obtained from leases.
[609] ACO 002327. United States Department of the Interior, Fish and Wildlife Service, Crab Orchard National Wildlife Refuge, Narrative Report, September Thru December, 1955, Page 17.

Lessee	Dates	Building Use
Southern Illinois University – Employment Training Center (SIU-ETC)	1970[610] to 1974[611]	Storage facility for Employment Training Center
Southern Illinois Plating	Six months in 1974 and 1975[612]	Unknown
The Federal Prison Industries – U.S. Department of Justice	1976[613] to 1981[614]	Warehousing of prison products[615]
Diagraph Corporation	1982 to 1985[616,617]	Warehouse
U.S. Department of Justice, Federal Bureau of Prisons	Current[618]	Unknown

Previous PCB Testing by Olin

Olin sampled this building for PCBs in 1992 when they were considering leasing it. USFWS had concerns about PCBs in the building.[619,620] In a letter to USFWS, Olin indicated that the testing in the Area 7 warehouses 7-6-1 and 7-6-2 (sic) was "performed by an independent laboratory" and that all samples showed that PCBs were not detected. Attached to Olin's letter was a report from Industrial Testing Laboratory, Inc. listing the results of five wipe samples, which were all reported as < 3 ug/100 cm^2 for PCBs[621].

Building IN-6-2

Lessee	Dates	Building Use
ACME Equipment Co.	At least 1949 through at least 1951[622,623,624]	Warehousing

[610] DPRA Document No. 00027245. Special Use Permit, dated April 13, 1970.
[611] DPRA Document No. 00027284. Special Use Permit, dated May 1, 1973.
[612] ACC 000065. Listing of Area 7 leasing information as obtained from leases.
[613] DPRA Document No. 00027026. Amendment No. 1 – Special Use Permit No. SUP-05-76, Crab Orchard NWR, dated January 20, 1976.
[614] ACC 000065. Listing of Area 7 leasing information as obtained from leases.
[615] ACO 002105. CONWR, Industrial Committee Report, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, August 1978 (Appendix J).
[616] DOI 000571 – DOI 000572. Building Lease Contract No. 14-16-0003-82-534 by and between U. S. Fish and Wildlife Service and Diagraph Bradley Industries, Inc., dated April 1, 1982, Pages 1-2.
[617] DOI 000597. Amendment No. 3 to Building Lease Contract No. 14-16-0003-82-534, Diagraph Bradley Industries, Incorporated, dated May 1, 1985.
[618] Industrial Tenant Roster – March 2001, Crab Orchard National Wildlife Refuge, Section 1, Table 1-3 of this report.
[619] DPRA Document No. 00007347. USFWS, Letter to Olin Corporation regarding PCB sampling in Buildings IN-6-1 and IN-6-2, dated June 22, 1992.
[620] DPRA Document No. 00007350. USFWS, Memorandum to the file regarding PCB testing in refuge buildings, dated June 22, 1992.
[621] DPRA document 00007323. Test report from Industrial Testing Laboratory, Inc.
[622] 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.

Lessee	Dates	Building Use
Allen Industries	1955 to 1956 and 1957 to 1967[625]	Warehousing and production of rug underlay samples and for warehousing of packing materials.[626,627]
Marion Metal and Roofing Company	1956[628] through 1957[629]	Warehousing roofing materials.[630]
Olin	1967 through 1976[631,632,633,634].	Unknown.
R.A. Wilkie Machine and Plating Co.	1976[635,636] through 1982[637]	Storage[638]
Little Egypt Grain Co.	At least 1986 through 1990[639,640]	Grain storage. Refer to Building IN-1-3 table.
Orpack Stone Corp.	Sometime after 1990[641] through 2000[642]	Manufacturing, assembly, and storage of boxes[643]

[623] DPRA Document No. 00009075. Undated Refuge lease information document showing new leases up until 10/1/49, from the CONWR files.
[624] DPRA Document No. 00009039. Crab Orchard National Wildlife Refuge, Lease Data, Industrial Unit, June 1, 1951, Page 15.
[625] ACC 000065. Listing of Area 7 leasing information as obtained from leases.
[626] U.S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Narrative Report, 1964, Page 48.
[627] ACO 002105. CONWR, Industrial Committee Report, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, August 1978 (Appendix J).
[628] DPRA Document No. 00006937. United States Department of the Interior, Fish and Wildlife Service, Crab Orchard National Wildlife Refuge, Narrative Report, September Thru December, 1955, Page 16.
[629] DPRA Document No. 00009411. United States Department of the Interior, Bureau of Sport Fisheries & Wildlife, Fish and Wildlife Service, Crab Orchard National Wildlife Refuge, Narrative Report, September Thru December, 1957, Table XI.
[630] DPRA Document No. 00006937. United States Department of the Interior, Fish and Wildlife Service, Crab Orchard National Wildlife Refuge, Narrative Report, September Thru December, 1955,Page 16.
[631] ACC 000065. Listing of Area 7 leasing information as obtained from leases.
[632] CRO 001515. Special Use Permit No. SUP-93-70, dated September 10, 1970.
[633] DOI 001491. Lease Contract No. 14-16-0003-13733 by and between U. S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife and Olin Corporation Energy Systems Division, dated May 1, 1972, Page 1.
[634] DOI 001506. Amendment No. 2 to Lease Contract No. 14-16-0003-13733, Olin Corporation Energy Systems Division, dated July 1, 1976.
[635] CRO-000506 through CRO-000511 – USFWS Lease information for R.A. Wilkie Machine and Plating Company.
[636] CRO-000412 through CRO-000416 – USFWS Lease information for Helical Bit Company, Incorporated.
[637] ACC 000065. Listing of Area 7 leasing information as obtained from leases.
[638] Deposition of Frank Wilkie, October 14, 1999, Page 129.
[639] DPRA Document No. 00006035. Building Lease Contract No. 14-16-0003-86-555 by and between U. S. Fish and Wildlife Service and Little Egypt Grain Company, dated August 1, 1986, Pages 1-2.
[640] CRO 000231. CONWR, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, October, 1990.
[641] CRO 000231. CONWR, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, October, 1990. Orpack Stone Corp. was not on this list, so it is assumed that they moved into these buildings after 1990.

Olin's activities in Building IN-6-2 around 1971 may have been related to the metal fabrication operation in Buildings IN-5-2 and IN-5-3, as discussed above.

Refer to discussion of PCB testing in this building under Building IN-6-1 discussion above.

Building IN-6-3

This building was never built.[644]

Building IN-6-4

Lessee	Dates	Building Use
National Distributing Company	At least 1951 to 1952[645]	Unknown
Southern Illinois Woodworking (foundation only)	1965[646] to 1966[647]	The foundation was used for open-air storage of lumber and materials.[648]
Ram Fiber Glass (foundation only)	1972 through 1973[649,650]	Not known.

As seen in the historical aerial photographs for Area 7, this building was destroyed by fire sometime between 1951 and 1960 and was not rebuilt.[651,652] In the 1960, 1965, and 1971 aerial photographs, the foundation is visible and was apparently being used for storage. In the 1980

[642] Industrial Tenant Roster – March 2001, Crab Orchard National Wildlife Refuge, Section 1, Table 1-3 of this report.
[643] Industrial Tenant Roster – March 2001, Crab Orchard National Wildlife Refuge, Section 1, Table 1-3 of this report.
[644] U.S. Army Corps of Engineers, 1944, War Department Facilities Inventory of the Illinois Ordnance Plant Carbondale, Illinois, Part I, Section 5. Page 5; and, aerial photograph interpretation, photographs of Area 7 dated 1951, 1960, 1965, 1971, 1980, and 1993 from the U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service, Aerial Photography Field Office, Salt Lake City, Utah and from the National Archives and Records Administration, College Park, Maryland.
[645] DPRA Document No. 00009039. Crab Orchard National Wildlife Refuge, Lease Data, Industrial Unit, June 1, 1951, Page 12.
[646] DPRA Document No. 00017763. Amendment No. 2 to Lease Contact No. 14-16-0003-6238, Southern Illinois Woodworking Company, dated July 27, 1965. (Document includes original Lease and Amendment No. 1)
[647] CRO 000585. Cancellation of Lease No. 14-16-0003-6238, dated January 31, 1966.
[648] DPRA Document No. 00017763. Amendment No. 2 to Lease Contact No. 14-16-0003-6238, Southern Illinois Woodworking Compan23y, dated July 27, 1965. (Document includes original Lease and Amendment No. 1)
[649] DPRA Document No. 00017856. Amendment No. 1 to Lease Contract No. 14-16-0003-13630 and Ram Fiber Glass, Incorporated, dated June 1, 1972.
[650] DPRA Document No. 00003891. CONWR, Letter to Ram Fiber-Glass, Inc. regarding cancellation notice for nonpayment of rent, dated June 27, 1973; and CRO 000502. Cancellation of Lease Contract No. 14-16-0003-13,630, Ram Fiber Glass, Incorporated, dated June 21, 1973.
[651] Original IOP Plan No.6544-101.11, dated February 28, 1942 with later notations added by Refuge personnel. The notations recorded some information about leases, building uses, and buildings that were removed or destroyed.
[652] DPRA Document No. 00013537. CONWR, 1975, List of lessee building numbers, names, and telephone numbers.

photograph the foundation is still visible, but storage is not apparent. In the 1993 photograph, the site appears to be vegetated, but the outline of the foundation is still visible.[653]

Building IN-6-5

Lessee	Dates	Building Use
National Distributing Company	At least 1951 to 1952[654]	Unknown
Norge (later Magic Chef, 1979; later Maytag, 1986)	1964[655]	Warehousing washers and dryers[656]
Southern Illinois Woodworking	1964[657] through 1966[658]	Specifics not known
Egyptian Woodcrafts, piano manufacturer[659]	6 months in 1966[660]	Specifics not known
Vern, Inc. (lease included a boiler house)	1967 through 1968[661]	Planned manufacture mobile homes; however, according to the USFWS they never began manufacturing.[662]
B & J Distributing	1973 through 1975.[663]	Unknown
National Tape Corporation (lease included a boiler house, location unknown)[664]	1968 through 1973[665,666,]	Manufacturing pressure sensitive tape[667]

[653] 1993 aerial photographs from the U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service, Aerial Photography Field Office, Salt Lake City, Utah.
[654] DPRA Document No. 00009039. Crab Orchard National Wildlife Refuge, Lease Data, Industrial Unit, June 1, 1951, Page 12.
[655] ACC 000065. Listing of Area 7 leasing information as obtained from leases.
[656] ACO 002105. CONWR, Industrial Committee Report, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, August 1978 (Appendix J).
[657] DPRA Document No. 00017763. Amendment No. 1 to Lease Contact No. 14-16-0003-6238, Southern Illinois Woodworking Company, dated August 27, 1964. (Document includes original Lease and Amendment No. 2)
[658] CRO 000585. Cancellation of Lease No. 14-16-0003-6238, dated January 31, 1966.
[659] CRO 000093. U. S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Narrative Report, 1966, Page 49.
[660] DPRA Document No. 00018058. Lease Contract No. 14-16-0003-12330 by and between U. S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife and Egyptian Woodcrafts Incorporated, dated June 24, 1966, Page 1.
[661] CRO 000621. Lease Contract No. 14-16-0003-12497 by and between U. S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife and Vern, Incorporated, dated April 1, 1967, Page 1.
[662] CRO 000111. U. S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Narrative Report, 1968, Page 59.
[663] CRO 000300. Lease Contract No. 14-16-0003-13,949 by and between U. S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife and B & J Distributing Company, July 1973, Page 1.
[664] Former employees of Technical Tape Corporation formed National Tape Corporation. Source: CRO 000111. U. S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Narrative Report, 1968, Page 59.
[665] FWM 001042. Lease Contract No. 14-16-0003-<<*illegible*>> by and between U. S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife and National Tape Corporation, dated April 30, 1968, Page 1.
[666] National Tape Corporation went bankrupt late in 1971 so they are assumed to have left these buildings in 1971, not in 1973 as the lease information states. Sources: CRO 000131. U. S. Department of the Interior, Bureau of

Lessee	Dates	Building Use
Ram Fiber Glass (foundation only)	1972 through 1973[668,669]	Warehouse for storage of plastics (fabricated or molded products)[670]
Martell Truck Body & Boat Manufacturing	1976[671] through 1981[672]	Mine car rebuilding[673]
Castel Properties	1982[674] through 1992[675]	Manufacturing.[676]
Primex Technologies, Inc./GDO&TS	1997[677] through the present (2001) [678]	Cold storage of inert materials and surplus equipment[679]

National Tape Corporation

According to lease information, National Tape Corporation leased Buildings IN-6-5, IN-6-6 and a Boiler House (location unknown) from 1968 through 1973.[680] However, National Tape

Sport Fisheries and Wildlife, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Narrative Report, 1971, Page 63; and CRO 000550. USFWS, Memorandum to Field Solicitor in Twin Cities, Minnesota regarding the cancellation of two lease contracts, dated February 1, 1972.

[667] CRO 000111. U. S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Narrative Report, 1968, Page 59.

[668] DPRA Document No. 00017847. Lease Contract No. 14-16-0003-13,630 by and between U. S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife and Ram Fiber Glass, Incorporated, February 17, 1972, Page 1.

[669] DPRA Document No. 00003891. CONWR, Letter to Ram Fiber-Glass, Inc. regarding cancellation notice for nonpayment of rent, dated June 27, 1973; and CRO 000502. Cancellation of Lease Contract No. 14-16-0003-13,630, Ram Fiber Glass, Incorporated, dated June 21, 1973.

[670] DPRA Document No. 00017860. Aetna Insurance Company, Special Multi-Peril Policy, Policy Number MP 48 58 61, General Schedule – Section H, dated March 24, 1972; and DPRA Document No. 00017862. Aetna Insurance Company, Change Endorsement, dated April 25, 1972.

[671] CRO 001340. Lease Contract No. 14-16-0003-<<*illegible*>> by and between U. S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife and Martell Truck Body and Boat Manufacturing, December 9, 1975, Page 1.

[672] ACC 000065. Listing of Area 7 leasing information as obtained from leases.

[673] ACO 002105. CONWR, Industrial Committee Report, Table of Industrial Tenants, Crab Orchard National Wildlife Refuge, August 1978 (Appendix J).

[674] FWM 000875 – FWM 000876. Building Lease Contract No. 14-16-0003-82-533 by and between U. S. Fish and Wildlife Service and Castel Properties, Ltd., dated April 1, 1982, Pages 1-2.

[675] DPRA Document No. 00016084. U. S. Department of the Interior, Fish and Wildlife Service, National Wildlife Refuge System, Crab Orchard National Wildlife Refuge, Cartersville, Illinois, Annual Narrative Report, Calendar Year 1992, Page 57. Castel Properties lease was terminated due to non-payment, failure to provide copy of required insurance and failure to maintain buildings properly.

[676] FWM 000876. Building Lease Contract No. 14-16-0003-82-533 by and between U. S. Fish and Wildlife Service and Castel Properties, Ltd., dated April 1, 1982, Page 2

[677] DPRA Document No. 00007524. Building and Igloo Lease Contract No. 14-16-0003-96-579 by and between U. S. Fish and Wildlife Service and Primex Technologies, Inc., January 1, 1997, Pages 1 and 6.

[678] Industrial Tenant Roster – March 2001, Crab Orchard National Wildlife Refuge, Section 1, Table 1-3 of this report.

[679] DPRA Document No. 00017640. "Environmental Site Closure Assessment" section of Amendment No. 9 to Building and Igloo Lease Contract No. 14-16-0003-96-579, Primex Technologies, Inc., amendment effective December 1, 1999, Environmental Site Closure Assessment dated December 3, 1993.

[680] FWM 001042. Lease Contract No. 14-16-0003-<<*illegible*>> by and between U. S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife and National Tape Corporation, dated April 30, 1968, Page 1.

Corporation went bankrupt late in 1971[681,682] so it is assumed they left these buildings in 1971. They reportedly used these buildings for manufacturing pressure sensitive tape.[683] Former employees of Technical Tape Corporation formed National Tape Corporation.[684]

Building IN-6-6

Lessee	Dates	Building Use
National Distributing Company	At least 1951 through 1952[685]	Unknown
Southern Illinois Woodworking	1964[686] through 1966[687]	Specifics not known
Vern, Inc. (lease included a boiler house)	1967 through 1968[688]	Planned manufacture of mobile homes; however, according to the USFWS they never began manufacturing.[689]
B & J Distributing	1973 through 1975.[690]	Unknown
National Tape Corporation (lease included a boiler house, location unknown)[691]	1968 to 1971 or sometime before 1971 (building burned before 1971)[692,693,]	Manufacturing pressure sensitive tape[694]

[681] CRO 000131. U. S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Narrative Report, 1971, Page 63.
[682] CRO 000550. USFWS, Memorandum to Field Solicitor in Twin Cities, Minnesota regarding the cancellation of two lease contracts, dated February 1, 1972.
[683] CRO 000111. U. S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Narrative Report, 1968, Page 59.
[684] CRO 000111. U. S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Narrative Report, 1968, Page 59.
[685] DPRA Document No. 00009039. Crab Orchard National Wildlife Refuge, Lease Data, Industrial Unit, June 1, 1951, Page 12.
[686] DPRA Document No. 00017763. Amendment No. 1 to Lease Contact No. 14-16-0003-6238, Southern Illinois Woodworking Company, dated August 27, 1964. (Document includes original Lease and Amendment No. 2)
[687] CRO 000585. Cancellation of Lease No. 14-16-0003-6238, dated January 31, 1966.
[688] CRO 000621. Lease Contract No. 14-16-0003-12497 by and between U. S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife and Vern, Incorporated, dated April 1, 1967, Page 1.
[689] CRO 000111. U. S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Narrative Report, 1968, Page 59.
[690] CRO 000300. Lease Contract No. 14-16-0003-13,949 by and between U. S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife and B & J Distributing Company, July 1973, Page 1.
[691] Former employees of Technical Tape Corporation formed National Tape Corporation. Source: CRO 000111. U. S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Narrative Report, 1968, Page 59.
[692] FWM 001042. Lease Contract No. 14-16-0003-<<*illegible*>> by and between U. S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife and National Tape Corporation, dated April 30, 1968, Page 1.
[693] National Tape Corporation went bankrupt late in 1971 so they are assumed to have left these buildings in 1971, not in 1973 as the lease information states. Sources: CRO 000131. U. S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Narrative Report, 1971, Page 63; and CRO 000550. USFWS, Memorandum to Field Solicitor in Twin Cities, Minnesota regarding the cancellation of two lease contracts, dated February 1, 1972.

Lessee	Dates	Building Use
Olin (foundation only)	1972 through January 1973	Storage[695]

This building was destroyed by fire in 1969[696,697] and it was not rebuilt.

Building IN-6-7

Lessee	Dates	Building Use
Crab Orchard Field and Trial Club (foundation only) [698]	1948 through at least 1969.[699,700,701]	Foundation was used for dog kennels, also a small support structure was built.[702]

Building IN-6-7 was moved to Area 12 in 1946.[703,704]

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.*"[705] This manual was to be used as a guide to develop a facility-specific plan for the decontamination of buildings, grounds and equipment.[706] 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 Area 7 was used by the IOP as a storage area, it may not have required decontamination, unlike load lines and other production areas. Post-World War II military

[694] CRO 000111. U. S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Narrative Report, 1968, Page 59.
[695] CRO 001519. Special Use Permit No. SUP-32-72, dated January 17, 1972.
[696] Original IOP Plan No.6544-101.11, dated February 28, 1942 with later notations added by Refuge personnel. The notations recorded some information about leases, building uses, and buildings that were removed or destroyed.
[697] DPRA Document No. 00013537. CONWR, 1975, List of lessee building numbers, names, and telephone numbers.
[698] DPRA Document No. 00006432. CONWR, List identifying areas, company Names, Lease/Permit, and Expiration Date for Businesses located at Crab Orchard National Wildlife Refuge.
[699] DPRA Document No. 00008035. Special Use Permit No. 49-596, dated April 27, 1949.
[700] DPRA Document No. 00008020. Crab Orchard Field Trial Club, Letter to Fish and Wildlife Service requesting a their Special Use Permit be renewed for a ten year period, dated August 25, 1959.
[701] DPRA Document No. 00008090. Special Use Permit No. 30739, dated September 11, 1959.
[702] DPRA Document No. 00007982. Amendment to Special Use Permit No. 49-610, dated April 24, 1953.
[703] U.S. Army Corps of Engineers, 1947, War Department Facilities Inventory Supplement No. 2 of the Illinois Ordnance Plant – Carbondale, Illinois, Part 1, Section 7, Page 1.
[704] 1951 aerial photograph from the National Archives and Records Administration, College Park, Maryland. (same photograph as used by Entech).
[705] ACO 005047 - ACO 005109. Office of Field Director of Ammunition Plants, Shut-Down and Decontamination Procedures for F.D.A.P. Facilities.
[706] ACO 004979 – ACO 004980. CONWR Former IOP Uncharacterized Sites Report, Pages 5 and 6.

records are inadequate to determine if this area was decontaminated and, if so, whether it was adequately decontaminated, and if decontamination instructions were followed.

Potential Land Disposal Cells

There were three "domed areas" southwest of the Area 7 warehouses that were identified in the 1951 aerial photograph as potential land disposal cells.[707,708] By 1960, the site was being cultivated and no indications of unusual attributes or activity were noted in aerial photographs.[709,710] Eventually the site became revegetated.[711,712]

11.1.3 Area 7 Previous Sampling Results

O'Brien & Gere Remedial Investigation, 1988

Two sites in or near Area 7 were investigated as part of the O'Brien & Gere Remedial Investigation (RI): Site 15 – the "Plating" Pond and Site 16 – Area 7 Industrial Site (Figure 11-3).

Site 15

Site 15 was remediated as part of the Metals Areas Operable Unit. It is actually just south of Area 7. Generally, remediated sites are not discussed in this report. However, Site 15 is discussed here because the source of the effluent that was discharged to the pond was probably a facility in Area 7. The name "Plating Pond" was based on hearsay and is probably inaccurate.

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[707] Entech, Inc., August 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 3-56. 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).

[708] Entech, Inc., August 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 II: Text, Page EE.

[709] Entech, Inc., August 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 3-56. 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).

[710] Entech, Inc., August 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 II: Text, Page EE.

[711] Entech, Inc., August 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 3-56. 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).

[712] Entech, Inc., August 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 II: Text, Page EE.

Site 15 was a pond (approximately 50ft by 30ft) located to the south of Area 7 that had an inlet pipe located on the north side of the pond. The origin of this pipe was not found, and the outlet portion was removed during remediation.

A sediment, a surface water (from pond), and a groundwater sample were collected from this site as part of the O'Brien & Gere RI. The results were compared with the PA screening values. Some results reported by O'Brien and Gere are not included here because they were determined to be not useable. Results reported here are estimated.[713] In the sediment sample (all sediment results are reported in dry weight), alpha endosulfan (811 micrograms per kilogram (ug/kg)) exceeded ECOTOX values. Arochlor 1260 (415 ug/kg) exceeded ECOTOX, Region IV Sediment Screening values, and Canadian Sediment Quality Guidelines (CSEQGs). Chromium (508 mg/kg) exceeded ECOTOX, Region IV Sediment Screening values, and CSEQGs. In the groundwater sample 15-3, chromium (15 micrograms per Liter (ug/L) exceeded Canadian Water Quality Guidelines (CWQGs) and New Dutchlist Groundwater Optimum Levels (DGOLs). PCBs were detected in groundwater.

Site 16

Nineteen samples were collected at Site 16 (Area 7 Industrial Park) during the O'Brien & Gere RI: five composite surface water samples, five composite sediment samples and nine composite soil samples. Some results reported by O'Brien and Gere are not included here because they were determined to be not useable. Results reported here are estimated.[714]

Next to Buildings IN-5-2 and IN-5-3, composite soil samples 16-15 and 16-16 were collected for chemical analysis (all soil and sediment results are in dry weight except where noted). The following constituents exceeded PA screening levels: Methylene chloride (30 ug/kg wet weight), and alpha-BHC (336 ug/kg) were detected above United States Environmental Protection Agency (USEPA) Soil Screening Levels (SSLs). Arochlor 1254 (280 ug/kg wet weight) was detected above DSOLs.

Next to Building IN-4-4, composite soil samples 16-11 and 16-12 were collected for chemical analysis. Antimony (22 mg/kg) exceeded Refuge background values,[715] USEPA SSLs, and CSOQGs.

Next to Building IN-3-5, composite soil samples 16-13 and 16-14 were collected for chemical analysis. The following compounds exceeded preliminary screening levels: Alpha-BHC (122

[713] DPRA Document No. 00018887. Letter from Richard Boice to Dick Ruelle of USFWS regarding Crab Orchard Lake RI/FS, dated February 18, 1987. The letter reports that the data for the following constituents are not useable: 2-butanone, vinyl acetate, 4-methyl-2-pentanone, aniline, bis(2-chloro-isopropyl)ether, 4-chloroaniline, 2-nitro-sodiphenylamine, benzidine, di-n-octyl-phthalate, benzo(a)pyrene, indeno(1,2,3-c,d)pyrene, dibenz(a,h)anthracene, cyanide, Ag, As, Be, Cd, Cu, Ni, Pb, Se, Zn, and Hg.

[714] DPRA Document No. 00018887. Letter from Richard Boice to Dick Ruelle of USFWS regarding Crab Orchard Lake RI/FS, dated February 18, 1987. The letter reports that the data for the following constituents are not useable: 2-butanone, vinyl acetate, 4-methyl-2-pentanone, aniline, bis(2-chloro-isopropyl)ether, 4-chloroaniline, 2-nitro-sodiphenylamine, benzidine, di-n-octyl-phthalate, benzo(a)pyrene, indeno(1,2,3-c,d)pyrene, dibenz(a,h)anthracene, cyanide, Ag, As, Be, Cd, Cu, Ni, Pb, Se, Zn, and Hg.

[715] See Table 2-6 of this report for Refuge background soil values used for the PA.

ug/kg) exceeded USEPA SSLs. Arochlor 1254 (2,552 ug/kg) exceeded USEPA SSLs, CSOQGs and DSOLs. Antimony (5.1 mg/kg) exceeded USEPA SSLs and Refuge background values.[716]

Next to Building IN-3-4, composite soil samples 16-9 and 16-10 were collected for chemical analysis. The following compounds exceeded preliminary screening levels: Arochlor 1254 (263 ug/kg)[717] exceeded DSOLs.

The remaining composite sediment and surface water samples (16-1 through 16-8) were collected from the north-flowing drainage ditch that runs through the center of the site. Samples (16-18 and 16-19) were collected from this same drainage ditch, only downstream of Area 7 (outside boundaries of Area 7). Carbon tetrachloride (66 ug/L), chloroform (77 ug/L) and trichloroethene (TCE) (1 ug/L) were detected in the surface water in this drainage ditch (within the boundaries of Area 7), but all were detected below PA screening criteria. No compounds were detected above preliminary screening levels in the surface water in this drainage ditch within the boundaries of Area 7. Anthracene (256 ug/kg wet weight) was detected in the sediment above Region IV Sediment Screening Values and above CSEQGs. Chrysene (453 ug/kg wet weight) was detected in the sediment above Region IV Sediment Screening Values and CSEQGs. Pyrene (356 ug/kg wet weight) was detected in the sediment above Region IV Sediment Screening Values, above Illinois Environmental Protection Agency (IEPA) Sediment Cleanup Objectives, and above CSEQGs. Alpha endosulfan (Endosulfan I) (137 ug/kg) was detected in the sediment above ECOTOX values. Antimony (20 mg/kg) was detected in sediment above ECOTOX values, Region IV Sediment Screening Values, and CSEQGs.

Site 16 was later addressed further as part of the Miscellaneous Areas Operable Unit (MISCA OU) RI.

Woodward Clyde Consultants,1996

Site 16 was included in the 1996 MISCA OU RI.[718] In the Phase I investigation, two composite/discrete soil sample pairs, plus a duplicate pair, were collected from the same drainageway in the center of the site that was sampled during the 1988 RI (O'Brien & Gere) and from near the same area around Building IN-3-4 that was sampled during the 1988 RI. The discrete samples were collected from depths of 1.8 and 1.9 ft below ground surface (bgs) and analyzed for the CERCLA TCL VOCs. The composite samples were taken from depths of about 0.5 to 0.8 ft bgs and analyzed for the CERCLA TAL inorganics and TCL organics (except VOCs), and explosives. Some of the results, along with some of the results from the 1988 RI, are shown in Figure 11-4. Aroclor 1254 (130 ug/kg) and Aroclor 1260 (61 ug/kg) were detected above the preliminary levels of concern (PLCs) established for the 1996 RI. Cadmium (4.2 mg/kg) was also detected above its PLC.[719] Phase II sampling in the same area resulted in no detections of PCBs or cadmium. However, 2-butanone (570J ug/kg), ethylbenzene (1,200J

[716] See Table 2-6 of this report for Refuge background soil values used for the PA.
[717] Duplicate sample.
[718] Woodward-Clyde Consultants, 1996, Remedial Investigation Report—Miscellaneous Areas Operable Unit, Crab Orchard National Wildlife Refuge, Marion, Illinois.
[719] Woodward-Clyde Consultants, 1996, Remedial Investigation Report—Miscellaneous Areas Operable Unit, Crab Orchard National Wildlife Refuge, Marion, Illinois, Pages 5-12 and 5-13.

ug/kg), methylene chloride (9J ug/kg), and total xylenes (13,000 ug/kg) were detected. All detections were below preliminary levels of concern (PLCs)[720].

11.1.4 Observations During Site Visit

At the time of the site visit in the spring of 1999, there were several areas of dead and/or stressed vegetation noted. These areas were located along the east sides of Buildings IN-1-2, IN-4-3, IN-4-5, IN-4-6 and IN-6-5. There were also aboveground fuel storage tanks noted next to Building IN-5-6, and staining was observed on the ground beneath the tank. There were three transformers located just to the northwest of Building IN-2-5.

Many buildings showed modifications presumably made by industrial tenants.

11.1.5 Recommendations Based on Preliminary Assessment

Based on the past industrial usage of this site and the fact that many parts of the sites were not addressed by previous investigations, AUS-0A07 was included in the SI.

11.2 SITE INVESTIGATION INFORMATION

URS conducted a Site Investigation at AUS-0A07 from May 10 through May 11, 2000. The rationale for sample locations, media, and analytes is presented in the Field Sampling Plan (FSP)[721] for the AUS OU PA/SI. Since the time the FSP was prepared, additional information has become available, and the historic discussion (Section 11.1) 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 11-5 and 11-6. Survey coordinates for all sample locations in Area 7 are listed in Table 11-2. Table 11-3 lists the sample locations and the matrix sampled at that location. All of the samples collected from Area 7 were soil samples.

11.2.1 Field Investigation

Sampling was done in accordance with the FSP, except as noted. The field investigation is summarized in this section, following the same order of description of site features as Section 11.1.2 of this report.

Building IN-1-1

Staining was observed during the site reconnaissance on the concrete loading dock that is located on the north side of Building IN-1-1. Sample 0A07-027 was collected from the soil next to the stained portion of the loading dock. Sample 0A07-028 was located to the northeast of Building IN-1-1, next to the concrete loading dock.

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[720] Woodward-Clyde Consultants, 1996, Remedial Investigation Report—Miscellaneous Areas Operable Unit, Crab Orchard National Wildlife Refuge, Marion, Illinois, Pages 5-47 and Figure 5-9.

[721] 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.

Building IN-1-2

Sample 0A07-026 was collected from an area of dead vegetation observed along the eastern edge and near the southeast corner of this building.

Building IN-1-3

Sample 0A07-025 was located to the northwest of this building in the drainageway that flows northward through the center of Area 7. This drainageway likely receives runoff from the area surrounding Building IN-1-3, as well as from other buildings in this area.

Building IN-1-4

During the site reconnaissance an aboveground storage tank with staining on the ground next to it was observed northeast of Building IN-1-4. Sample 0A07-006 was collected next to this AST.

Buildings IN-1-5 and IN-1-6

Great Lakes T&T stored pesticides in these buildings. Five samples were collected north of these two buildings. Sample 0A07-001 was collected from a low spot to the west of the railroad loading dock of Building IN-1-6. Sample 0A07-002 was collected next to the loading dock, north of Building IN-1-6 and sample 0A07-003 was collected just northeast of this building, in the drainage ditch that flows eastward behind this building. Sample 0A07-004 was collected from an area of black-stained soil west of Building IN-1-5, and sample 0A07-005 was collected from north of Building IN-1-5, next to the loading dock. All of these samples were analyzed for pesticides only.

Building IN-2-1

Hospital and Physicians Service, Inc. may have printed medical manuals in this building so there is the potential for solvent and metals contamination related to ink/solvent spillage or dumping in the areas surrounding this building. Two samples (0A07-011 and 0A07-014) were collected from the east-flowing drainage ditch that just south of Building IN-2-1. It is likely that this drainage ditch would have received runoff from the areas surrounding this building.

Building IN-2-5 and IN-2-6

Midwest Woodworking & Fixture, Central Fixtures Manufacturing Company, and Cubicon Corporation leased Buildings IN-2-5 and IN-2-6 for the manufacture and retail of fixtures for stores (i.e. wall displays and shelves). One sample (0A07-012) was collected south of Building IN-2-5, near an overhead door. Sample 0A07-007 was located next to three old transformers that were observed to the northwest of Building IN-2-5 during the site reconnaissance. The transformers appeared to be in poor condition. The oils in the transformers may contain PCBs.

Three samples (0A07-008, 0A07-009 and 0A07-010) were collected next to Building IN-2-6. Sample 0A07-008 was collected on the west side of the building. Sample 0A07-009 was next to a discharge pipe that appears to receive drainage from the floor drain in a flammable materials

storage vault. Cleaning fluids may have been discharged through this floor drain. Sample 0A07-010 was located next to an exhaust fan that may vent a paint booth from inside this building.

Building IN-3-4

This building was used by the IOP as a workshop, by Radionics for manufacturing of radio components, and by Pennzoil for various oil-related activities (i.e. barrel washing operations and oil products distribution). Refuge reports note that there were oil spots previously observed outside the former Pennzoil buildings. There was a sump observed on the west side of Building IN-3-4. Sample 0A07-013 was collected on the north side of the sump and analyzed for organics and PCBs.

Building IN-4-1

Sample 0A07-015 was located in a drainage ditch southeast of Building IN-4-1. This drainage ditch appears to have received drainage mostly from Building IN-4-1, but also from Buildings IN-5-1, and IN-4-2; and also Building IN-5-2 therefore, it may have received runoff from former Olin and Wilkie (Helical Bit Co. and R.A. Wilkie Machine and Plating Co.) operations.

Buildings IN-4-2 and IN-4-3

Sample 0A07-023 was collected from an area of stressed vegetation between these two buildings. There were electrical insulators also observed in this area of stressed vegetation.

Sample 0A07-015 was located in a drainage ditch to the southeast of Building IN-4-1. This drainage ditch appears to have received runoff mostly from Building IN-4-1, but also from Buildings IN-5-1, IN-5-2 and IN-4-2.

Building IN-4-5

There is potential for contamination near this building as a result of Oxford Electric (possible PCBs), Ram Fiber Glass (possible manufacture of fiber glass products), Dolan Machinery Co. (rebuilding mining equipment), Turco Manufacturing (toy manufacturing), and Olin (unknown). Sample 0A07-018 was located in an area of stressed vegetation along the east side of Building IN-4-5. Sample 0A07-017 was located in a drainage ditch to the southwest of Building IN-4-5, which received drainage from the areas surrounding this building and Building IN-4-6.

Building IN-4-6

Sample 0A07-016 is located in an area of stressed vegetation along the east side of Building IN-4-6.

Building IN-5-1

Sample 0A07-015 was located in a drainage ditch to the southeast of Building IN-4-1. This drainage ditch appears to have received runoff mostly from Building IN-4-1, but also from Buildings IN-5-1, IN-5-2 and IN-4-2.

Building IN-5-2

Sample 0A07-015 was located in a drainage ditch southeast of Building IN-4-1. This drainage ditch appears to have received runoff mostly from Building IN-4-1, but also from Buildings IN-5-1, IN-5-2 and IN-4-2.

Building IN-5-3

Sample 0A07-022 was located in a drainage ditch northwest of former Building IN-5-3 (former Helical Bit Co. and R.A. Wilkie Machine and Plating Co. operations). During previous investigations, both metals and PCBs were found in this ditch.

Building IN-5-6

There were fuel ASTs with ground staining nearby observed to the north of Building IN-5-6, and sample 0A07-019 was collected next to these tanks.

Building IN-6-5

Sample 0A07-021 was located in an area of stressed vegetation along the east side of Building IN-6-5, and Sample 0A07-020 was on the south side of this building to detect potential contamination related to spillage or dumping of materials.

Main Drainageway

Samples 0A07-022 and 0A07-024 were located in the main drainageway that flows north through the center of Area 7. Sample 0A07-024 was located just downstream of Building IN-3-3 and Building IN-3-4. It is likely that this portion of the drainage ditch receives runoff from all of the buildings south of and including the third row of warehouses. Sample 0A07-022 was located just downstream of Building IN-5-4 and former Building IN-5-3. It is likely that this portion of the drainage ditch received runoff from all of the buildings south of and including the fifth row of warehouses.

Potential Land Disposal Cells

There were two potential land disposal cells identified southeast of the Area 7 warehouses, by Entech, Inc. during the historical aerial photograph review. Because there is no present-day evidence of these features, they were located using coordinates that were obtained from the historical aerial photographs.[722] Samples 0A07-029 and 0A07-030 were collected from these two locations.

[722] 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 disposal cells.

All samples were collected in accordance with the tables in the Field Sampling Plan except that planned groundwater samples AUS-0A07-029-GW-00 and AUS-0A07-030-GW-00 were not taken because groundwater was not encountered during excavation at those locations.

11.2.2 Field Results

11.2.2.1 Site Conditions

11.2.2.1.1 Geologic Conditions

One groundwater monitoring well was installed in Area 7 during O'Brien & Gere's RI, however significant geologic information from this well was not found in the report.

No monitoring wells were installed in Area 7 during the PA/SI. The available geologic information for Area 7 was obtained through test pits. Test pit logs are included in Appendix A. Two test pits were excavated west of the main portion of Area 7 (Figure 11-5). At both locations the upper two to three ft of soil was described as topsoil and fill. Beneath the fill in both test pits the soil was described as clayey silt and silty clay loess that continued to the bottom of the both test pits-- 11.5 ft below ground surface (bgs) at Location 0A07-030; and 12.0 ft bgs at Location 0A07-029.

11.2.2.1.2 Hydrogeologic Conditions

One groundwater monitoring well was installed in Area 7 during O'Brien & Gere's RI, which indicated a groundwater elevation of 428.12 ft mean sea level (msl) in June 1987.[723]

No monitoring wells were installed during the PA/SI. No water was encountered during excavation of the pits. The deepest test pit was excavated to 12.0 ft bgs (0A07-029).

11.2.2.1.3 Hydrologic Conditions

There is a north-flowing drainage ditch in roughly the middle of the site, which flows toward Crab Orchard Lake. The north-flowing ditch collects drainage from smaller east-west flowing ditches within Area 7. Several drainage ditches flow east including one that begins near IN-2-1, and one that collects drainage from near buildings IN-4-2, IN-6-2, IN-4-1, and IN-5-1, see Figure 11-5. In the western portion of the site, there is drainage ditch between Buildings IN-4-6 and IN-4-5 that flows east from Building IN-4-5, then south between the two buildings, and finally turns to flow east.

There are no permanent water bodies on site.

11.2.2.2 Chemical Results

Table 11-4 lists the chemicals detected in AUS-0A07 during this investigation, along with the frequency and range of detections. Tabulated results of all analyses are included in the QCSR.

[723] O'Brien & Gere. 1988. Remedial Investigation Report – Crab Orchard National Wildlife Refuge, Volume I, Final Report, Figure 34-4.

Sample results are presented in figures as follows:

- Figure 11-5 -- organic results for soil, and
- Figure 11-6 -- inorganic results for soil.

11.3 SCREENING RISK ASSESSMENT

Results of the screening are presented in Tables 11-5 and 11-6 as follows:

- Table 11-5--human health risk screening for soils
- Table 11-6--ecological risk screening for soils.

Each table lists the maximum detected concentration for each constituent analyzed at AUS-0A07. 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 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 11-5 and 11-6 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 11-7 (human health risk) and 11-8 (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 11-7) and COPECs (Table 11-8) are shaded in the tables.

11.3.1 Human Health Risk

11.3.1.1 Soil

Human health screening results for soil samples are presented in Table 11-5. 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 x 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 (DAF=1), the Illinois 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.

11.3.2 Ecological Risk

11.3.2.1 Soil

Ecological screening results for soil samples are presented in Table 11-6. Soil screening concentrations for direct exposures were developed using toxicity reference values (TRVs) derived from several sources, including the following:

- USEPA (2000)[724]
- Environment Canada (1995)[725]
- Talmage *et al.* (1999)[726]
- Efroymson *et al.* (1997a, 1997b)[727]
- CCME (1999)[728]
- MHSPE (1994)[729]
- 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*

[724] USEPA. 2000. Ecological Soil Screening Level Guidance (Draft). USEPA Office of Emergency and Remedial Response, Washington, DC.

[725] 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.

[726] 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.

[727] Efroymson, 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.

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.

[728] Canadian Council of Ministers of the Environment. 1999. Canadian Environmental Quality Guidelines.

[729] 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.

Surface Waters (USEPA 1991)[730] 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.

11.4 SCIENTIFIC MANAGEMENT DECISION POINT

An RI is recommended for Site AUS-0A07, 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 11-7; and on the COPEC list, Table 11-8. COPCs in this category include antimony, chromium, and selenium in soil. COPECs coded with "D" on Table 11-8 include boron, chromium, manganese, mercury, 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 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 11-9.

Note that a number of the human heath COPCs exceed migration to groundwater screening criteria. Other areas of the site, 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. The discussion of past usage included in this section should be carefully reviewed during work plan development, since this information was updated after the field investigation, and all potential release areas at this site may not have been investigated in the SI.

Site AUS-0021, the IOP fire station located just south of Area 7, has been recommended for inclusion in Site AUS-0A07. It is recommended that the site designation AUS-0021 be dropped, and that location be included in Site AUS-0A07 only to address the TCE detection in the soil at Site AUS-0021. A groundwater monitoring well is recommended at the location of Site AUS-0021 as part of the RI for Area 7.

[730] USEPA 1991. Assessment and Control of Bioconcentratable Contaminants in Surface Waters (Draft). US Environmental Protection Agency Office of Research and Development, Washington, D.C.

TABLE 11-1
-- NOT USED --

TABLE 11-2
SURVEY COORDINATES FOR SAMPLE LOCATIONS IN AUS-0A07

Sample Location	Northing	Easting	Ground Surface Elevation	Top of Casing Elevation	Comments
0A07-001	371128.2	793045.8	424.83	NA	
0A07-002	371134.6	793120.2	425.20	NA	
0A07-003	371159.4	793268.5	423.38	NA	
0A07-004	371127.6	793355.0	425.02	NA	
0A07-005	371155.8	793471.0	423.24	NA	
0A07-006	371182.8	793869.6	420.84	NA	
0A07-007	370996.7	793330.5	428.66	NA	
0A07-008	370938.4	793063.5	426.30	NA	
0A07-009	370893.5	793127.0	425.27	NA	
0A07-010	370895.4	793167.6	425.23	NA	
0A07-011	370992.7	794949.9	421.98	NA	
0A07-012	370932.9	793562.2	424.89	NA	
0A07-013	370814.7	793688.2	431.89	NA	
0A07-014	371005.4	795087.5	420.84	NA	
0A07-015	370678.9	795074.8	423.23	NA	
0A07-016	370629.3	793300.5	429.12	NA	
0A07-017	370594.5	793402.1	429.24	NA	
0A07-018	370650.8	793608.4	432.77	NA	
0A07-019	370492.2	793205.9	431.10	NA	
0A07-020	370286.2	793570.8	431.00	NA	
0A07-021	370335.0	793631.6	434.70	NA	
0A07-022	370616.6	794117.0	423.51	NA	
0A07-023	370668.4	794490.6	427.52	NA	
0A07-024	370926.1	794116.3	420.28	NA	
0A07-025	371218.8	794033.1	417.09	NA	
0A07-026	371167.4	794710.7	423.83	NA	
0A07-027	371240.6	794844.5	422.61	NA	
0A07-028	371273.3	795011.8	420.64	NA	
0A07-029	369918.9	793032.0	434.66	NA	
0A07-030	370038.1	793027.5	434.29	NA	

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NA = Not Applicable

TABLE 11-3
MATRICES SAMPLED AT EACH
SAMPLE LOCATION AT AUS-0A07

Soil
AUS-0A07-001
AUS-0A07-002
AUS-0A07-003
AUS-0A07-004
AUS-0A07-005
AUS-0A07-006
AUS-0A07-007
AUS-0A07-008*
AUS-0A07-009
AUS-0A07-010
AUS-0A07-011*
AUS-0A07-012
AUS-0A07-013
AUS-0A07-014*
AUS-0A07-015*
AUS-0A07-016
AUS-0A07-017*
AUS-0A07-018
AUS-0A07-019
AUS-0A07-020
AUS-0A07-021
AUS-0A07-022*
AUS-0A07-023
AUS-0A07-024*
AUS-0A07-025*
AUS-0A07-026
AUS-0A07-027
AUS-0A07-028
AUS-0A07-029
AUS-0A07-030

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

TABLE 11-4
SOIL SAMPLE ANALYTICAL RESULTS SUMMARY

Constituent	Number of Detections	Range of Detections
Volatile Organic Compounds		
Cis-1,2-Dichloroethylene	1/26	2 ug/kg
Total 1,2-Dichloroethene	1/26	2 ug/kg
Methylene Chloride	1/26	5 ug/kg
Trichloroethylene (TCE)	21/26	3 ug/kg to 25 ug/kg
Semivolatile Organic Compounds		
2-Methylnaphthalene	3/23	89 ug/kg to 430 ug/kg
Acenaphthylene	3/23	81 ug/kg to 530 ug/kg
Anthracene	4/23	66 ug/kg to 290 ug/kg
Benzo(a)Anthracene	7/23	47 ug/kg to 1,300 ug/kg
Benzo(a)Pyrene	7/23	48 ug/kg to 2,400 ug/kg
Benzo(b)Fluoranthene	8/23	57 ug/kg to 3,200 ug/kg
Benzo(g,h,i)Perylene	5/23	130 ug/kg to 1,900 ug/kg
Benzo(k)Fluoranthene	8/23	51 ug/kg to 2,800 ug/kg
Bis(2-ethylhexyl) Phthalate	6/23	48 ug/kg to 10,000 ug/kg
Carbazole	3/23	63 ug/kg to 130 ug/kg
Chrysene	9/23	47 ug/kg to 2,100 ug/kg
Dibenz(a,h)Anthracene	4/23	95 ug/kg to 550 ug/kg
Dibenzofuran	3/23	52 ug/kg to 590 ug/kg
Dimethyl Phthalate	1/23	170 ug/kg
Di-n-Butyl Phthalate	2/23	64 ug/kg to 130 ug/kg
Di-n-Octylphthalate	4/23	51 ug/kg to 3,900 ug/kg
Fluoranthene	9/23	43 ug/kg to 1,200 ug/kg
Fluorene	1/23	51 ug/kg
Indeno(1,2,3-c,d)Pyrene	4/23	240 ug/kg to 1,200 ug/kg
Naphthalene	2/23	240 ug/kg to 280 ug/kg
Phenanthrene	5/23	220 ug/kg to 430 ug/kg
Pyrene	9/23	51 ug/kg to 2,400 ug/kg
Pesticides		
4,4'-DDD	6/11	1.7 ug/kg to 1,400 ug/kg
4,4'-DDE	6/11	5.4 ug/kg to 290 ug/kg
4,4'-DDT	6/11	1ug/kg to 630 ug/kg
Aldrin	9/11	8.7 ug/kg to 520,000 ug/kg
Alpha Endosulfan	4/11	0.62 ug/kg to 12 ug/kg
Alpha-Chlordane	5/11	0.66 ug/kg to 78 ug/kg
Beta BHC (Beta Hexachlorocyclohexane)	2/11	1.3 ug/kg to 8.4 ug/kg
Beta Endosulfan	1/11	18 ug/kg
Dieldrin	10/11	24 ug/kg to 290,000 ug/kg
Endosulfan Sulfate	1/11	7.7 ug/kg
Endrin	7/11	7.1 ug/kg to 1,100 ug/kg
Endrin Aldehyde	3/11	1.7 ug/kg to 26 ug/kg
Endrin Ketone	9/11	1.9 ug/kg to 840 ug/kg
Gamma BHC (Lindane)	5/11	0.59 ug/kg to 5.6 ug/kg

TABLE 11-4
SOIL SAMPLE ANALYTICAL RESULTS SUMMARY

Constituent	Number of Detections	Range of Detections
Gamma-Chlordane	7/11	0.73 ug/kg to 310 ug/kg
Heptachlor	5/11	4 ug/kg to 69 ug/kg
Heptachlor Epoxide	6/11	0.72 ug/kg to 11 ug/kg
Hexachlorobenzene	5/11	4.4 ug/kg to 150 ug/kg
Isodrin	9/11	0.9 ug/kg to 60,000 ug/kg
Methoxychlor	1/11	26 ug/kg
PCBs		
PCB (total)	1/11	140 ug/kg
PCB-1260 (Arochlor 1260)	1/11	140 ug/kg
Metals		
Aluminum	18/18	2,600 mg/kg to 19,500 mg/kg
Antimony	4/18	0.27 mg/kg to 0.45 mg/kg
Arsenic	18/18	3.9 mg/kg to 16.9 mg/kg
Barium	18/18	23 mg/kg to 311 mg/kg
Beryllium	13/18	0.48 mg/kg to 1.9 mg/kg
Boron	15/18	0.64 mg/kg to 4.4 mg/kg
Cadmium	2/18	0.68 mg/kg to 9 mg/kg
Calcium	18/18	1,470 mg/kg to 201,000 mg/kg
Chromium, Total	18/18	4.8 mg/kg to 24 mg/kg
Cobalt	18/18	2.6 mg/kg to 12.6 mg/kg
Copper	18/18	5.2 mg/kg to 22.6 mg/kg
Iron	18/18	5,950 mg/kg to 28,800 mg/kg
Lead	18/18	7.8 mg/kg to 64.8 mg/kg
Magnesium	18/18	1,840 mg/kg to 52,300 mg/kg
Manganese	18/18	178 mg/kg to 971 mg/kg
Mercury	13/18	0.011 mg/k to 0.033 mg/kg
Nickel	18/18	6.8 mg/kg to 42.2 mg/kg
Potassium	18/18	287 mg/kg to 1,420 mg/kg
Selenium	5/18	0.33 mg/kg to 0.62 mg/kg
Sodium	16/18	56.3 mg/kg to 350 mg/kg
Thallium	2/18	0.5 mg/kg to 0.9 mg/kg
Vanadium	18/18	8.8 mg/kg to 45.3 mg/kg
Zinc	18/18	24.4 mg/kg to 89.1 mg/kg
Other Inorganics		
Total Organic Carbon	1/2	5,980 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: ARE 5/25/01

TABLE 11-5
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AREA 7 (AUS-0A07)

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)
Volatile Organic Compounds								
71-55-6	1,1,1-Trichloroethane	7	U	UG/KG			2.10E-06	7.00E-02
79-34-5	1,1,2,2-Tetrachloroethane	7	U	UG/KG		7.79E-09	1.79E-06	3.50E+01
79-00-5	1,1,2-Trichloroethane	7	U	UG/KG		3.68E-09	4.60E-05	7.78E+00
75-34-3	1,1-Dichloroethane	7	U	UG/KG			3.40E-06	7.00E-03
75-35-4	1,1-Dichloroethene	7	U	UG/KG		5.90E-08	1.04E-04	2.33E+00
107-06-2	1,2-Dichloroethane (EDC)	7	U	UG/KG		9.15E-09	1.99E-04	7.00E+00
540-59-0	1,2-Dichloroethene (total)	2	J	UG/KG			1.36E-05	1.00E-01
78-87-5	1,2-Dichloropropane	7	U	UG/KG		9.12E-09	3.29E-04	7.00E+00
78-93-3	2-Butanone (MEK)	14	U	UG/KG			5.05E-07	
591-78-6	2-Hexanone	14	U	UG/KG				
108-10-1	4-Methyl-2-pentanone (MIBK)	14	U	UG/KG			4.85E-06	
67-64-1	Acetone	14	U	UG/KG			2.25E-06	1.75E-02
71-43-2	Benzene	7	U	UG/KG		4.78E-09	2.89E-04	3.50E+00
75-27-4	Bromodichloromethane	7	U	UG/KG		2.97E-09	6.71E-06	2.33E-01
75-25-2	Bromoform	7	U	UG/KG		2.24E-11	3.97E-07	1.75E-01
74-83-9	Bromomethane	7	U	UG/KG			5.33E-04	7.00E-01
75-15-0	Carbon disulfide	7	U	UG/KG			5.79E-06	3.50E-03
56-23-5	Carbon tetrachloride	7	U	UG/KG		1.32E-08	1.00E-03	2.33E+00
108-90-7	Chlorobenzene	7	U	UG/KG			1.29E-05	1.00E-01
75-00-3	Chloroethane	7	U	UG/KG		1.08E-09	3.71E-07	
67-66-3	Chloroform	7	U	UG/KG		1.34E-08	5.43E-03	2.33E-01
74-87-3	Chloromethane	7	U	UG/KG		2.63E-09		
156-59-2	cis-1,2-Dichloroethene	2	J	UG/KG			1.36E-05	1.00E-01

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10061-01-5	cis-1,3-Dichloropropene	7	U	UG/KG		3.94E-08	1.59E-04	
124-48-1	Dibromochloromethane	7	U	UG/KG		2.64E-09	4.40E-06	3.50E-01
100-41-4	Ethylbenzene	7	U	UG/KG			1.17E-06	1.00E-02
75-09-2	Methylene chloride	5		UG/KG		2.44E-10	5.11E-07	5.00E+00
110-54-3	N-Hexane	7	U	UG/KG			1.73E-05	
100-42-5	Styrene	7	U	UG/KG			3.42E-07	3.50E-02
127-18-4	Tetrachloroethylene (PCE)	7	U	UG/KG		3.75E-10	4.11E-06	2.33E+00
108-88-3	Toluene	7	U	UG/KG			3.52E-06	1.17E-02
1330-20-7	total Xylenes	7	U	UG/KG			1.57E-06	7.00E-04
156-60-5	trans-1,2-Dichloroethene	7	U	UG/KG			3.27E-05	2.33E-01
10061-02-6	trans-1,3-Dichloropropene	7	U	UG/KG		3.94E-08	1.59E-04	
79-01-6	Trichloroethylene (TCE)	25		UG/KG		4.09E-09	3.16E-04	8.33E+00
75-01-4	Vinyl chloride	7	U	UG/KG		1.44E-07		1.00E+01
Semivolatile Organic Compounds								
120-82-1	1,2,4-Trichlorobenzene	480	UJ	UG/KG			6.30E-05	1.60E+00
95-50-1	1,2-Dichlorobenzene	480	UJ	UG/KG			1.45E-04	5.33E-01
541-73-1	1,3-Dichlorobenzene	480	UJ	UG/KG			9.27E-03	
106-46-7	1,4-Dichlorobenzene	480	UJ	UG/KG		5.91E-08	2.50E-04	4.80E+00
95-95-4	2,4,5-Trichlorophenol	2400	UJ	UG/KG			2.72E-05	2.40E-01
88-06-2	2,4,6-Trichlorophenol	480	UJ	UG/KG		2.14E-09		6.00E+01
120-83-2	2,4-Dichlorophenol	480	UJ	UG/KG			1.82E-04	9.60E+00
105-67-9	2,4-Dimethylphenol	480	UJ	UG/KG			2.72E-05	1.20E+00
51-28-5	2,4-Dinitrophenol	2400	UJ	UG/KG			1.36E-03	2.40E+02
91-58-7	2-Chloronaphthalene	480	UJ	UG/KG			1.76E-05	

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TABLE 11-5
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AREA 7 (AUS-0A07)

ADDITIONAL AND UNCHARACTERIZED SITES OU
CRAB ORCHARD NATIONAL WILDLIFE REFUGE

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95-57-8	2-Chlorophenol	480	UJ	UG/KG			1.99E-03	2.40E+00
91-57-6	2-Methylnaphthalene	430		UG/KG			7.93E-06	2.15E-03
95-48-7	2-Methylphenol	480	UJ	UG/KG			1.09E-05	6.00E-01
88-74-4	2-Nitroaniline	2400	UJ	UG/KG			4.77E-02	
88-75-5	2-Nitrophenol	480	UJ	UG/KG			6.81E-05	
91-94-1	3,3'-Dichlorobenzidine	480	UJ	UG/KG		8.76E-08		1.60E+03
99-09-2	3-Nitroaniline	2400	UJ	UG/KG			4.77E-02	
534-52-1	4,6-Dinitro-2-methylphenol	2400	UJ	UG/KG				
101-55-3	4-Bromophenyl phenyl ether	480	UJ	UG/KG				
59-50-7	4-Chloro-3-methylphenol	480	UJ	UG/KG			1.09E-05	
106-47-8	4-Chloroaniline	960	UJ	UG/KG			2.72E-04	3.20E+01
7005-72-3	4-Chlorophenyl phenyl ether	480	UJ	UG/KG				
106-44-5	4-Methylphenol	480	UJ	UG/KG			1.09E-04	
100-01-6	4-Nitroaniline	2400	UJ	UG/KG			4.77E-02	
100-02-7	4-Nitrophenol	2400	UJ	UG/KG			3.41E-04	
83-32-9	Acenaphthene	480	UJ	UG/KG			1.25E-05	1.60E-02
208-96-8	Acenaphthylene	530	J	UG/KG			9.77E-06	2.65E-03
120-12-7	Anthracene	290	J	UG/KG			7.44E-07	4.83E-04
56-55-3	Benzo(a)anthracene	1300	J	UG/KG		4.50E-07		1.63E+01
50-32-8	Benzo(a)pyrene	2400	J	UG/KG		8.31E-06		6.00E+00
205-99-2	Benzo(b)fluoranthene	3200	J	UG/KG		1.11E-06		1.60E+01
191-24-2	Benzo(g,h,i)perylene	1900	J	UG/KG			3.50E-05	9.50E-03
207-08-9	Benzo(k)fluoranthene	2800	J	UG/KG		9.70E-08		1.40E+00
111-91-1	bis(2-Chloroethoxy)methane	480	UJ	UG/KG				

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TABLE 11-5
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AREA 7 (AUS-0A07)

ADDITIONAL AND UNCHARACTERIZED SITES OU
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111-44-4	bis(2-Chloroethyl) ether	480	UJ	UG/KG		7.74E-07		2.40E+04
108-60-1	bis(2-Chloroisopropyl) ether	480	UJ	UG/KG		5.94E-08	1.13E-04	
117-81-7	bis(2-Ethylhexyl) phthalate (DEHP)	10000	J	UG/KG		5.68E-08	5.68E-04	
85-68-7	Butyl benzyl phthalate	480	UJ	UG/KG			2.72E-06	6.00E-04
86-74-8	Carbazole	130	J	UG/KG		1.05E-09		4.33E+00
218-01-9	Chrysene	2100	J	UG/KG		7.28E-09		2.63E-01
84-74-2	Di-n-butyl phthalate	130	J	UG/KG			1.48E-06	4.33E-04
117-84-0	Di-n-octyl phthalate	3900	J	UG/KG			2.21E-04	3.90E-04
53-70-3	Dibenz(a,h)anthracene	550	J	UG/KG		1.91E-06		6.88E+00
132-64-9	Dibenzofuran	590		UG/KG			1.17E-04	
84-66-2	Diethyl phthalate	480	UJ	UG/KG			6.81E-07	
131-11-3	Dimethyl phthalate	170	J	UG/KG			1.93E-08	
206-44-0	Fluoranthene	1200	J	UG/KG			3.99E-05	6.00E-03
86-73-7	Fluorene	51	J	UG/KG			1.54E-06	1.70E-03
118-74-1	Hexachlorobenzene	150	EJ	UG/KG		9.73E-08	2.13E-04	1.50E+00
87-68-3	Hexachlorobutadiene	480	UJ	UG/KG		1.52E-08	2.72E-03	4.80E+00
77-47-4	Hexachlorocyclopentadiene	480	UJ	UG/KG			8.14E-05	2.40E-02
67-72-1	Hexachloroethane	480	UJ	UG/KG		2.72E-09	5.45E-04	2.40E+01
193-39-5	Indeno(1,2,3-c,d)pyrene	1200	J	UG/KG		4.16E-07		1.71E+00
78-59-1	Isophorone	480	UJ	UG/KG		1.85E-10	2.72E-06	1.60E+01
621-64-7	N-Nitroso-di-n-propylamine	480	UJ	UG/KG		1.36E-06		2.40E+05
86-30-6	N-Nitrosodiphenylamine	480	UJ	UG/KG		9.54E-10		8.00E+00
91-20-3	Naphthalene	280	J	UG/KG			1.48E-03	7.00E-02
87-86-5	Pentachlorophenol	2400	UJ	UG/KG		2.16E-07	1.68E-04	2.40E+03

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85-01-8	Phenanthrene	430	J	UG/KG			7.93E-06	2.15E-03
108-95-2	Phenol	480	UJ	UG/KG			9.08E-07	9.60E-02
129-00-0	Pyrene	2400	J	UG/KG			4.43E-05	1.20E-02
Explosives								
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	480	UJ	UG/KG			2.72E-04	1.20E+04
606-20-2	2,6-Dinitrotoluene	480	UJ	UG/KG			5.45E-04	1.60E+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	
98-95-3	Nitrobenzene	480	UJ	UG/KG			4.19E-03	
121-82-4	RDX	620	UJ	UG/KG		2.76E-08	2.35E-04	
479-45-8	Tetryl	930	UJ	UG/KG			1.06E-04	
Metals								
7429-90-5	Aluminum	20200		MG/KG	7.01E-01		1.20E-02	
7440-36-0	Antimony	0.45	J	MG/KG	5.42E-01		5.50E-04	1.50E+00
7440-38-2	Arsenic	16.9		MG/KG	1.25E+00	6.20E-06	3.85E-02	1.69E-01
7440-39-3	Barium	311	J	MG/KG	1.59E+00		2.50E-03	3.89E-00
7440-41-7	Beryllium	1.9		MG/KG	2.50E+00	8.48E-10	5.14E-04	6.33E-01

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7440-42-8	Boron	4.4	J	MG/KG	8.30E-01		5.56E-05	
7440-43-9	Cadmium	9		MG/KG	4.74E+01	3.01E-09	1.11E-02	2.25E+01
7440-70-2	Calcium	201000		MG/KG	8.05E+01			
7440-47-3	Chromium	24		MG/KG	9.52E-01	5.35E-08		1.20E+01
7440-48-4	Cobalt	19.3	J	MG/KG	8.89E-01		1.57E-04	
7440-50-8	Copper	22.6		MG/KG	2.00E+00		2.98E-04	
7439-89-6	Iron	28800		MG/KG	1.49E+00		4.70E-02	
7439-92-1	Lead	64.8		MG/KG	2.77E+00			
7439-95-4	Magnesium	52300		MG/KG	3.37E+01			
7439-96-5	Manganese	990		MG/KG	2.72E-01		3.07E-02	
7439-97-6	Mercury	0.033	J	MG/KG	5.50E-01			
7440-02-0	Nickel	42.2		MG/KG	2.23E+00		1.03E-03	6.03E+00
2023695	Potassium	1420		MG/KG	2.27E+00			
7782-49-2	Selenium	0.65	J	MG/KG	2.78E-01		6.36E-05	2.17E+00
7440-22-4	Silver	2.2	U	MG/KG	3.79E+00		2.15E-04	1.10E+00
7440-23-5	Sodium	350		MG/KG	2.06E+00			
7440-28-0	Thallium	0.9	J	MG/KG	2.20E+00		6.29E-06	
7440-62-2	Vanadium	45.3		MG/KG	9.60E-01		3.17E-03	1.51E-01
7440-66-6	Zinc	89.1		MG/KG	1.73E+00		1.45E-04	1.49E-01
Pesticides (Organochlorine)								
72-54-8	4,4'-DDD	1400	J	UG/KG		8.20E-08		1.75E+00
72-55-9	4,4'-DDE	290	EJ	UG/KG		2.41E-08		9.67E-02
50-29-3	4,4'-DDT	630	EJ	UG/KG		5.23E-08	8.61E-04	3.15E-01
309-00-2	Aldrin	520000	J	UG/KG		3.58E-03	1.97E+01	8.67E-01

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319-84-6	alpha-BHC	0.51	UJ	UG/KG		8.58E-10		1.70E+01
5103-71-9	alpha-Chlordane	120	EJ	UG/KG		1.12E-08	1.80E-04	2.40E-01
959-98-8	alpha-Endosulfan	12	EJ	UG/KG			2.27E-06	
319-85-7	beta-BHC	8.4	EJ	UG/KG		4.04E-09		8.40E+01
33213-65-9	beta-Endosulfan	18	EJ	UG/KG			3.41E-06	
57-74-9	Chlordane	10	UJ	UG/KG		9.35E-10	1.50E-05	2.00E-02
319-86-8	delta-BHC	0.51	UJ	UG/KG		2.45E-10		
60-57-1	Dieldrin	290000	J	UG/KG		1.88E-03	6.58E+00	1.45E+06
1031-07-8	Endosulfan sulfate	44	EJ	UG/KG			8.32E-06	
72-20-8	Endrin	1100	EJ	UG/KG			4.16E-03	2.20E+01
7421-93-4	Endrin aldehyde	26	EJ	UG/KG			9.84E-05	5.20E-01
53494-70-5	Endrin Ketone	840	EJ	UG/KG			3.18E-03	1.68E+01
58-89-9	gamma-BHC (Lindane)	5.6	J	UG/KG		1.94E-09	1.40E-05	1.12E+01
5566-34-7	gamma-Chlordane	310	EJ	UG/KG		2.90E-08	4.64E-04	6.20E-01
76-44-8	Heptachlor	69	EJ	UG/KG		1.26E-07	1.57E-04	6.90E-02
1024-57-3	Heptachlor epoxide	11	EJ	UG/KG		4.06E-08	9.61E-04	3.67E-01
465-73-6	Isodrin	60000	J	UG/KG				
72-43-5	Methoxychlor	26	J	UG/KG			5.90E-06	3.25E-03
8001-35-2	Toxaphene	51	UJ	UG/KG		2.27E-08		2.55E-02
Polychlorinated Biphenyls (PCB)								
12674-11-2	PCB-1016	11	U	UG/KG		3.83E-10	2.19E-04	
11104-28-2	PCB-1221	22	U	UG/KG		2.19E-08		
11141-16-5	PCB-1232	11	U	UG/KG		1.09E-08		
53469-21-9	PCB-1242	11	U	UG/KG		1.09E-08		

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

TABLE 11-5
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AREA 7 (AUS-0A07)

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)
12672-29-6	PCB-1248	11	U	UG/KG		1.09E-08		
11097-69-1	PCB-1254	11	U	UG/KG		1.09E-08	7.66E-04	
11096-82-5	PCB-1260	140	J	UG/KG		1.39E-07		
Other Parameters								
TOC	TOC	5980		MG/KG	1.90E-01			

ND = Not Detected E = Outside of Range UJ = Estimated Nondetect
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TABLE 11-5
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AREA 7 (AUS-0A07)

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
Volatile Organic Compounds							
71-55-6	1,1,1-Trichloroethane	7	U	UG/KG			3.50E-03
79-34-5	1,1,2,2-Tetrachloroethane	7	U	UG/KG			
79-00-5	1,1,2-Trichloroethane	7	U	UG/KG	8.54E-07	8.54E-07	3.50E-01
75-34-3	1,1-Dichloroethane	7	U	UG/KG	3.50E-08	3.50E-08	3.04E-04
75-35-4	1,1-Dichloroethene	7	U	UG/KG	3.89E-07	3.89E-06	1.17E-01
107-06-2	1,2-Dichloroethane (EDC)	7	U	UG/KG	1.11E-04	5.00E-06	3.50E-01
540-59-0	1,2-Dichloroethene (total)	2	J	UG/KG	1.00E-07	1.00E-07	5.00E-03
78-87-5	1,2-Dichloropropane	7	U	UG/KG	8.33E-05	3.89E-06	2.33E-01
78-93-3	2-Butanone (MEK)	14	U	UG/KG			
591-78-6	2-Hexanone	14	U	UG/KG			
108-10-1	4-Methyl-2-pentanone (MIBK)	14	U	UG/KG			
67-64-1	Acetone	14	U	UG/KG	7.00E-08	7.00E-08	8.75E-04
71-43-2	Benzene	7	U	UG/KG	3.50E-05	1.63E-06	2.33E-01
75-27-4	Bromodichloromethane	7	U	UG/KG	7.61E-05	3.50E-06	1.17E-02
75-25-2	Bromoform	7	U	UG/KG	9.72E-06	4.38E-07	8.75E-03
74-83-9	Bromomethane	7	U	UG/KG	2.41E-06	7.00E-06	3.50E-02
75-15-0	Carbon disulfide	7	U	UG/KG	3.50E-08	3.50E-07	2.19E-04
56-23-5	Carbon tetrachloride	7	U	UG/KG	1.59E-04	1.71E-05	1.00E-01
108-90-7	Chlorobenzene	7	U	UG/KG	1.71E-07	1.71E-06	7.00E-03
75-00-3	Chloroethane	7	U	UG/KG			
67-66-3	Chloroform	7	U	UG/KG	7.45E-06	3.50E-06	1.17E-02
74-87-3	Chloromethane	7	U	UG/KG			
156-59-2	cis-1,2-Dichloroethene	2	J	UG/KG	1.00E-07	1.00E-07	5.00E-03

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J = Estimated U = Nondetect

TABLE 11-5
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AREA 7 (AUS-0A07)

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	7	U	UG/KG			
124-48-1	Dibromochloromethane	7	U	UG/KG	1.71E-07	1.71E-07	1.75E-02
100-41-4	Ethylbenzene	7	U	UG/KG	3.50E-08	3.50E-07	5.38E-04
75-09-2	Methylene chloride	5		UG/KG	6.58E-06	4.17E-07	2.50E-01
110-54-3	N-Hexane	7	U	UG/KG			
100-42-5	Styrene	7	U	UG/KG	1.71E-08	1.71E-07	1.75E-03
127-18-4	Tetrachloroethylene (PCE)	7	U	UG/KG	6.36E-05	2.92E-06	1.17E-01
108-88-3	Toluene	7	U	UG/KG	1.71E-08	1.71E-08	5.83E-04
1330-20-7	total Xylenes	7	U	UG/KG	7.00E-09	1.71E-08	4.67E-05
156-60-5	trans-1,2-Dichloroethene	7	U	UG/KG	1.71E-07	1.71E-07	1.00E-02
10061-02-6	trans-1,3-Dichloropropene	7	U	UG/KG			
79-01-6	Trichloroethylene (TCE)	25		UG/KG	4.81E-05	2.08E-05	4.17E-01
75-01-4	Vinyl chloride	7	U	UG/KG	2.33E-03	1.08E-04	7.00E-01
Semivolatile Organic Compounds							
120-82-1	1,2,4-Trichlorobenzene	480	UJ	UG/KG	2.40E-05	2.40E-04	9.60E-02
95-50-1	1,2-Dichlorobenzene	480	UJ	UG/KG	2.67E-06	2.67E-05	2.82E-02
541-73-1	1,3-Dichlorobenzene	480	UJ	UG/KG			
106-46-7	1,4-Dichlorobenzene	480	UJ	UG/KG			2.40E-01
95-95-4	2,4,5-Trichlorophenol	2400	UJ	UG/KG	1.20E-05	1.20E-05	8.89E-03
88-06-2	2,4,6-Trichlorophenol	480	UJ	UG/KG	9.23E-04	4.36E-05	2.40E+00
120-83-2	2,4-Dichlorophenol	480	UJ	UG/KG	7.87E-05	7.87E-04	4.80E-01
105-67-9	2,4-Dimethylphenol	480	UJ	UG/KG	1.17E-05	1.17E-05	5.33E-02
51-28-5	2,4-Dinitrophenol	2400	UJ	UG/KG	5.85E-04	5.85E-03	1.20E+01
91-58-7	2-Chloronaphthalene	480	UJ	UG/KG			

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J = Estimated U = Nondetect

TABLE 11-5
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AREA 7 (AUS-0A07)

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	480	UJ	UG/KG	4.80E-05	4.80E-05	1.20E-01
91-57-6	2-Methylnaphthalene	430		UG/KG	7.05E-06	7.05E-06	1.02E-04
95-48-7	2-Methylphenol	480	UJ	UG/KG	4.80E-06	4.80E-06	3.20E-02
88-74-4	2-Nitroaniline	2400	UJ	UG/KG			
88-75-5	2-Nitrophenol	480	UJ	UG/KG			
91-94-1	3,3'-Dichlorobenzidine	480	UJ	UG/KG	3.69E-02	1.71E-03	6.86E+01
99-09-2	3-Nitroaniline	2400	UJ	UG/KG			
534-52-1	4,6-Dinitro-2-methylphenol	2400	UJ	UG/KG			
101-55-3	4-Bromophenyl phenyl ether	480	UJ	UG/KG			
59-50-7	4-Chloro-3-methylphenol	480	UJ	UG/KG			
106-47-8	4-Chloroaniline	960	UJ	UG/KG	1.17E-04	1.17E-03	1.37E+00
7005-72-3	4-Chlorophenyl phenyl ether	480	UJ	UG/KG			
106-44-5	4-Methylphenol	480	UJ	UG/KG			
100-01-6	4-Nitroaniline	2400	UJ	UG/KG			
100-02-7	4-Nitrophenol	2400	UJ	UG/KG			
83-32-9	Acenaphthene	480	UJ	UG/KG	4.00E-06	4.00E-06	8.42E-04
208-96-8	Acenaphthylene	530	J	UG/KG	8.69E-06	8.69E-06	1.26E-04
120-12-7	Anthracene	290	J	UG/KG	4.75E-07	4.75E-07	2.42E-05
56-55-3	Benzo(a)anthracene	1300	J	UG/KG	1.63E-01	7.65E-03	6.50E-01
50-32-8	Benzo(a)pyrene	2400	J	UG/KG	3.00E+00	1.41E-01	3.00E-01
205-99-2	Benzo(b)fluoranthene	3200	J	UG/KG	4.00E-01	1.88E-02	6.40E-01
191-24-2	Benzo(g,h,i)perylene	1900	J	UG/KG	3.11E-05	3.11E-05	4.52E-04
207-08-9	Benzo(k)fluoranthene	2800	J	UG/KG	3.59E-02	1.65E-03	5.71E-02
111-91-1	bis(2-Chloroethoxy)methane	480	UJ	UG/KG			

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

TABLE 11-5
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AREA 7 (AUS-0A07)

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	480	UJ	UG/KG	9.60E-02	6.40E-03	1.20E+03
108-60-1	bis(2-Chloroisopropyl) ether	480	UJ	UG/KG			
117-81-7	bis(2-Ethylhexyl) phthalate (DEHP)	10000	J	UG/KG	2.44E-02	2.44E-03	2.78E-03
85-68-7	Butyl benzyl phthalate	480	UJ	UG/KG	1.17E-06	1.17E-06	5.16E-04
86-74-8	Carbazole	130	J	UG/KG	4.48E-04	2.10E-05	2.17E-01
218-01-9	Chrysene	2100	J	UG/KG	2.69E-03	1.24E-04	1.31E-02
84-74-2	Di-n-butyl phthalate	130	J	UG/KG	6.50E-07	6.50E-07	5.65E-05
117-84-0	Di-n-octyl phthalate	3900	J	UG/KG	9.51E-05	9.51E-04	3.90E-04
53-70-3	Dibenz(a,h)anthracene	550	J	UG/KG	6.88E-01	3.24E-02	2.75E-01
132-64-9	Dibenzofuran	590		UG/KG			
84-66-2	Diethyl phthalate	480	UJ	UG/KG	4.80E-07	4.80E-07	1.02E-03
131-11-3	Dimethyl phthalate	170	J	UG/KG			
206-44-0	Fluoranthene	1200	J	UG/KG	1.46E-05	1.46E-05	2.79E-04
86-73-7	Fluorene	51	J	UG/KG	6.22E-07	6.22E-07	9.11E-05
118-74-1	Hexachlorobenzene	150	EJ	UG/KG	3.75E-02	1.92E-03	7.50E-02
87-68-3	Hexachlorobutadiene	480	UJ	UG/KG			
77-47-4	Hexachlorocyclopentadiene	480	UJ	UG/KG	3.43E-05	3.43E-05	1.20E-03
67-72-1	Hexachloroethane	480	UJ	UG/KG	2.40E-04	2.40E-04	9.60E-01
193-39-5	Indeno(1,2,3-c,d)pyrene	1200	J	UG/KG	1.50E-01	7.06E-03	8.57E-02
78-59-1	Isophorone	480	UJ	UG/KG	1.17E-06	1.17E-06	6.00E-02
621-64-7	N-Nitroso-di-n-propylamine	480	UJ	UG/KG	6.00E-01	2.67E-02	9.60E+03
86-30-6	N-Nitrosodiphenylamine	480	UJ	UG/KG	4.00E-04	1.92E-05	4.80E-01
91-20-3	Naphthalene	280	J	UG/KG	3.41E-06	3.41E-05	3.33E-03
87-86-5	Pentachlorophenol	2400	UJ	UG/KG	1.00E-01	4.62E-03	8.00E+01

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TABLE 11-5
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AREA 7 (AUS-0A07)

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	430	J	UG/KG	7.05E-06	7.05E-06	1.02E-04
108-95-2	Phenol	480	UJ	UG/KG	4.80E-07	4.00E-06	4.80E-03
129-00-0	Pyrene	2400	J	UG/KG	3.93E-05	3.93E-05	5.71E-04
Explosives							
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	480	UJ	UG/KG	5.71E-02	2.67E-03	6.00E+02
606-20-2	2,6-Dinitrotoluene	480	UJ	UG/KG	5.71E-02	2.67E-03	6.86E+02
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			
98-95-3	Nitrobenzene	480	UJ	UG/KG	4.80E-04	4.80E-04	4.80E+00
121-82-4	RDX	620	UJ	UG/KG			
479-45-8	Tetryl	930	UJ	UG/KG			
Metals							
7429-90-5	Aluminum	20200		MG/KG			
7440-36-0	Antimony	0.45	J	MG/KG	5.49E-04	5.49E-03	9.00E-02
7440-38-2	Arsenic	16.9		MG/KG	5.63E+00	2.77E-01	6.04E-01
7440-39-3	Barium	311	J	MG/KG	2.22E-03	2.22E-02	2.59E-01
7440-41-7	Beryllium	1.9		MG/KG	1.90E+00	6.55E-02	2.88E-01

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TABLE 11-5
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AREA 7 (AUS-0A07)

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	4.4	J	MG/KG	2.44E-05	2.44E-04	
7440-43-9	Cadmium	9		MG/KG	4.50E-03	4.50E-02	2.43E+00
7440-70-2	Calcium	201000		MG/KG			
7440-47-3	Chromium	24		MG/KG	2.40E-03	5.85E-03	8.57E-01
7440-48-4	Cobalt	19.3	J	MG/KG	1.61E-04	1.61E-03	
7440-50-8	Copper	22.6		MG/KG	2.76E-04	2.76E-03	2.05E-03
7439-89-6	Iron	28800		MG/KG			
7439-92-1	Lead	64.8		MG/KG	1.62E-01	1.62E-01	
7439-95-4	Magnesium	52300		MG/KG			
7439-96-5	Manganese	990		MG/KG	1.03E-02	1.03E-01	
7439-97-6	Mercury	0.033	J	MG/KG	5.41E-05	5.41E-04	2.20E-01
7440-02-0	Nickel	42.2		MG/KG	1.03E-03	1.03E-02	5.55E-01
2023695	Potassium	1420		MG/KG			
7782-49-2	Selenium	0.65	J	MG/KG	6.50E-05	6.50E-04	2.71E-01
7440-22-4	Silver	2.2	U	MG/KG	2.20E-04	2.20E-03	1.47E+00
7440-23-5	Sodium	350		MG/KG			
7440-28-0	Thallium	0.9	J	MG/KG	5.63E-03	5.63E-03	3.75E-01
7440-62-2	Vanadium	45.3		MG/KG	3.24E-03	3.24E-02	4.62E-02
7440-66-6	Zinc	89.1		MG/KG	1.46E-04	1.46E-03	2.48E-02
Pesticides (Organochlorine)							
72-54-8	4,4'-DDD	1400	J	UG/KG	5.83E-02	2.69E-03	8.75E-02
72-55-9	4,4'-DDE	290	EJ	UG/KG	1.71E-02	7.84E-04	5.37E-03
50-29-3	4,4'-DDT	630	EJ	UG/KG	3.71E-02	6.30E-03	1.97E-02
309-00-2	Aldrin	520000	J	UG/KG	1.73E+03	8.52E+01	1.04E+03

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J = Estimated U = Nondetect

TABLE 11-5
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AREA 7 (AUS-0A07)

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
319-84-6	alpha-BHC	0.51	UJ	UG/KG	5.67E-04	2.55E-05	1.02E+00
5103-71-9	alpha-Chlordane	120	EJ	UG/KG	3.00E-02	1.00E-02	1.20E-02
959-98-8	alpha-Endosulfan	12	EJ	UG/KG			
319-85-7	beta-BHC	8.4	EJ	UG/KG			
33213-65-9	beta-Endosulfan	18	EJ	UG/KG			
57-74-9	Chlordane	10	UJ	UG/KG	2.50E-03	8.33E-04	8.33E-04
319-86-8	delta-BHC	0.51	UJ	UG/KG			
60-57-1	Dieldrin	290000	J	UG/KG	7.25E+02	3.72E+01	7.25E+04
1031-07-8	Endosulfan sulfate	44	EJ	UG/KG			2.44E-03
72-20-8	Endrin	1100	EJ	UG/KG	1.80E-03	1.80E-02	1.10E+00
7421-93-4	Endrin aldehyde	26	EJ	UG/KG	4.26E-05	4.26E-04	2.60E-02
53494-70-5	Endrin Ketone	840	EJ	UG/KG	1.38E-03	1.38E-02	8.40E-01
58-89-9	gamma-BHC (Lindane)	5.6	J	UG/KG	1.40E-03	5.83E-05	6.22E-01
5566-34-7	gamma-Chlordane	310	EJ	UG/KG	7.75E-02	2.58E-02	3.10E-02
76-44-8	Heptachlor	69	EJ	UG/KG	6.90E-02	2.46E-03	3.00E-03
1024-57-3	Heptachlor epoxide	11	EJ	UG/KG	1.83E-02	4.07E-03	1.57E-02
465-73-6	Isodrin	60000	J	UG/KG			
72-43-5	Methoxychlor	26	J	UG/KG	2.60E-06	2.60E-05	1.63E-04
8001-35-2	Toxaphene	51	UJ	UG/KG	9.81E-03	4.64E-04	1.65E-03
Polychlorinated Biphenyls (PCB)							
12674-11-2	PCB-1016	11	U	UG/KG			
11104-28-2	PCB-1221	22	U	UG/KG			
11141-16-5	PCB-1232	11	U	UG/KG			
53469-21-9	PCB-1242	11	U	UG/KG			

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

TABLE 11-5
HUMAN HEALTH SCREENING OF SOIL RESULTS FROM AREA 7 (AUS-0A07)

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
12672-29-6	PCB-1248	11	U	UG/KG			
11097-69-1	PCB-1254	11	U	UG/KG			
11096-82-5	PCB-1260	140	J	UG/KG			
Other Parameters							
TOC	TOC	5980		MG/KG			

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

TABLE 11-6
ECOLOGICAL SCREENING OF SOIL RESULTS FROM AREA 7 (AUS-0A07)

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
Volatile Organic Compounds							
71-55-6	1,1,1-Trichloroethane		7	U	UG/KG	2.35E-04	
79-34-5	1,1,2,2-Tetrachloroethane		7	U	UG/KG	5.50E-02	
79-00-5	1,1,2-Trichloroethane		7	U	UG/KG	2.45E-04	
75-34-3	1,1-Dichloroethane		7	U	UG/KG	3.48E-04	
75-35-4	1,1-Dichloroethene		7	U	UG/KG	8.45E-04	
107-06-2	1,2-Dichloroethane (EDC)		7	U	UG/KG	3.30E-04	
540-59-0	1,2-Dichloroethene (total)		2	J	UG/KG	2.54E-03	
78-87-5	1,2-Dichloropropane		7	U	UG/KG	1.00E-05	
78-93-3	2-Butanone (MEK)		14	U	UG/KG	1.56E-04	
591-78-6	2-Hexanone		14	U	UG/KG	1.11E-03	
108-10-1	4-Methyl-2-pentanone (MIBK)		14	U	UG/KG	3.16E-05	
67-64-1	Acetone		14	U	UG/KG	5.60E-03	
71-43-2	Benzene		7	U	UG/KG	4.38E-04	
75-27-4	Bromodichloromethane		7	U	UG/KG	1.30E-02	
75-25-2	Bromoform		7	U	UG/KG	4.40E-04	
74-83-9	Bromomethane		7	U	UG/KG	2.98E-02	
75-15-0	Carbon disulfide		7	U	UG/KG	7.44E-02	
56-23-5	Carbon tetrachloride		7	U	UG/KG	7.00E-06	
108-90-7	Chlorobenzene		7	U	UG/KG	1.75E-04	
75-00-3	Chloroethane		7	U	UG/KG		
67-66-3	Chloroform		7	U	UG/KG	5.88E-03	
74-87-3	Chloromethane		7	U	UG/KG	6.73E-04	
156-59-2	cis-1,2-Dichloroethene		2	J	UG/KG	2.54E-03	
10061-01-5	cis-1,3-Dichloropropene		7	U	UG/KG	1.76E-02	
124-48-1	Dibromochloromethane		7	U	UG/KG	3.41E-03	
100-41-4	Ethylbenzene		7	U	UG/KG	1.40E-03	
75-09-2	Methylene chloride		5		UG/KG	1.23E-03	
110-54-3	N-Hexane		7	U	UG/KG		
100-42-5	Styrene		7	U	UG/KG	2.33E-05	
127-18-4	Tetrachloroethylene (PCE)		7	U	UG/KG	5.38E-04	
108-88-3	Toluene		7	U	UG/KG	2.33E-03	
1330-20-7	total Xylenes		7	U	UG/KG	1.17E-02	
156-60-5	trans-1,2-Dichloroethene		7	U	UG/KG	8.89E-03	
10061-02-6	trans-1,3-Dichloropropene		7	U	UG/KG	1.76E-02	
79-01-6	Trichloroethylene (TCE)		25		UG/KG	2.78E-03	
75-01-4	Vinyl chloride		7	U	UG/KG	1.08E-02	
Semivolatile Organic Compounds							
120-82-1	1,2,4-Trichlorobenzene		480	UJ	UG/KG	2.40E-02	
95-50-1	1,2-Dichlorobenzene		480	UJ	UG/KG	1.62E-01	
541-73-1	1,3-Dichlorobenzene		480	UJ	UG/KG	1.27E-02	
106-46-7	1,4-Dichlorobenzene		480	UJ	UG/KG	2.40E-02	

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

TABLE 11-6
ECOLOGICAL SCREENING OF SOIL RESULTS FROM AREA 7 (AUS-0A07)

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	UJ	UG/KG	6.00E-01	
88-06-2	2,4,6-Trichlorophenol		480	UJ	UG/KG	4.80E-02	
120-83-2	2,4-Dichlorophenol		480	UJ	UG/KG	5.49E-03	
105-67-9	2,4-Dimethylphenol		480	UJ	UG/KG	4.80E+01	
51-28-5	2,4-Dinitrophenol		2400	UJ	UG/KG	1.20E-01	
91-58-7	2-Chloronaphthalene		480	UJ	UG/KG	3.94E+01	
95-57-8	2-Chlorophenol		480	UJ	UG/KG	1.98E+00	
91-57-6	2-Methylnaphthalene		430		UG/KG	1.33E-01	YES
95-48-7	2-Methylphenol		480	UJ	UG/KG	1.19E-02	
88-74-4	2-Nitroaniline		2400	UJ	UG/KG	3.24E-02	
88-75-5	2-Nitrophenol		480	UJ	UG/KG	3.00E-01	
91-94-1	3,3'-Dichlorobenzidine		480	UJ	UG/KG	7.43E-01	
99-09-2	3-Nitroaniline		2400	UJ	UG/KG	7.59E-01	
534-52-1	4,6-Dinitro-2-methylphenol		2400	UJ	UG/KG		
101-55-3	4-Bromophenyl phenyl ether		480	UJ	UG/KG		
59-50-7	4-Chloro-3-methylphenol		480	UJ	UG/KG	6.04E-02	
106-47-8	4-Chloroaniline		960	UJ	UG/KG	8.73E-01	
7005-72-3	4-Chlorophenyl phenyl ether		480	UJ	UG/KG		
106-44-5	4-Methylphenol		480	UJ	UG/KG	2.94E-03	
100-01-6	4-Nitroaniline		2400	UJ	UG/KG	1.10E-01	
100-02-7	4-Nitrophenol		2400	UJ	UG/KG	3.43E-01	
83-32-9	Acenaphthene		480	UJ	UG/KG	7.03E-04	
208-96-8	Acenaphthylene		530	J	UG/KG	7.77E-04	
120-12-7	Anthracene		290	J	UG/KG	1.96E-04	YES
56-55-3	Benzo(a)anthracene		1300	J	UG/KG	2.50E-01	YES
50-32-8	Benzo(a)pyrene		2400	J	UG/KG	5.45E-04	YES
205-99-2	Benzo(b)fluoranthene		3200	J	UG/KG	5.35E-02	YES
191-24-2	Benzo(g,h,i)perylene		1900	J	UG/KG	1.60E-02	YES
207-08-9	Benzo(k)fluoranthene		2800	J	UG/KG	4.68E-02	YES
111-91-1	bis(2-Chloroethoxy)methane		480	UJ	UG/KG	1.58E+00	
111-44-4	bis(2-Chloroethyl) ether		480	UJ	UG/KG	2.03E-02	
108-60-1	bis(2-Chloroisopropyl) ether		480	UJ	UG/KG		
117-81-7	bis(2-Ethylhexyl) phthalate (DEHP)		10000	J	UG/KG	1.08E+01	YES
85-68-7	Butyl benzyl phthalate		480	UJ	UG/KG	2.01E+00	
86-74-8	Carbazole		130	J	UG/KG		YES
218-01-9	Chrysene		2100	J	UG/KG	4.44E-01	YES
84-74-2	Di-n-butyl phthalate		130	J	UG/KG	6.50E-04	YES
117-84-0	Di-n-octyl phthalate		3900	J	UG/KG	5.50E-03	YES
53-70-3	Dibenz(a,h)anthracene		550	J	UG/KG	2.99E-02	YES
132-64-9	Dibenzofuran		590		UG/KG		YES
84-66-2	Diethyl phthalate		480	UJ	UG/KG	4.80E-03	
131-11-3	Dimethyl phthalate		170	J	UG/KG	8.50E-04	

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J = Estimated U = Nondetect

TABLE 11-6
ECOLOGICAL SCREENING OF SOIL RESULTS FROM AREA 7 (AUS-0A07)

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		1200	J	UG/KG	9.84E-03	YES
86-73-7	Fluorene		51	J	UG/KG	1.70E-03	YES
118-74-1	Hexachlorobenzene		150	EJ	UG/KG	1.50E-04	YES
87-68-3	Hexachlorobutadiene		480	UJ	UG/KG	1.21E+01	
77-47-4	Hexachlorocyclopentadiene		480	UJ	UG/KG	4.80E-02	
67-72-1	Hexachloroethane		480	UJ	UG/KG	8.05E-01	
193-39-5	Indeno(1,2,3-c,d)pyrene		1200	J	UG/KG	1.10E-02	YES
78-59-1	Isophorone		480	UJ	UG/KG	3.45E-03	
621-64-7	N-Nitroso-di-n-propylamine		480	UJ	UG/KG	8.83E-01	
86-30-6	N-Nitrosodiphenylamine		480	UJ	UG/KG	2.40E-02	
91-20-3	Naphthalene		280	J	UG/KG	1.12E-03	
87-86-5	Pentachlorophenol		2400	UJ	UG/KG	4.00E-01	
85-01-8	Phenanthrene		430	J	UG/KG	9.41E-03	YES
108-95-2	Phenol		480	UJ	UG/KG	1.20E-02	
129-00-0	Pyrene		2400	J	UG/KG	3.06E-02	YES
Explosives							
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		480	UJ	UG/KG	3.75E-01	
606-20-2	2,6-Dinitrotoluene		480	UJ	UG/KG	1.46E+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	
98-95-3	Nitrobenzene		480	UJ	UG/KG	1.20E-02	
121-82-4	RDX		620	UJ	UG/KG	6.20E-03	
479-45-8	Tetryl		930	UJ	UG/KG		
Metals							
7429-90-5	Aluminum	28800	20200		MG/KG		
7440-36-0	Antimony	0.83	0.45	J	MG/KG	9.00E-02	
7440-38-2	Arsenic	13.5	16.9		MG/KG	1.88E+00	
7440-39-3	Barium	195	311	J	MG/KG	6.22E-01	
7440-41-7	Beryllium	0.76	1.9		MG/KG	1.90E-01	
7440-42-8	Boron	5.3	4.4	J	MG/KG	8.80E+00	
7440-43-9	Cadmium	0.19	9		MG/KG	3.10E-01	
7440-70-2	Calcium	2497	201000		MG/KG		
7440-47-3	Chromium	25.2	24		MG/KG	4.80E+00	
7440-48-4	Cobalt	21.7	19.3	J	MG/KG	9.65E-01	
7440-50-8	Copper	11.3	22.6		MG/KG	7.29E-01	

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J = Estimated U = Nondetect

TABLE 11-6
ECOLOGICAL SCREENING OF SOIL RESULTS FROM AREA 7 (AUS-0A07)

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	28800		MG/KG	1.44E+02	
7439-92-1	Lead	23.4	64.8		MG/KG	1.50E-01	
7439-95-4	Magnesium	1552	52300		MG/KG		
7439-96-5	Manganese	3640	990		MG/KG	9.90E+00	
7439-97-6	Mercury	0.06	0.033	J	MG/KG	4.71E-03	YES
7440-02-0	Nickel	18.9	42.2		MG/KG	1.41E+00	
2023695	Potassium	625	1420		MG/KG		
7782-49-2	Selenium	2.34	0.65	J	MG/KG	6.50E-01	YES
7440-22-4	Silver	0.58	2.2	U	MG/KG	1.10E+00	
7440-23-5	Sodium	170	350		MG/KG		
7440-28-0	Thallium	0.41	0.9	J	MG/KG	9.00E-01	
7440-62-2	Vanadium	47.2	45.3		MG/KG	9.85E-01	
7440-66-6	Zinc	51.4	89.1		MG/KG	7.43E-01	
Pesticides (Organochlorine)							
72-54-8	4,4'-DDD		1400	J	UG/KG	1.85E+00	YES
72-55-9	4,4'-DDE		290	EJ	UG/KG	4.87E-01	YES
50-29-3	4,4'-DDT		630	EJ	UG/KG	3.60E+01	YES
309-00-2	Aldrin		520000	J	UG/KG	1.57E+05	YES
319-84-6	alpha-BHC		0.51	UJ	UG/KG	5.13E-03	
5103-71-9	alpha-Chlordane		120	EJ	UG/KG	5.36E-01	YES
959-98-8	alpha-Endosulfan		12	EJ	UG/KG	1.01E-01	
319-85-7	beta-BHC		8.4	EJ	UG/KG	2.11E+00	YES
33213-65-9	beta-Endosulfan		18	EJ	UG/KG	1.51E-01	
57-74-9	Chlordane		10	UJ	UG/KG	4.46E-02	
319-86-8	delta-BHC		0.51	UJ	UG/KG	5.13E-05	
60-57-1	Dieldrin		290000	J	UG/KG	1.22E+05	YES
1031-07-8	Endosulfan sulfate		44	EJ	UG/KG	1.23E+00	YES
72-20-8	Endrin		1100	EJ	UG/KG	1.09E+02	YES
7421-93-4	Endrin aldehyde		26	EJ	UG/KG	2.48E+00	YES
53494-70-5	Endrin Ketone		840	EJ	UG/KG		
58-89-9	gamma-BHC (Lindane)		5.6	J	UG/KG	1.12E+00	YES
5566-34-7	gamma-Chlordane		310	EJ	UG/KG	1.38E+00	YES
76-44-8	Heptachlor		69	EJ	UG/KG	1.15E+01	YES
1024-57-3	Heptachlor epoxide		11	EJ	UG/KG	7.24E-02	YES
465-73-6	Isodrin		60000	J	UG/KG	1.81E+04	
72-43-5	Methoxychlor		26	J	UG/KG	1.31E+00	YES
8001-35-2	Toxaphene		51	UJ	UG/KG	4.28E-01	
Polychlorinated Biphenyls (PCB)							
12674-11-2	PCB-1016		11	U	UG/KG		
11104-28-2	PCB-1221		22	U	UG/KG		
11141-16-5	PCB-1232		11	U	UG/KG		
53469-21-9	PCB-1242		11	U	UG/KG		

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

TABLE 11-6
ECOLOGICAL SCREENING OF SOIL RESULTS FROM AREA 7 (AUS-0A07)

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
12672-29-6	PCB-1248		11	U	UG/KG		
11097-69-1	PCB-1254		11	U	UG/KG		
11096-82-5	PCB-1260		140	J	UG/KG		YES
Other Parameters							
TOC	TOC	31393	5980		MG/KG		

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

TABLE 11-7, AUS-0A07
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
Volatile Organic Compounds								
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	F
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	F
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	Yes	E
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
Semivolatile Organic Compounds								
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 11-7, AUS-0A07
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	F
Di-n-octyl phthalate	NA	NA	NA	NA	NA	NA	No	F
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	F
Fluoranthene	NA	NA	NA	NA	NA	NA	No	F

TABLE 11-7, AUS-0A07
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	Yes	E
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
Metals and Inorganics								
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	E
Barium	NA	NA	NA	NA	NA	NA	Yes	E
Beryllium	NA	NA	NA	NA	NA	NA	Yes	E
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	E
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	Uncertainty	B
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
Explosives								
1,3,5-Trinitrobenzene	NA	NA	NA	NA	NA	NA	No	A
1,3-Dinitrobenzene	NA	NA	NA	NA	NA	NA	No	A

TABLE 11-7, AUS-0A07
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
Other Parameters								
Nitrogen, Nitrate-Nitrite	NA	NA	NA	NA	NA	NA	NA	NA
Phosphorus, Total (as P)	NA	NA	NA	NA	NA	NA	NA	NA
Pesticides (Organochlorine)								
4,4'-DDD	NA	NA	NA	NA	NA	NA	Yes	E
4,4'-DDE	NA	NA	NA	NA	NA	NA	No	F
4,4'-DDT	NA	NA	NA	NA	NA	NA	No	F
Aldrin	NA	NA	NA	NA	NA	NA	Yes	E
alpha-BHC	NA	NA	NA	NA	NA	NA	Uncertainty	B
alpha-Chlordane	NA	NA	NA	NA	NA	NA	No	F
alpha-Endosulfan	NA	NA	NA	NA	NA	NA	No	F
beta-BHC	NA	NA	NA	NA	NA	NA	Yes	E
beta-Endosulfan	NA	NA	NA	NA	NA	NA	No	F
Chlordane	NA	NA	NA	NA	NA	NA	No	A
delta-BHC	NA	NA	NA	NA	NA	NA	No	A
Dieldrin	NA	NA	NA	NA	NA	NA	Yes	E
Endosulfan sulfate	NA	NA	NA	NA	NA	NA	No	F
Endrin	NA	NA	NA	NA	NA	NA	Yes	E
Endrin aldehyde	NA	NA	NA	NA	NA	NA	No	F
Endrin Ketone	NA	NA	NA	NA	NA	NA	Yes	E
gamma-BHC (Lindane)	NA	NA	NA	NA	NA	NA	Yes	E
gamma-Chlordane	NA	NA	NA	NA	NA	NA	No	F
Heptachlor	NA	NA	NA	NA	NA	NA	No	F
Heptachlor epoxide	NA	NA	NA	NA	NA	NA	No	F
Isodrin	NA	NA	NA	NA	NA	NA	Uncertainty	G
Methoxychlor	NA	NA	NA	NA	NA	NA	No	F
4,4'-DDD	NA	NA	NA	NA	NA	NA	No	A

TABLE 11-7, AUS-0A07
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
Polychlorinated Biphenyls (PCB)								
PCB-1016	NA	NA	NA	NA	NA	NA	No	A
PCB-1221	NA	NA	NA	NA	NA	NA	No	A
PCB-1232	NA	NA	NA	NA	NA	NA	No	A
PCB-1242	NA	NA	NA	NA	NA	NA	No	A
PCB-1248	NA	NA	NA	NA	NA	NA	No	A
PCB-1254	NA	NA	NA	NA	NA	NA	No	A
PCB-1260	NA	NA	NA	NA	NA	NA	No	F

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 exceeeded 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 11-8, AUS-0A07
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
Volatile Organic Compounds						
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	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	F
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	F
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
Semivolatile Organic Compounds						
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 11-8, AUS-0A07
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	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	Yes	E
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	F
Fluoranthene	NA	NA	NA	NA	Yes	E

TABLE 11-8, AUS-0A07
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	Yes	E
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
Metals and Inorganics						
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	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	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	Yes	E
Potassium	NA	NA	NA	NA	Uncertainty	G,H
Selenium	NA	NA	NA	NA	Yes	D
Silver	NA	NA	NA	NA	Uncertainty	B
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
Explosives						
1,3,5-Trinitrobenzene	NA	NA	NA	NA	No	A
1,3-Dinitrobenzene	NA	NA	NA	NA	No	A

TABLE 11-8, AUS-0A07
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
Pesticides (Organochlorine)						
4,4'-DDD	NA	NA	NA	NA	Yes	E
4,4'-DDE	NA	NA	NA	NA	Yes	E
4,4'-DDT	NA	NA	NA	NA	Yes	E
Aldrin	NA	NA	NA	NA	Yes	E
alpha-BHC	NA	NA	NA	NA	No	A
alpha-Chlordane	NA	NA	NA	NA	Yes	E
alpha-Endosulfan	NA	NA	NA	NA	No	F
beta-BHC	NA	NA	NA	NA	Yes	E
beta-Endosulfan	NA	NA	NA	NA	No	F
Chlordane	NA	NA	NA	NA	No	A
delta-BHC	NA	NA	NA	NA	No	A
Dieldrin	NA	NA	NA	NA	Yes	E
Endosulfan sulfate	NA	NA	NA	NA	Yes	E
Endrin	NA	NA	NA	NA	Yes	E
Endrin aldehyde	NA	NA	NA	NA	Yes	E
Endrin Ketone	NA	NA	NA	NA	Uncertainty	G
gamma-BHC (Lindane)	NA	NA	NA	NA	Yes	E
gamma-Chlordane	NA	NA	NA	NA	Yes	E
Heptachlor	NA	NA	NA	NA	Yes	E
Heptachlor epoxide	NA	NA	NA	NA	Yes	E
Isodrin	NA	NA	NA	NA	Yes	E
Methoxychlor	NA	NA	NA	NA	Yes	E
Toxaphene	NA	NA	NA	NA	No	A
Polychlorinated Biphenyls (PCB)						
PCB-1016	NA	NA	NA	NA	No	C
PCB-1221	NA	NA	NA	NA	No	C
PCB-1232	NA	NA	NA	NA	No	C

TABLE 11-8, AUS-0A07
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
PCB-1242	NA	NA	NA	NA	No	C
PCB-1248	NA	NA	NA	NA	No	C
PCB-1254	NA	NA	NA	NA	No	C
PCB-1260	NA	NA	NA	NA	Yes	E

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 11-9
AUS-0A07 - INERT STORAGE AREA
CHEMICALS DETECTED ABOVE SCREENING CRITERIA AND ABOVE REFUGE BACKGROUND (WHERE APPLICABLE)

ADDITIONAL AND UNCHARACTERIZED SITES OU SI

Chemical	Drum[1]	Soil	Sediment	Ground Water	Surface Water
VOCs					
Methylene chloride		H	NA	NA	NA
Trichloroethylene (TCE)		H	NA	NA	NA
SVOCs					
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		E	NA	NA	NA
Carbazole		H,E	NA	NA	NA
Chrysene		E	NA	NA	NA
Di-n-butyl phthalate		E	NA	NA	NA
Di-n-octyl phthalate		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
Hexachlorobenzene		H,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
Metals					
Arsenic		H,E	NA	NA	NA
Barium		H	NA	NA	NA
Beryllium		H	NA	NA	NA
Cadmium		H	NA	NA	NA
Iron		E	NA	NA	NA
Nickel		H,E	NA	NA	NA
Pesticides (Organochlorine)					
4,4'-DDD		H,E	NA	NA	NA
4,4'-DDE		E	NA	NA	NA
4,4'-DDT		E	NA	NA	NA
Aldrin		H,E	NA	NA	NA
alpha-Chlordane		E	NA	NA	NA
beta-BHC		H,E	NA	NA	NA
Dieldrin		H,E	NA	NA	NA
Endosulfan sulfate		E	NA	NA	NA
Endrin		H,E	NA	NA	NA
Endrin aldehyde		E	NA	NA	NA
Endrin Ketone		H	NA	NA	NA

TABLE 11-9
AUS-0A07 - INERT STORAGE AREA
CHEMICALS DETECTED ABOVE SCREENING CRITERIA AND ABOVE REFUGE BACKGROUND (WHERE APPLICABLE)

ADDITIONAL AND UNCHARACTERIZED SITES OU SI

Chemical	Drum[1]	Soil	Sediment	Ground Water	Surface Water
gamma-BHC (Lindane)		**H,E**	NA	NA	NA
gamma-Chlordane		**E**	NA	NA	NA
Heptachlor		**E**	NA	NA	NA
Heptachlor epoxide		**E**	NA	NA	NA
Isodrin		**E**	NA	NA	NA
Methoxychlor		**E**	NA	NA	NA
Polychlorinated Biphenyls (PCB)					
PCB-1260		**E**	NA	NA	NA

Key:

[1] Drums were not present at this site.

NA = not analyzed

H = human health screening criteria exceeded

E = ecological screening criteria exceeded

SOURCE: USGS DIGITAL RASTER GRAPHIC

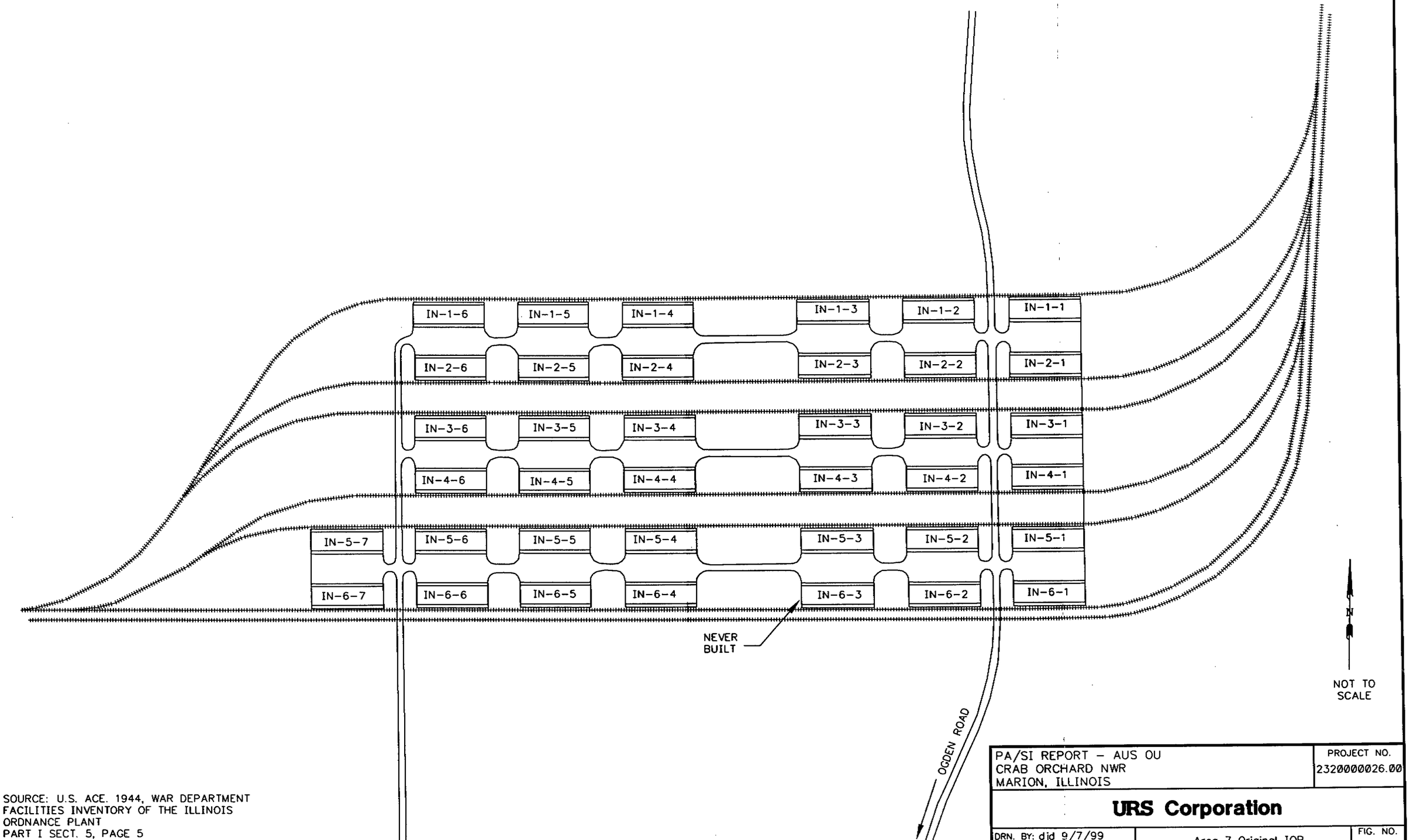
N

0 2000

SCALE FEET

PA/SI REPORT–AUS OU CRAB ORCHARD NWR MARION, ILLINOIS		PROJECT NO. 2320000026.00
URS		
DRN. BY: djd 8/25/99 DSGN. BY: mch CHKD. BY: mch	Area 7 Site Location Map	FIG. NO. 11–1

File: F:\45FOM9602N\FIG 11-1.DWG Last edited: JUL 16, 01 @ 11:37 a.m. URS Corp.



SOURCE: U.S. ACE. 1944, WAR DEPARTMENT
FACILITIES INVENTORY OF THE ILLINOIS
ORDNANCE PLANT
PART I SECT. 5, PAGE 5
(PLAN NO. 6544-101.11)

PA/SI REPORT - AUS OU CRAB ORCHARD NWR MARION, ILLINOIS	PROJECT NO. 2320000026.00
URS Corporation	
DRN. BY: djd 9/7/99 DSGN. BY: mh CHKD. BY: cmw	Area 7 Original IOP Configuration — FIG. NO. 11-2

File: E:\2320000026.00\PA-SI REPORT-AUS OU\CRABFIG11-2LS.DWG Last edited: 06/29/01 @ 10:46 a.m. @ WCC-ST.LOUIS

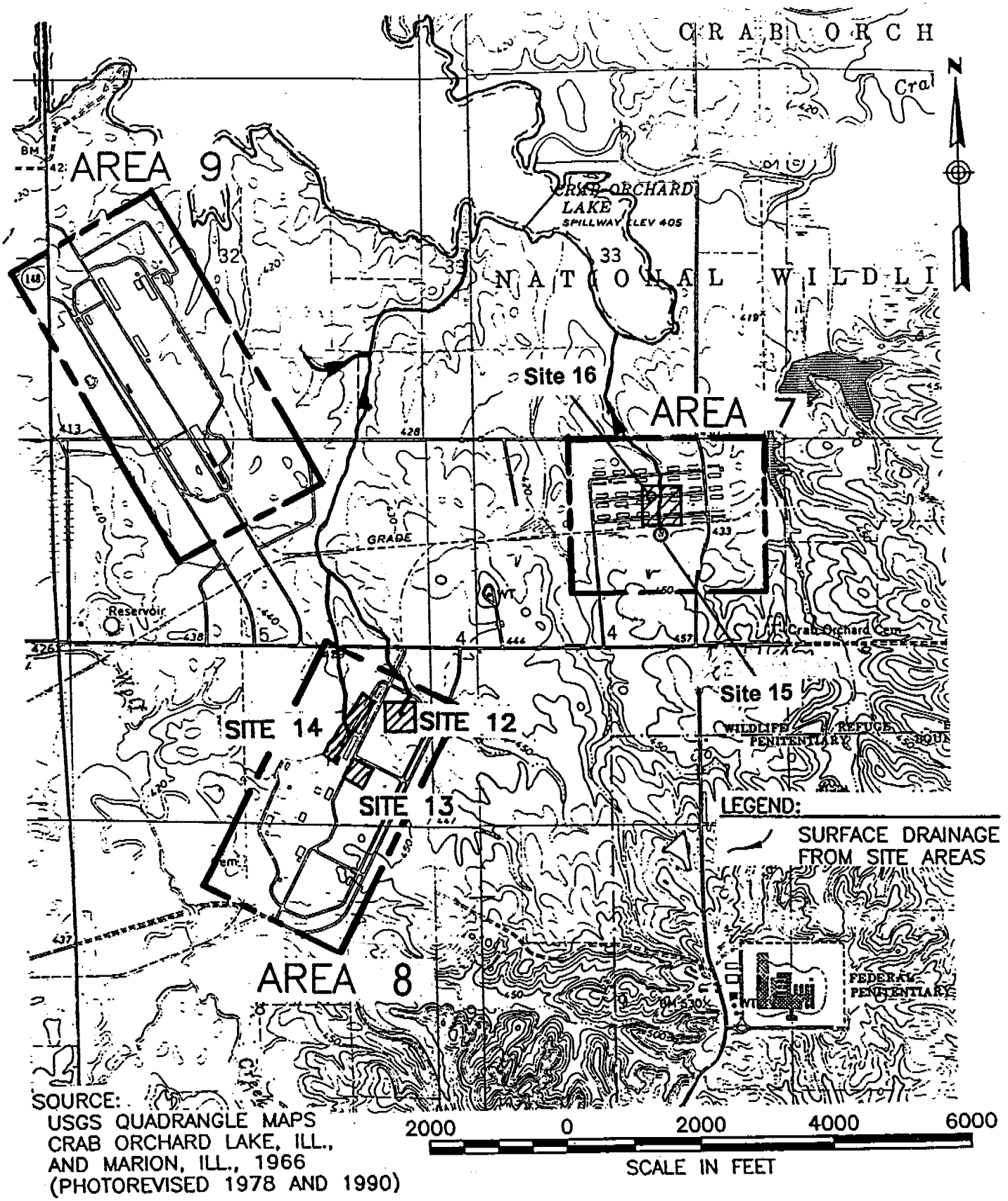


Figure 11-3
MISCA OU Sites in Areas 7 and 8

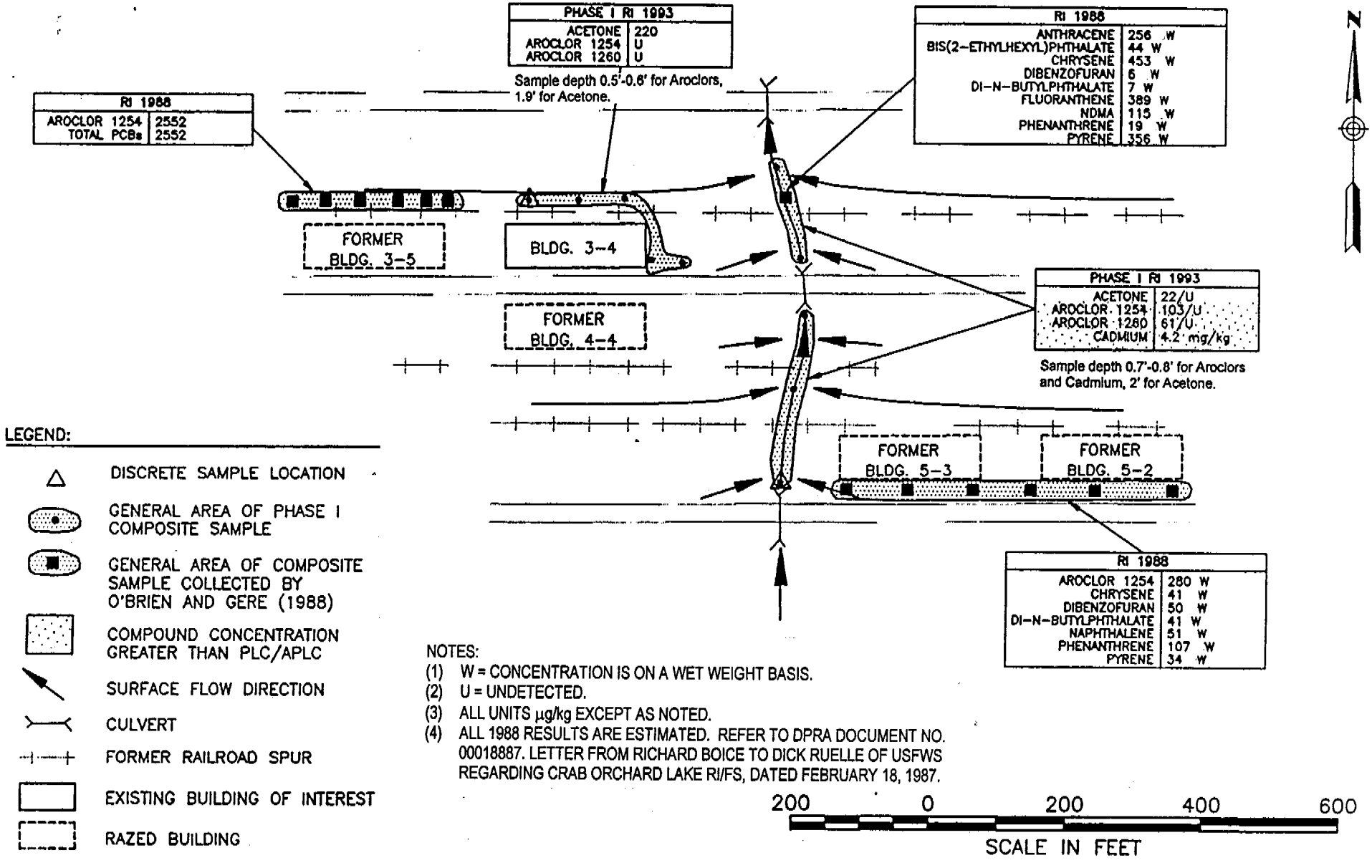
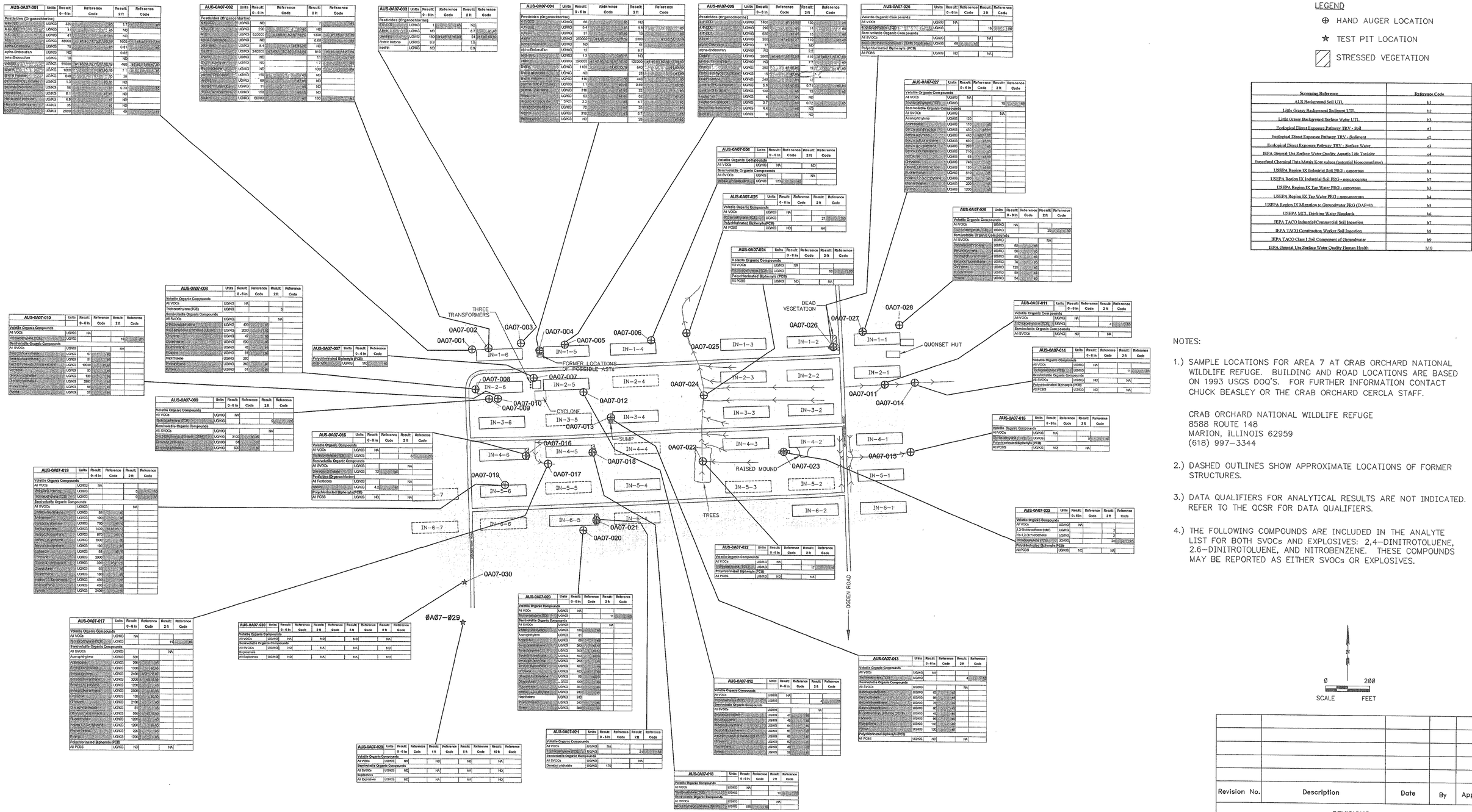


Figure 11-4

Previous Results, Site 16 (Area 7)



AUS-0A07-001

	Units	Result: 0 - 6 ft	Reference Code	Result: 2 ft	Reference Code
Pesticides (Organochlorine)					
4,4'-DDD	UG/KG	320		1.7	
4,4'-DDE	UG/KG	31		ND	
4,4'-DDT	UG/KG	41		ND	
Aldrin	UG/KG	48000		ND	
alpha-Chlordane	UG/KG	78		0.81	
alpha-Endosulfan	UG/KG	ND		0.62	
beta-Endosulfan	UG/KG	18		ND	
Dieldrin	UG/KG	35000		460	
Endrin	UG/KG	1000		7.1	
Endrin ketone	UG/KG	840		20	
gamma-BHC (Lindane)	UG/KG	1.3		ND	
gamma-Chlordane	UG/KG	56		0.73	
Heptachlor	UG/KG	6.1		ND	
Heptachlor epoxide	UG/KG	4.9		ND	
Methoxychlor	UG/KG	36		ND	
Toxaphene	UG/KG	2900		49	

AUS-0A07-002

	Units	Result: 0 - 6 ft	Reference Code	Result: 2 ft	Reference Code
Pesticides (Organochlorine)					
4,4'-DDD	UG/KG	ND		7	
4,4'-DDE	UG/KG	290		ND	
4,4'-DDT	UG/KG	520000		67	
Aldrin	UG/KG	ND		ND	
alpha-Chlordane	UG/KG	8.4		ND	
Dieldrin	UG/KG	240000		610	
Endrin	UG/KG	ND		11	
Endrin aldehyde	UG/KG	ND		17	
Endrin ketone	UG/KG	ND		100	
gamma-BHC (Lindane)	UG/KG	150		ND	
Heptachlor	UG/KG	69		ND	
Heptachlor epoxide	UG/KG	11		ND	
Methoxychlor	UG/KG	100		ND	
Toxaphene	UG/KG	62000		130	

AUS-0A07-003

	Units	Result: 0 - 6 ft	Reference Code	Result: 2 ft	Reference Code
Pesticides (Organochlorine)					
4,4'-DDD	UG/KG	1		ND	
4,4'-DDE	UG/KG	3.7		6.7	
4,4'-DDT	UG/KG	180		24	
Endrin ketone	UG/KG	0.9		1.9	
Isodrin	UG/KG	ND		0.9	

AUS-0A07-004

	Units	Result: 0 - 6 ft	Reference Code	Result: 2 ft	Reference Code
Pesticides (Organochlorine)					
4,4'-DDD	UG/KG	66		ND	
4,4'-DDE	UG/KG	5.4		5.8	
4,4'-DDT	UG/KG	37		13	
Aldrin	UG/KG	350000		2800	
alpha-Chlordane	UG/KG	ND		41	
alpha-Endosulfan	UG/KG	2.2		6.7	
beta-BHC	UG/KG	1.3		ND	
Dieldrin	UG/KG	250000		120000	
Endrin	UG/KG	1100		540	
Endrin aldehyde	UG/KG	ND		24	
Endrin ketone	UG/KG	410		440	
gamma-BHC (Lindane)	UG/KG	1.1		0.59	
gamma-Chlordane	UG/KG	310		32	
Heptachlor	UG/KG	63		52	
Heptachlor epoxide	UG/KG	2.2		4.7	
Methoxychlor	UG/KG	72		20	
Toxaphene	UG/KG	310		67	
Isodrin	UG/KG	ND		20	

AUS-0A07-005

	Units	Result: 0 - 6 ft	Reference Code	Result: 2 ft	Reference Code
Pesticides (Organochlorine)					
4,4'-DDD	UG/KG	1400		130	
4,4'-DDE	UG/KG	290		14	
4,4'-DDT	UG/KG	630		15	
Aldrin	UG/KG	350		110	
alpha-Chlordane	UG/KG	17		ND	
alpha-Endosulfan	UG/KG	ND		2.2	
Dieldrin	UG/KG	2600		410	
Endosulfan sulfate	UG/KG	ND		7.7	
Endrin	UG/KG	290		19	
Endrin aldehyde	UG/KG	15		4.4	
Endrin ketone	UG/KG	240		12	
gamma-BHC (Lindane)	UG/KG	5.6		0.71	
gamma-Chlordane	UG/KG	190		17	
Heptachlor	UG/KG	4		ND	
Heptachlor epoxide	UG/KG	22		0.72	
Methoxychlor	UG/KG	4.4		ND	
Toxaphene	UG/KG	9		ND	

AUS-0A07-026

	Units	Result: 0 - 6 ft	Reference Code	Result: 2 ft	Reference Code
Volatile Organic Compounds					
All VOCs	UG/KG	NA			
Trichloroethylene (TCE)	UG/KG			16	
Semivolatile Organic Compounds					
All SVOCs	UG/KG			NA	
Polychlorinated Biphenyls (PCB)					
All PCBS	UG/KG	ND		NA	

AUS-0A07-027

	Units	Result: 0 - 6 ft	Reference Code	Result: 2 ft	Reference Code
Volatile Organic Compounds					
All VOCs	UG/KG	NA			
Trichloroethylene (TCE)	UG/KG	3.7		16	
Semivolatile Organic Compounds					
All SVOCs	UG/KG			NA	
Acenaphthylene	UG/KG	120			
Anthracene	UG/KG	110			
Benzo(a)anthracene	UG/KG	430			
Benzo(a)pyrene	UG/KG	440			
Benzo(b)fluoranthene	UG/KG	660			
Benzo(g,h,i)perylene	UG/KG	250			
Benzo(k)fluoranthene	UG/KG	710			
Carbazole	UG/KG	63			
Chrysene	UG/KG	740			
Dibenz(a,h)anthracene	UG/KG	130			
Fluoranthene	UG/KG	910			
Indeno(1,2,3-cd)pyrene	UG/KG	260			
Phenanthrene	UG/KG	220			
Pyrene	UG/KG	1200			

AUS-0A07-006

	Units	Result: 0 - 6 ft	Reference Code	Result: 2 ft	Reference Code
Volatile Organic Compounds					
All VOCs	UG/KG	NA		ND	
Semivolatile Organic Compounds					
All SVOCs	UG/KG			NA	
Benzo(b)fluoranthene	UG/KG	130			

AUS-0A07-025

	Units	Result: 0 - 6 ft	Reference Code	Result: 2 ft	Reference Code
Volatile Organic Compounds					
All VOCs	UG/KG	NA			
Trichloroethylene (TCE)	UG/KG			21	
Polychlorinated Biphenyls (PCB)					
All PCBS	UG/KG	ND		NA	

AUS-0A07-024

	Units	Result: 0 - 6 ft	Reference Code	Result: 2 ft	Reference Code
Volatile Organic Compounds					
All VOCs	UG/KG	NA			
Trichloroethylene (TCE)	UG/KG			68	
Polychlorinated Biphenyls (PCB)					
All PCBS	UG/KG	ND		NA	

AUS-0A07-028

	Units	Result: 0 - 6 ft	Reference Code	Result: 2 ft	Reference Code
Volatile Organic Compounds					
All VOCs	UG/KG	NA			
Trichloroethylene (TCE)	UG/KG			25	
Semivolatile Organic Compounds					
All SVOCs	UG/KG		NA		
Benzo(a)anthracene	UG/KG	60			
Benzo(a)pyrene	UG/KG	50			
Benzo(b)fluoranthene	UG/KG	85			
Benzo(k)fluoranthene	UG/KG	76			
Chrysene	UG/KG	120			
Fluoranthene	UG/KG	59			
Pyrene	UG/KG	54			

AUS-0A07-011

	Units	Result: 0 - 6 ft	Reference Code	Result: 2 ft	Reference Code
Volatile Organic Compounds					
All VOCs	UG/KG	NA			
Trichloroethylene (TCE)	UG/KG			4	
Semivolatile Organic Compounds					
All SVOCs	UG/KG	ND		NA	

AUS-0A07-014

	Units	Result: 0 - 6 ft	Reference Code	Result: 2 ft	Reference Code
Volatile Organic Compounds					
All VOCs	UG/KG	NA			
Trichloroethylene (TCE)	UG/KG			11	
Semivolatile Organic Compounds					
All SVOCs	UG/KG	ND		NA	
Polychlorinated Biphenyls (PCB)					
All PCBS	UG/KG	ND		NA	

AUS-0A07-015

	Units	Result: 0 - 6 ft	Reference Code	Result: 2 ft	Reference Code
Volatile Organic Compounds					
All VOCs	UG/KG	NA			
Trichloroethylene (TCE)	UG/KG			9	
Polychlorinated Biphenyls (PCB)					
All PCBS	UG/KG	ND		NA	

AUS-0A07-023

	Units	Result: 0 - 6 ft	Reference Code	Result: 2 ft	Reference Code
Volatile Organic Compounds					
All VOCs	UG/KG	NA			
1,2-Dichloroethene (total)	UG/KG			3	
cis-1,2-Dichloroethene	UG/KG			2	
Trichloroethylene (TCE)	UG/KG			24	
Polychlorinated Biphenyls (PCB)					
All PCBS	UG/KG	ND		NA	

AUS-0A07-008

	Units	Result: 0 - 6 ft	Reference Code	Result: 2 ft	Reference Code
Volatile Organic Compounds					
All VOCs	UG/KG	NA			
Trichloroethylene (TCE)	UG/KG			3	
Semivolatile Organic Compounds					
All SVOCs	UG/KG			NA	
2-Methylnaphthalene	UG/KG	430			
bis(2-Ethylhexyl) phthalate	UG/KG	3000			
Chrysene	UG/KG	47			
Dibenzofuran	UG/KG	690			
Fluorene	UG/KG	45			
Naphthalene	UG/KG	51			
Phenol	UG/KG	280			
Pyrene	UG/KG	340			
Xylene	UG/KG	51			

AUS-0A07-007

	Units	Result: 0 - 6 ft	Reference Code
Polychlorinated Biphenyls (PCB)			
AROCLOR-1260	UG/KG	140	

AUS-0A07-009

	Units	Result: 0 - 6 ft	Reference Code	Result: 2 ft	Reference Code
Volatile Organic Compounds					
All VOCs	UG/KG	NA			
Trichloroethylene (TCE)	UG/KG			9	
Semivolatile Organic Compounds					
All SVOCs	UG/KG			NA	
Benzo(b)fluoranthene	UG/KG	3100			
Benzo(k)fluoranthene	UG/KG	64			
Chrysene	UG/KG	690			

AUS-0A07-016

	Units	Result: 0 - 6 ft	Reference Code	Result: 2 ft	Reference Code
Volatile Organic Compounds					
All VOCs	UG/KG	NA			
Trichloroethylene (TCE)	UG/KG			6	
Semivolatile Organic Compounds					
All SVOCs	UG/KG			NA	
bis(2-Ethylhexyl) phthalate	UG/KG	72			
Pesticides (Organochlorine)					
All Pesticides	UG/KG			NA	
Dieldrin	UG/KG	4.2			
Polychlorinated Biphenyls (PCB)					
All PCBS	UG/KG	ND		NA	

AUS-0A07-017

	Units	Result: 0 - 6 ft	Reference Code	Result: 2 ft	Reference Code
Volatile Organic Compounds					
All VOCs	UG/KG	NA			
Trichloroethylene (TCE)	UG/KG			11	
Semivolatile Organic Compounds					
All SVOCs	UG/KG			NA	
Acenaphthylene	UG/KG	530			
Anthracene	UG/KG	290			
Benzo(a)anthracene	UG/KG	1300			
Benzo(a)pyrene	UG/KG	2400			
Benzo(b)fluoranthene	UG/KG	3300			
Benzo(g,h,i)perylene	UG/KG	1200			
Benzo(k)fluoranthene	UG/KG	2800			
Carbazole	UG/KG	130			
Chrysene	UG/KG	2100			
Dibenz(a,h)anthracene	UG/KG	51			
Dibenzofuran	UG/KG	590			
Fluoranthene	UG/KG	1200			
Indeno(1,2,3-cd)pyrene	UG/KG	1200			
Phenanthrene	UG/KG	22			
Pyrene	UG/KG	1700			
Polychlorinated Biphenyls (PCB)					
All PCBS	UG/KG	ND		NA	

AUS-0A07-019

	Units	Result: 0 - 6 ft	Reference Code	Result: 2 ft	Reference Code
Volatile Organic Compounds					
All VOCs	UG/KG	NA			
Trichloroethylene (TCE)	UG/KG			9	
Semivolatile Organic Compounds					
All SVOCs	UG/KG			NA	
Benzo(b)fluoranthene	UG/KG	89			
Anthracene	UG/KG	190			
bis(2-Ethylhexyl)phthalate	UG/KG	700			
Benzo(a)anthracene	UG/KG	1400			
Benzo(k)fluoranthene	UG/KG	870			
Benzo(g,h,i)perylene	UG/KG	1900			
Benzo(k)fluoranthene	UG/KG	190			
Carbazole	UG/KG	64			
Chrysene	UG/KG	2000			
Dibenz(a,h)anthracene	UG/KG	320			
Dibenzofuran	UG/KG	100			
Fluoranthene	UG/KG	180			
Indeno(1,2,3-cd)pyrene	UG/KG	430			
Phenanthrene	UG/KG	430			
Pyrene	UG/KG	2400			

AUS-0A07-030

	Units	Result: 0 - 6 ft	Reference Code	Result: 2 ft	Reference Code	Result: 5 ft	Reference Code	Result: 10 ft	Reference Code
Volatile Organic Compounds									
All VOCs	UG/KG	NA		ND		ND		NA	
Semivolatile Organic Compounds									
All SVOCs	UG/KG	ND		NA		NA		ND	
Explosives									
All Explosives	UG/KG	ND		NA		NA		ND	

AUS-0A07-029

	Units	Result: 0 - 6 ft	Reference Code	Result: 1 ft	Reference Code	Result: 5 ft	Reference Code	Result: 10 ft	Reference Code
Volatile Organic Compounds									
All VOCs	UG/KG	NA		ND		ND		NA	
Semivolatile Organic Compounds									
All SVOCs	UG/KG	ND		NA		NA		ND	
Explosives									
All Explosives	UG/KG	ND		NA		NA		ND	

AUS-0A07-020

	Units	Result: 0 - 6 ft	Reference Code	Result: 2 ft	Reference Code
Volatile Organic Compounds					
All VOCs	UG/KG	NA			
Trichloroethylene (TCE)	UG/KG			11	
Semivolatile Organic Compounds					
All SVOCs	UG/KG			NA	
2-Methylnaphthalene	UG/KG	130			
Acenaphthylene	UG/KG	61			
Anthracene	UG/KG	60			
Benzo(a)anthracene	UG/KG	240			
Benzo(a)pyrene	UG/KG	350			
Benzo(b)fluoranthene	UG/KG	450			
Benzo(g,h,i)perylene	UG/KG	240			
Benzo(k)fluoranthene	UG/KG	420			
Carbazole	UG/KG	420			
Chrysene	UG/KG	420			
Dibenz(a,h)anthracene	UG/KG	55			
Dibenzofuran	UG/KG	150			
Fluoranthene	UG/KG	350			
Indeno(1,2,3-cd)pyrene	UG/KG	240			
Naphthalene	UG/KG	240			
Phenanthrene	UG/KG	240			
Pyrene	UG/KG	300			

AUS-0A07-021

	Units	Result: 0 - 6 ft	Reference Code	Result: 2 ft	Reference Code
Volatile Organic Compounds					
All VOCs	UG/KG	NA			
Trichloroethylene (TCE)	UG/KG			21	
Semivolatile Organic Compounds					
All SVOCs	UG/KG			NA	
Dimethyl phthalate	UG/KG	170			

AUS-0A07-022

	Units	Result: 0 - 6 ft	Reference Code	Result: 2 ft	Reference Code
Volatile Organic Compounds					
All VOCs	UG/KG	NA			
Trichloroethylene (TCE)	UG/KG			17	
Polychlorinated Biphenyls (PCB)					
All PCBS	UG/KG	ND		NA	

AUS-0A07-012

	Units	Result: 0 - 6 ft	Reference Code	Result: 2 ft	Reference Code
Volatile Organic Compounds					
All VOCs	UG/KG	NA			
Trichloroethylene (TCE)	UG/KG			6	
Semivolatile Organic Compounds					
All SVOCs	UG/KG			NA	
2-Methylnaphthalene	UG/KG	47			
Acenaphthylene	UG/KG	45			
Anthracene	UG/KG	64			
Benzo(a)anthracene	UG/KG	61			
Benzo(a)pyrene	UG/KG	60			
Chrysene	UG/KG	62			
Fluoranthene	UG/KG	67			
Pyrene	UG/KG	58			

AUS-0A07-018

	Units	Result: 0 - 6 ft	Reference Code	Result: 2 ft	Reference Code
Volatile Organic Compounds					
All VOCs	UG/KG	NA			
Trichloroethylene (TCE)	UG/KG			10	
Semivolatile Organic Compounds					
All SVOCs	UG/KG			NA	
bis(2-Ethylhexyl)phthalate	UG/KG	130			

AUS-0A07-013

	Units	Result: 0 - 6 ft	Reference Code	Result: 2 ft	Reference Code
Volatile Organic Compounds					
All VOCs	UG/KG	NA			
Trichloroethylene (TCE)	UG/KG			4	
Semivolatile Organic Compounds					
All SVOCs	UG/KG		NA		
Benzo(a)anthracene	UG/KG	63			
Benzo(a)pyrene	UG/KG	55			
Benzo(b)fluoranthene	UG/KG	84			
Benzo(g,h,i)perylene	UG/KG	45			
Benzo(k)fluoranthene	UG/KG	82			
bis(2-Ethylhexyl) phthalate	UG/KG	45			
Chrysene	UG/KG	96			
Fluoranthene	UG/KG	140			
Pyrene	UG/KG	130			
Polychlorinated Biphenyls (PCB)					
All PCBS	UG/KG	ND		NA	

LEGEND

⊕ HAND AUGER LOCATION

★ TEST PIT LOCATION

▨ STRESSED VEGETATION

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
Screened Chemical Data Matrix Kow values (terrestrial 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.) SAMPLE LOCATIONS FOR AREA 7 AT CRAB ORCHARD NATIONAL WILDLIFE REFUGE. BUILDING AND ROAD LOCATIONS ARE BASED ON 1993 USGS DOQ'S. FOR FURTHER INFORMATION CONTACT CHUCK BEASLEY OR THE CRAB ORCHARD CERCLA STAFF.

CRAB ORCHARD NATIONAL WILDLIFE REFUGE
8588 ROUTE 148
MARION, ILLINOIS 62959
(618) 997–3344

2.) DASHED OUTLINES SHOW APPROXIMATE LOCATIONS OF FORMER STRUCTURES.

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 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
CRAB ORCHARD NWR
MARION, ILLINOIS

AUS–ØAØ7 Sample Locations and Detections of Organic Compounds in Soils

Date: 11/03/00	Project Number: 2320000026.00	Figure Number: 11–5
Drawn by: djd	Design by: mch	Checked by: mch/cmw

URS

AUS–ØAØ7–IOP INERT STORAGE AREA

File: E:\2320000026.00\PA-SI REPORT-AUS OU\AUS-0A07 11-5.DWG Last edited: 09/13/01 @ 2:59 p.m. @ WCC-ST.LOUIS

File: E:\2320000026.00\PA-SI REPORT-AUS OU\AUS-0A07 11-6.DWG Last edited: 09/13/01 @ 2:59 p.m. @ WCC-ST.LOUIS

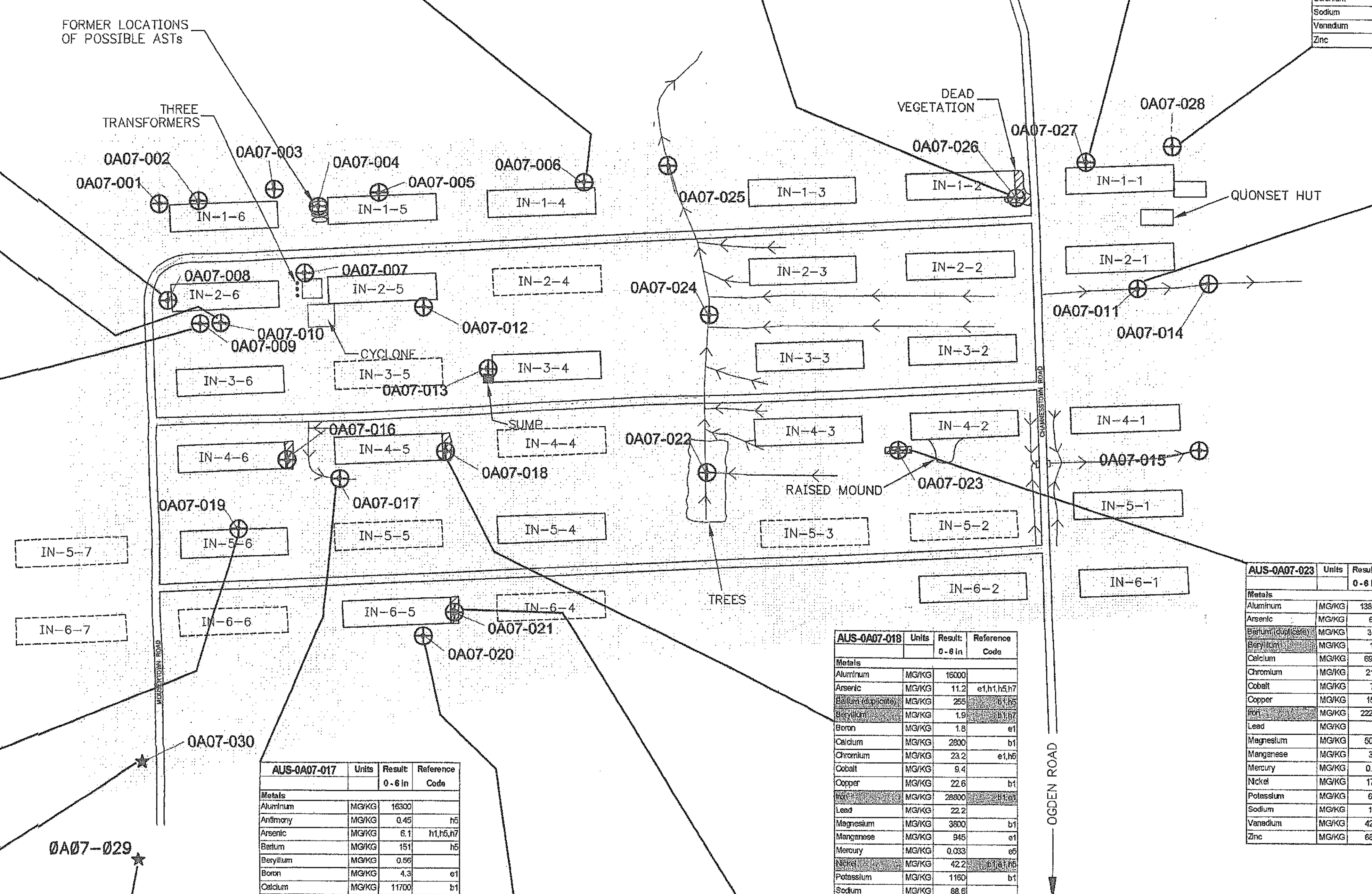
LEGEND

⊕ TEST PIT LOCATION

★ TEST PIT LOCATION

STRESSED VEGETATION

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-0A07-008	Units	Result: 0 - 6 in	Reference Code
Metals			
Aluminum	MG/KG	8670	
Arsenic	MG/KG	6	h1,h5,h7
Barium	MG/KG	143	h5
Beryllium	MG/KG	0.59	
Boron (duplicate)	MG/KG	1.8	e1
Calcium	MG/KG	79900	b1
Chromium	MG/KG	13.5	e1,h5
Cobalt	MG/KG	7.2	
Copper	MG/KG	9	
Iron	MG/KG	14600	e1
Lead	MG/KG	12.3	
Magnesium	MG/KG	13500	b1
Manganese	MG/KG	679	e1
Mercury	MG/KG	0.011	e5
Nickel (duplicate)	MG/KG	20.1	b1,h5
Potassium	MG/KG	558	
Sodium	MG/KG	350	b1
Vanadium	MG/KG	25.5	
Zinc	MG/KG	39	

AUS-0A07-006	Units	Result: 0 - 6 in	Reference Code
Metals			
Aluminum	MG/KG	16100	
Antimony	MG/KG	0.34	h5
Arsenic	MG/KG	7.1	h1,h5,h7
Barium	MG/KG	135	h5
Beryllium	MG/KG	0.67	
Boron	MG/KG	0.85	e1
Calcium	MG/KG	3850	b1
Chromium	MG/KG	20.7	e1,h5
Cobalt	MG/KG	9.9	
Copper	MG/KG	14.5	b1
Iron	MG/KG	22100	b1,e1
Lead	MG/KG	64.8	b1
Magnesium	MG/KG	3760	b1
Manganese	MG/KG	568	e1
Mercury	MG/KG	0.011	e5
Nickel	MG/KG	16.4	h5
Potassium	MG/KG	897	b1
Sodium	MG/KG	60.4	
Vanadium	MG/KG	38.4	
Zinc	MG/KG	58.2	b1

AUS-0A07-026	Units	Result: 0 - 6 in	Reference Code
Metals			
Aluminum	MG/KG	12700	
Arsenic	MG/KG	16.9	b1,e1,h1,h5,h7
Barium (duplicate)	MG/KG	229	b1,h5
Beryllium	MG/KG	0.76	
Boron	MG/KG	1.1	e1
Cadmium	MG/KG	0.68	b1,h5
Calcium	MG/KG	4360	b1
Chromium	MG/KG	17.7	e1,h5
Cobalt	MG/KG	7.7	
Copper	MG/KG	14.8	b1
Iron	MG/KG	15400	e1
Lead	MG/KG	54.9	b1
Magnesium	MG/KG	3180	b1
Manganese	MG/KG	178	e1
Mercury	MG/KG	0.017	e5
Nickel (duplicate)	MG/KG	19.6	b1,h5
Potassium	MG/KG	654	b1
Sodium	MG/KG	56.3	
Vanadium	MG/KG	29.3	
Zinc	MG/KG	83.4	b1
Other Parameters			
TOC	MG/KG	5980	

AUS-0A07-027	Units	Result: 0 - 6 in	Reference Code
Metals			
Aluminum	MG/KG	11500	
Arsenic	MG/KG	4.7	h1,h5,h7
Barium	MG/KG	87.5	h5
Beryllium	MG/KG	0.49	
Boron	MG/KG	1.3	e1
Calcium	MG/KG	30500	b1
Chromium	MG/KG	16.3	e1,h5
Cobalt	MG/KG	6	
Copper	MG/KG	14.9	b1
Iron	MG/KG	14300	e1
Lead	MG/KG	31.3	b1
Magnesium	MG/KG	19400	b1
Manganese	MG/KG	378	e1
Mercury	MG/KG	0.025	e5
Nickel	MG/KG	12.4	h5
Potassium	MG/KG	597	
Sodium	MG/KG	81.6	
Thallium	MG/KG	0.5	b1
Vanadium	MG/KG	25.6	
Zinc	MG/KG	89.1	b1

AUS-0A07-028	Units	Result: 0 - 6 in	Reference Code
Metals			
Aluminum	MG/KG	13400	
Arsenic	MG/KG	7	h1,h5,h7
Barium	MG/KG	126	h5
Beryllium	MG/KG	0.66	
Boron	MG/KG	1.8	e1
Calcium	MG/KG	3610	b1
Chromium	MG/KG	20.3	e1,h5
Cobalt	MG/KG	6.8	
Copper	MG/KG	13.6	b1
Iron	MG/KG	19400	b1,e1
Lead	MG/KG	27.3	b1
Magnesium	MG/KG	3170	b1
Manganese	MG/KG	325	e1
Mercury	MG/KG	0.02	e5
Nickel	MG/KG	13.6	h5
Potassium	MG/KG	795	b1
Selenium	MG/KG	0.49	e5,h5
Sodium	MG/KG	128	
Vanadium	MG/KG	30.8	
Zinc	MG/KG	64.4	b1

AUS-0A07-010	Units	Result: 0 - 6 in	Reference Code
Metals			
Aluminum	MG/KG	16400	
Arsenic	MG/KG	5.5	h1,h5,h7
Barium	MG/KG	154	h5
Beryllium	MG/KG	0.71	
Boron	MG/KG	1.1	e1
Cadmium	MG/KG	9	b1,h5,h9
Calcium	MG/KG	3950	b1
Chromium	MG/KG	24	e1,h5
Cobalt	MG/KG	9.3	
Copper	MG/KG	14	b1
Iron	MG/KG	18700	e1
Lead	MG/KG	21.7	
Magnesium	MG/KG	2430	b1
Manganese	MG/KG	971	e1
Mercury	MG/KG	0.03	e5
Nickel	MG/KG	15.4	h5
Potassium	MG/KG	691	b1
Sodium	MG/KG	117	
Vanadium	MG/KG	38.1	
Zinc	MG/KG	54.8	b1

AUS-0A07-011	Units	Result: 0 - 6 in	Reference Code
Metals			
Aluminum	MG/KG	11200	
Arsenic	MG/KG	4.9	h1,h5,h7
Barium	MG/KG	76.9	
Beryllium	MG/KG	0.48	
Calcium	MG/KG	2770	b1
Chromium	MG/KG	15.1	e1,h5
Cobalt	MG/KG	4.3	
Copper	MG/KG	9.2	
Iron	MG/KG	13300	e1
Lead	MG/KG	7.8	
Magnesium	MG/KG	1840	b1
Manganese	MG/KG	189	e1
Mercury	MG/KG	0.023	e5
Nickel	MG/KG	10.6	h5
Potassium	MG/KG	471	
Selenium (duplicate)	MG/KG	0.44	e5,h5
Sodium	MG/KG	86.1	
Vanadium	MG/KG	23.3	
Zinc	MG/KG	31.4	

AUS-0A07-009	Units	Result: 0 - 6 in	Reference Code
Metals			
Aluminum	MG/KG	17500	
Antimony	MG/KG	0.44	h5
Arsenic	MG/KG	6.9	h1,h5,h7
Barium	MG/KG	263	b1,h5
Beryllium	MG/KG	0.72	
Boron	MG/KG	1.2	e1
Calcium	MG/KG	3250	b1
Chromium	MG/KG	23.1	e1,h5
Cobalt	MG/KG	12.6	
Copper	MG/KG	14.9	b1
Iron	MG/KG	21700	b1,e1
Lead	MG/KG	16.5	
Magnesium	MG/KG	3350	b1
Manganese	MG/KG	603	e1
Mercury	MG/KG	0.021	e5
Nickel	MG/KG	22	b1,h5
Potassium	MG/KG	1080	b1
Sodium	MG/KG	155	
Vanadium	MG/KG	40.2	
Zinc	MG/KG	56.8	b1

AUS-0A07-023	Units	Result: 0 - 6 in	Reference Code
Metals			
Aluminum	MG/KG	13800	
Arsenic	MG/KG	6.7	h1,h5,hh7
Barium (duplicate)	MG/KG	311	b1,h5
Beryllium	MG/KG	1.1	b1,h7
Calcium	MG/KG	6910	b1
Chromium	MG/KG	21.1	e1,h5
Cobalt	MG/KG	7.1	
Copper	MG/KG	15.9	b1
Iron	MG/KG	22200	b1,e1
Lead	MG/KG	13	
Magnesium	MG/KG	5070	b1
Manganese	MG/KG	309	e1
Mercury	MG/KG	0.02	e5
Nickel	MG/KG	17.6	h5
Potassium	MG/KG	600	
Sodium	MG/KG	139	
Vanadium	MG/KG	42.7	
Zinc	MG/KG	68.6	bb1

AUS-0A07-019	Units	Result: 0 - 6 in	Reference Code
Metals			
Aluminum	MG/KG	2600	
Arsenic	MG/KG	4.2	h1,h5,h7
Barium	MG/KG	23	
Boron	MG/KG	4.4	e1
Calcium	MG/KG	201000	b1
Chromium	MG/KG	4.8	h5
Cobalt	MG/KG	2.6	
Copper	MG/KG	5.2	
Iron	MG/KG	5950	e1
Lead	MG/KG	34	b1
Magnesium	MG/KG	52300	b1
Manganese	MG/KG	253	e1
Nickel	MG/KG	6.8	
Potassium	MG/KG	351	
Sodium	MG/KG	171	b1
Vanadium	MG/KG	8.8	
Zinc	MG/KG	26.4	

AUS-0A07-018	Units	Result: 0 - 6 in	Reference Code
Metals			
Aluminum	MG/KG	16000	
Arsenic	MG/KG	11.2	e1,h1,h5,h7
Barium (duplicate)	MG/KG	255	b1,h5
Beryllium	MG/KG	1.9	b1,h7
Boron	MG/KG	1.8	e1
Calcium	MG/KG	2800	b1
Chromium	MG/KG	23.2	e1,h5
Cobalt	MG/KG	9.4	
Copper	MG/KG	22.6	b1
Iron	MG/KG	28800	b1,e1
Lead	MG/KG	22.2	
Magnesium	MG/KG	3800	b1
Manganese	MG/KG	945	e1
Mercury	MG/KG	0.033	e5
Nickel	MG/KG	42.2	b1,e1,h5
Potassium	MG/KG	1160	b1
Sodium	MG/KG	88.6	
Thallium	MG/KG	0.9	b1
Vanadium	MG/KG	45.3	
Zinc	MG/KG	85.2	b1

AUS-0A07-017	Units	Result: 0 - 6 in	Reference Code
Metals			
Aluminum	MG/KG	16300	
Antimony	MG/KG	0.45	h5
Arsenic	MG/KG	6.1	h1,h5,h7
Barium	MG/KG	151	h5
Beryllium	MG/KG	0.56	
Boron	MG/KG	4.3	e1
Calcium	MG/KG	11700	b1
Chromium	MG/KG	22.6	e1,h5
Cobalt	MG/KG	6.7	
Copper	MG/KG	11.6	b1
Iron	MG/KG	18800	e1
Lead	MG/KG	24.9	b1
Magnesium	MG/KG	8560	b1
Manganese	MG/KG	441	e1
Mercury	MG/KG	0.023	e5
Nickel	MG/KG	14.3	h5
Potassium	MG/KG	996	b1
Sodium	MG/KG	91	
Vanadium	MG/KG	39.6	
Zinc	MG/KG	49.2	
Other Parameters			
TOC	MG/KG	ND	

AUS-0A07-030	Units	Result: 0 - 6 in	Reference Code	Result: 6 ft	Reference Code
Metals					
Aluminum	MG/KG	9930		9120	
Arsenic	MG/KG	7.2	h1,h5,h7	4.9	h1,h5,h7
Barium	MG/KG	112	h5	64.2	
Boron	MG/KG	ND		1.5	e1
Calcium	MG/KG	3260	b1	1470	
Chromium	MG/KG	12.5	e1,h5	19	e1,h5
Cobalt	MG/KG	5.9		6.7	
Copper	MG/KG	11		10.5	
Iron	MG/KG	18400	e1	19600	b1,e1
Lead	MG/KG	11.7		12.5	
Magnesium	MG/KG	3220	b1	2090	b1
Manganese	MG/KG	489	e1	358	e1
Nickel	MG/KG	13.2	h5	17.3	h5
Potassium	MG/KG	453		333	
Selenium	MG/KG	0.62	e5,h5	0.33	e5,h5
Sodium	MG/KG	ND		266	b1
Vanadium	MG/KG	21.2		30	
Zinc	MG/KG	35.9		30.2	

AUS-0A07-029	Units	Result: 0 - 6 in	Reference Code	Result: 10 ft	Reference Code
Metals					
Aluminum	MG/KG	11300		8260	
Antimony	MG/KG	ND		0.27	
Arsenic	MG/KG	7.8	h1,h5,h7	3.9	h1,h5,h7
Barium	MG/KG	120	h5	73.6	
Boron	MG/KG	3.8	e1	2.6	e1
Calcium	MG/KG	2070		1530	
Chromium	MG/KG	14.6	e1,h5	13	e1,h5
Cobalt	MG/KG	4.8		12.5	
Copper	MG/KG	11.4	b1	7.9	
Iron	MG/KG	20400	b1,e1	15900	e1
Lead	MG/KG	12.3		12.1	
Magnesium	MG/KG	2490	b1	1960	b1
Manganese	MG/KG	345	e1	747	e1
Nickel	MG/KG	11.5	h5	14.8	h5
Potassium	MG/KG	603		287	
Sodium	MG/KG	ND		348	b1
Vanadium	MG/KG	25.9		25.9	
Zinc	MG/KG	36.5		24.4	

AUS-0A07-020	Units	Result: 0 - 6 in	Reference Code
Metals			
Aluminum	MG/KG	19500	
Arsenic	MG/KG	10.2	e1,h1,h5,h7
Barium	MG/KG	147	h5
Beryllium	MG/KG	0.65	
Boron	MG/KG	0.64	e1
Calcium	MG/KG	4990	b1
Chromium	MG/KG	23	e1,h5
Cobalt	MG/KG	7.8	
Copper	MG/KG	20.3	b1
Iron	MG/KG	26500	b1,e1
Lead	MG/KG	21.4	
Magnesium	MG/KG	5800	b1
Manganese	MG/KG	263	e1
Mercury	MG/KG	0.017	e5
Nickel (duplicate)	MG/KG	21.4	b1,h5
Potassium	MG/KG	1420	b1
Selenium	MG/KG	0.47	e5,h5
Sodium	MG/KG	88.4	
Vanadium	MG/KG	38.6	
Zinc	MG/KG	65.6	b1

AUS-0A07-021	Units	Result: 0 - 6 in	Reference Code
Metals			
Aluminum	MG/KG	14900	
Arsenic	MG/KG	5.6	h1,h5,h7
Barium	MG/KG	161	h5
Beryllium	MG/KG	0.66	
Boron	MG/KG	1.4	e1
Calcium	MG/KG	4940	b1
Chromium	MG/KG	20.1	e1,h5
Cobalt	MG/KG	6.7	
Copper	MG/KG	13.1	b1
Iron	MG/KG	18000	e1
Lead	MG/KG	14.7	
Magnesium	MG/KG	3130	b1
Manganese	MG/KG	574	e1
Mercury	MG/KG	0.024	e5
Nickel	MG/KG	18.5	h5
Potassium	MG/KG	680	b1
Sodium	MG/KG	66.8	
Vanadium	MG/KG	30.6	
Zinc	MG/KG	67.9	b1

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0 200
SCALE FEET

AUS-ØAØ7-IOP INERT STORAGE AREA

NOTES:

1.) SAMPLE LOCATIONS FOR AREA 7 AT CRAB ORCHARD NATIONAL WILDLIFE REFUGE.
BUILDING AND ROAD LOCATIONS ARE BASED ON 1993 USGS DOQ'S.
FOR FURTHER INFORMATION CONTACT CHUCK BEASLEY OR THE CRAB ORCHARD CERCLA STAFF.

CRAB ORCHARD NATIONAL WILDLIFE REFUGE
8588 ROUTE 148
MARION, ILLINOIS 62959
(618) 997-3344

2.) DASHED OUTLINES SHOW APPROXIMATE LOCATIONS OF FORMER STRUCTURES.

3.) DATA QUALIFIERS FOR ANALYTICAL RESULTS ARE NOT INDICATED.
REFER TO THE QCSR FOR DATA QUALIFIERS.

Revision No.	Description	Date	By	App.

REVISIONS

PA/SI REPORT
CRAB ORCHARD NWR
MARION, ILLINOIS

AUS-ØAØ7 Sample Locations and Detections of Inorganic Compounds in Soils

Date: 11/Ø3/ØØ	Project Number: 2320ØØØ026.ØØ	Figure Number: 11-6
Drawn by: djd	Design by: mch	Checked by: mch/cmw

URS