FEASIBILITY STUDY

EXPOSURE UNIT 8 – OCCIDENTAL CHEMICAL CORPORATION PROPERTY AT THE FORMER LAKE ONTARIO ORDNANCE WORKS SITE, NIAGARA COUNTY, NEW YORK

Prepared for:

U.S. Army Corps of Engineers
Buffalo District

Contract W912QR-08-D-0012
Delivery Order DA 02

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for
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COMPLETION OF SENIOR TECHNICAL REVIEW

This document has been produced within the framework of the ERT, Inc. (ERT) and EA Engineering, Science, and Technology, Inc. (EA) total quality management system. As such, a senior technical review, as defined in the Quality Control Plan (QCP) for this project, has been conducted. This included review of the overall design addressed within the document, proposed or utilized technologies and alternatives and their applications with respect to project objectives and framework of U.S. Army Corps of Engineers (USACE) regulatory constraints under the current Defense Environmental Restoration Program for Formerly Used Defense Site (DERP-FUDS) No. C02NY0025 project, within which this work has been completed. Comments and concerns resulting from review of the document have been addressed and corrected as necessary.

[redacted]

23 March 2014

[redacted]NYS Professional Engineer (PE), No. [redacted] Date

EA Engineering, P.C. and its affiliate EA Science and Technology
Senior Technical Reviewer

COMPLETION OF INDEPENDENT TECHNICAL REVIEW

This document has been produced within the framework of ERT's total quality management system. As such, an independent technical review, appropriate to the level of risk and complexity inherent in the project as defined in the QCP for this project, has been conducted. This included review of assumptions (methods, procedures, and material used in analyses), alternatives evaluated; the appropriateness of data used and level of data obtained; and reasonableness of the results, including whether the product accomplishes the stated project objectives. Comments and concerns resulting from review of the document have been addressed and corrected as necessary.

[redacted]

7 May 2015

Date

Independent Technical Reviewer

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LIST OF ACRONYMS AND ABBREVIATIONS

AEC	Atomic Energy Commission
AFP	Air Force Plant
AOC	area of concern
AOI	area of interest
AR	access restriction
ARAR	applicable or relevant and appropriate requirements
atm-m^3/mol	atmosphere-meter cubed per mole
ATSDR	Agency for Toxic Substances and Disease Registry
bgs	below ground surface
CDD	Central Drainage Ditch
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulation
COC	constituent of concern
COPC	constituent of potential concern
CREEL	Cold Regions Research and Engineering Laboratory
CSM	conceptual site model
DERP	Defense Environmental Restoration Program
DNT	dinitrotoluene
DoD	Department of Defense
DOE	Department of Energy
EA	EA Engineering, Science, and Technology, Inc.
EC	engineering control
ECL	Environmental Conservation Law
EPC	exposure point concentration
ERDA	Energy Research and Development Administration
ERT	ERT, Inc.
EU	exposure unit
FRTR	Federal Remedial Technology Roundtable
FS	feasibility study
ft	foot (feet)
ft/day	feet per day
ft/yr	feet per year
ft^2	square feet
FUDS	Formerly Used Defense Sites
FUSRAP	Formerly Utilized Sites Remedial Action Program
GLC	glaciolacustrine clay
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient

LIST OF ACRONYMS AND ABBREVIATIONS

IC	institutional control
Kd	soil-water partition coefficient
K_{oc}	soil organic carbon-water partition coefficient
Kow	octanol-water partition coefficient
L/kg	liters per kilogram
LF	linear feet
LOOW	Lake Ontario Ordnance Works
LTM	long-term monitoring
LUC	land-use control
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mm Hg	millimeters of mercury
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NFSS	Niagara Falls Storage Site
NRAA	Niagara River Angler's Association
NYCRR	New York Codes, Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
NYSDOP	New York State Digital Orthoimagery Program
NYSECL	New York State Environmental Conservation Law
OCCP	Occidental Chemical Corporation Property
Occidental	Occidental Chemical Corporation
O&M	operation and maintenance
PCB	polychlorinated biphenyl
PRG	preliminary remediation goal
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
RSL	regional screening level
SARA	Superfund Amendments and Reauthorization Act
SCO	soil cleanup objective
SCG	standards, criteria, and guidance
SLERA	screening level ecological risk assessment
SO	surface and subsurface soil
SVOC	semi-volatile organic compound
SWDD	Southwest Drainage Ditch
TAL	Target Analyte List
TBC	to-be-considered
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure

LIST OF ACRONYMS AND ABBREVIATIONS

TEC	Topographic Engineering Center
THQ	target hazard quotient
TNT	trinitrotoluene
TR	target carcinogenic risk level
TSDF	treatment, storage, and disposal facility
UCT	upper clay till
USACE	U.S. Army Corps of Engineers
USC	United States Code
USEPA	U.S. Environmental Protection Agency
UU/UE	unlimited use/unrestricted exposure
VOC	volatile organic compound
VP	Vicinity Property
WWTP	wastewater treatment plant
yd^3	cubic yards
°F	degrees Fahrenheit
^oC	degrees Celsius

METRIC CONVERSION CHART

To Convert to Metric			To Convert from Metric		
If you know	**Multiply by**	**To get**	**If you know**	**Multiply by**	**To get**
Length					
inches	2.54	centimeters	centimeters	0.3937	inches
feet	30.48	centimeters	centimeters	0.0328	feet
feet	0.3048	meters	meters	3.281	feet
yards	0.9144	meters	meters	1.0937	yards
miles	1.6093	kilometers	kilometers	0.6214	miles
Area					
square feet	0.0929	square meters	square meters	10.7639	square feet
square yards	0.8361	square meters	square meters	1.196	square yards
acres	0.4047	hectares	hectares	2.471	acres
Volume					
gallons	3.7854	liters	liters	0.2642	gallons
cubic yards	0.7646	cubic meters	cubic meters	1.308	cubic yards
Weight					
pound	0.4536	kilogram	kilogram	2.2046	pound
Temperature					
Fahrenheit	Subtract by 32 then multiply by 5/9	Celsius	Celsius	Multiply by 9/5 then add 32	Fahrenheit

EXECUTIVE SUMMARY

This feasibility study (FS) was prepared to evaluate remedial alternatives to address identified constituents of concern (COCs) that pose potential risk to human receptors at the Department of Defense exposure unit (EU) 8 site within the Occidental Chemical Corporation Property (OCCP) on the former Lake Ontario Ordnance Works (LOOW), Niagara County, New York. This FS is part of ongoing investigation and remediation activities at the former LOOW that are being conducted under the Defense Environmental Restoration Program [for] Formerly Used Defense Sites (DERP-FUDS).

The FS evaluates remedial technologies for COCs and debris identified in surface and subsurface soil at EU 8 to ensure that potential remedial alternatives will protect human health and the environment. The FS report documents background information and historical data, develops preliminary remediation goals (PRGs) and remedial action objectives, identifies and evaluates remediation technologies, assembles remedial alternatives, and evaluates the alternatives. This report also presents additional soil data that was collected subsequent to a Remedial Investigation of the OCCP (USACE 2013b).

The OCCP is an approximately 304-acre parcel located within the former LOOW FUDS boundary. The OCCP is situated within a buffer zone where no manufacturing activities took place. The western half of the OCCP, where the site is located, is zoned low-density residential in Chapter 200-5 (Attachment 2) of the Town of Porter Zoning Law (Town of Porter 2004); the property is currently undeveloped and proposed future land use is industrial (Smith 2004). Current zoning permits land uses as specified in Chapter 200-7 of the Town of Porter Zoning Law (Town of Porter 2004). The Niagara River Angler's Association uses the property immediately south of the OCCP as a wilderness preserve for fishing and picnicking. An easement for electrical power transmission lines is located to the east and undeveloped property owned by the Lewiston-Porter Central School District is located to the west. Balmer Road is immediately north of the OCCP. Future land use may also include recreational activities such as hunting.

The site is approximately 425 feet (ft) by 325 ft and is located within the southwestern portion of the OCCP. Trash and debris, which includes deteriorated steel 55-gallon drums, are present on the site. Surface and subsurface soil samples were analyzed for environmental contamination during a remedial investigation of the site in 2002 by the U.S. Army Corps of Engineers. Contaminants were identified at concentrations greater than health-based or project screening criteria. Potential carcinogenic risks were primarily driven by explosives (i.e., 2,4,6-trinitrotoluene [TNT]) in soil. In addition, there is a potential for lead in surface soil to pose risk to possible future child residents.

PRGs were developed for COCs in total soil that contribute ten percent or greater to the cumulative estimated carcinogenic risks or have an estimated target organ specific non-cancer HI greater than 1. Human health PRGs were conservatively developed for potentially exposed resident adult and child receptors at the site and are presented in **Table ES-1.**

The remedial action objective for the site is to prevent direct contact (ingestion and/or dermal contact) with 2,4,6-TNT and lead in total soil that may cause an unacceptable risk to a hypothetical future resident.

The estimated volume of contaminated soil above the PRGs is 611 cubic yards, which includes approximately 204 cubic yards of debris.

Table ES-1. Summary of Human Health Preliminary Remediation Goals for Total Soil at OCCP - EU 8

Chemical of Concern	EPC (mg/kg)	Max (mg/kg)	PRG (mg/kg)	Basis
Resident Adult and Child				
Explosives				
2,4,6-TNT	4,109	19,000	18	Risk-based (carcinogenic, $>10^{-6}$)
Metals				
Lead	496	2,760	400	Risk-based

Legend:
2,4,6-TNT = 2,4,6-trinitrotoluene
EPC = exposure point concentration
mg/kg = milligrams per kilogram
Max = maximum detected concentration
PRG = preliminary remediation goal

Five remedial alternatives were assembled and screened using criteria provided by the U.S. Environmental Protection Agency:

- *Alternative 1: No Action* – This alternative is required under *40 CFR 300: National Oil and Hazardous Substances Pollution Contingency Plan* for the FS process (USEPA 1994b). This alternative would not implement any active remedial actions, controls, or monitoring at the site. No public awareness or education training would be initiated regarding potential risks associated with the contaminated soil.
- *Alternative 2: Land-Use Controls* – This alternative would include the implementation of land-use controls (LUCs)/institutional controls (ICs) and engineering controls/access restrictions to prevent potential exposure to the contaminated soil. The LUCs would protect human health from exposure to the COCs. However, the volume, toxicity, and mobility of the contaminants would not be addressed.
- *Alternative 3: Landfill Cap* – This alternative would include the placement of a low permeability cap over the contaminated soil. The cap would protect human health and the environment from exposure to the COCs. LUC/ICs, access restrictions, long-term monitoring, and site close-out activities would be required.
- *Alternative 4: Excavation and Off-Site Disposal* – This alternative would include the removal of contaminated soil and co-mingled solid debris from the site. Contaminated soil and excavated debris would be disposed in appropriate off-site permitted treatment, storage, and disposal facilities. Some pretreatment/stabilization of the contaminated soil may be necessary to meet land disposal restrictions. The site would be restored to a condition that allows for unlimited use and unrestricted exposure.
- *Alternative 5: In Situ Chemical Reduction/Oxidation* - This alternative includes on-site treatment of contaminated soil using chemical reduction/oxidation to reduce the 2,4,6-

TNT concentrations and stabilize the lead. Co-mingled debris would be removed from the contaminated soil and disposed at a municipal landfill prior to treatment. Following successful confirmatory sampling, the treated soil would be used to backfill the site. LUC/ICs, long-term monitoring, and site close-out activities may be required.

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1.0 INTRODUCTION

ERT, Inc., (ERT) was contracted by the U.S. Army Corps of Engineers (USACE), Buffalo District, to conduct a feasibility study (FS) of remedial alternatives to address the risks posed by constituents of concern (COCs) identified within exposure unit (EU) 8 (hereinafter "the site") at the Occidental Chemical Corporation Property (OCCP) on the former Lake Ontario Ordnance Works (LOOW) in New York (see **Figure 1-1** and **Figure 1-2**). This FS was completed under Contract W912QR-08-D-0012, delivery order DA 02, dated 23 September 2011, and is part of an ongoing hazardous, toxic, and radioactive waste project (C02NY0025-11) under the Defense Environmental Restoration Program (DERP) for Formerly Used Defense Sites (FUDS). All work was performed in accordance with the contract statement of work (USACE 2008a) and the U.S. Environmental Protection Agency (USEPA) *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (USEPA 1988).

Environmental investigation and cleanup activities conducted by USACE at LOOW have been performed in accordance with DERP-FUDS. Consequently, no funds from the federal Superfund program have or will be utilized for remedial actions conducted by USACE and the statutory limits of Section 104(c)(1) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) do not apply.

1.1 Statutory Authority

Environmental restoration activities at FUDS, such as the former LOOW, were first initiated under the Defense Appropriations Act in 1983. In 1984, the Department of Defense (DoD) delegated execution of the FUDS Program to USACE through the headquarters of the Army. In October 1986, the Superfund Amendments and Reauthorization Act (SARA) amended CERCLA and established the DERP. The DERP legislation authorized the Secretary of Defense to carry out response actions, in accordance with the CERCLA, with respect to releases of hazardous substances from active defense sites, FUDS, and vessels owned or operated by the DoD. Three overarching goals were identified in the DERP legislation:

1. Identification, investigation, research and development, and cleanup of contamination from hazardous substances, pollutants, and contaminants
2. Correction of other environmental damage due to DoD use of the property (such as detection and disposal of unexploded ordnance), which creates an imminent and substantial endangerment to the public health or welfare or to the environment
3. Demolition and removal of unsafe buildings and structures, including buildings and structures of the DoD at sites formerly used by or under the jurisdiction of the Secretary, and that meet certain eligibility criteria

Pursuant to DoD Instruction 4715.7- Environmental Restoration Program, the Secretary of the Army is designated as the DoD Executive Agent for the FUDS Program (DoD 2001); the Secretary of the Army further delegated the program management and execution responsibility for FUDS to the Chief of Engineers of the USACE (USACE 2004a). Therefore, USACE has the authority and responsibility to carry out the FUDS Program and to achieve the goals of the DERP in accordance with the DERP legislation, applicable guidance, and DoD policies.

The FUDS program addresses real property that meets two criteria (USACE 2004a):

1. Properties that were formerly owned by, leased by, possessed by or otherwise under the jurisdiction of the Secretary of Defense, or governmental entities that are the legal predecessors of the DoD, and those properties where accountability rested with the DoD but where the activities at the property were conducted by contractors
2. Properties that were transferred from DoD control prior to 17 October 1986

Since both of these criteria apply to LOOW real property, LOOW is considered a FUDS and USACE is responsible for the management and execution of the DERP-FUDS activities at the former LOOW properties (USACE 2013a).

1.2 Purpose, Scope, and Objectives

The purpose of this FS is to provide decision makers with an assessment and evaluation of applicable remedial alternatives to address risks posed by COCs in soil at the site.

This FS documents background information and historical analytical data, develops preliminary remediation goals (PRGs) and remedial action objectives (RAOs), identifies and evaluates remediation technologies, assembles remedial alternatives and evaluates the alternatives.

The objective of this FS is to evaluate remedial technologies applicable to the COCs in surface and subsurface soil that pose a potential threat to human (i.e., potentially exposed resident adult and resident child) receptors and the environment to ensure that appropriate remedial alternatives are developed to achieve the RAO for the site. This FS also presents additional soil data collected subsequent to the *Final Remedial Investigation Report for the OCCP* (USACE 2013b) to determine whether hexavalent chromium would be retained as a COC.

1.3 Report Organization

- Section 1.0: Provides an introduction
- Section 2.0: Identifies the RAO for the site
- Section 3.0: Identifies project-specific applicable or relevant and appropriate requirements (ARARs)
- Section 4.0: Identifies general response actions
- Section 5.0: Identifies and screens treatment technologies and process options
- Section 6.0: Assembles and screens remedial alternatives
- Section 7.0: Provides a detailed analysis of remedial alternatives
- Section 8.0: Provides references

1.4 Background

1.4.1 LOOW History

In 1942, the War Department obtained a 7,500-acre parcel of land in northwestern Niagara County, New York for the construction of a trinitrotoluene (TNT) production facility designated as the Lake Ontario Ordnance Works. Production operations, production support, and facility storage occupied 2,500 acres of the eastern portion of the former LOOW. The remaining 5,000 acres were left undeveloped to serve as a buffer zone for the TNT production facility and to

allow for the possible expansion of TNT production. The site is located within the undeveloped zone of the former LOOW.

Expansion of the facility never occurred and, in 1943 after nine months of operation, the former LOOW was decommissioned due to excess TNT production at other War Department facilities. The eastern 2,500 acres, which comprised the TNT production area, were subsequently used by the U.S. Air Force and U.S. Navy for manufacturing plants (i.e., Air Force Plant [AFP] 38, AFP 68, and the Navy Interim Production Pilot Plant) to produce high-efficiency boron fuels. The U.S. Army subsequently used a portion of this area for the construction of a Nike Missile Base.

In the mid-1940s, 1,500 acres of the southern portion of the former LOOW south of Balmer Road were transferred to the USACE Manhattan Engineer District, which later gave rise to the U.S. Atomic Energy Commission (AEC). In 1974, the AEC was replaced by the Energy Research and Development Administration (ERDA) and the U.S. Nuclear Regulatory Commission. In 1977, ERDA became the U.S. Department of Energy (DOE). While under operation of the Manhattan Engineer District, radioactive materials were stored on portions of the southern 1,500 acres of the former LOOW. Between the 1950s and 1980s, radioactive materials housed on the acreage were consolidated, removed, and transferred to the current 191-acre Niagara Falls Storage Site (NFSS). During consolidation, the acreage surrounding the NFSS, formerly used by AEC and its predecessor, was designated as "Vicinity Properties" (VP) to facilitate the DOE environmental cleanup and closure. The NFSS and the LOOW VPs that remain open are currently being addressed under the Formerly Utilized Sites Remedial Action Program (FUSRAP). The OCCP is located within the undeveloped buffer zone of the former LOOW and is not considered a VP.

1.4.2 Occidental Chemical Corporation Property

The OCCP is an approximately 304-acre parcel situated in the undeveloped buffer zone of the former LOOW where no manufacturing took place (**Figure 1-1**). The undeveloped buffer zone occupies approximately 5,000 acres of the western, northern, and southern portion of the former LOOW.

The developed zone, also referred to as the "developed area," is an area of the former LOOW where manufacturing took place. Comprised of approximately 2,500 acres within the eastern portion of the former LOOW, the developed zone consists of the former TNT storage bunkers (north of Balmer Road), nitration area (north of M Street), former wastewater treatment plant (WWTP) (on property currently owned by the Town of Lewiston), shops and acid concentration area (on property currently owned by the DOE for the NFSS), and administrative area (north of Pletcher Road, on property currently owned by Modern Disposal) (USACE 2012b).

The site is approximately 425 feet (ft) by 325 ft and is located in the southwest portion of the OCCP (**Figure 1-2**). It is situated within a freshwater forested/shrub wetland (USFWS 2012c), designated LE-18, according to aerial imagery available at New York State Orthos Online for Niagara County (**Figure 1-3**) (New York Statewide Digital Orthoimagery Program [NYSDOP] 2012).

The current zoning of low-density residential permits land uses as specified in Chapter 200-7 of the Town of Porter Zoning Law (Town of Porter 2004). Additionally, a State Article 24 permit will be required to impact the wetland for any future development. Any impact to the State

mapped wetland will require the future property owner to follow proper permitting procedures. Future development will be difficult because of the wetlands.

Waste Management, LLC property and the former WWTP (Town of Lewiston Property) are located immediately east of the National Grid utility easement. Unused, forested land is located to the west and south. The western half of the OCCP, where the site is located, is zoned low-density residential in Chapter 200-5 (Attachment 2) of the Town of Porter Zoning Law (Town of Porter 2004). Current property use, as defined in the Town Comprehensive Plan (Smith 2004), is described as undeveloped. Future land use is proposed as industrial in the current Town Comprehensive Plan (Smith 2004). The Niagara River Angler's Association (NRAA) uses the property to the south of the OCCP as a wilderness preserve for fishing and picnicking. An easement for electrical power transmission lines is located to the east and undeveloped property owned by the Lewiston-Porter Central School District is located to the west. Balmer Road is immediately north of the OCCP.

1.4.3 OCCP History

Prior to development of LOOW, the OCCP was mixed agricultural land (e.g., forest, orchard, and farms with some farmsteads and farm ponds). The largely undeveloped buffer zone of the former LOOW was transferred to the General Services Administration in 1945 for conveyance to private landowners (USACE 2002). Use and ownership of the OCCP between 1945 and 1975 is unknown. The Hooker Chemical and Plastics Corporations purchased the land from a private landowner in 1975 and later sold it to the current owner, the Occidental Chemical Corporation (Occidental), a wholly-owned subsidiary of Occidental Petroleum Corporation (USACE 2012c). The land is currently owned by Occidental.

During development of LOOW, a 30-inch diameter outfall line was installed across the southern portion of the OCCP from the LOOW WWTP to the Niagara River. The 30-inch outfall line conveyed treated wastewater west to the Niagara River.

Numerous aerial anomalies were noted on this parcel in photographs from 1944 and 1951. The anomaly at EU 8 was present in 1944, while the TNT plant was operational. The size and shape of this anomaly are similar in the 1944 and 1951 aerial photographs, which suggests that fill in this area is related to DoD activities.

1.5 Physical Characteristics

1.5.1 Geology

An extensive geologic investigation has been conducted at the former LOOW, which included more than 1,000 borings and test pits. Subsurface data indicates that the former LOOW is underlain by approximately 30 to 60 ft of unconsolidated glacial deposits that overlie shale bedrock of the Queenston Formation. Subsurface stratigraphy is generally characterized by glacial till that includes an upper clay till (UCT) consisting primarily of silty clay and clay, and upper and middle silt tills that contain fine sand, silty sand with clay, and clay-sand mixture with occasional traces of gravel. A glaciolacustrine clay (GLC) layer is present between 12 and 20 ft below ground surface (bgs) (USACE 2002).

The UCT is commonly composed of stiff to hard, moderate brown to purple-brown silty clay with fine to coarse sand and fine gravel. Occasional deposits of cobbles, discontinuous wet sand, gravel and silt layers less than six inches thick are present and tend to be thicker near the base of

the unit. The upper glacial till is typically dry with wet sand or gravel lenses at the lower strata (USACE 1999).

East of the OCCP, an upper silt till layer is present which divides the GLC. This unit is composed of a well graded, compact to very dense gray to gray brown silt and coarse to fine sand (USACE 1999). The GLC underlies the upper glacial till sequence and is typically high in natural moisture content, averaging approximately 28 percent (USACE 1999).

1.5.2 Hydrology

1.5.2.1 Regional Hydrogeology

The regional hydrogeology of the unconsolidated overburden across the former LOOW is determined by glacial and fluvial deposits. Previous investigations indicate that glacial deposits are between 30 ft and 60 ft thick, and vary in permeability from low within glacial lake deposits to high within sand and gravel outwashes (USACE 1999). Groundwater flow within the unconsolidated deposits and surface water flow at the OCCP are generally influenced by local topography, trending north towards Lake Ontario and northwest towards the Niagara River.

Subsurface hydrostratigraphy at the former LOOW is divided into three units or zones (e.g., Zone 1, Zone 2, and Zone 3).

- *Zone 1*, also known as the Upper Water Bearing Zone, consists of unconfined water-bearing zones within silt and clay till of the UCT and fill. This zone lacks a contiguous, dominant flow system. Where devoid of sand lenses, the hydraulic properties of the UCT are representative of an aquitard and thus the term 'aquifer' is not used (USACE 2007). Flow in this zone generally proceeds toward the northwest with localized and seasonal variations. Vertical gradients are typically downward, but vary depending on the season and localized lithologic variations. The low permeability of near-surface materials restricts recharge to the Upper Water Bearing Zone which results in a swampy landscape with poor surficial drainage.
- *Zone 2* consists of moist, relatively impermeable material in the GLC unit. The GLC/Middle Silt Till Units form an aquitard and confine the Lower Water Bearing Zone. This aquitard is continuous across the former LOOW, saturated and homogeneous.
- *Zone 3*, also known as the Lower Water Bearing Zone, is a confined water-bearing zone predominantly within glaciolacustrine silt and sand. The zone consists of alluvial sand and gravel and the Upper Queenston Formation. A basal red till serves as a secondary, discontinuous aquitard which further confines localized zones of the Upper Queenston Formation. Flow in the Lower Water Bearing Zone is to the northwest, with localized deviations due to lithologic heterogeneities (USACE 2007). Seasonal influences do not have the pronounced impact on flow directions as is typical of flow in the Upper Water Bearing Zone (USACE 2007). The Lower Water Bearing Zone has a greater transmissivity than the Upper Water Bearing Zone. It is recharged by a combination of connate water from the Queenston Formation, regional sources, and to a lesser degree the overlying Zone 2 GLC.

The hydraulic conductivities of each formation vary considerably with Zone 3 being the most permeable. **Table 1-1** summarizes vertical and horizontal hydraulic conductivity for each zone.

Table 1-1. Regional Hydraulic Conductivities for Groundwater Zones at the Former LOOW

Zone	Stratigraphic Unit	Hydraulic Conductivity (ft/day)	
		Vertical	Horizontal
1	Upper Clay Till	2×10^{-3}	6×10^{-3}
	Upper Silt Till	2×10^{-3}	6×10^{-3}
	Middle Silt Till	3×10^{-4}	9×10^{-3}
2	Glaciolacustrine Clay	6×10^{-5}	1×10^{-4}
3	Glaciolacustrine Silt and Sand	8.5×10^{-5}	
	1.Stratified Coarse Sand		6×10^{-1}
	2.Non-Stratified Silt and Fine Sand		9×10^{-2}
	3.Stratified Silt and Fine Sand		3×10^{-2}
	4.Interlayered Silt, Sand and Clay		9×10^{-3}

Legend:
ft/day = feet per day
Source:
Hydrogeologic Characterization, Chemical Waste Management, Inc. (Golder 1985)
Note:
Values presented in the table were derived from rising head tests following the bail-down of piezometers

Groundwater within the Queenston Formation is moderate to highly mineralized, with total dissolved solids concentrations averaging 2,600 milligrams per liter (mg/L). High total dissolved solids concentrations are generally attributed to elevated levels of sodium, calcium, and chloride in the connate water within the formation (Johnston 1964). Connate water refers to water that was deposited simultaneously with the bedrock and became trapped in rock pore space. Essentially connate waters exhibit zero flow.

1.5.2.2 Surface Hydrology

During operation of the former LOOW, a system of drainage ditches was constructed and maintained in order to drain surface water runoff across the former LOOW to the Central Drainage Ditch (CDD). The system of drainage ditches, ephemeral in nature, consists of pre-existing agricultural ditches used to irrigate farmland and drainage ditches constructed during DoD development. The drainage ditches are no longer maintained which results in impeded flow and flooding. The Southwestern Drainage Ditch (SWDD) is a receiving surface water body that hydraulically separates the OCCP from the Lewiston-Porter Central School District property to the west. The SWDD ultimately discharges to Four Mile Creek north of Balmer Road.

Six Mile Creek, which originally flowed across the former LOOW, was diverted to the CDD and ultimately discharges into Four Mile Creek. Six Mile Creek is described by the New York State Department of Environmental Conservation (NYSDEC) as a Class C fresh water source, indicating that it is suitable for fishing and primary and secondary recreational use. Four Mile Creek is described by NYSDEC as a Class B water body from its mouth at Lake Ontario to approximately 0.9 mile upstream (located 0.3 mile southeast of the intersection of Lake Road and Creek Road) and the remaining upstream portion is classified as a Class C water body (USACE 1999). Classification as a Class B water body indicates the water body is suitable for

primary and secondary recreational use. It is not considered suitable as a potable water source (USACE 2011).

1.6 History of Contamination

1.6.1 Previous Investigations

This FS is part of ongoing investigations and remediation activities at the former LOOW. Details of previous investigation activities are available in the following documents:

- *Preliminary Contamination Assessment Report, Operable Unit No. 2, Volume I of II* (USACE 1992)
- *Final Report of Results for the Phase I Remedial Investigation at the Lake Ontario Ordnance Works, Niagara County, New York* (USACE 1999)
- *Final Report of Results for the Phase II Remedial Investigation at the Lake Ontario Ordnance Works, Niagara County, New York* (USACE 2002) – hereinafter the "LOOW Phase II RI Report"
- *Small-Bermed Clearing Supplemental Investigation Summary Report* (USACE 2004b)
- *Final Report of Results for the Phase III Remedial Investigation at the Lake Ontario Ordnance Works, Niagara County, New York* (USACE 2008b)
- *Final Remedial Investigation Report for the Occidental Chemical Corporation Property at Formerly Used Defense Site Former Lake Ontario Ordnance Works, Niagara County, New York* (USACE 2013b) – hereinafter the "OCCP RI Report"

1.6.1.1 LOOW Phase II Remedial Investigation

During a review of historical aerial photographs from 1944 and 1951, a disturbed area of approximately 200,000 ft^2 on the OCCP appeared to be enclosed with a fence. Because the timeframe coincided with DoD ownership, the OCCP was included for investigation during the Phase II RI.

The LOOW Phase II RI included the collection and analysis of surface soil, subsurface soil, surface water, and sediment samples from AOC 1 (the site) and AOC 2. AOC 1 contained trash and debris, including clay pipe, transite siding, ceramic electrical junctions, and approximately six to eight deteriorated steel 55-gallon drums. A solid, caked, fibrous, brownish-black material was observed and identified as possible former 55-gallon drum contents, based on the shape of material. Surface soil sampling (0 ft to 1 ft bgs) and subsurface soil sampling (3 ft to 7 ft bgs) was conducted. AOC 2 was evaluated because it represented a surface water body that may have been contaminated from historical operations. Surface water and sediment samples were taken from this area.

Analytes from AOC 1 were reported at concentrations greater than health-based or project screening criteria. The highest reported concentration(s) were from fill near the drums and possible drum contents. Contaminants were not detected above health-based or project screening criteria from AOC 2.

1.6.1.2 LOOW Phase III Remedial Investigation

Underground utilities formerly used by the DoD throughout LOOW were investigated during a Phase III RI conducted during 2005 to 2007. A 30 inch WWTP outfall line that traverses the OCCP was included in this investigation. Data collected from the outfall line and the ensuing risk assessment determined that there are no human health concerns associated with exposure to constituents within the outfall line.

1.6.1.3 OCCP Remedial Investigation

The OCCP RI included non-intrusive and intrusive activities. Based on the *Examination of Historical Aerial Photography – Selected Sites, Former LOOW* (U.S. Army Topographic Engineering Center [TEC] 2002), 39 areas of interest (AOIs) were prioritized and preliminarily assessed. Following the assessment of each AOI for evidence of environmental impacts from former DoD operations, six AOCs were selected for investigation. These AOCs were labeled AOC 1 through AOC 6 (see **Figure 1-2**) and contained the following features:

- AOC 1 – Former dump area identified by TEC as a "presumed storage area" (1944 aerial photograph) and "disturbed ground" (1951 aerial photograph)
- AOC 2 – Pond located in the eastern section of the site
- AOC 3 – Small fill area identified by USACE during site reconnaissance performed in 2010
- AOC 4 – Location of two buildings and a small structure that were identified by TEC (1944 aerial photograph)
- AOC 5 – Mounded material at the intersection of a dirt road and 30 inch outfall line that was identified by USACE during site reconnaissance performed in 2010
- AOC 6 – Pond located in the north central section of the site

Investigation activities were performed between 2001 and 2011 at AOCs 1 through 6 to characterize surface soil, subsurface soil, surface water, and sediment using field screening and sampling activities. Laboratory analysis was performed on 51 surface soil, 26 subsurface soil, 3 surface water, and 3 sediment samples. The samples were analyzed for some or all of the following: Target Compound List (TCL) volatile organic compounds (VOCs), TCL semi-volatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), explosives, Target Analyte List (TAL) metals, boron, lithium, and/or radionuclides. Following laboratory analysis, the analytical data were validated and evaluated against established project screening criteria. Detected constituents were further evaluated in site-specific risk assessments for human health and ecological receptors.

A summary of analytical results for the overall risks and preliminary COCs for AOC 1 (EU 8) is presented in **Figure 1-4**. The RI determined that an area of contaminated soil exceeding project screening criteria was located in the vicinity of deteriorated steel 55-gallon drums. This area consists of fill at an average depth of 3 ft across an area of approximately 37,500 ft^2. The concentrations reported in subsurface soil do not suggest there is an impact to groundwater. The estimated volume of soil exhibiting concentrations greater than USEPA Regional Screening Levels (RSLs) is 611 cubic yards (yd^3).

1.6.1.4 OCCP Baseline Risk Assessment

Risk to humans or ecological receptors was determined to be negligible from exposure to constituents in soil, sediment, and surface water for any receptors at AOCs 2, 3, 4, 5, and 6. No further environmental action or management was recommended for these areas.

Potential unacceptable risks could occur from exposure to constituents detected at AOC 1 (the site). The baseline risk assessment considered future residential, commercial, and industrial use of the site and also considered a trespasser scenario. Cancer risk and non-carcinogenic health effects outside of the acceptable risk range were identified for the following potential receptors from exposure to 2,4,6-TNT in surface and subsurface soil at the site: adult trespasser, adolescent trespasser, maintenance worker, commercial worker, construction worker, resident adult, and resident child. Additionally, lead in surface soil at the site is a potential concern for human health, especially for children.

A screening level ecological risk assessment (SLERA) indicated that lower trophic level receptors (e.g., plants and invertebrates) and higher trophic level receptors (e.g., shrew, rabbit, robin, and hawk) are potentially at risk from exposure to explosives (especially TNT) and heavy metals (especially barium, cadmium, total chromium, lead, and zinc) at the site.

Although upland receptors were evaluated in the SLERA (instead of wetland-specific receptors), wetland receptors are also generalist species that will be protected under the cleanup alternatives. Potential risk to human and ecological receptors was determined at the site and the SLERA recommended that RAOs should be based on protection of human health. It is expected that compliance with waste management regulations and human health standards will concurrently decrease risks to ecological receptors.

1.6.2 Nature and Extent of Contamination

Anthropogenic features on the OCCP consist of disturbed ground, small-bermed clearings, and mounded material or debris piles. Evidence of buildings associated with former DoD operations was not identified during RI activities. Surface features also include a single unnamed dirt road that traverses south from Balmer Road to the NRAA wilderness preserve. AOC 1 (the site) contains evidence of waste (e.g., beverage containers, asphalt shingles, and tires), debris (e.g., pipe, siding, ceramic electrical junctions, and deteriorated steel drums), used incendiary devices, and incineration residues.

During the OCCP RI, debris was observed that appeared to be related to former DoD operations. Two areas were identified; an elevated fill area and an assumed burn area. The elevated fill area measured approximately 225 ft (west to east) and 125 ft (north to south). The remains of corroded 55-gallon drums, old tires, beverage containers, and miscellaneous trash were observed within this area. The assumed burn area measured approximately 75 ft (west to east) and 35 ft (north to south). Ring adaptors, lids for incendiary devices, a 2-inch munitions ring clamp, and a 4-pound incendiary device fuze (potentially an M 54 series or M 126 device) were identified in this area. Evidence of burning, including solidified residue with a metallic luster, was identified to approximately 1 ft bgs. This material was directly underlain by undisturbed native soil.

Based on the fill characteristics and extent of fill observed in a 1944 aerial photograph, the fill and associated contaminants are attributed to former DoD activities. 2,4,6-TNT is present at concentrations greater than the screening level at six locations near the deteriorated 55-gallon drums. The elevated concentrations occur in fill from 0.5 to 3 ft bgs. Lead is present at seven

locations at concentrations greater than the screening criterion. Five samples that contained elevated lead were located near the deteriorated drums and were collected from 0 to 1 ft bgs. Based on their proximity to areas of elevated 2,4,6-TNT, lead is also attributed to former DoD activities at the site.

The TNT and lead concentrations in subsurface soil do not suggest there is an impact to groundwater. Based on the conclusions of the OCCP RI and post-RI sampling and analysis, the total estimated volume of soil exhibiting concentrations greater than PRGs is 611 yd^3. Approximately 204 yd^3 of solid debris is present in the fill. The estimated extent and volumes of impacted media at the site are presented in **Table 1-2**.

Table 1-2. Estimated Volumes of Impacted Media at OCCP - EU 8

Area	Horizontal				Area		Vertical		Volume	
	North to South		West to East				Depth			
	(ft)	(yds)	(ft)	(yds)	(ft^2)	(yds^2)	(ft)	(yds)	(ft^3)	(yd^3)
EU 8	425	142	325	108	138,000	15,500	---	---	---	---
Impacted Soil	100	33.3	55	18.3	5,500	612	3	1	16,500	611
Debris[a]	100	33.3	55	18.3	5,500	612	1	0.3	5,500	204

Legend:
yd^3 = cubic yards
EU = exposure unit
ft = feet or foot
yds = yards
[a] = volume of debris assumed to account for approximately 30% of the total volume of the soil

The COCs in soil are associated with a limited number of sample locations. The estimated volume of contaminated soil and solid debris may be underestimated due to the uncertainty associated with the characterization of these materials. The sampling pattern used during the OCCP RI that did not employ a random or systematic approach across that site. Observations suggest that the fill is similar throughout the site, it was placed directly on the ground surface, and its extent is distinguished by an increase in ground surface elevation.

1.6.3 Post Remedial Investigation Activities

1.6.3.1 Hexavalent Chromium Sampling

Additional soil data was collected subsequent to the OCCP RI to determine whether hexavalent chromium would be retained as a COC. Based on the additional data, hexavalent chromium in soil was not retained as a COC.

Laboratory analytical results for hexavalent chromium reported during the OCCP RI were considered subjective due to potential analytical method interference, and because the source(s) of hexavalent chromium were unknown and not considered characteristic of DoD operations at the site. Furthermore, the most probable fate of hexavalent chromium in the environment is reduction to trivalent chromium in the subsurface as a result of interaction with natural

reductants. Due to uncertainties in previously reported hexavalent chromium concentrations, further confirmatory sampling and analysis was performed.

Soil samples were collected from the site and analyzed for total chromium and hexavalent chromium. Hexavalent chromium in soil was analyzed using USEPA Method 7199 as well as Method 7196A (the analytical method used during the OCCP RI). USEPA Method 7199 is considered more sensitive and specific for detecting hexavalent chromium because it separates the hexavalent chromium via ion chromatography before colorimetric detection, thus eliminating many sources of interference experienced with Method 7196A.

Ten post RI soil samples were collected from eight locations at the site by USACE in May 2013. Post RI samples were located adjacent to the original soil sample sites collected during the OCCP RI. The sample locations and results are presented on Figure A-1 (**Appendix A**).

Hexavalent chromium was detected in seven of the nine samples analyzed via Method 7196A and ranged from 0.42 to 5 milligrams per kilogram (mg/kg), above the USEPA RSL for residential soil (0.29 mg/kg). Hexavalent chromium was not detected in any of the samples analyzed via Method 7199. A summary comparing the OCCP RI and post RI results for total chromium and hexavalent chromium is provided in Table A-1 (**Appendix A**).

The results were evaluated to determine whether the hexavalent chromium concentrations pose unacceptable cancer risk to potential residential receptors at the site. Revised exposure point concentrations (EPCs) for the site were estimated to be 1.91 mg/kg for surface soil and 1.49 mg/kg for total soil (**Attachment B-2**). The EPC for hexavalent chromium in soil used in the RI for the risk evaluation was 56.1 mg/kg, which produced an incremental lifetime cancer risk for residential receptors of 2×10^{-4} (i.e., 2 in 10,000) (USACE 2013b). Using the new hexavalent chromium EPC, the residential incremental lifetime cancer risk for exposure to the newly estimated hexavalent chromium EPC is approximately 7×10^{-6} (i.e., 7 in 1,000,000), which is within USEPA's acceptable cancer risk range. Based on the evaluation, hexavalent chromium levels in soil do not pose unacceptable cancer risk and are not considered further as a COC in this FS.

A summary of post RI activities, results, and interpretations is presented in **Appendix A**. **Appendix B** presents information (revised ProUCL outputs) for determining the revised EPCs for hexavalent chromium in surface and total soil. The results are within the acceptable carcinogenic risk range of up to 10^{-4} and non-carcinogenic hazard index (HI) of 0.1 for all receptors.

1.6.3.2 Cork Elm Survey

A State listed endangered tree, the Cork Elm (*Ulmus thomasii*), was recorded on a State web site as a rare plant on the Threatened and Endangered list. It was noted as one of 40 groves still left in New York State. A tree survey was performed at the site and the Cork Elm was not identified.

1.6.4 Contaminant Fate and Transport

1.6.4.1 Potential Routes of Migration

Migration pathways from a source provide the route of transport for released chemicals across and between media. Migration pathways can be naturally occurring or man-made pathways. The primary routes of migration for COCs at the site are through groundwater, surface water, and air.

Groundwater Transport

Groundwater transport via leaching of impacted surface soil is possible, but considered unlikely due to the low permeability of the Upper Water Bearing Zone; precipitation recharge is extremely low (less than 1 inch per year [2.54 centimeters/year]). In addition, soils comprising the Upper Water Bearing Zone are heterogeneous. Permeable sand lenses within the Upper Water Bearing Zone are limited in extent and do not act as conduits for preferential groundwater flow and contaminant migration.

In 2013, USACE completed a vadose zone model (VS2DTI) to evaluate the potential for groundwater contamination from 2,4,6-TNT in near surface soils at EU 8. Modeling results indicate that 2,4,6-TNT transport from the source (i.e., two locations of highest 2,4,6-TNT concentrations [C10-GS-P22 and C10-GS2-HW]) is limited to the surrounding soils with an estimated migration of up to 1 ft vertically and 1.6 ft horizontally. Lead is not considered a migration concern for this site due to a lower mobility and higher soil-water partitioning coefficient (Kd).

Surface Water Transport

The site is located within a freshwater forested/shrub wetland. Surface water transport of contaminated sediment is possible but limited by heavy vegetation and low relief. Surface water surrounding the site, when present, is nearly quiescent. It will predominantly be lost to evaporation and to a lesser extent, infiltration.

Airborne Transport

Airborne transport of impacted surface soil is possible, but considered unlikely due to the minimal amount of exposed soil at the site and the heavy vegetation cover. These features will significantly reduce the likelihood of airborne transport of contaminated soil to on-site and/or off-site receptors.

Subsurface Soil

Subsurface soil is not susceptible to airborne or surface water transport. The fate and transport of COCs on subsurface soil is also limited by the UCT confining layer which retards surface water and groundwater leaching in subsurface soil.

1.6.4.2 Contaminant Persistence

2,4,6-TNT

The most important processes affecting the fate and transport of TNT are transformation, sorption, and irreversible soil binding (due to soil organic matter). TNT transformations in soil can occur both biologically and abiotically. TNT transformation generally occurs by sequential reduction of nitro groups into amino groups. Commonly observed reductive transformation products include 2-amino-4,6-dinitrotoluene, 4-amino-2,6-dinitrotoluene, and 2,6-diamino-4-nitrotoluene. Transformation to 2,4,6-triaminotoluene is also possible. The TNT transformation rates are significantly enhanced under anaerobic conditions (USACE 1997).

Physical and chemical properties of TNT are provided in **Table 1-3** and discussed below.

- The partition coefficients indicate that soils have a high capacity for rapid sorption of TNT. TNT not sorbed into soil is usually transformed rapidly under anaerobic conditions (CREEL 2006; USACE 1997).

- TNT has a high aqueous solubility and is mobile in surface water and groundwater. However, if TNT reaches groundwater, it would be sorbed by the aquifer material and undergo transformation processes that would limit its mobility (USEPA 2005; CREEL 2006).
- TNT in surface water undergoes rapid photolysis to several degradation products, most notably 1,3,5-trinitrobenzene (ATSDR 1995; CREEL 2006).
- TNT is broken down by biodegradation in water and surface soils but at rates much slower than photolysis (ATSDR 1995; CREEL 2006).
- TNT released to the atmosphere is expected to undergo direct photolysis (ATSDR 1995).

Table 1-3. Physical and Chemical Properties for 2,4,6-TNTa,b, c

Water Solubility (mg/L at 25°C)	Half-Life Range[a] (hours)	K_{ow}	K_{oc}	Kd (L/kg)	Retarded Migration Rate (ft/yr)	Vapor Pressure at 25°C (mm Hg)	Henry's Law Constant (atm-m^3/mol at 20°C)
130	672–4,320	1.6	300	0.37	1.78×10^{-2}	1.99×10^{-4}	4.57×10^{-7}

Legend:
atm-m^3/mol = atmosphere – meter cubed/mole
ft/yr = ft per year
K_{ow} = Octanol-water partition coefficient
K_{oc} = Soil organic carbon-water partition coefficient
Kd = Soil-water partition coefficient
L/kg = liters per kilogram
mg/L = milligrams per liter
mm Hg = millimeters of mercury
°C = degrees Celsius
a = ATSDR (1995)
b = USEPA (2011)
c = Mackay (1993)

Lead

Lead is generally treated as infinitely persistent in the environment and unaffected by naturally occurring degradation. The potential for transport of lead is based upon analyte specific affinity to sediment, surface water, and soil. Factors affecting transport dynamics include soil-water chemistry and charge deficiency on adsorbent surfaces, such as soil and sediment. In order to neutralize the surface charge, an accumulation of ions near the soil-groundwater interface is required. Factors including soil texture, soil chemistry, pH, and redox potential also enhance or diminish the mobility of a particular metal analyte. Typically, the solubility of metals tends to increase proportionally to increased acidity, and conversely under alkaline conditions.

There are numerous natural materials that strongly interact with water. Metal sorption is affected primarily by physical and chemical processes. Generally, the sorption coefficient for lead is indicative of the relative affinity of lead to soil, and ultimately the immobility of lead. Physical adsorption is due to surface charges which attract ionic species of the opposite charge. Hydrous oxides may also promote the sorption of lead. Lead ions sorbed to these surfaces become precipitated with the hydrous oxides. Chemical processes for adsorption include ion exchanges,

precipitation, solid-state diffusion, and isomorphic substitution. Organic matter may also result in lead sorbing to soil and sediment making lead insoluble in groundwater.

1.6.4.3 Potential Routes of Exposure to Receptors

A conceptual site model (CSM) was formulated for the OCCP based on site history, field investigations, and exposure setting. The human health CSM is presented as **Figure 1-5**, which identifies the potential sources of contamination, routes of migration, and potential receptors. Exposure pathways begin from potential source areas and progress through the environment via various fate and transport processes to potential human receptors. The CSM identifies which exposure pathways are complete and require further evaluation in the human health risk assessment (HHRA). An exposure pathway describes a mechanism by which a population individual may be exposed to COCs present at the site. For the site, multiple exposure scenarios are possible based on a number of factors involving property boundaries, routes of contact, contaminated media, and potential receptors (USACE 2013b).

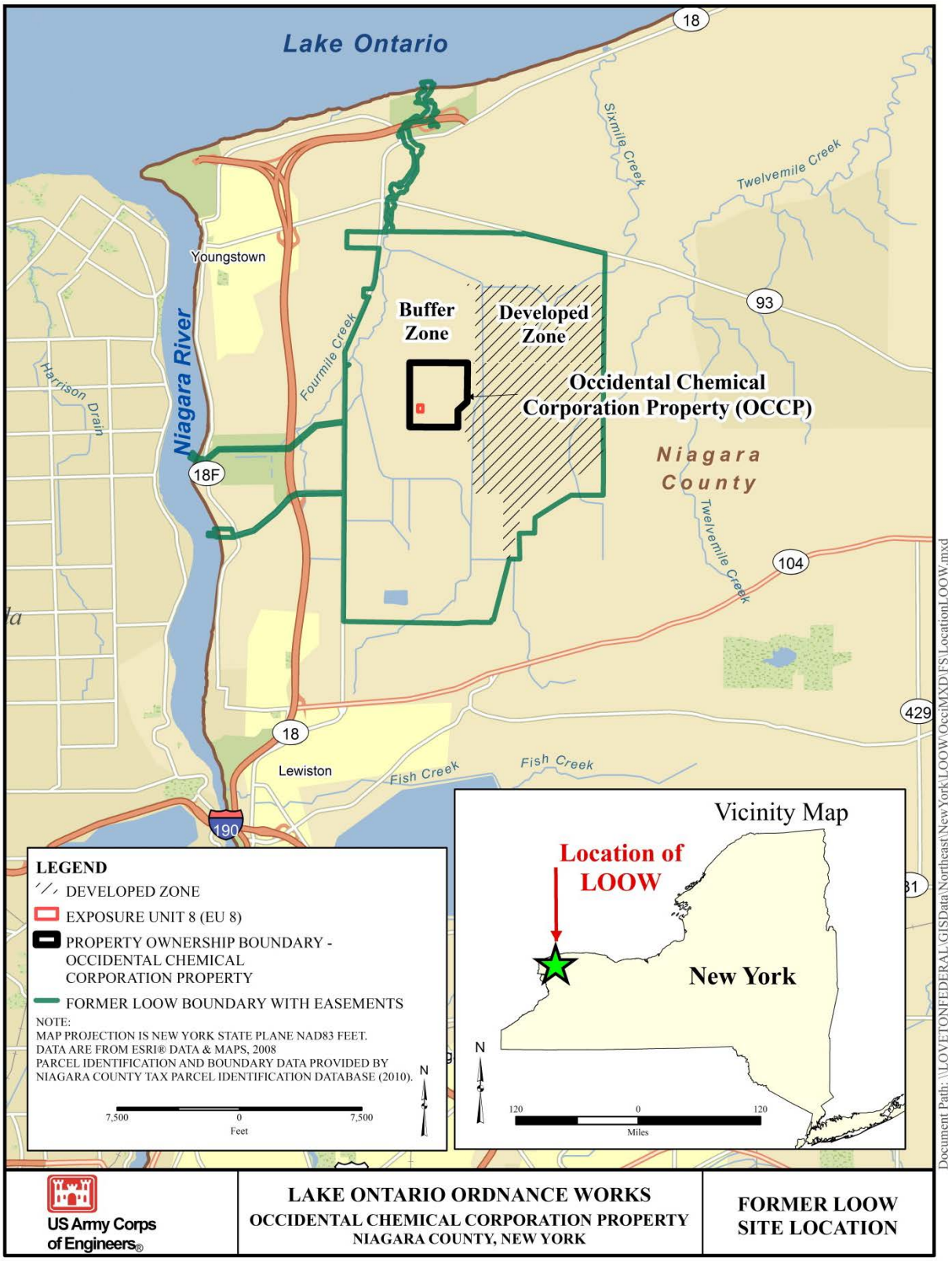

Figure 1-1: Former LOOW Site Location

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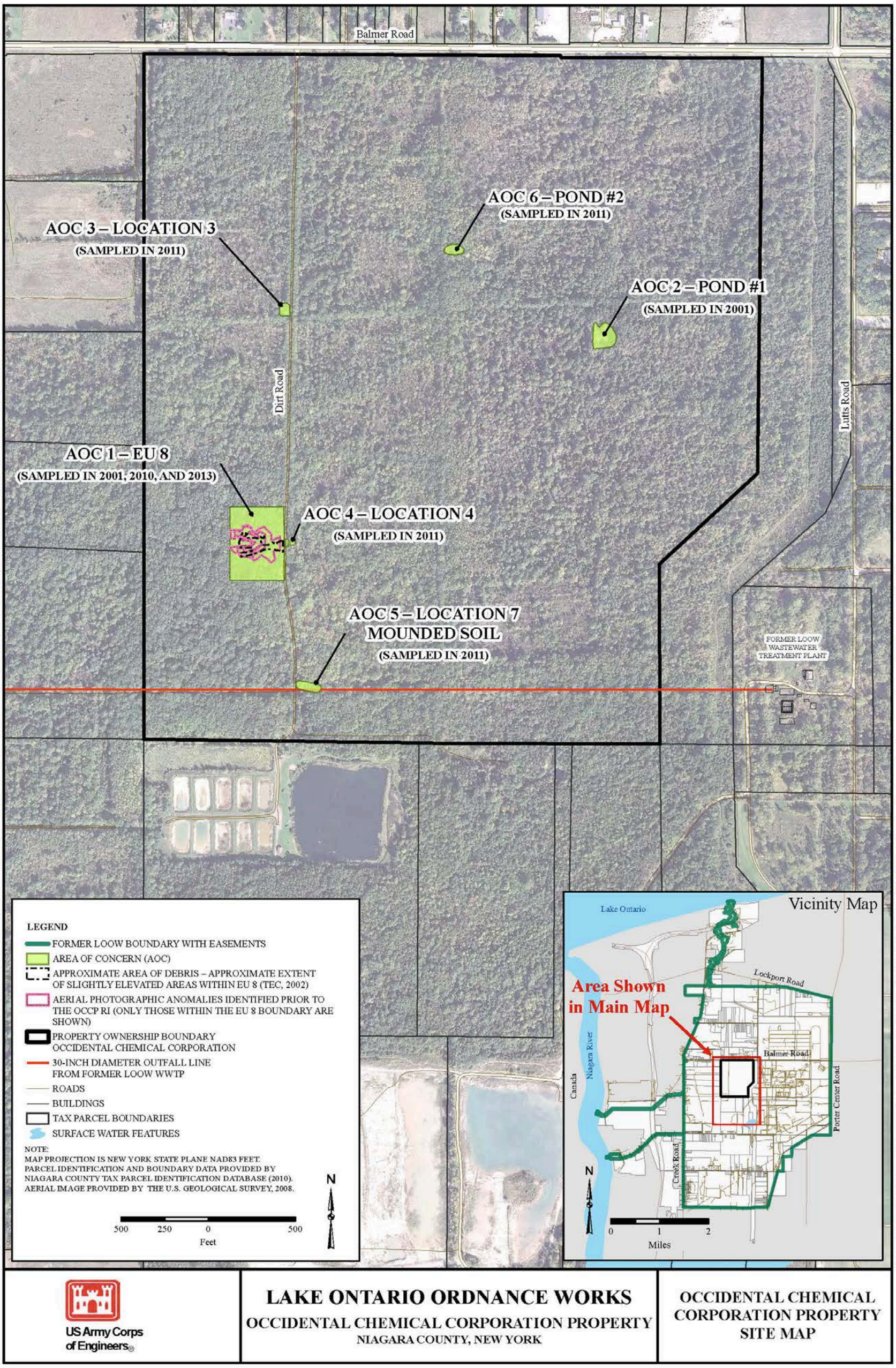

Figure 1-2: Occidental Chemical Corporation Property Site Map

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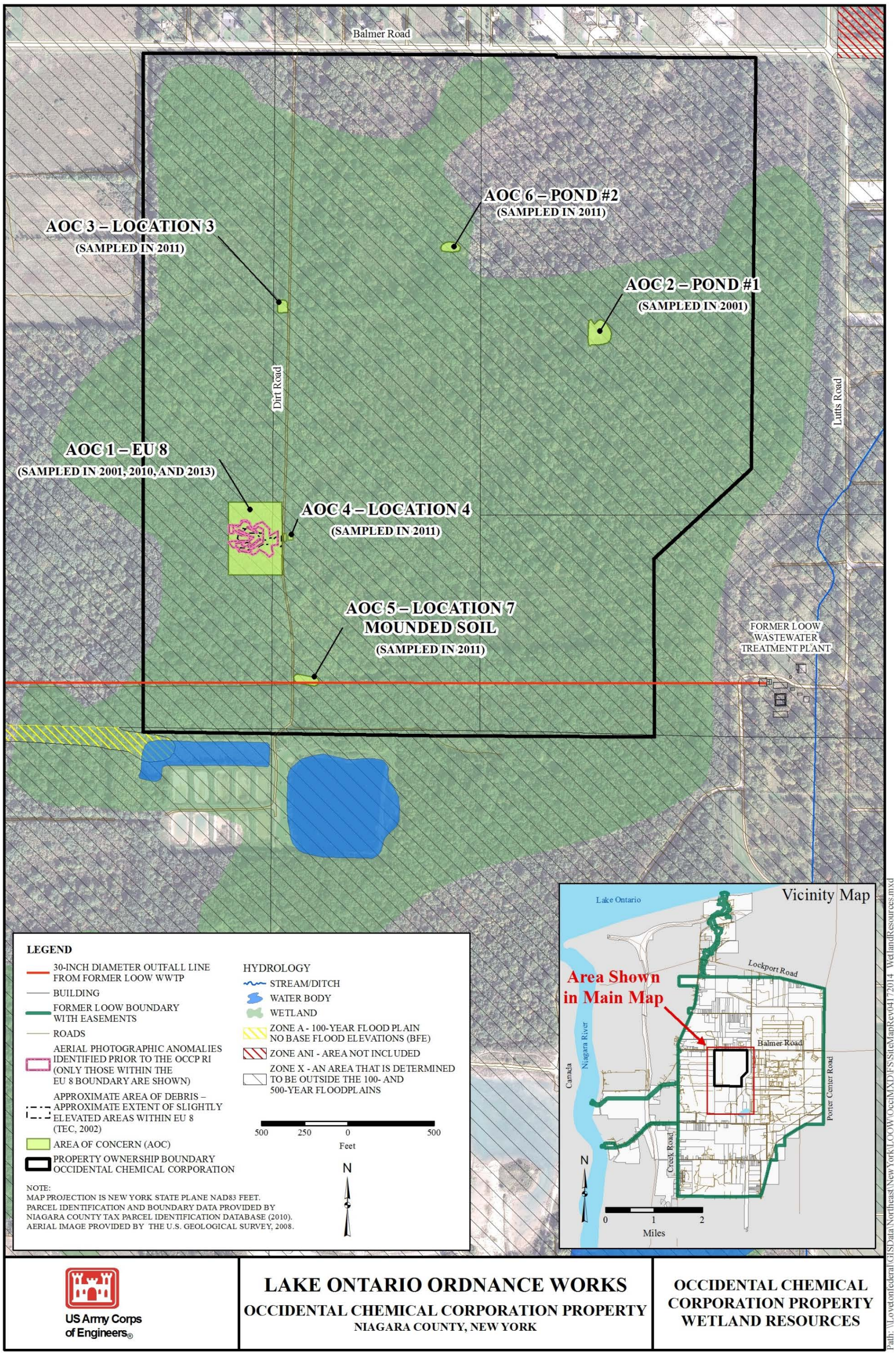

Figure 1-3: Wetland Resources

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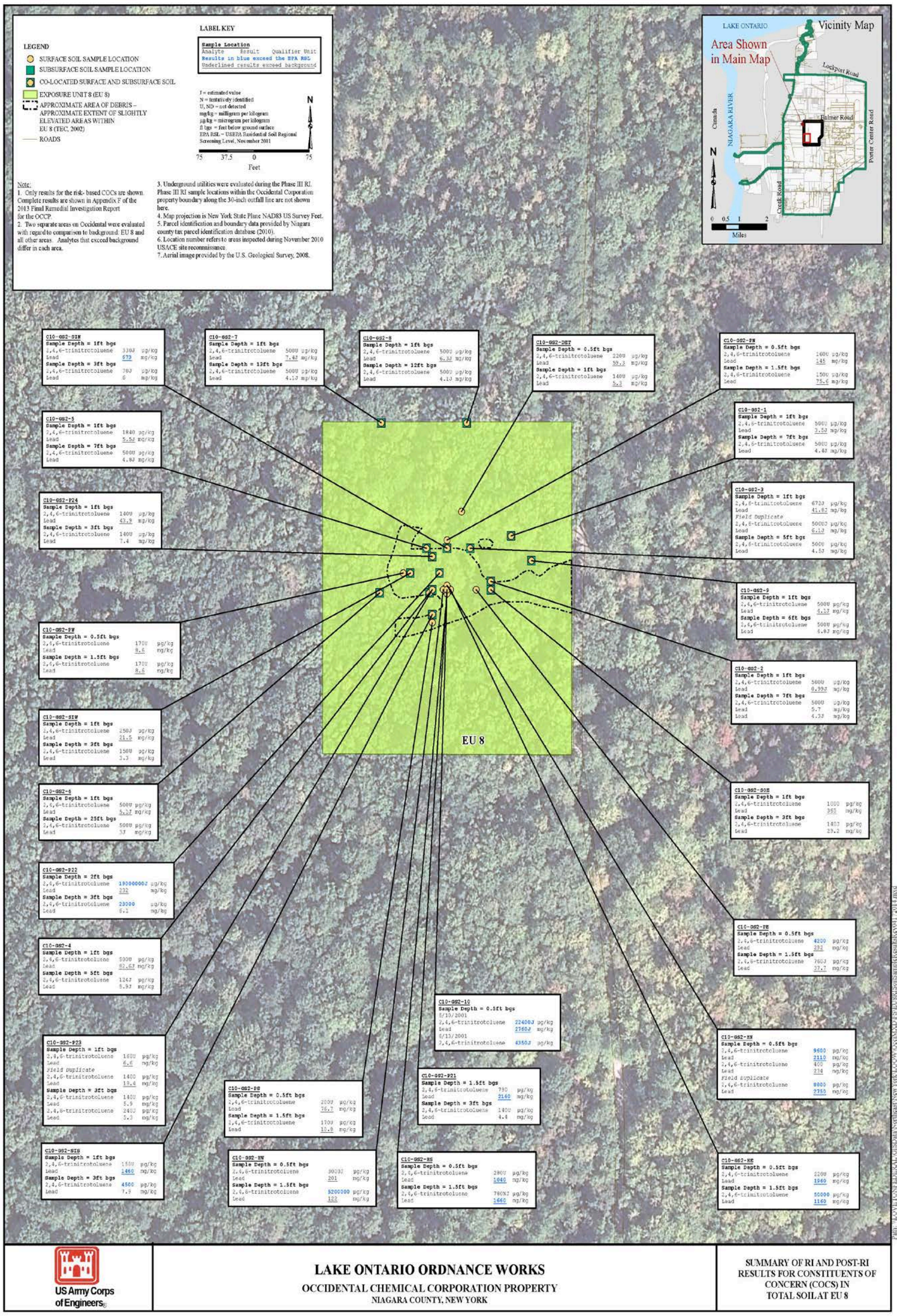

Figure 1-4: COCs in Total Soil at EU 8

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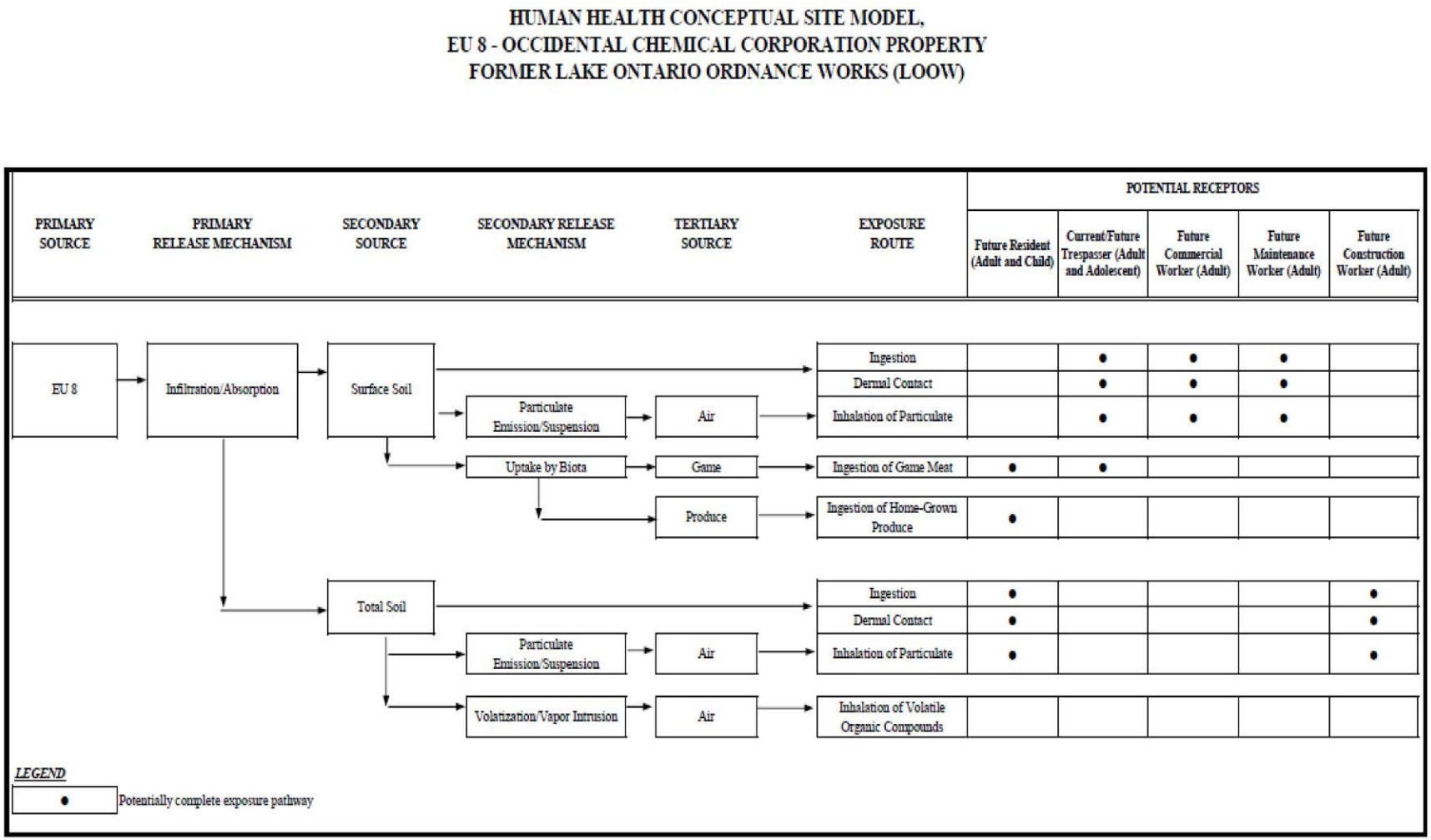

Figure 1-5: Human Health Conceptual Site Model

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2.0 REMEDIAL ACTION OBJECTIVE

RAOs are developed to specify contaminants and media of concern, potential exposure pathways, and remediation goals, and provide a basis for selecting appropriate remedial technologies and developing remedial alternatives for the site. Remediation goals establish acceptable levels of exposure that are protective of human health and the environment.

The RAO for this site is based on analytical results, ARARs, the HHRA, and the SLERA.

In assessing the need for remediation and evaluating remedial alternatives, two threshold criteria must be met under CERCLA and the National Contingency Plan (NCP):

- the remedy must be protective of human health and the environment
- the remedy must achieve ARARs

The RAO for this site is to prevent direct contact (ingestion and/or dermal contact) with COCs in total soil that cause an unacceptable risk to an exposed hypothetical potential future resident.

2.1 Impacted Media and Contaminants of Concern

Based on the results of previous investigations, the media of concern and COCs at the site are 2,4,6- TNT and lead surface soil and 2,4,6- TNT in subsurface soil (USACE 2013b and **Appendix A**).

2.2 Estimated Volume of Contaminated Soil

The estimated volume of contaminated soil is identified in **Table 1-2** and discussed below.

- Concentrations of COCs exceeding risk-based criteria for human health extend to a depth of 3 ft bgs
- The estimated total volume of soil exhibiting concentrations of 2,4,6-TNT and/or lead greater than PRGs is 611 yd^3
- The estimated area impacted by the COCs is approximately 5,500 ft^2 and the approximated volume of debris is 204 yd^3
- The lead concentrations in soil suggest that areas may be classified as Resource Conservation and Recovery Act (RCRA) hazardous waste (D008) if excavated because they are greater than 20 times the toxicity characteristic level provided in 40 CFR 261.64. Analysis using the toxicity characteristics leaching procedure (TCLP) would be required to confirm this assumption.

2.3 Risk-Based Cleanup Objectives

Under the NCP (USEPA 1994b), acceptable exposure for known or suspected carcinogens is expressed in terms of lifetime cancer risk to an individual. As stated in Section 300.400(e)(2)(i)(A)(2) of the NCP, "acceptable exposure levels are generally concentrations resulting in excess upper bound lifetime cancer risk to an individual of between 10^{-4} and 10^{-6} using information on the relationship between dose and response" (USEPA 2011b). For non-carcinogenic effects, acceptable exposure levels are generally concentrations that represent a HI of less than 1 (USEPA 1988a). USACE has established a site-specific acceptable exposure

threshold for cumulative carcinogenic risk to an individual at 10^{-4} and non-carcinogenic effects at a HI of 1.

Based on the post-RI results for hexavalent chromium and the revised HHRA outputs, carcinogenic risk and non-carcinogenic effects to potentially exposed resident adult and child receptors from contact with 2,4,6-TNT within soil is: 2×10^{-4} (incremental lifetime cancer risk for combined childhood through adult exposures), and 138 and 10 (child and adult hazard quotients [HQs], respectively) **(Appendix B)**.

2.4 Development of Preliminary Remediation Goals

The site-specific PRGs are chemical limits calculated based upon toxicity values and site-specific exposure conditions evaluated in the HHRA (USACE 2013b). The HHRA selected the lower end of the carcinogenic risk range of 10^{-6} and non-carcinogenic hazards greater than 1 (based upon target organ endpoints) as the point of departure. All receptors evaluated for exposure to the site had risk results above the point of departure. The only medium of concern at the site is soil. Surface soil (0 to 2 ft) is the medium of concern for the adolescent trespasser, adult trespasser, operations/maintenance worker, and commercial worker. Total soil is the medium of concern for the construction worker and resident (adult and child). A resident (adult and child) was also evaluated for the ingestion of home-grown produce in surface soil.

Within the HHRA, the Summary of Significant Contributors to Risk (i.e., RAGS Table 10s) was presented for each receptor with risk results greater than the point of departure. These tables present all constituents of potential concern (COPCs) with carcinogenic risks greater than 10^{-6} and HIs greater than 0.1.

Appendix D presents site-specific PRGs calculated for all COPCs identified in the "Summary of Significant Contributors to Risks" in the HHRA, except hexavalent chromium as detailed in Section 1.6.3.1. Tables 1 through 6 **(Appendix D)** present the PRG calculations. For all receptors, the following equation was used to calculate site-specific PRGs:

For carcinogens:

$$Site - Specific\ PRG = \frac{EPC}{Risk} \times TR$$

Where,

PRG	=	Preliminary remediation goal
TR	=	Target carcinogenic risk level (i.e., 10^{-6}, 10^{-5}, 10^{-4})
Risk	=	Chemical-specific cumulative carcinogenic risk shown in HHRA
EPC	=	Chemical-specific exposure point concentration presented in HHRA

For non-carcinogens:

$$Site - Specific\ PRG = \frac{EPC}{HQ} \times THQ$$

Where,

PRG	=	Preliminary remediation goal
THQ	=	Target hazard quotient (i.e., 1 or 0.1)
HQ	=	Chemical-specific total hazard quotient shown in HHRA
EPC	=	Chemical-specific exposure point concentration presented in HHRA

For the resident, the site-specific PRG takes into account complete exposures to both total soil and surface soil. Exposure routes for total soil include ingestion, dermal contact, and inhalation of particulates. Exposure routes for surface soil include ingestion of home-grown produce. Because the EPC calculated for surface soil and total soil are different, a site-specific PRG was calculated for each exposure route for the resident based upon the equations presented above, and the final site-specific PRG was cumulative based upon all exposure routes. The final site-specific PRG was calculated based upon the following equation:

$$Site - Specific\ PRG = \frac{1}{\left(\frac{1}{PRG_{ingestion}}\right) + \left(\frac{1}{PRG_{dermal}}\right) + \left(\frac{1}{PRG_{inhalation}}\right) + \left(\frac{1}{PRG_{produce}}\right)}$$

Tables 1 through 6 **(Appendix D)** present the site-specific PRG calculations for each receptor evaluated in the HHRA.

2.5 Selection of Site-Specific PRGs

For the selection of final site-specific PRGs, the exposure setting for the site and potential future land use were evaluated. The OCCP consists of undeveloped, forested land with no structures. It is located within a freshwater forested/shrub wetland (USFWS 2012c). Current zoning of low-density residential permits land uses as specified in Chapter 200-7 of the Town of Porter Zoning Law (Town of Porter 2004). Additionally, future development that may impact wetlands will require Federal 404 and State Article 24 permits. Future development under the 33 CFR 404 (b) (1) federal guidance requirements will be difficult to obtain if the wetlands are to be impacted. The site is current owned by Occidental, and its current land use (undeveloped), zoning (low-density residential), cited future land use (industrial), and adjacent land use (agricultural, residential). Therefore, the resident (adult and child) was considered as the primary receptor of concern for the site.

Chemicals within the soil exposure pathways were considered COCs if their carcinogenic risks were greater than 10^{-6} and they contributed to greater than 10 percent of the carcinogenic risk or the non-carcinogenic hazard quotient (based upon a target organ endpoint) was greater than 1. Table 7 **(Appendix D)** presents the contribution to carcinogenic risks for each COPC evaluated at the site. For non-carcinogenic hazards, the HHRA determined that liver, blood, and kidneys are the target organs with HQs greater than 1. Tables 8 and 9 **(Appendix D)** summarize the COCs and the proposed PRG according to the receptor evaluated. If both a carcinogenic and non-carcinogenic site-specific PRG were calculated, then the lower of the two values was considered the appropriate site-specific PRG.

The risk-based lead PRG of 400 mg/kg in total soil is based upon the Revised Interim, Soil Lead Guidance for CERCLA sites RCRA Corrective Action Facilities (USEPA 1994a). This concentration is supported by USEPA's Integrated Exposure Uptake Biokinetic (IEUBK) Model for Lead in Children (USEPA 2001). The IEUBK model predicts that 400 mg/kg of lead in soil could cause a six year old resident child (averaged across the preceding 84 months) to have a probability of no greater than 5% of having a blood lead level of 10 micrograms of lead per deciliter of blood (µg/dL), which is associated with adverse health effects.

The human health PRGs were conservatively developed for potentially exposed resident adult and child receptors at the site in OCCP and are presented in **Table 2-1**. The area of soil

exhibiting concentrations of COCs exceeding the human health PRGs for total soil at the site are presented in **Figure 2-1**.

Table 2-1. Summary of Human Health Preliminary Remediation Goals for Total Soil at OCCP - EU 8

COC	EPC (mg/kg)	Max (mg/kg)	PRG (mg/kg)	Basis
Resident Adult and Child				
Explosives				
2,4,6-TNT	4,109	19,000	18	Risk-based (carcinogenic, $>10^{-6}$)
Metals				
Lead	496	2,760	400	Risk-based

Legend:
2,4,6-TNT = 2,4,6-trinitrotoluene
COC = constituent of concern
EPC = exposure point concentration
mg/kg = milligrams per kilogram
Max = maximum detected concentration
PRG = preliminary remediation goal

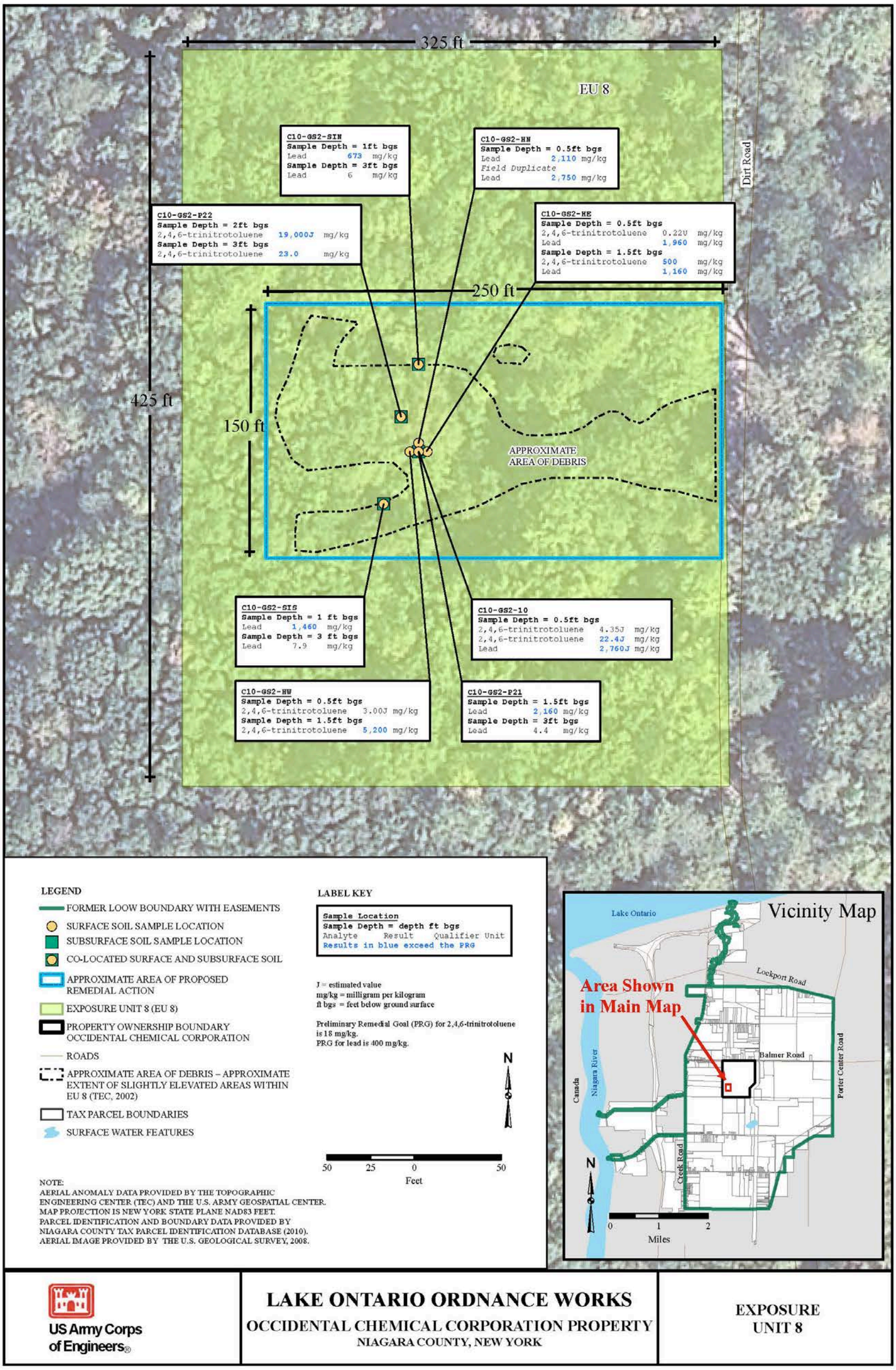

Figure 2-1: Exposure Unit 8

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3.0 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

CERCLA Section 121 (d)(2)(A) requires that remedial actions meet federal standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate. Such remedial actions shall attain a degree of cleanup of hazardous substances, pollutants, and contaminants released into the environment and of control of further release, which at a minimum assures protection of human health and the environment. The remedial actions shall be relevant and appropriate under the circumstances presented by the release or threatened release of such substance, pollutant, or contaminant.

ARARs may either be federal or state statutes or regulations, with state ARARs being applicable or relevant and appropriate if promulgated, legally enforceable, identified in a timely manner, consistently applied, and more stringent that federal requirements.

The selected remedial action must meet the standards of the identified ARARs, as defined by CERCLA, 42 United States Code (USC) 9601 et seq. in Section 121, or a waiver be obtained for those ARARs that are not satisfied under conditions allowed by CERCLA. Waivers are allowed for remedial actions that do not meet the requirements of the ARARs if the selected remedial action is part of a more inclusive remedial action designed to attain an acceptable level of control, compliance would result in greater risk to human health and/or the environment, compliance is technically impracticable from an engineering perspective, or the selected alternative remedial action would result in an equivalent level of control. In addition, waivers are allowed if a state has not consistently required or demonstrated the intention to consistently require that remedial action attain an acceptable level of control. This requirement for a waiver is in accordance with 40 CFR § 300.430(f) of the NCP and USACE guidance.

Agencies conducting remedial actions under CERCLA must ensure that the selected remedies comply with ARARs, defined in CERCLA Section 121(d)(2)(A) as:

> *"any standard, requirement, criteria, or limitation under any federal environmental law, including, but not limited to, the Toxic Substances Control Act, the Safe Drinking Water Act, the Clean Air Act, the Clean Water Act, the Marine Protection, Research and Sanctuaries Act, or the Solid Waste Disposal Act"*

and/or

> *"any promulgated standard, requirement, criteria, or limitation under a state environmental or facility siting law that is more stringent than any federal standard, requirement, criteria, or limitation, including each such state standard, requirement, criteria, or limitation contained in a program approved, authorized, or delegated by USEPA that has been identified in a timely manner"*

Applicable requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal environmental, state environmental, or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site. An applicable requirement directly and fully addresses an element of the remedial action.

Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria or limitations promulgated under federal environmental, state environmental, or facility siting laws that while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is suited to the particular site.

Only those state standards that are promulgated, are identified by the state in a timely manner, and are more stringent that federal requirements may be applicable or relevant and appropriate.

Based on CERCLA guidance, there are three types of ARARs:

- Chemical-specific requirements, which define acceptable exposure concentrations or water quality standards
- Location-specific requirements, which may restrict remediation activities at sensitive or hazard-prone locations such as active fault zones, wildlife habitat and floodplains
- Action-specific requirements, which may control activities and/or technology

The following sections describe the three types of ARARs and provide examples of each. Any ARAR presented is considered preliminary until a remedial alternative has been selected and evaluated. **Table 3-1** provides a summary of ARARs that have been retained for evaluation in the detailed analysis of alternatives.

3.1 Action-Specific ARARs

Action-specific ARARs are technology-based rules that specify how a remedial alternative must be achieved and generally set performance or design standards, controls or restrictions on particular alternative actions. Most action-specific ARARs address treatment, transportation, and disposal of hazardous waste. Action-specific ARARs that were considered in this FS are the federal RCRA regulations (40 CFR 260-268), and New York State hazardous waste regulations (6 New York Codes, Rules, and Regulations [NYCRR] Parts 370-374 and 376).

40 CFR 260-268 (RCRA)

RCRA (40 CFR Parts 260-268) regulates material that constitutes “hazardous waste” as defined in 40 CFR 261.3. Waste that has not been specifically listed (i.e. F-list under 40 CFR Part 261.31, K-list under 40 CFR Part 261.32, and P-list and U-list under 40 CFR Part 261.33) may still be considered a hazardous waste if it exhibits one of the four characteristics defined in 40 CFR Part 261 Subpart C - ignitability (D001), corrosivity (D002), reactivity (D003), and toxicity (D004 - D043). The TCLP is a soil sample extraction method for chemical analysis employed as an analytical method to simulate leaching through a landfill. The testing methodology is used to determine if a waste is characteristically hazardous.

No TCLP data is available for the site to confirm whether the contaminated surface soil is hazardous or not. However, total lead was detected in the surface soil at concentrations greater than 20 times the TCLP maximum concentrations listed in Title 40 of the Code of Federal Regulations Part 261.41 (40 CFR 261.24). This suggests that excavated surface soil may be classified as hazardous waste (code D008).

Pending hazardous waste confirmation with TCLP data, RCRA is identified as a potential action-specific ARAR for the site. Substantive, non-procedural, non-permit-related parts of RCRA that

may be potentially applicable or relevant and appropriate to the protectiveness of the proposed remedial actions on the site include:

- 40 CFR Part 264.301 (Design and Operating Requirement) - This Part regulates the design, construction and operation standards that may be applicable to on-site alternatives evaluated in this FS.
- 40 CFR Part 264.95 (Groundwater Compliance Monitoring) – This Part defines compliance for groundwater monitoring requirements that may be applicable to on-site alternatives evaluated in this FS.
- 40 CFR Part 268.48 (Land Disposal Restrictions) – This Part identifies treatment standards required for hazardous wastes to be land disposed. The treatment standards for hazardous waste may be applicable for on-site alternatives evaluated in this FS.

Since no on-site disposal alternatives are being evaluated in this FS, the RCRA design and operating requirements and land disposal restrictions are not applicable to the OCCP. However, portions of these requirements are relevant and appropriate to the circumstances at the OCCP. As discussed in Appendix C, the VS2DTI modeling predicts minimal TNT (the most mobile COC at the OCCP) transport from the source (i.e., debris pile) due to seasonal flooding of the site. As such, design features (i.e. RCRA Subtitle C equivalent cap for Alternative 3) in 40 CFR 264.301, groundwater compliance monitoring requirements in 40 CFR 264.95 for Alternatives 3 and 5, and meeting treatment standards in 40 CFR 268.48 (to minimize leaching of residual hazardous waste to groundwater for Alternative 5) are relevant and appropriate to the COCs, media, conditions at the site, and FS alternatives evaluated.

6 NYCRR Parts 370-374 and 376 (Hazardous Waste Management System)

In an August 26, 2013 letter to USACE, NYSDEC proposed 6 NYCRR Parts 370-373 as potentially relevant and appropriate regulations to address COCs in surface soil at the OCCP.

Hazardous wastes are governed by the regulatory program established by the federal RCRA, 42 U.S.C. §§6901, *et seq.*, and its implementing regulations at 40 CFR Parts 260-272. RCRA provides for "cradle to grave" regulation of hazardous wastes, from the initial waste generators, to transporters, and finally hazardous waste treatment, storage, and disposal facilities (TSDFs). The statute allows a state to be delegated primary authority for enforcement and administration of the hazardous waste program, provided it enacts a regulatory program at least as strict as RCRA (RCRA §3006, 42 USC §6926).

Like many states, New York has implemented a regulatory program by enacting the Industrial Hazardous Waste Act in 1978, which is found in Title 9 of Article 27 of the Environmental Conservation Law, and promulgating regulations contained at 6 NYCRR Parts 370-374 and 376. Accordingly, New York State's hazardous waste regulations, which largely parallel the federal regulations, provide more stringent soil cleanup objectives (SCOs) for inactive hazardous waste disposal sites pursuant to 6 NYCRR Part 375 (b)(1). Nonetheless, to the extent new federal mandates have not yet been added to the New York hazardous wastes regulations, the new federal regulations apply. Regulations in delegated states are updated from time to time to comply with new federal mandates, and in New York are often more stringent than those required by RCRA.

New York State's hazardous waste regulations (6 NYCRR Parts 370-373) are promulgated, consistently applied, and identified in a timely manner. However, since they are not more stringent than federal (i.e. RCRA) requirements for the COCs in surface soil at the site, they are not considered potential ARARs.

3.2 Chemical-Specific ARARs

Chemical-specific ARARs are rules that define permissible concentrations of chemicals for various environmental media. They are generally based on health or risk-based criteria. Some apply state-wide while others are based on site-specific calculations.

Chemical-specific ARARs identify specific numerical standards for remediation of the COCs in the media of concern (i.e., soil) at the site. Chemical-specific ARARs provide health or risk-based concentration limits in various environmental media (i.e., soil, sediment, water, and air). The limits, detailed for specific hazardous substances, pollutants, or contaminants, are protective of human health and the environment.

There is one chemical specific regulation being considered as a potential ARAR to address COCs in surface soil at the site: NYSDEC's environmental remediation program requirements for inactive hazardous waste disposal sites (6 NYCRR Part 375).

6 NYCRR Part 375 (Environmental Restoration Programs)

In an August 26, 2013 letter to USACE, NYSDEC proposed 6 NYCRR Part 375 as a potentially applicable regulation to address COCs in surface soil at the site.

The rule provides for the orderly and efficient administration of New York State's Environmental Conservation Law. The requirements set forth in this rule apply to the development and implementation of remedial programs for inactive hazardous waste disposal sites, specifically under subpart 375-2, including, but not limited to, sites which are either on the national priorities list or are being addressed by the DoD or the DOE. 6 NYCRR Part 35 develops soil cleanup objectives for specific land use categories, including sites where no restrictions would be placed on use (unrestricted), as well as for sites where land use restrictions or engineering controls may limit possible exposures (commercial and industrial). In addition to the protection of health, soil cleanup objectives were developed to be protective of groundwater and ecological resources.

The NYSDEC SCOs listed in 6 NYCRR Part 375-6 are promulgated regulations that address a COC (i.e. lead) and the media of concern (surface soil) at the site, and may therefore may be applicable standards that are protective of human health and the environment. SCOs may apply to actions planned to address lead in surface soil at the site if this state cleanup standard is more stringent than its federal counterpart.

Unrestricted use SCOs under 6 NYCRR Part 375-6.8(a) present the lower of the groundwater, ecological resources, and unrestricted public health values. Restricted use SCOs under 6 NYCRR Part 375-6.8(b) are designed to protect public health.

The site is located within a state and potential federal wetland, which is considered sensitive habitat. However, the RAO for the site was based upon the protection of human health. It is expected that compliance with human health standards will reduce lead concentrations in surface soil and decrease risk to ecological receptors. Additionally, the current zoning of low-density residential in Chapter 200-5 (Attachment 2) of the Town of Porter Zoning Law (Town of Porter

2004) most closely matches a NYSDEC restricted-residential land use designation. Therefore, restricted-residential land use SCOs under 6 NYCRR Part 375-6.8(b) were further evaluated as a potential ARAR. However, since the restricted-residential land use SCOs for lead in soil under 6 NYCRR Part 375-6.8(b) was not more stringent than the USEPA risk-based residential lead cleanup goal for the protection of human health (child resident) [400 mg/kg], then 6 NYCRR Part 375 was determined to not be an ARAR for the OCCP.

3.3 Location-Specific ARARs

Location-specific ARARs are requirements that limit the concentration of hazardous substances or activities solely because of geographical location, land use, or site characteristics. Potential location-specific ARARs include the protection of floodplains and wetlands; wilderness areas, wildlife refuges, and scenic rivers; historical sites and archaeological findings; and/or rare, threatened, or endangered species.

No substantive, non-procedural, non-permit-related location-specific ARARs have been identified for the site that are applicable to the circumstances of release or remedial alternatives considered that would impact their protectiveness.

3.4 To-Be-Considered Criteria

To-be-considered (TBC) criteria are non-promulgated federal or state advisories, criteria, or guidance regarding protection of human health or the environment which may be reasonably related to the remedial action. TBC criteria do not have the status of ARARs; however, as specified in the NCP (USEPA 1994b) they should be identified as supplements to the ARARs where ARARs do not exist and/or when existing ARARs are inadequate. Although there may be TBC criteria for the site RAO, there is no legal requirement to comply with TBCs.

The site is located within a freshwater forested/shrub wetland, designated LE-18, according to aerial imagery available at New York State Orthos Online for Niagara County (NYSDOP 2012). A jurisdictional determination is required for potential federal wetlands. The site is not located within a 100-year floodplain.

Current zoning permits land uses as specified in Chapter 200-7 of the Town of Porter Zoning Law (Town of Porter 2004). Additionally, any future development that may impact wetlands will require federal 404 (40 CFR 230) and state article 24 permits (6 NYCRR Part 663 and 664). Any form of impact to these federal and state mapped wetland(s) will require the future owner of the property to follow the proper permitting procedures. Future development under the 33 CFR 404 (b) (1) federal guidance requirements will be difficult to obtain if the wetlands are to be impacted.

3.5 Waivers

Under CERCLA, a selected remedial action must meet all the requirements of the identified ARARs unless a waiver from a specific requirement has been granted. A waiver from compliance with a specific ARAR can be granted for an alternative under the following circumstances:

- The alternative is an interim measure and will become part of a total remedial action that will meet ARARs

- Compliance with the ARAR is technically impractical from an engineering perspective
- Compliance with the ARAR will result in a greater risk to human health and the environment than other alternatives
- The alternative will attain a standard of performance that is equivalent to that required under the otherwise applicable standard, requirement, or limitation through use of another method or approach
- With respect to a state ARAR, the state has not consistently applied, or demonstrated the intention to consistently apply the promulgated requirement in similar circumstances at other remedial actions within the state

No waivers have been identified as currently applicable.

3.6 Identified ARARs and TBC Criteria

Table 3-1 presents the preliminary ARARs retained for future evaluation. Any ARAR presented here will be considered preliminary until remedial alternatives have been selected and evaluated. The preliminary ARARs will be further evaluated and refined during this FS process, after a range of remedial alternatives has been identified.

Table 3-1. Potentially Applicable or Relevant and Appropriate Requirements for OCCP – EU 8

Authority	Citation	Requirement Synopsis	Determination	Comments
Action-Specific ARARs				
Solid Waste Disposal Act (Resource Conservation and Recovery Act [RCRA]) 42 USC s/s 6901 et seq.	40 CFR Part 268.48 (Subpart D)	Federal regulations pertinent to the identification of treatment standards required for hazardous waste to be land disposed.	ARAR if waste is identified as hazardous and remedial action involves land disposal of regulated waste.	Relevant and Appropriate for the development of on-site alternatives for hazardous waste.
	40 CFR Part 264.301 (Subpart C)	Federal regulations pertinent to the design, construction, and operation standards for hazardous waste to be land disposed.	ARAR if waste is identified as hazardous and remedial action involves land disposal of regulated waste.	Relevant and Appropriate for the development of on-site alternatives for hazardous waste.
Chemical-Specific ARARs				
None	None	NA	NA	NA
Location-Specific ARARs				
None	None	NA	NA	NA

Legend:
ARAR = applicable relevant and appropriate requirement
CERCLA = Comprehensive Environmental Response, Compensation, and Recovery Act
CFR = Code of Federal Regulation
COCs = constituents of concern
RCRA = Resource Conservation and Recovery Act
USC = United States Code

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4.0 GENERAL RESPONSE ACTIONS

General response actions describe a broad variety of remedial measures that are capable of satisfying the RAOs for a site. A general response action may consist of several remedial action technologies and process options. These response actions will address the RAOs by either reducing the contaminant concentrations below the site-specific PRGs or by preventing exposure to the contaminated medium by the receptor of concern.

Before screening remedial technologies, general response actions must be identified that are applicable to the contaminated media and COCs. The following general response actions, either alone or in conjunction with other response actions, may achieve the site RAO:

- No Action
- Passive Response Actions
- Active Response Actions

4.1 No Action

CERCLA guidance requires consideration of no action as a baseline for comparison with other potential response actions and remedial alternatives. No action provides no remedial actions for the contaminated media and therefore, no technologies or process options are included.

4.2 Passive Response Actions

Passive response actions involve risk and management actions and containment actions. Risk and management actions consist of monitoring contaminant concentrations and establishing and maintaining land-use controls (LUCs). The LUCs typically consist of institutional controls (ICs) and engineering controls (EC)/access restrictions (ARs), which are containment actions. Collectively, they eliminate or minimize potential exposure to contaminants at the site.

4.2.1 Risk and Hazard Management Actions

Risk and hazard management is a limited action response restricting site access and inhibiting future land and resource use as the primary means for mitigating risk to potential receptors. As long as restrictions remain in place, contamination would not be actively remediated. An institutional action is considered a limited action in which monitoring is incorporated with the LUC to limit or eliminate the potential for exposure to contaminants.

4.2.2 Containment Actions

Containment is a response restricting or eliminating the transfer or migration of contaminants by installing barriers, effectively controlling or “containing” the contaminants, thereby mitigating the potential exposure risk. Containment actions isolate the contaminated media from the receptors of concern and include, but are not limited to, capping and subsurface barriers.

4.3 Active Response Actions

Active response actions include measures to remove or treat the contaminated media to eliminate or minimize the potential for exposure.

4.3.1 Removal Actions

Removal is an active response that removes or recovers the contaminants by a variety of methods, such as excavation, pumping, or dredging. The recovery and/or removal of source materials effectively remediate and mitigate potential exposure risks by reducing the contaminant volume at the site, but do not reduce the overall volume or concentration of the COCs. Recovery actions are often used in combination with other response actions such as treatment or disposal.

4.3.2 Treatment Actions

Treatment is an active response, either in situ or ex situ, which utilizes biological, chemical, physical, or thermal methods to reduce the toxicity, mobility, and/or volume of the contaminants. Treatment actions are typically preferred under CERCLA/SARA.

4.3.3 Disposal Actions

Disposal is an active response that does not reduce the volume or concentration of COCs, but reduces the mobility of the contaminants by placing the contaminated media in an engineered containment facility in a manner that protects human health and the environment.

4.4 Ongoing Response Actions

There are currently no active response actions in place at the site to protect human health and the environment from exposure to identified COCs in soil. The only access restrictions in-place at the site includes a gate restricting vehicular traffic on Balmer Road from entering the property. However, there are other means of accessing the site on foot without restrictions, which does not limit potential exposures to the identified COCs in soil.

5.0 IDENTIFICATION AND SCREENING OF TECHNOLOGY TYPES AND PROCESS OPTIONS

Potentially applicable, media-specific, remedial action technology types and process options for each general response action are identified in this section. Several technology types may be identified for each general response action, and multiple process options may exist within each technology type. The term "technology type" refers to the following general treatment categories: no action, risk and hazard management, containment, removal, ex situ treatment, in situ treatment, and disposal.

Under each of these technology types, there are multiple potentially applicable "process options," which refers to a specific treatment method. For example, under the risk and hazard management technology, there are three process options, which include ICs, EC/ARs, and long-term monitoring (LTM).

It is expected that during implementation of any technology or process option, the protection of workers, the public, and the environment from contamination would be achieved through the implementation of an approved site-specific safety and health plan.

The technology types and process options discussed in the following subsections have been identified and screened to determine applicability of achieving the RAOs by addressing contaminated soil within the site. A description and initial screening of each process option is included in **Table 5-1**.

5.1 Identification of Technology Types and Process Options

5.1.1 No Action

Under no action, measures would not be implemented to monitor site COCs or to reduce the toxicity, mobility, or volume of the contaminated media. Any LUCs and access restrictions would not be maintained. LTM would not be performed.

5.1.2 Risk and Hazard Management

Risk and hazard management would reduce and/or eliminate exposure to the contaminated media by using a combination of ICs, ECs, ARs, and LTM. It does not include active remedial measures that would reduce the toxicity, mobility, or volume of the contaminated soil.

5.1.3 Containment

Containment is a passive response that would not reduce the toxicity or volume of COCs, but would reduce the mobility and potential for COC migration. Containment is commonly one process option in an alternative that includes LUCs to mitigate exposure and LTM to detect potential releases.

Under this technology, containment process options that have been evaluated include capping and subsurface barriers consisting of clay, slurry, or grout walls. Capping involves covering an area with a low-permeability material to reduce the potential infiltration of water and the potential migration of COCs. Subsurface barriers involve constructing trenches and then filling them with compacted clay, slurry, or grout to provide vertical barriers that would inhibit groundwater flow.

5.1.4 Removal

Removal technologies would reduce and/or eliminate the volume of the contaminated media at the site. Removal alone would not reduce the toxicity of the contaminated media. The process options screened include manual and mechanical excavation.

Removal options are commonly used in conjunction with other process options, such as ex situ treatment to reduce the contaminant volume and/or toxicity. Risk and hazard management activities (e.g., LUCs and LTM) might be required if the remedial action does not remove COCs to levels that would allow for unlimited use and unrestricted exposure (UU/UE).

5.1.5 Ex Situ Treatment

Ex situ treatment includes biological, physical/chemical, and thermal treatment methods. These are active remedial measures that reduce the toxicity, mobility, and volume of contaminated media.

Compared to in situ treatment, ex situ treatment generally requires shorter time periods and provides more certainty about the uniformity of treatment. Ex situ treatment methods generally provide the ability to homogenize, screen, and continuously mix the contaminated media. Ex situ treatment requires removal of the contaminated media to a treatment cell or facility, which typically increases material handling/worker exposure considerations.

Ex situ biological treatment technologies are destruction or transformation techniques directed toward stimulating microorganisms to grow and use the contaminants as a food and energy source by creating a favorable environment. These technologies are capable of providing some combination of oxygen, nutrients, and moisture while controlling the temperature and pH. Microorganisms, adapted for degradation of the specific contaminants, may be applied to enhance the process.

Ex situ physical/chemical treatment technologies use the physical properties of the contaminants or the contaminated medium to destroy, separate, or immobilize the contamination. Ex situ physical/chemical treatment technologies typically can be completed in short time periods. Residuals may require disposal.

Ex situ thermal treatment technologies offer rapid cleanup times but are typically the most costly process option. Cost is driven by energy and equipment costs and is both capital and operation and maintenance (O&M) intensive. Ex situ thermal technologies, such as hot gas decontamination, incineration, pyrolysis, and thermal desorption use heat to volatize, incinerate, detonate, or immobilize contaminants.

Ex situ treatment process options that have been evaluated are listed below.

- Ex Situ Biological Treatment
  - Biopiles
  - Composting
  - Landfarming
  - Slurry Phase Biological Treatment
- Ex Situ Physical/Chemical Treatment
  - Chemical Extraction

  - Chemical Reduction/Oxidation
  - Dehalogenation
  - Separation
  - Soil Washing
  - Solidification/Stabilization
- Ex Situ Thermal Treatment
  - Hot Gas Decontamination
  - Incineration
  - Pyrolysis
  - Thermal Desorption

Following treatment, the material would be used as backfill or disposed, either on site or off site. These technologies are typically followed by a combination of risk and hazard management technologies (e.g., LUCs and LTM) when the remedial action does not allow for UU/UE.

5.1.6 In Situ Treatment

In situ treatment technologies include biological, physical/chemical, and thermal methods. They are active remedial measures that reduce the toxicity, mobility, and volume of the contaminated media.

In situ treatment is conducted in place and does not require the contaminated media to be removed and transported. Compared to ex situ treatment, in situ treatment methods generally require greater time and provide less certainty about the uniformity of treatment due to subsurface variability. In addition, completion of in situ treatment is typically more difficult to verify.

In situ biological treatment technologies are destruction or transformational techniques that stimulate microorganisms to grow and use the contaminants as an energy source by creating a favorable environment. Bioventing and enhanced biodegradation are common process options.

In situ physical/chemical treatment technologies use the physical and/or chemical properties of the contaminants or the contaminated medium to destroy, separate, or contain the contamination. Chemical oxidation, soil flushing, soil vapor extraction, and solidification/stabilization are common process options. Soil vapor extraction uses the contaminant's volatility to separate it from the contaminated media. Chemical oxidation converts the contaminants to non-hazardous or less toxic compounds that are more stable, less mobile, or inert. Soil flushing uses the contaminant's solubility in liquid to physically separate it from the contaminated media. Solidification encapsulates the contaminant while stabilization physically alters or binds with the contaminant.

In situ thermal treatment technologies offer quick cleanup times but generally result in higher costs, which are driven by energy and equipment costs. These methods are typically capital and O&M intensive. In situ steam/hot air injection, electrical resistance/electromagnetic heating, or fiber optic/radio frequency heating are demonstrated technologies. Thermal injection or heating is used to increase the volatilization rate of semi-volatiles and facilitate their extraction.

In situ treatment process options that have been evaluated are listed below.

- In Situ Biological Treatment
  - Bioventing
  - Enhanced Biodegradation
  - Phytoremediation
- In Situ Physical/Chemical Treatment
  - Chemical Oxidation
  - Electrokinetic Separation
  - Fracturing
  - Soil Flushing
  - Soil Vapor Extraction
  - Solidification/Stabilization
- In Situ Thermal Treatment
  - Steam/Hot Air Injection
  - Electrical Resistance/Electromagnetic Heating
  - Fiber Optic/Radio Frequency Heating

These technologies are typically followed by a combination of risk and hazard management technologies (e.g., LUCs and LTM) when the remedial action does not allow for UU/UE.

5.1.7 Disposal

Disposal is an active response action that would reduce and/or eliminate the mobility and volume of the contaminated media at the site, but would not reduce its overall toxicity and volume.

On-site and off-site disposal options were screened. Disposal technologies are used in conjunction with removal. Characterization of the contaminated media would be required prior to transportation and disposal at an appropriately permitted off-site facility or at an on-site constructed cell. Treatment is often performed to reduce the toxicity or volume of the contaminated media prior to disposal.

On-site disposal is typically followed by a combination of risk and hazard management technologies (e.g., LUCs and LTM).

5.2 Summary of Initial Screening

The initial screening of technology types and potential process options included those, which if implemented, may achieve the RAO for the site. Those technology types and process options that were not applicable to the site, based on one or more considerations, were removed from further consideration. **Table 5-1** presents a summary of the initial screening of technology types and process options for the site. Screening was conducted utilizing the *Guidance for Conducting RI/FS Under CERCLA* (USEPA 1988) and *Remediation Technologies Screening Matrix and Reference Guide, Version 4.0* (Federal Remediation Technologies Roundtable [FRTR] 2013).

The initial screening of technology types resulted in the identification of 16 process options that were determined to be appropriate for further evaluation based on effectiveness, implementability, and cost.

The following technology types and process options were retained for further evaluation based on the initial screening.

- No Action
  - No Action
- Risk Hazard Management
  - ICs
  - ECs/ARs
  - LTM
- Containment
  - Landfill Cap
  - Compacted Clay, Slurry or Grout Wall
- Removal
  - Manual Excavation
  - Mechanical Excavation
- Ex Situ Physical/Chemical Treatment (assuming excavation)
  - Chemical Reduction/Oxidation
  - Separation
  - Solidification/stabilization
- In Situ Biological Treatment
  - Enhanced Biodegradation
  - Phytoremediation
- In Situ Physical/Chemical Treatment
  - Chemical Oxidation
  - Solidification/stabilization
- Disposal
  - Off-Site Disposal

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Table 5-1. Summary of Initial Screening of Technology Types and Process Options for COCs in Total Soil at OCCP – EU 8

General Response Action	Technology Type	Process Option	Description	Comments[1]
No Response	None	No Further Action	No further remedial actions.	Required for consideration by the NCP (USEPA 1994b).
Passive Response Action	Risk Hazard Management	ICs	Legal instruments that minimize the potential for human exposure to contamination by limiting land or resource use.	Potentially applicable in conjunction with other process options for explosives and lead in soil and solid debris.
		ECs/ARs	Equipment and materials used to eliminate or reduce human exposure to contamination via physical barriers and other access restrictions.	Potentially applicable in conjunction with other process options for explosives and lead in soil and solid debris.
		LTM	Monitoring of environmental media and/or the selected remedy as natural attenuation reduces the contaminated volume.	Potentially applicable during the implementation of response actions that destroy, reduce, or immobilize explosives and lead in soil.
	Containment	Landfill Cap	Caps are used for contaminant source control. Includes geotextile fabric, low permeability soil caps, RCRA Subtitle C Caps, and RCRA Subtitle D Caps.	Potentially applicable based on site COCs and fill characteristics.
		Landfill Cap with Enhancements/ Alternatives	Caps are used for contaminant source control. Includes geotextile fabric, low permeability soil caps, RCRA Subtitle C caps, RCRA Subtitle D caps, and enhancements/alternatives (i.e. leachate collection system or other).	Landfill cap enhancements/alternatives are unnecessary based on site characteristics.
		Compacted Clay, Slurry or Grout Wall	Subsurface barriers that consist of vertically excavated trenches filled with compacted clay, slurry or cementitious grout to retard ground water flow.	Potentially applicable based on COCs, and characteristics of the site and fill area.
Active Response Action	Removal	Manual Excavation	Small-scale removal/extraction of subsurface material and/or structures via hand tools.	Potentially applicable in conjunction with other process options for explosives and lead in soil and solid debris.
		Mechanical Excavation	Large-scale removal/extraction of subsurface material and/or structures via an excavator or backhoe.	Potentially applicable in conjunction with other process options for explosives and lead in soil and solid debris.
	Ex Situ Biological Treatment (assuming excavation)	Biopiles	Excavated soils are mixed with soil amendments and placed in aboveground enclosures. Typically an aerated static pile composting process in which compost is formed into piles and aerated with blowers or vacuum pumps.	Potentially applicable in conjunction with other process options for explosives in soil. Not applicable for lead in soil and solid debris.
		Composting	Contaminated soil is excavated and mixed with bulking agents and organic amendments such as wood chips, hay, manure, and vegetative (e.g., potato) wastes. Proper amendment selection ensures adequate porosity and provides a balance of carbon and nitrogen to promote thermophilic, microbial activity.	Potentially applicable in conjunction with other process options for explosives in soil. Not applicable for lead in soil and solid debris.
		Land Farming	Contaminated soil, sediment, or sludge is excavated, applied into lined beds, and periodically turned over or tilled to aerate the waste.	Potentially applicable in conjunction with other process options for explosives in soil. Not applicable for lead in soil and solid debris.
		Slurry Phase Biological Treatment	Aqueous slurry is created by combining soil, sediment, or sludge with water and other additives. The slurry is mixed to keep solids suspended and microorganisms in contact with the soil contaminants. Upon completion of the process, the slurry is dewatered and the treated soil is disposed. Includes slurry-phase bioreactors.	Potentially applicable in conjunction with other process options for explosives in soil. Not applicable for lead in soil and solid debris.
	Ex Situ Physical/Chemical Treatment (assuming excavation)	Chemical Extraction	Waste contaminated soil and extractant are mixed in an extractor, thereby dissolving the contaminants. The extracted solution is then placed in a separator, where the contaminants and extractant are separated for treatment and further use. Includes acid extraction and solvent extraction.	Has not been demonstrated effective in the treatment of comingled explosives and lead in soil. Not applicable for solid debris.
		Chemical Reduction/ Oxidation	Reduction/oxidation chemically converts hazardous contaminants to non-hazardous or less toxic compounds that are more stable, less mobile, and/or inert. The oxidizing agents most commonly used are ozone, hydrogen peroxide, hypochlorites, chlorine, and chlorine dioxide.	Potentially applicable in conjunction with other process options for explosives and lead in soil. May require the removal of solid debris beforehand.
		Dehalogenation	Reagents are added to soils contaminated with halogenated organics. The dehalogenation process is achieved by either the replacement of the halogen molecules or the decomposition and partial volatilization of the contaminants. Includes base-catalyzed decomposition and glycolate/alkaline polyethylene glycol.	Not applicable for explosives and lead in soil.
		Separation	Separation techniques concentrate contaminated solids through physical and chemical means. These processes seek to detach contaminants from their medium (i.e., the soil, sand, and/or binding material that contains them). Includes gravity separation, magnetic separation, and sieving/physical separation.	Potentially applicable for solid debris in soil. Not applicable for explosives and lead in soil. May be used in conjunction with other process options.

Table 5-1. Summary of Initial Screening of Technology Types and Process Options for COCs in Total Soil at OCCP – EU 8

General Response Action	Technology Type	Process Option	Description	Comments[1]
		Soil Washing	Contaminants sorbed onto fine soil particles are separated from bulk soil in an aqueous-based system on the basis of particle size. The wash water may be augmented with a basic leaching agent, surfactant, pH adjustment, or chelating agent to help remove organics and heavy metals.	Potentially applicable for lead in soil. Not applicable for explosives in soil or solid debris.
		Solidification/ Stabilization	Contaminants are physically bound or enclosed within a stabilized mass (solidification), or chemical reactions are induced between the stabilizing agent and contaminants to reduce their mobility (stabilization). Includes bituminization, emulsified asphalt, modified sulfur content, Pozzolan/Portland cement, soluble phosphates, and vitrification/molten glass.	Potentially applicable for explosives and lead in soil. May require the removal of solid debris beforehand.
	Ex Situ Thermal Treatment (assuming excavation)	Hot Gas Decontamination	The process involves raising the temperature of the contaminated equipment or material for a specified period of time. The gas effluent from the material is treated in an afterburner system to destroy all volatilized contaminants.	Not applicable for the environmental media (i.e., soil).
		Incineration	High temperatures, 870-1,200 °C (1,600- 2,200 °F), are used to combust (in the presence of oxygen) organic constituents in hazardous wastes. Includes circulating bed combustor, fluidized bed, infrared combustion, and rotary kilns.	Potentially applicable for explosives in soil. Not applicable for lead in soil or solid debris.
		Pyrolysis	Chemical decomposition is induced in organic materials by heat in the absence of oxygen. Organic materials are transformed into gaseous components and a solid residue (coke) containing fixed carbon and ash. Includes rotary kiln, fluidized bed furnace, and molten salt destruction.	Not applicable for explosives and lead in soil or solid debris.
		Thermal Desorption	Wastes are heated to volatilize water and organic contaminants. A carrier gas or vacuum system transports volatilized water and organics to the gas treatment system. Includes high and low temperature thermal desorption.	Potentially applicable for explosives in soil. Not applicable for lead in soil or solid debris.
	In Situ Biological Treatment	Bioventing	Oxygen is delivered to contaminated unsaturated soils by forced air movement (either extraction or injection of air) to increase oxygen concentrations and stimulate biodegradation.	Not applicable for explosives and lead in soil and solid debris.
		Enhanced Biodegradation	The activity of naturally occurring microbes is stimulated by circulating water-based solutions through contaminated soils to enhance in situ biological degradation of organic contaminants or immobilization of inorganic contaminants. Nutrients, oxygen, or other amendments may be used to enhance bioremediation and contaminant desorption from subsurface materials.	Potentially applicable in conjunction with other process options for explosives in soil. Not applicable for lead in soil and solid debris. May be used in conjunction with other process options.
		Phytoremediation	Process that uses plants to remove, transfer, stabilize, and destroy contaminants in soil and sediment. Contaminants may be either organic or inorganic. Includes enhanced rhizosphere biodegradation, phyto-accumulation, phyto-degradation, and phyto-stabilization.	Potentially applicable in conjunction with other process options for explosives and led in soil. May require the removal of solid debris beforehand.
	In Situ Physical/Chemical Treatment	Chemical Oxidation	Oxidation chemically converts hazardous contaminants to non-hazardous or less toxic compounds that are more stable, less mobile, and/or inert. The oxidizing agents most commonly used are ozone, hydrogen peroxide, hypochlorites, chlorine, and chlorine dioxide. Includes ozone addition, peroxide, and permanganate.	Potentially applicable in conjunction with other process options for explosives and lead in soil. May require the removal of solid debris beforehand.
		Electrokinetic Separation	Process removes metals and organic contaminants from low permeability soil, mud, sludge, and marine dredging. Uses electrochemical and electrokinetic processes to desorb, and then remove, metals and polar organics. This in situ soil processing technology is primarily a separation and removal technique for extracting contaminants from soils.	Not applicable for explosives and lead in soil or solid debris.
		Fracturing	Cracks are developed by fracturing beneath the surface in low permeability and over-consolidated sediments to open new passageways that increase the effectiveness of many in situ processes and enhance extraction efficiencies. Includes blast-enhanced fracturing, Lasagna process, and pneumatic fracturing.	Not applicable for explosives and lead in soil or solid debris.
		Soil Flushing	Water, or water containing an additive to enhance contaminant solubility, is applied to the soil or injected into the ground water to raise the water table into the contaminated soil zone. Contaminants are leached into the ground water, which is then extracted and treated.	Not applicable for explosives and lead in soil or solid debris.
		Soil Vapor Extraction	Vacuum is applied through extraction wells to create a pressure/concentration gradient that induces gas-phase volatiles to be removed from soil through extraction wells. This technology also is known as in situ soil venting, in situ volatilization, enhanced volatilization, or soil vacuum extraction.	Not applicable for explosives and lead in soil or solid debris.

Table 5-1. Summary of Initial Screening of Technology Types and Process Options for COCs in Total Soil at OCCP – EU 8

General Response Action	Technology Type	Process Option	Description	Comments[1]
		Solidification/ Stabilization	Contaminants are physically bound or enclosed within a stabilized mass (solidification), or chemical reactions are induced between the stabilizing agent and contaminants to reduce their mobility (stabilization). Includes bituminization, emulsified asphalt, modified sulfur content, Pozzolan/Portland cement, sludge stabilization, soluble phosphates, and vitrification/molten glass.	Potentially applicable for explosives and lead in soil. May require the removal of solid debris beforehand.
	In Situ Thermal Treatment	Steam/Hot Air Injection	Steam/hot air injection is used to increase the volatilization rate of semi-volatiles and facilitate extraction.	Potentially applicable, but untested on treating explosives in soil. Not applicable for lead in soil and solid debris.
		Electrical Resistance/Electromagnetic Heating	Electrical resistance/electromagnetic heating are used to increase the volatilization rate of semi-volatiles and facilitate extraction.	Potentially applicable, but untested on treating explosives in soil. Not applicable for lead in soil and solid debris.
		Fiber Optic/Radio Frequency Heating	Fiber optic/radio frequency heating is used to increase the volatilization rate of semi-volatiles and facilitate extraction.	Potentially applicable, but untested on treating explosives in soil. Not applicable for lead in soil and solid debris.
	Disposal	Off-Site Disposal	Contaminated material is removed and transported to permitted off-site disposal facilities. Pretreatment may be conducted, as required.	Potentially applicable in conjunction with other process options for explosives and lead in soil and solid debris.
		On-Site Disposal	Following any necessary treatment of contaminated material, remediated material is disposed of onsite.	On-site Disposal is no more effective than capping and presents higher costs.

Legend:
Red highlighted = Process option has been eliminated from consideration based on further evaluation.
AR = access restriction
COC = constituent of concern
EC = engineering control
IC = institutional control
LTM = long-term monitoring
NCP = National Oil and Hazardous Substances Pollution Contingency Plan
RCRA = Resource Conservation and Recovery Act
°F = degrees Fahrenheit

Sources:
1 = Remediation Technologies Screening Matrix and Reference Guide, Version 4.0 (FRTR 2013)

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5.3 Evaluation of Process Options

The retained process options are evaluated in this section in accordance with the *Guidance for Conducting RI/FS Under CERCLA* (USEPA 1988):

Effectiveness: Evaluates (1) the potential effectiveness of process options in addressing the estimated volumes of contaminated media and meeting the PRGs identified in the RAOs, (2) the potential impacts to human health and the environment during construction and implementation, and (3) the adequacy and reliability of the process with respect to the contaminants and site-specific conditions.

Implementability: Evaluates both the technical and administrative feasibility of implementing a technology process option. Technical implementability is used as an initial screen of technology types and process options to eliminate those that are clearly ineffective or infeasible in achieving the RAOs for a site.

Cost: Evaluates in a limited fashion, the capital, O&M, and relative costs of the technology process options. Preliminary cost estimation should be made on the basis of engineering judgment, and each process option should be evaluated as to whether costs are high, medium, or low relative to other technology process options evaluated. In accordance with Appendix F of the *Guidance for Conducting RI/FS Under CERCLA* (USEPA 1988), the minimum cost associated with each technology (other than the "no action" alternative) or process option would include five-year review reporting requirements and reflect a 30 year period of performance.

Summary: Outlines the evaluation criteria (i.e., effectiveness, implementability, and cost) in a limited fashion and provides positive and negative attributes of each process option. Each summary focuses on the evaluation criteria (i.e., effectiveness, implementability, and cost).

5.3.1 No Action

Effectiveness: "No action" would not reduce toxicity, mobility, or volume of COCs at the site. This option would not be effective in reducing the volume of contaminated material, would not meet the PRGs, and would not reduce the potential exposure to contaminants.

Implementability: No activity would be implemented with this action.

Cost: There is no cost associated with this action.

Summary: No action provides a baseline for comparing the other alternatives. Because no remedial actions would be implemented, long-term health and environmental risks for the site would essentially be the same as those identified in the baseline risk assessment. There would be no cost.

5.3.2 Risk and Hazard Management

Effectiveness: LTM, ICs, and EC/ARs would not reduce the toxicity, mobility, or volume of the contaminated soil. These options can limit human exposure to the COCs; however they may not limit exposure to all potential environmental receptors. ICs, EC/ARs, and LTM are routinely implemented to address similar COCs under comparable conditions, although they are more typically applied in conjunction with other process options.

Implementability: ICs, EC/ARs, and LTM are both technically and administratively feasible. LTM is commonly used at sites where contaminants remain. Implementation would consist of

deed restrictions, installation and maintenance of a perimeter fence, and site inspections. Administrative measures would be required to execute long-term management and provide coordination with various stakeholders and regulators. Long-term management of ICs may require the federal government to take a real estate interest in the site.

Cost: The relative cost for risk and hazard management are typically low to moderate , and are low compared to other process options considered for the site.

Summary: ICs, EC/ARs, and LTM are options that could be used to address COCs identified at the site. Each is commonly used in conjunction with other remedial options and are maintained for further consideration.

5.3.3 Containment

Effectiveness: A clay, slurry or grout wall, or cap would reduce the mobility of COCs, but not their toxicity or volume. COCs would be isolated and the human health and environmental exposure pathways would be eliminated. Impacts to human health and the environment during installation could be mitigated by using worker health measures and carefully planned construction techniques. A low-permeability cap keyed into the native clay would provide a barrier that reduces the potential for horizontal migration or flushing of contaminants. Clay, slurry or grout walls are typically used in conjunction with landfill caps in order to mitigate potential horizontal migration of COCs in saturated soil and groundwater. Landfill caps are typically used in conjunction with ICs and EC/ARs. LTM and maintenance would be required to assure the adequacy and reliability of the cap. LUC/ICs would be required because the cap would not remediate the site to a level that provides UU/UE.

Implementability: A clay, slurry or grout wall, or cap can be installed in a relatively short time using conventional construction techniques and labor. It is easily monitored using visual inspections and field screening methods. This option may require administrative approvals that would be difficult to obtain.

Cost: Clay, slurry or grout wall costs are typically low to moderate. Containment options require moderate capital and O&M costs compared to other evaluated process options projected over a 30 year period of performance.

Summary: Capping the contaminated soil would prevent direct contact with the COCs. It could be used in conjunction with LUC/ICs to meet the RAO and is retained for further consideration. Clay, slurry or grout walls may be used in conjunction with a landfill cap in order to mitigate potential horizontal migration of COCs in saturated soil and groundwater.

5.3.4 Removal

Effectiveness: Excavation would reduce the contaminant toxicity, mobility, and volume at the site and achieve the PRGs for the contaminated media. Excavation would not reduce the overall toxicity and volume of the contaminated media. It could be used in conjunction with off-site disposal at a permitted TSDF that uses treatment technologies. Potential impacts to human health and the environment could be mitigated by implementing a worker health and safety program and by using proper construction and monitoring methods. In conjunction with other options, removal would provide long-term protection to human health and the environment.

Implementability: Removal options are technically and administratively feasible. Mechanical and manual excavations are common construction activities that require standard equipment and

labor. The nature of the site fill, which includes a considerable amount of debris and solidified residues, would limit the implementability of manual excavation methods.

Cost: Excavation would require moderate capital, low O&M, and moderate overall costs compared to other evaluated options. Construction costs associated with this activity can be estimated with a relatively high degree of accuracy.

Summary: Mechanical excavation is a reliable process that would address the contaminated media and is retained for further consideration. Manual excavation is not retained because it would be difficult to implement at the site.

5.3.5 Ex Situ Treatment

Effectiveness: Ex situ physical/chemical treatment options have varying degrees of effectiveness. Chemical reduction/oxidation has been moderately effective for the treatment of explosives and lead, and might achieve the RAOs. Solidification/stabilization would treat the lead contaminated areas; it has not been demonstrated effective for the treatment of explosives in soil. Physical separation would be used to remove the solid debris prior to treatment by chemical reduction/oxidation or solidification/stabilization. Impacts to human health and the environment during implementation of these options could be mitigated by using proper health/safety and construction/monitoring techniques.

Implementability: These processes are technically implementable and the equipment/reagents are commercially available. Chemical reduction/oxidation, physical separation, and solidification/stabilization are more easily implemented and more reliable than the other ex situ treatment processes. Solidification/stabilization would produce a greater volume of treated material due to the added mass of the reagents. Screening and removal of debris would be required prior to implementing both processes. Bench and pilot-scale testing would be required to determine the efficacy of both processes. Ex situ treatment performed on-site would require construction of a treatment cell. The administrative feasibility of this approach is rated low because the site is located in a wetland. Off-site treatment at an appropriate TSDF would be relatively easy to implement.

Cost: All processes would require moderate capital costs and moderate overall costs compared to other evaluated options. The O&M costs are low for chemical reduction/oxidation and separation and moderate for solidification/stabilization.

Summary: Ex situ chemical reduction/oxidation is a potentially reliable process option to address the site COCs. Separation would be an effective method of removing debris from the soil prior to treatment. Both processes, performed off site, are maintained for further consideration. On-site application is not considered further because of the low administrative feasibility. Solidification/stabilization has not been retained for further consideration because it has not been demonstrated as effective for the treatment of explosives in soil.

5.3.6 In Situ Treatment

In situ biological and physical/chemical treatment options are evaluated.

5.3.6.1 In Situ Biological Treatment

Effectiveness: In situ biological treatment, including phytoremediation, has limited demonstrated effectiveness at full scale for comingled explosives and lead-contaminated media at the PRGs for this site. These options would reduce the volume, toxicity and mobility of 2,4,6-TNT; they have

not been proven effective for the treatment of lead, particularly in northern climates. Properly executed, in situ biological treatment would not impact human health and the environment. LUC/ICs and LTM would be required because the processes would not remediate the site to a level that provides UU/UE.

Implementability: In situ bioremediation and phytoremediation would be moderately difficult to implement. Each process would require bench and pilot-scale tests to determine efficacy and design considerations. The material and technical resources needed to implement these options are commercially available. In situ treatment may require administrative approvals that may be difficult to achieve because of the wetland.

Cost: In situ enhanced biodegradation would require moderate capital, high O&M, and moderate overall relative costs. Phytoremediation would require low capital, O&M, and overall relative costs.

Summary: In situ biological treatment options are not retained for further consideration because they may not be able to remediate lead to the PRG and would be administratively difficult to implement in the wetland.

5.3.6.2 In Situ Physical/Chemical Treatment

Effectiveness: In situ physical/chemical treatment (chemical reduction/oxidation) has been demonstrated at full scale for comingled explosives and lead-contaminated media at the PRGs for this site. Solidification/stabilization would effectively treat the lead contaminated areas; it has not been demonstrated effective for the treatment of explosives in soil. Physical separation would be a suitable method to remove the solid debris prior to treatment by chemical reduction/oxidation or solidification/stabilization. Properly executed, the chemical reduction/ oxidation and solidification/stabilization processes would not impact human health and the environment. Chemical reduction/oxidation would reduce the toxicity and volume of explosives in soil. It would reduce the toxicity and mobility of lead in soil but would not reduce the volume of lead contaminated soil.

Implementability: In situ chemical reduction/oxidation and solidification/stabilization would be moderately difficult to implement, both technically and administratively. Each option would require a treatability study and pilot test to determine efficacy and design considerations. The equipment and technical resources are commercially available. In situ treatment may require administrative approvals that are difficult to achieve because of the wetland.

Cost: In situ chemical reduction/oxidation and solidification/stabilization would require moderate capital, moderate O&M, and moderate overall costs.

Summary: In situ chemical oxidation is retained for further. Solidification/stabilization has not been retained for further consideration because it has not been demonstrated as effective for the treatment of explosives in soil.

5.3.7 Disposal

Effectiveness: Disposal at a permitted off-site facility would prevent the contaminants from migrating, would protect human health and the environment, and would reduce contaminant mobility.

Implementability: Disposal is technically implementable and reliable. Permitted off-site TSDFs that can accept contaminated media from the site are available. Waste characterization,

acceptance by the disposal facility and host state, and transportation would be required. This option is administratively feasible.

Cost: Off-site disposal would require moderate capital, low O&M, and moderate overall costs compared to other evaluated options.

Summary: Off-site disposal is a viable process option that is maintained for further consideration.

5.4 Summary of Evaluation

Potential process options evaluated included those, which if implemented as part of an alternative, may achieve the RAO for the site. **Table 5-2** provides a summary of the evaluation.

Those process options that ranked lower for either effectiveness or implementability and higher for cost were removed from further consideration and not carried forward to the development of alternatives. Processes that ranked higher for either effectiveness or implementability and lower for cost were retained for further consideration. These are listed below and carried forward to the development and evaluation of alternatives in Section 6.0.

The following technology types and process options were retained for further consideration based on the evaluation of potential process options.

- No Action
  - No Action
- Risk Hazard Management
  - ICs
  - ECs/ARs
  - LTM
- Containment
  - Landfill Cap
  - Compacted Clay, Slurry or Grout Wall
- Removal
  - Mechanical Excavation
- In Situ Physical/Chemical Treatment
  - Chemical Reduction/Oxidation
  - Separation
- Disposal
  - Off-Site Disposal

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Table 5-2. Evaluation of Potential Process Options for COCs in Total Soil at OCCP – EU 81, 2, 3

General Response Action	Technology Type	Process Option	Effectiveness	Implementability	Cost			Conclusions
					Capital	O&M	Relative	
No Response	None	No Further Action	Does not reduce the volume, toxicity, and mobility of contaminated material or eliminate potential exposure pathways; no construction activities; potential impacts to human health and the environment will persist.	Easily implemented; state and property owner acceptance is considered unlikely.	Low	Low	Low	Retained as a "baseline" case
Passive Response Action	Risk and Hazard Management	ICs	Does not reduce the volume, toxicity, and mobility of contaminated material. Eliminates potential exposure pathways; may not eliminate environmental exposure pathways. No construction activities.	Administrative decisions would be difficult because the property is privately owned. Requires routine verification to ensure that the ICs are being complied with. May require the federal government to take a real estate interest in the property.	Low	Low	Low	Retained because of potential viability (i.e., effectiveness in eliminating human exposure to COCs), and also applicable for use after implementation of a technology that leaves contaminants at levels that do not allow for UU/UE.
		ECs/ARs	Does not reduce the volume, toxicity, and mobility of contaminated material. Eliminates potential human health exposure pathways; does not eliminate all environmental exposure pathways. Protection of human health during installation can be maintained by implementing health and safety controls; minimal environmental impacts are expected during installation.	Easily implemented, requires readily available products and services and continued maintenance. May be administratively difficult because the property is privately owned.	Low	Low	Low	Retained because of potential viability (i.e., effectiveness in eliminating human exposure to COCs), and also applicable for use after implementation of a technology that leaves contaminants at levels that do not allow for UU/UE.
		LTM	Does not reduce the volume, toxicity, and mobility of contaminated material or eliminate potential exposure pathways. Protection of human health during monitoring can be maintained by implementing health and safety controls. Provides a mechanism to monitor the volume toxicity, and mobility of the contaminated material.	Easily implemented, standard option that requires a long-term right of entry agreement with property owner.	Low	Low	Low	Retained; applicable for use after implementation of a technology that leaves contaminants at levels that do not allow for UU/UE.
	Containment	Landfill Cap	Does not reduce the volume or toxicity of contaminated material. Reduces the mobility of contaminated material and eliminates potential exposure pathways. Protection of human health during construction can be maintained by implementing health and safety controls; minimal environmental impacts are expected. Protects human health and the environment during implementation.	Easily implemented, standard technology that uses readily available products and conventional construction methods. Requires continued maintenance. May be administratively difficult to implement because the site is privately owned and located in a New York State wetland.	Moderate	Moderate	Moderate	Retained because of potential viability (i.e., effectiveness).

Table 5-2. Evaluation of Potential Process Options for COCs in Total Soil at OCCP – EU 81, 2, 3

General Response Action	Technology Type	Process Option	Effectiveness	Implementability	Cost			Conclusions
					Capital	O&M	Relative	
		Compacted Clay, Slurry or Grout Wall	Does not reduce the volume or toxicity of contaminated material. Reduces the mobility of contaminated material and eliminates potential exposure pathways. Protection of human health during construction can be maintained by implementing health and safety controls; minimal environmental impacts are expected. Protects human health and the environment during implementation.	Easily implemented, standard technology that uses readily available products and conventional construction methods. Requires continued maintenance. May be administratively difficult to implement because the site is privately owned and located in a New York State wetland.	Moderate	Moderate	Moderate	Retained because of potential viability in conjunction with other process options (i.e., Landfill Cap)
Active Response Action	Removal	Manual Excavation	Reduces the volume of contaminated material; does not reduce the toxicity or mobility of the contaminants. Protection of human health during implementation can be maintained by implementing health and safety controls; minimal environmental impacts are expected. Contaminated materials would not remain at the site.	Standard method that uses conventional manual equipment. Compared to mechanical excavation, this method is labor intensive and would increase the potential for worker exposure to COCs. The presence of solid debris and solidified residues would make this option difficult to implement. The administrative feasibility is considered likely.	Moderate	Low	Moderate	Not retained due to lower rating for implementability when compared with mechanical excavation
		Mechanical Excavation	Reduces the volume of contaminated material; does not reduce the toxicity or mobility of the contaminants. Protection of human health during implementation can be maintained by implementing health and safety controls; minimal environmental impacts are expected. Contaminated materials would not remain at the site.	Standard method that uses conventional construction equipment. Compared to manual excavation, this method requires less labor, would reduce the potential for worker exposure to COCs, and can remove solid debris and solidified residues. Administrative feasibility is considered likely.	Moderate	Low	Moderate	Retained because of potential viability (i.e., effectiveness, implementability, and cost)
		Chemical Reduction/ Oxidation	A specific technology (munitions degradation and lead stabilization via chemical treatment) is capable of treating explosives and lead in soil. It would reduce the volume, toxicity, and mobility of contaminated material and eliminate potential exposure pathways. Protection of human health during implementation can be maintained by implementing health and safety controls; minimal environmental impacts are expected.	Available technology that would require the performance of bench and pilot scale tests prior to full-scale application. Requires removal of solid debris from the soil prior to treatment and construction of an on-site treatment cell. The administrative feasibility of this is considered low because the site is located in a New York State wetland.	Moderate	Low	Moderate	Not retained based on lower rating in comparison with in situ chemical reduction/ oxidation

Table 5-2. Evaluation of Potential Process Options for COCs in Total Soil at OCCP – EU 81, 2, 3

General Response Action	Technology Type	Process Option	Effectiveness	Implementability	Cost			Conclusions
					Capital	O&M	Relative	
		Separation	Effective method of removing solid debris from the soil. Ineffective in reducing the volume, toxicity, and mobility of contaminated material or eliminating potential exposure pathways. Protection of human health can be maintained by implementing health and safety controls during processing; minimal environmental impacts are expected.	Common method that is typically used in conjunction with other process options. Materials and equipment are commercially available. Administrative feasibility is considered likely.	Moderate	Low	Moderate	Retained; viable in conjunction with other process options.
		Solidification/ Stabilization	Not demonstrated effective for the treatment of explosives in soil. Demonstrated effective for the treatment of lead in soil. Would not reduce the volume of contaminated material. May not adequately reduce the mobility of explosive contaminants and may not eliminate potential exposure pathways. Protection of human health can be maintained by implementing health and safety controls during implementation; minimal environmental impacts are expected.	Materials and equipment are commercially available; uses conventional construction methods. Requires removal of solid debris prior to treatment and construction of an on-site treatment cell. The administrative feasibility is considered low because the site is located in a New York State wetland.	High	Moderate	Moderate	Not retained due to low ratings for effectiveness and implementability
	In Situ Biological Treatment	Enhanced Biodegradation	Demonstrated effective for the treatment of explosives in soil. Not demonstrated effective for the treatment of lead in soil. Would not reduce the volume, toxicity, and mobility of lead contaminated soil. Would not eliminate potential exposure pathways. Protection of human health can be maintained by implementing health and safety controls during processing; minimal environmental impacts are expected.	Materials and equipment are commercially available, standard construction methods are used. Requires removal of solid debris prior to treatment and construction of an on-site treatment cell. The administrative feasibility is considered low because the site is located in a New York State wetland.	Moderate	High	Moderate	Not retained due to low ratings for effectiveness and implementability
		Phytoremediation	Demonstrated effective for the treatment of explosives in soil. Not demonstrated effective for the treatment of lead in soil. Would not eliminate potential exposure pathways. Protection of human health during implementation can be maintained by implementing health and safety controls; minimal environmental impacts are expected.	Available technology that would require the performance of bench and pilot scale tests prior to full-scale application. Requires removal of solid debris from soil prior to treatment.	Low	Low	Low	Not retained due to low ratings for effectiveness and implementability

Table 5-2. Evaluation of Potential Process Options for COCs in Total Soil at OCCP – EU 81, 2, 3

General Response Action	Technology Type	Process Option	Effectiveness	Implementability	Cost			Conclusions
					Capital	O&M	Relative	
	In Situ Physical/ Chemical Treatment	Chemical Reduction/ Oxidation	Demonstrated effective (i.e., munitions degradation and lead stabilization via chemical treatment) for the treatment of explosives and stabilization of lead in soil. Would reduce the volume, toxicity, and mobility of explosives and the mobility of lead in soil, thereby eliminating potential exposure pathways. Effective in protecting human health and the environment during construction and implementation.	Available technology that would require the performance of bench and pilot scale tests prior to full-scale application. Would require removal of debris and consolidated residues beforehand. Administrative feasibility is ranked low because the site is located in a New York State wetland.	Moderate	High	High	Retained because it satisfies the stator preference for treatment that reduces the toxicity and mobility of contaminants.
		Solidification/ Stabilization	Not demonstrated effective for the treatment of explosives in soil. Demonstrated effective for the treatment of lead in soil. Would not reduce the volume of contaminated material. May not adequately reduce the mobility of explosive contaminants and may not eliminate potential exposure pathways. Protection of human health can be maintained by implementing health and safety controls during implementation; minimal environmental impacts are expected.	Materials and equipment are commercially available; uses conventional construction methods. Would require the removal of solid debris beforehand. The administrative feasibility is considered low because the site is located in a New York State wetland.	Moderate	Moderate	Moderate	Not retained due to low ratings for effectiveness and implementability
	Disposal	Off-Site Disposal	Reduces the mobility of and limits exposure to COCs. Does not reduce the volume of contaminated materials.	Easily implemented; disposal facilities able to accept the waste are available. Administrative feasibility is considered likely.	Moderate	Low	Moderate	Retained based on high ratings for effectiveness and implementability

Legend:
COC = constituent of concern
RAO = remedial action objective
AR = access restriction
IC = institutional control
COC = constituent of concern
LTM = long-term monitoring
EC = engineering control
= Process option is not retained for further evaluation

Sources:
1 - Remediation Technologies Screening Matrix and Reference Guide, Version 4.0 (FRTR, 2013)
2 - Remediation Technologies Screening Matrix and Reference Guide, Version 4.0; Table 2-8 (FRTR, 2013)
3 - Remediation Technologies Screening Matrix and Reference Guide, Version 4.0; Table 3-1 and 3-2 (FRTR, 2013)

6.0 DEVELOPMENT AND SCREENING OF ALTERNATIVES

In this section the remedial action technologies and process options that were retained after the initial screening and evaluation are assembled into alternatives that represent a range of remedial options. This section also documents the results of the screening process to eliminate those alternatives with only limited opportunity for success at the site.

The general response actions that are either required by CERCLA or considered applicable for the site include: No Action, Risk and Hazard Management, Containment Action, Treatment in Place, and Removal, Treatment, and Disposal. The Containment, Treatment in Place, and Removal, Treatment, and Disposal response actions meet the threshold criteria for:

- Overall protection of human health and the environment
- Compliance with ARARs

No action does not meet these threshold criteria.

6.1 Development of Alternatives

Requirements specified by the USEPA in the NCP for developing alternatives include the following:

- A No Action alternative should be developed
- One or more alternatives should be considered that involves little or no treatment, but address identified COCs that pose a potential threat to human health and the environment primarily by preventing or controlling exposure to hazardous substances, pollutants, or contaminants through engineering controls
- A range of alternatives should be developed in which the principal element is treatment resulting in reduced toxicity, mobility, or volume of the contaminants

Five potential remedial alternatives, listed in **Table 6-1**, have been developed for the site on the basis of these requirements, the site contaminants, and site conditions. The potential alternatives are evaluated against three criteria: effectiveness, implementability, and cost.

- *Effectiveness:* a measure of how the alternative will protect human health and the environment and meet ARARs. Each alternative is evaluated with respect to its protectiveness and how it will reduce the toxicity, mobility, and volume of the COCs. Both short- and long-term components are evaluated; short-term referring to the construction and implementation period, and long-term referring to the period after the remedial action is complete. Reduction of toxicity, mobility, or volume refers to changes in one or more characteristics of the hazardous substances or contaminated media by the use of treatment that decreases the inherent threats or risks.
- *Implementability:* a measure of both the technical and administrative feasibility of constructing, operating, and maintaining a remedial action alternative. Technical feasibility refers to the ability to construct, reliably operate, and meet technology-specific regulations until a remedial action is complete; it also includes operation, maintenance, replacement, and monitoring of technical components of an alternative, if required, after the remedial action is complete. Administrative feasibility refers to the ability to obtain approvals from other offices and agencies, the availability of treatment, storage, and

disposal services and capacity, and the requirements for, and availability of, specific equipment and technical specialists.

- *Cost:* cost estimates for the alternatives are based on a variety of cost estimating data; including cost curves, generic unit costs, vendor information, conventional cost-estimating guides, and prior similar estimates as modified by site-specific information. The cost estimates are used to compare the alternatives with relative accuracy so that cost decisions among alternatives will be sustained as the accuracy of cost estimates improves beyond the evaluating process.

Table 6-1. Potential Alternatives for COCs in Total Soil at OCCP – EU 8

Utilized Process Options	Potential Alternative				
	#1: No Further Action	#2: Land-Use Controls	#3: Landfill Cap	#4: Excavation and Off-Site Disposal	#5: In Situ Chemical Reduction/Oxidation
No Further Action	X				
ICs		X[1]	X	X[2]	X[2]
ECs/ARs		X[1]	X[1]	X[2]	X[1]
LTM			X[1]		X[1]
Landfill Cap			X		
Compacted Clay, Slurry or Grout Wall			X		
Mechanical Excavation				X	X
In Situ Chemical Reduction/Oxidation[5]					X
Separation				X	X
Off-Site Disposal				X[3,4]	X[3]

Legend:
IC = institutional control
EC = engineering control
AR = access restriction
LUCs = land-use controls

Notes:
[1] *= necessary in perpetuity as part of the remedy at EU 8*
[2] *= necessary only during implementation of the selected alternative at EU 8*
[3] *= disposal of debris*
[4] *=disposal of explosives and lead contaminated soil*

6.2 Alternative 1: No Action

6.2.1 Description

No remediation, controls, or monitoring would be implemented for the no action alternative. LUCs would not be considered and existing access restrictions would not be maintained. In addition, no public awareness or education training would be initiated regarding potential risks associated with the COCs and other contaminants at the site.

6.2.2 Evaluation

Effectiveness: All activities at the site would cease. The no action alternative would not reduce the contaminant mass and potential risk to receptors in the short-term. Natural degradation through physical, chemical, and biological processes may reduce site COC concentrations over time. The contaminants are not expected to migrate to subsurface soil or groundwater in the near future.

The no action alternative would not achieve the RAO for the site. Landowner and community acceptance would be difficult since the RAO and PRGs would not be attained and potential risk to human health and the environment would not be addressed.

Implementability: No activities would be performed, including LTM and site closeout activities.

Cost: There are no costs associated with the no action alternative.

Summary: No action is technically feasible, implementable and has no cost. The contaminated media would not be addressed. Landowner and community acceptance would be difficult to obtain. No action has been retained pursuant to NCP requirements and will be evaluated in the detailed analysis to provide a baseline for comparison with the other alternatives.

6.3 Alternative 2: Land-Use Controls

6.3.1 Description

This alternative limits land and resource use, and also limits or eliminates human contact with site contaminants. It would be used to prohibit recreational use and development of the site. LUCs are commonly utilized when contamination is first discovered, remedies are ongoing, and/or residual COCs remain onsite at concentrations that do not allow for UU/UE. However, LUCs can also effectively limit potential human exposure to COCs by restricting access to the contamination. Process options under this alternative would include ICs and EC/ARs, such as environmental easements, deed restrictions, deed notices, consent orders, groundwater use restrictions, fencing, access controls, and signage.

Implementation of ICs would place legally enforceable restrictions or controls on the use of property and limit potential receptor exposure to the site COCs by restricting access to the contaminated media. EC/ARs eliminate or reduce the potential for exposure to a chemical or physical hazard. ICs and ECs/ARs would restrict land uses for residential development, educational facilities, child or adult care facilities; prohibit the removal of soil/fill from the site; and prohibit excavation or drilling into the soil/fill unless conducted as part of an environmental investigation or for restoration purposes. Overall, LUCs would provide a means for stakeholders to utilize coordinated efforts to reduce potential exposure risk through behavior modifications and restrictions.

6.3.2 Evaluation

The LUCs alternative would not actively reduce the volume, mobility or toxicity of the COC-contaminated soil; the COCs in soil would remain untreated. This alternative would inhibit human exposure to the COCs. It would include ICs (deed restrictions, easements, prohibitions, and building or excavation permit requirements), EC/ARs (fencing and signage), and informational devices (fact sheets, public information meetings, and articles/advertisements). Successful implementation of the LUCs alternative would be contingent on the cooperation of stakeholders or the federal government taking a real estate interest in the property to ensure enforcement and maintenance of the LUCs.

Effectiveness: LUCs protect human health during implementation and minimize the potential for human exposure to the COCs. This alternative limits potential receptors (i.e. trespasser and recreational users) access to the site. LUCs would not prevent exposure to all potential environmental receptors. LUCs will not reduce the volume, toxicity, and mobility of the contaminated material.

Implementability: LUCs are easily implemented; EC/ARs require standard materials and methods that are readily available. However, there are several factors that may limit the applicability and effectiveness of this alternative, including:

- The NCP (USEPA 1994b) emphasizes that ICs are meant to supplement engineering controls and that ICs would rarely be the sole remedy at a site
- The government currently does not own the property and implementation of LUCs would require agreement by the current property owner or the federal government taking a real estate interest in the property

Cost: The LUCs alternative has a low relative cost compared to other evaluated alternatives. These include costs for implementing EC/ARs, inspection, and reporting activities for a minimum period of 30 years.

Summary: This alternative is carried through to the detailed analysis in Section 7.0 as it meets the RAO, and is a widely implemented and well-proven option. It meets the statutory preference for considering an alternative that involves little or no treatment and does limit potential human exposure to the COCs. However, it does not address the volume, toxicity, or mobility of the COCs that pose a potential threat to human health and the environment. The federal government would need to restrict property access to ensure future protection. Successful implementation would require landowner and community cooperation, or the federal government taking a real estate interest in the property.

6.4 Alternative 3: Landfill Cap

6.4.1 Description

Installation of a landfill cap would prevent exposure to the contaminants. It would involve the placement of a RCRA Subtitle C equivalent cap over the contaminated fill. The cap would consist of an upper layer (i.e., vegetative cover and topsoil), a drainage layer, a low permeability layer (i.e., synthetic liner over compacted clay), and a grading layer.

The cap would be keyed into the underlying clay soil to prevent the potential for migration of contained soil. This alternative would reduce exposure to human health and the environment by

preventing direct contact with the COCs. The toxicity and volume of the contaminated media would not be reduced.

This alternative would include post-remedy LUCs, ARs, LTM, and site close-out activities. LUCs would include ICs (deed restrictions, easements, prohibitions, and building or excavation permit requirements), ARs (fencing and signage), and informational devices (fact sheets, public information meetings, and articles/advertisements). The LTM program would consist of groundwater monitoring wells that would be sampled for 30 years to evaluate the potential for contaminants leaching into groundwater. LTM work plans and reports would be necessary. Site close-out documentation would be needed at the end of the LTM period.

6.4.2 Evaluation

Effectiveness: This alternative is capable of satisfying the RAO. Capping would not reduce the toxicity of the contaminated soil. Capping inhibits percolation which mitigates potential migration of the COCs in soil. Residual contamination would remain on site.

Implementability: Capping would employ standard construction methods and labor. Impacts to human health and the environment during the remedial action could be mitigated by using proper health/safety and construction/monitoring techniques. Capping would hinder future use of the site. This alternative would require the permitted clearing of vegetation (including the removal of tree stumps), which is a federal and state regulated activity due to the wetland. The administrative feasibility of this action is considered low because of the wetland. The government currently does not own the property and implementation of LUCs would require agreement by the current property owner.

Cost: The relative cost for this alternative is moderate compared to other evaluated alternatives. Future costs are moderate and include LTM, maintenance of LUCs and ARs, and site close-out activities. A 30 year period of performance is assumed for cost estimating purposes.

Summary: This alternative meets the RAO and is a widely implemented and well-proven option. It is carried through to the detailed analysis in Section 7.0 because it reduces the mobility of the COCs and is protective of human health and the environment. Successful implementation would require landowner and community cooperation.

6.5 Alternative 4: Excavation and Off-Site Disposal

6.5.1 Description

Excavation and off-site disposal would include the removal of contaminated soil and co-mingled solid debris. Confirmatory sampling and analysis of the excavated area would be performed to verify that all contaminated soil above the PRGs has been removed. Contaminated soil would be transported off site to a permitted TSDF, provided that it meets disposal requirements. Disposal characterization would be required under the land disposal restrictions. At a minimum, testing would be performed to determine RCRA characteristics and compliance with TSDF requirements. The disposal of hazardous wastes, if present, is regulated by RCRA (40 CFR Parts 261-265). The U.S. Department of Transportation regulates the transport of hazardous materials (49 CFR Parts 172-179, 49 CFR Part 1387, and USDOT-E-8876). The excavated area would be backfilled with clean soil to existing grade and reseeded to re-establish the wetland.

LUCs, ICs, and ARs would not be required because the site would be restored to a condition that allows for UU/UE. Site close-out documentation would be performed at the end of the remedial action.

6.5.2 Evaluation

Effectiveness: This alternative is capable of satisfying the RAO. All contaminated media would be removed and UU/UE conditions would be attained. Overall reduction of the toxicity and volume of the contaminants would require pretreatment at the TSDF.

Implementability: This alternative is fully implementable and both technically and administratively feasible. Standard construction methods and labor are required, which are readily available. Impacts to human health and the environment during the remedial action could be mitigated by using proper health and safety measures, approved construction methods, and monitoring. This alternative would require the permitted clearing of vegetation (including the removal of tree stumps), which is a federal and state regulated activity due to the wetland. Disposal options for the contaminated soils are readily available.

Cost: The relative cost for this alternative is moderate compared to other evaluated alternatives. O&M and LTM would not be required because the site would be remediated to a UU/UE condition.

Summary: Excavation and off-site disposal is a widely implemented and well proven remedial action alternative. It satisfies the RAO, meets the ARARs, reduces the mobility of the contaminants by disposal at a TSDF, and restores the site to a UU/UE condition. It has been retained for detailed analysis in Section 7.0.

6.6 Alternative 5: In Situ Chemical Reduction/Oxidation and Stabilization

6.6.1 Description

In situ chemical reduction/oxidation and stabilization would consist of using a proprietary, innovative technology to destroy 2,4,6-TNT in soil and stabilize areas of elevated lead. The technology would oxidize TNT in soil to innocuous end products. Sulfide species generated during the reaction would precipitate lead as lead sulfide, which is immobile.

Bench and pilot-scale testing would be required beforehand to determine efficacy of the process and to evaluate performance under different conditions. The chemical formulation would be designed based on geochemical conditions of the site. Solid debris would be removed from the contaminated soil prior to treatment and would be disposed at an appropriate TSDF.

The proprietary chemical formulation would be applied in granular form to areas of contaminated soil and water would be added to initiate a chemical reaction. Performance would be monitored by soil sampling and analysis. Reapplications may be necessary, dependent on the results of the confirmatory sampling. UU/UE conditions may not be attained.

This alternative would include work zone fencing during remedy implementation, LUCs, LTM, and site close-out activities. Site close-out documentation would be needed at the end of the remedial action.

6.6.2 Evaluation

Effectiveness: This alternative is capable of satisfying the RAO. The mobility and toxicity of the COCs would be reduced by chemical destruction of TNT and stabilization of lead. This alternative would decrease the total contaminant volume and would not require any off-site disposal of contaminated soil. The technology has not been demonstrated full-scale to attain the PRGs for this site. Therefore, LUCs and LTM may be required.

Implementability: This alternative relies on a proprietary technology that is available and easily implemented. It would require the removal of solid debris and solidified wastes to enable adequate mixing of the chemical formulation with the soil. The removed debris and solidified waste would be disposed off site at an appropriate permitted TSDF.

Implementation of LUCs may be difficult because the federal government does not own the property and any LUCs would have to be agreed upon by the current property owner.

Cost: Capital cost for this alternative is ranked high compared to other evaluated alternatives. Future costs are ranked high and include LTM, maintenance of LUCs and ARs, and site close-out activities. A 30 year period of performance is assumed for cost estimating purposes.

Summary: This alternative would reduce the toxicity, mobility, and volume of COC-contaminated soil at the site. Its overall effectiveness would depend on attaining sufficient treatment of TNT and lead in the soil. Additional costs and schedule impacts would be incurred from bench and pilot-scale testing, design of the chemical formulation, and confirmatory sampling/analysis. This alternative meets the statutory preference for an alternative that principally includes treatment resulting in a reduction of toxicity, mobility, and volume of the contaminants. It is retained for detailed analysis in Section 7.0.

6.7 Summary of Evaluated Remedial Alternatives

The following remedial alternatives were evaluated and retained based on the screening, evaluation criteria, site-specific conditions, and best professional judgment:

- *Alternative 1: No Action* – retained as required by the NCP (USEPA 1994b); to be used a baseline for comparison with other alternatives.
- *Alternative 2: Land-Use Controls* - retained because it meets the statutory preference for considering an alternative that involves little or no treatment, but addresses the COCs that pose a potential threat to human health and the environment.
- *Alternative 3: Landfill Cap* – retained because it satisfies the RAO and is implementable.
- *Alternative 4: Excavation and Off-Site Disposal* – retained because it satisfies the RAO, meets the ARARs, reduces the mobility of the contaminants by disposal at a TSDF, is implementable, and restores the site to a UU/UE condition.
- *Alternative 5: In Situ Chemical Reduction/Oxidation* – retained because it is capable of satisfying the RAO, and satisfies the statutory preference for treatment that reduces the toxicity and mobility of the contaminants, and is implementable.

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7.0 DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

This section presents a detailed analysis of the remedial alternatives remaining after the screening and evaluation performed in Section 6.0. The criteria used to evaluate each alternative are presented below. **Table 7-1** provides a summary of the comparative analysis.

Protection of Human Health and the Environment: Assesses whether the alternative is protective of human health and the environment.

Compliance with ARARs: Evaluates whether the alternative is compliant with the identified ARARs.

Short-Term Effectiveness: Evaluates the impact on human health and the environment during the construction and implementation of the technology based on the protection of the community, on-site workforce, environment, and time to complete the remedial action.

Long-Term Effectiveness and Permanence: Evaluates the protection of human health and the environment after the remedial action has been completed. This criterion is based on the magnitude of remaining risk and the adequacy and reliability of control measures.

Reduction of Toxicity, Mobility or Volume through Treatment: Evaluates the anticipated performance of the remedial alternative based on the amount of waste material to be destroyed or treated, irreversibility of treatment, type and quantity of residuals remaining, treatment process, and degree of reduction.

Implementability: Addresses the technical and administrative feasibility of implementing the remedial action. Technical feasibility includes construction and operations, availability of services, reliability of technology, ease of undertaking additional, unforeseen remedial action and monitoring. Administrative feasibility includes activities related to coordination between regulatory agencies, stakeholders and the project team. Availability of services includes necessary personnel and equipment, technology, service providers, and treatment, storage and disposal capacities.

Cost: Addresses the capital and annual costs, including a contingency for unanticipated expenses. Capital cost includes all direct and indirect cost associated with the remedial technology. O&M costs include post-construction costs necessary to continue an effective remedial response action. All cost estimates were converted to a present worth basis and reflect current 2015 costs for comparison purposes.

Regulator Acceptance: Addresses the concerns local, state, and federal regulatory agencies may have regarding the remedial alternatives evaluated and the proposed alternative. This criterion will be evaluated following comment on the FS.

Community Acceptance: Addresses the concerns stakeholders and/or community members may have regarding the remedial alternatives evaluated and the proposed alternative. This criterion will be evaluated following comment on the FS.

7.1 Analysis of Alternative 1: No Action

7.1.1 Description

The no action alternative is considered in accordance with NCP requirements found in 40 CFR 300.430(e)(6). Under this alternative, no remedial actions would be undertaken to address contaminants at the site. LUCs and access restrictions would not be implemented or maintained.

7.1.2 Assessment

Protection of Human Health and the Environment: The no action alternative would not protect human health and the environment because it does not actively address the potential risks associated with site contaminants.

Compliance with ARARs: Since no remedial actions would be conducted and ARs would not be maintained, this alternative would not comply with the identified ARARs. This alternative does not satisfy the statutory preference for treatment as a principal element of remedial response.

Short-Term Effectiveness: No additional short-term exposure risks to remediation workers or the community would result since no remedial action would take place. There would be no short-term impacts to the environment.

Long-Term Effectiveness: Release of contaminants to the environment is possible in the long-term. Site data suggests that COCs have persisted for over 70 years and will persist for the foreseeable future. No reduction in toxicity, mobility, or the volume of contaminants would be achieved.

Reduction of Toxicity, Mobility, or Volume Through Treatment: The no action alternative does not actively treat or remove the contaminants. Reduction would only occur by natural attenuation processes.

Implementability: No actions would be undertaken.

Cost: There would be no capital or O&M costs associated with the no action alternative.

7.2 Analysis of Alternative 2: Land-Use Controls

7.2.1 Description

The LUC alternative would prevent human exposure to the contaminants. The alternative would include the implementation of ICs and ARs. ICs would include proprietary controls (easements), governmental controls (deed restrictions, prohibitions, and building or excavation permit requirements), and informational devices (signs, state registries, and deed notices). ARs would include a fence with warning signs and informational devices such as fact sheets, public information meetings, and articles/advertisements. Periodic reviews of established ICs and ARs would be required and updates would be necessary if future site conditions change.

Under this alternative the following major activities would be required in the general order presented:

- Project planning documents would be required and include an Accident Prevention/Site Safety and Health Plan.
- Equipment and personnel would be mobilized to the site. Lay-down areas, staging areas, and work zones would be established. Vegetation would be cleared to install a fence.

- Approximately 350 ft of 5-ft high chain linked fence with warning signs would be installed around the contaminated area.
- LUC/ICs would be implemented to restrict access to the site and to restrict future development of the site.

7.2.2 Assessment

Protection of Human Health and the Environment: The LUC alternative would protect human health by reducing the potential for exposure by restricting access to the site and prohibiting future development of the site. It would not prevent exposure to all potential environmental receptors.

Compliance with ARARs: The LUC alternative does not comply with ARARs.

Short-Term Effectiveness: There would be additional risks to site personnel during installation of a fence around the contaminated area. These risks can be mitigated by using approved procedures established in the Accident Prevention/Site Safety and Health Plan. The RAO would be achieved by preventing human access to the contaminated soils.

Long-Term Effectiveness: Release of contaminants to the environment is possible in the long-term. Site data suggests that COCs have persisted for over 70 years and will persist for the foreseeable future. No reduction in toxicity, mobility, or the volume of contaminants would be achieved. LUCs would ensure that any exposure to human receptors remains within acceptable levels. However, to ensure long-term effectiveness of the LUCs, the federal government would likely need to take a real estate interest in the property.

Reduction of Toxicity, Mobility, and/or Volume: This alternative does not actively treat or remove the contaminants. Reduction would only occur by natural attenuation processes.

Implementability: This alternative is technically feasible. Equipment, materials, and labor are readily available to install the fence. The administrative feasibility of this action is considered difficult because the federal government does not own the property and implementation of LUCs would require agreement by the current property owner and public acceptance.

Cost: As shown in **Table 7-1**, the approximate cost for this alternative is $3,049,326. This includes capital costs ($364,861) and O&M costs ($2,684,465). Quantities, assumptions, and cost calculations are provided in **Appendix E**.

7.3 Analysis of Alternative 3: Landfill Cap

7.3.1 Description

This alternative involves covering the contaminated soil with a RCRA Subtitle C equivalent cap that complies with 40 CFR 268. The cap would generally consist of an upper layer (i.e., vegetative cover and topsoil), a geotextile filter/separator, a drainage layer, a low permeability layer (i.e., synthetic liner over two ft of compacted clay), and a grading layer. A vertical barrier would be installed that consists of compacted clay, a grout curtain, or a slurry wall that would be keyed into the underlying clay.

Contaminants would remain beneath the cap at levels that would not allow UU/UE. LUCs and LTM would be required.

Under this alternative, the following major activities would be required to achieve the RAO.

- Project design and planning documents would be prepared. These include a Landfill Cap Design, Construction Operations Plan, Accident Prevention/Site Safety and Health Plan, Contractor Quality Control Plan, Air Monitoring, Water Management, and Erosion/Sedimentation Control Plan, and Site Restoration Plan.
- Equipment and personnel would be mobilized to the site. Vegetation would be cleared to facilitate the construction activities. Lay-down areas, staging areas, work zones, storm water controls, and erosion/sedimentation controls would be established.
- A cap would be installed over contaminated fill; which includes:
    - A subsurface vertical barrier keyed into the underlying clay
    - A grading layer
    - A low permeability layer consisting of a synthetic liner over compacted clay
    - A geotextile filter/separator and drainage layer
    - An upper layer consisting of vegetative cover and topsoil
- A fence would be installed around the capped area.
- Monitoring wells would be installed for LTM.
- The site would be restored, which includes seeding of the cap and restoring adjacent areas that have been disturbed.

Estimated quantities are documented in **Appendix E** and summarized below.

- Capped area: 5,618 ft^2
- Subsurface barrier: 6328 linear feet (LF)
- Grading layer: 383 yd^3
- Compacted clay layer: 416 yd^3
- Synthetic liner: 6,328 ft^2
- Geotextile filter: 6,328 ft^2
- Drainage netting: 6,328 ft^2
- Topsoil: 133 yd^3
- Perimeter fence: 350 LF

ICs would be implemented that include proprietary controls (easements), deed restrictions, and informational devices (signs, state registries, and deed notices). A fence with warning signs would be installed around the capped area. Periodic reviews of the ICs would be required and updates would be necessary if future site conditions change. The fence would be maintained.

LTM would consist of a network of groundwater monitoring wells to assess the potential for contaminant migration. Upgradient and downgradient wells would be sampled and analyzed for 2,4,6-TNT and lead annually for 30 years.

7.3.2 Assessment

Protection of Human Health and the Environment: The capping alternative would protect human health and the environment by reducing the potential for contaminant leaching and by eliminating potential receptor exposure via restricted access and groundwater monitoring.

Compliance with ARARs: The landfill cap complies with the identified ARARs because it would be designed, installed, maintained, and monitored in accordance with relevant and appropriate components of 40 CFR Part 264.

Short-Term Effectiveness: There would be additional risks to site personnel and the environment during implementation of this alternative. These risks can be mitigated by using approved procedures established in the Accident Prevention/Site Safety and Health Plan, and Air Monitoring, Water Management, and Erosion/Sedimentation Control Plan. The RAO would be achieved during the remedial action, which is estimated to require 3 months.

Long-Term Effectiveness: Exposure to the contaminants would be eliminated and risk to the evaluated receptor (future resident adult and child) would not persist. The LUCs and LTM program would ensure that any exposure to human and environmental receptors remains within acceptable levels.

Reduction of Toxicity, Mobility, and/or Volume: This alternative would not reduce the toxicity or volume of site contaminants. The mobility of contaminants would be reduced by installing cap that is keyed into the underlying clay layer.

Implementability: This alternative is technically feasible. Equipment, materials, and labor are readily available to install the cap and fence. ICs would be used to supplement ECs which would be monitored and evaluated as long as the risks are present at the site. The administrative feasibility of this action is considered low.

Cost: As shown in **Table 7-1**, the approximate cost for this alternative is $5,510,363. This includes capital costs ($574,836), and O&M and LTM costs ($4,935,527). Quantities, assumptions, and cost calculations are provided in **Appendix E**.

7.4 Analysis of Alternative 4: Excavation and Off-Site Disposal

7.4.1 Description

This alternative would include excavation and off-site disposal of contaminated soil and comingled solid debris. Major activities that would be required for this alternative are summarized below.

- Project planning documents would include a Construction Operations Plan, Accident Prevention/Site Safety and Health Plan, Contractor Quality Control Plan, Air Monitoring, Water Management, and Erosion/Sedimentation Control Plan, Waste Management, Transportation, and Disposal Plan, and Site Restoration Plan.
- Equipment and personnel would be mobilized to the site. Vegetation would be cleared to facilitate the construction activities. Lay-down areas, staging areas, work zones, storm water controls, and erosion/sedimentation controls would be established.
- COC-contaminated soil and comingled solid debris would be excavated, segregated, and placed in containers (i.e. roll-off boxes, intermodals, etc.).
- Excavated soil would be sampled and analyzed for explosives, TCLP lead, and any other requirements of the TSDF.
- The excavated contaminated soil would be disposed off-site at a permitted TSDF; non-contaminated debris would be disposed at a subtitle D landfill.

- The excavated area would be inspected and soil samples would be collected for laboratory analysis (i.e., 2,4,6-TNT and lead).
- Excavation and sampling/analysis would continue until it was determined that all contaminated material has been removed to below the PRGs.
- The site would be restored to match the conditions of the surrounding wetland.

Estimated quantities are documented in **Appendix E** and summarized below.

- Contaminated soil: 611 yd^3
- Debris: 204 yd^3

7.4.2 Assessment

Protection of Human Health and the Environment: This alternative would be protective of human health and the environment and achieve RAO.

Compliance with ARARs: This alternative complies with the identified ARARs as contaminated soil would be excavated and disposed off-site in a permitted TSDF. Pre-treatment would be performed at the TSDF, if necessary, to meet land disposal restrictions.

Short-Term Effectiveness: There would be additional risk to site personnel and the environment during implementation of this alternative. These risks can be mitigated by using approved procedures established in the Accident Prevention/Site Safety and Health Program, Air Monitoring, Water Management, and Erosion/Sedimentation Control Plan, and Waste Management, Transportation, and Disposal Plan. The RAO would be achieved during the remedial action, which is estimated to require 3 months.

Long-Term Effectiveness: Excavation with off-site disposal would remove all contaminants and restore the site to a UU/UE condition. LUCs and LTM would not be required. The TSDF would be required to manage the treated/landfilled wastes from the site. The adequacy and reliability of controls at the TSDF would be assured by the facility's permit requirements and environmental surveillance program.

Reduction of Toxicity, Mobility, and/or Volume: Excavation and off-site disposal permanently eliminates the toxicity, mobility, and volume of contaminants at the site. Waste treatment at the TSDF, if necessary, would reduce the toxicity and/or volume of the contaminants. Contaminant mobility at the TSDF would be reduced by the facility's engineering controls.

Implementability: This alternative is technically and administratively feasible. Excavation, transportation, and disposal are reliable, relatively easy to implement, and would utilize services and materials that are readily available. The disposal options for materials containing RCRA hazardous waste are readily available.

Cost: As shown in **Table 7-1**, the approximate cost for this alternative is $846,045. This includes capital costs ($846,045), there are no O&M costs associated with this alternative. Quantities, assumptions, and cost calculations are provided in **Appendix E**.

ICs would be implemented that include proprietary controls (easements), governmental controls (deed restrictions), and informational devices (signs, state registries, and deed notices). Periodic reviews of established ICs would be required and updated if site conditions change.

7.5 Analysis of Alternative 5: In Situ Chemical Reduction/Oxidation and Stabilization

7.5.1 Description

The in situ chemical reduction/oxidation and stabilization alternative involves on-site treatment of contaminated soil using a proprietary compound formulated to destroy organic explosives and stabilize metals in soil. Debris would be separated from the soil beforehand to enable adequate blending of the compound with the contaminate soil. Removed debris would be disposed off site at an appropriate TSDF.

Major activities that would be required for this alternative are summarized below.

- A treatability study/bench-scale testing would be conducted to formulate a mix specific to the site's geochemical conditions and contaminant concentrations.
- Project planning documents would include a Treatability Study/Bench-Scale Testing Plan, Pilot Testing Plan, Site Operations Plan, Accident Prevention/Site Safety and Health Plan, Contractor Quality Control Plan, Air Monitoring, Water Management, and Erosion/Sedimentation Control Plan, and Site Restoration Plan.
- Pilot-scale testing would be performed to evaluate the compounds performance under scaled-up, field conditions. Changes to the formulation and site planning documents would be made, as necessary, based on the results of the pilot testing.
- Equipment and personnel would be mobilized to the site. Vegetation would be cleared to facilitate the remediation process. Lay-down areas, staging areas, work zones, storm water controls, and erosion/sedimentation controls would be established.
- Solid debris would be removed and disposed at an off-site permitted landfill.
- The chemical compound would be applied to contaminated soils.
- Confirmatory sampling and analysis would be performed to determine performance. Reapplications would be performed if necessary.
- A fence would be installed around the treated area.

Estimated quantities are documented in **Appendix E** and summarized below.

- Contaminated soil: 611 yd^3
- Debris: 204 yd^3

ICs would be implemented that include proprietary controls (easements), governmental controls (deed restrictions), and informational devices (signs, state registries, and deed notices). Periodic reviews of established ICs would be required and updated if site conditions change.

7.5.2 Assessment

Protection of Human Health and the Environment: This alternative would protect human health and the environment by reducing the toxicity and volume of explosives in soil and stabilizing lead concentrations in soil, making it inaccessible to potential receptors.

Compliance with ARARs: This alternative is expected to comply with identified ARARs as lead in soil would be stabilized in to form an insoluble metal sulfide.

Short-Term Effectiveness: There would be additional risk to site personnel and the environment during implementation of this alternative. These risks can be mitigated by using approved procedures established in the Accident Prevention/Site Safety and Health Program, and Air Monitoring, Water Management, and Erosion/Sedimentation Control Plan. The RAO might be achieved during the remedial action, which is estimated to require 3 months.

Long-Term Effectiveness: The long-term effectiveness would be demonstrated by confirmation sampling and analysis. The effectiveness of the proprietary technology has been demonstrated on other sites contaminated with organic explosives and metals. However, LUCs and LTM may be required after implementation.

Reduction of Toxicity, Mobility, and/or Volume Through Treatment: This alternative reduces the toxicity, volume, and mobility of the contaminated soil.

Implementability: The alternative relies on a proprietary technology that is available and easily implemented. It would require the removal of solid debris and solidified wastes to enable adequate mixing of the formulation with the soil. The removed debris and solidified waste would be disposed off site at an appropriate permitted TSDF.

Implementation of LUCs may be difficult because the federal government does not own the property and any LUCs would have to be agreed upon by the current property owner.

Cost: As shown in **Table 7-1**, the approximate cost for this alternative is $6,370,882. This includes capital costs ($1,435,354), and O&M and LTM costs ($4,935,528). Quantities, assumptions, and cost calculation are provided in **Appendix E**.

7.6 Comparative Analysis of Remedial Alternatives

The comparative analysis of alternatives provides the basis for selecting a remedial action. **Table 7-1** presents a summary of the analysis of each remedial alternative.

Table 7-1. Comparative Analysis of Alternatives for COCs in Total Soil at OCCP – EU 8

Alternative	Protection of HH&E	Compliance with ARARs	Short-Term Effectiveness	Long-Term Effectiveness	Reduction of Toxicity, Mobility, or Volume	Implementability	Costs ($-2015)		
							Total	Capital	Operation, Maintenance, and Monitoring
Alternative 1: No Action	○	○	●	○	○	◍	$0	$0	$0
Alternative 2: Land-Use Controls	◍	○	●	○	○	◍	$3,049,326	$364,861	$2,684,465
Alternative 3: Landfill Cap	●	●	●	◍	◍	◍	$5,510,363	$574,836	$4,935,528
Alternative 4: Excavation and Off-site Disposal	●	●	●	●	●	●	$846,045	$846,045	$0
Alternative 6: In Situ Chemical Reduction/Oxidation and Stabilization	●	●	●	◍	●	◍	$6,370,882	$1,435,354	$4,935,528

Legend:
ARARs – applicable or relevant and appropriate requirements
COC – constituent of concern
HH&E – human health and the environment

Ratings			
Factors	●	◍	○
Protection of HH&E	Protective	Moderate rating or not all factors addressed	Not protective
Compliance with ARARs	Compliant	Moderate rating or not all factors addressed	Non-compliant
Short-Term Effectiveness	Protective of the community and workers during the remedial action, low environmental impacts, low period of time to achieve RAOs	Moderate rating or not all factors addressed	Not protective of the community and workers during the remedial action, high environmental impacts, long period of time to achieve RAOs
Long-Term Effectiveness	Low residual risk, adequate and reliable controls	Moderate rating or not all factors addressed	High residual risk, inadequate and unreliable controls
Reduction of Toxicity, Mobility, or Volume	Will reduce toxicity, mobility, and volume through treatment	Moderate rating or not all factors addressed	Will not reduce toxicity, mobility, and volume through treatment
Implementability	Easy to implement, available services and materials, administratively feasible	Moderate rating or not all factors addressed	Difficult to implement, limited availability of services and materials, and low administrative feasibility

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APPENDIX A
POST REMEDIAL INVESTIGATION RESULTS

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Appendix A

Re-analysis of hexavalent chromium concentrations in soil and re-evaluation of the hexavalent chromium exposure point concentration.

Background

Soil samples from AOC 1 were collected and analyzed for total and hexavalent chromium in accordance with Section 5.1.3 of the Occidental Chemical Corporation Property (OCCP) remedial investigation (RI) report, which states, *"Additional sampling and analysis for hexavalent chromium will need to be completed prior to completion of the remedial FS to indicate whether or not hexavalent chromium is retained as a COC"* (USACE, 2013).

Sample Collection

Ten soil samples were collected from eight locations on AOC 1 by USACE - Buffalo on 16 May 2013. Three samples were collected from location C10-GS2-SO-HN2; which consisted of samples from 0 – 0.5 ft, 1 – 1.5 ft, and a duplicate from the 0-0.5 ft interval. All samples were located adjacent to 2010 soil sample sites that were documented in the RI report (USACE, 2013). C10-GS2-SO-HE, -HN, -HS, and -HW were situated next to 2010 samples that had suspected quality control issues associated with hexavalent chromium analysis. These samples were within close proximity to a deteriorated drum that was sampled during the phase II RI (USACE, 2002). Samples C10-GS2-SO-PN, -SOE, -PS, and –PW were situated on the north, east, south, and west areas of the fill and represent a larger area of AOC 1. All sample locations are illustrated on Figure A-1.

A hand held global positioning system (Trimble Geo Explorer 3000) was used to identify the sample locations using coordinates provided in the RI report. All samples were collected with a hand auger. Soil from each location was placed in a pre-cleaned stainless steel bowl, homogenized, and aliquots were taken for laboratory analysis. Results are discussed below and summarized in Table A-1.

Laboratory Analyses

The soil samples were analyzed by RTI Laboratories for total chromium by EPA method 6010 and hexavalent chromium by EPA method 7196. Separate aliquots were submitted to BC Laboratories (through a subcontract with RTI) for analysis of hexavalent chromium by EPA method 7199. The laboratory analytical results were validated by a USACE chemist. A completed data verification and validation form is provided in Attachment A-1.

Analytical Results and Interpretation

A summary comparing the 2013 total and hexavalent chromium results with the 2010 results presented in the RI report is provided in Table A-1. Analytical method 7196 was the only method utilized during the RI for measuring hexavalent chromium in soil. For the 2013 samples, hexavalent chromium was not detected in any of the samples analyzed by method 7196. This could indicate that hexavalent chromium should not be considered a COC for the site.

The 2013 analysis also used method 7199 for measuring hexavalent chromium in soil. Method 7199 is considered more sensitive and specific for detecting hexavalent chromium because it separates hexavalent chromium via ion chromatography before colorimetric detection, thus eliminating many sources of interference. Hexavalent chromium was detected in 8 of the 10 samples analyzed via this method, ranging from 0.42 to 5 milligrams per kilogram (mg/kg). All of the detected hexavalent chromium concentrations are above the EPA residential Regional Screening Level (RSL) of 0.29 mg/kg.

These results were evaluated to determine what the potential hexavalent chromium soil exposure point concentration (EPC) would be to a residential receptor in EU 8, to determine whether they are large enough to pose an unacceptable cancer risk. A 95th percentile upper confidence limit on the mean (UCL95) of hexavalent chromium concentrations was estimated using the EPA's ProUCL computer program (USEPA 2010), which was used as the EPC for EU 8. The EPC was estimated to be 2.14 mg/kg (Appendix B). The EPC for hexavalent chromium used in the RI for the risk evaluation was 56.1 mg/kg, which produced an incremental lifetime cancer risk (ILCR) for residential receptors of 2×10^{-4} (i.e. 2 in 10,000) (USACE 2013). This is above the EPA's acceptable cancer risk range and indicated that hexavalent chromium would be a COC for the site. However, there were suspected quality control issues which called into question the validity and magnitude of the hexavalent chromium results. Using the new hexavalent chromium EPC of 2.14 mg/kg, the residential ILCR for exposure to the newly estimated hexavalent chromium EPC is approximately 7×10^{-6} (i.e. 7 in 1,000,000). This ILCR is within EPA's acceptable cancer risk range and hexavalent chromium would not be considered a COC at the site when measured via the more specific method 7199.

Conclusion

Recent analytical results from both methods (7196 and 7199) indicate that hexavalent chromium should not be considered a COC for the site. Hexavalent chromium in soil will not be considered further in the FS.

References

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Table A-1
AOC 1 Soil Sample Results

		Total Chromium (method 6010)		Hexavalent Chromium (method 7196)		Hexavalent Chromium (method 7199)
Sample ID	Units	2013 Samples	2010 Samples	2013 Samples	2010 Samples	2013 Samples
C10-GS2-SO-HE2-.5	mg/kg	32	33.9 J	0.4 U	3.6 UJ	0.42 J
C10-GS2-SO-HN2-.5	mg/kg	74	111 J	0.31 U	22.4 J	1.1
C10-GS2-SO-Dup (HN2-.5)	mg/kg	280	111 J	0.32 U	22.4 J	1.2
C10-GS2-SO-HN2-1.5	mg/kg	16	214 J	0.25 U	4.4 J	0.49 J
C10-GS2-SO-HS2-.5	mg/kg	190	46.8 J	0.32 U	11.8 J	0.41 U
C10-GS2-SO-HW2-.5	mg/kg	210	92.2 J	0.36 U	170 J	0.41 U
C10-GS2-SO-PN2-.5	mg/kg	170	92.7 J	0.27 U	1.9 J	2.4 J
C10-GS2-SO-PS2-.5	mg/kg	170	307 J	0.3 U	12.7 J	5 J
C10-GS2-SO-PW2-.5	mg/kg	13	9.6 J	0.3 U	0.29 UJ	0.61 J
C10-GS2-SO-SOE2-.5	mg/kg	17	17	0.28 U	0.26 UJ	0.94 J

Legend:

mg/kg = milligrams per kilogram

shaded results = suspected QC issues

Laboratory Qualifiers:

J = estimated value

U = analyte was analyzed for but was not detected above the method detection limit and the value presented is the limit of detection

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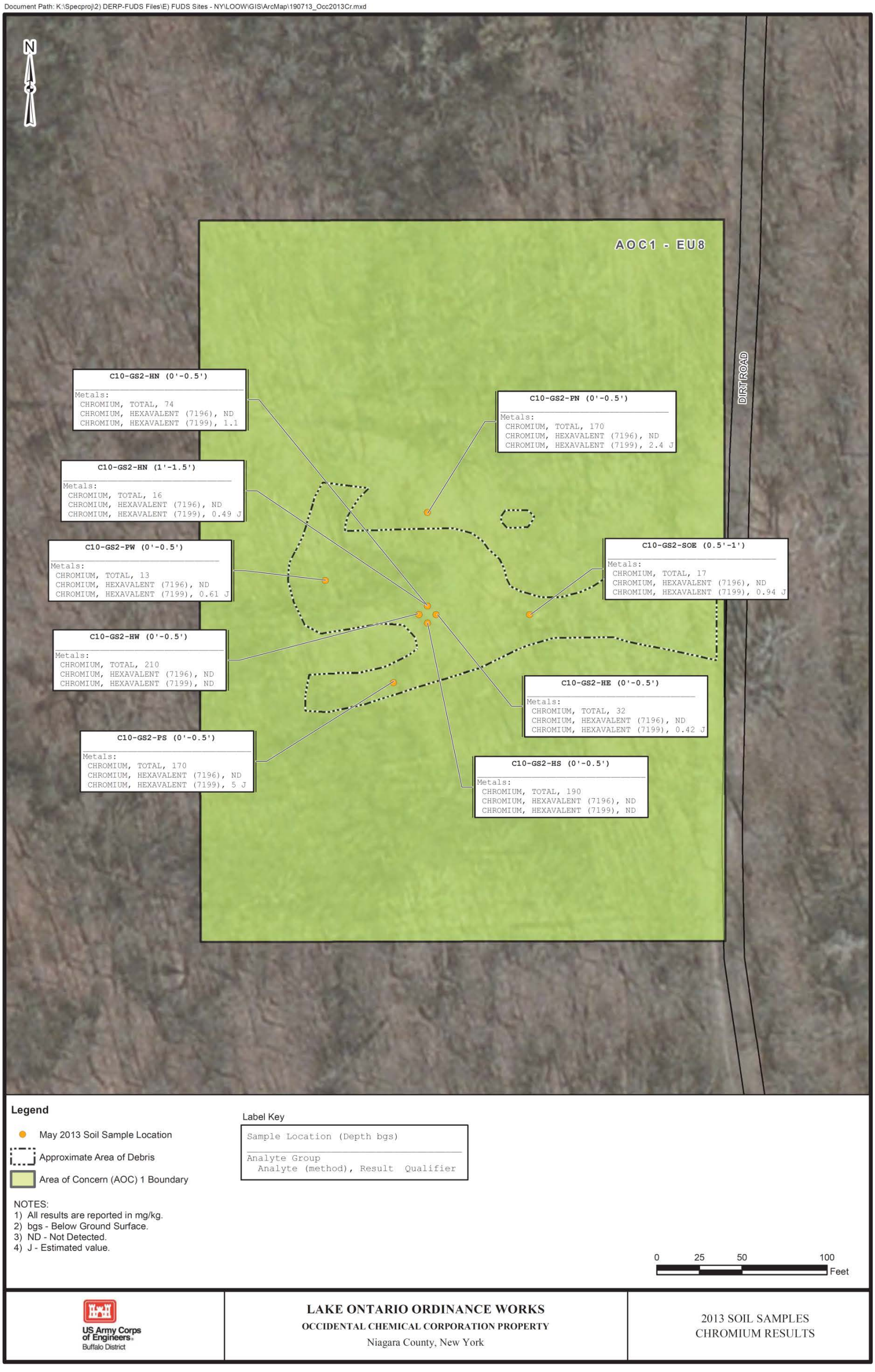

Figure A-1 2013 Soil Sample Locations from AOC 1

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Attachment A-1

Data Verification and Validation Form

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USACE - Buffalo District
Data Verification and Validation Form
Chemical
SDG 1305712, 1305735, 1306364

Data Package Summary

- Ten soil samples were analyzed by RTI Laboratories for total chromium by EPA method 6010 and hexavalent chromium by EPA method 7196. Separate aliquots were submitted to BC Laboratories (through a subcontract with RTI) for analysis of hexavalent chromium by EPA method 7199. Although there are no validation guidelines for hexavalent chromium, it was reviewed similarly to the other inorganics (metals).

Data Deliverables Completeness

- All required information was provided.

Analytical Completeness

- Data completeness was 100%

Analytical Deviations

Instrumentation

- No deviations in the instrumentation were noted.

Batch QC Deviations

- The MS and MSD recoveries in the batch for method 7199 were below the lower limit. As a result, the parent sample (C10-GS2-SO-PS2-.5) was given a J qualifier.

Sample Deviations

- In the analysis for method 7199, the retention time for the peak in sample C10-GS2-SO-PN2-.5 was significantly later than the hexavalent chromium peak in all other analyses. This makes the identification somewhat uncertain, so the sample was given a J qualifier.

Other

- The sample cooler containing the samples for analysis at RTI was late in arriving due to unknown reasons with the shipping company. Both sets of samples were shipped for overnight delivery. The samples for BC Laboratories arrived the next day; however, the samples for RTI arrived four days after being shipped. Since the holding time for method 7196 doesn't begin until the samples are extracted, there is no holding time issue. (The EPA reports that soil samples are stable for 30 days, and

3060A extracts are stable for 7 days). However, the ice in the cooler had melted, and the samples arrived at the laboratory ranging from 20 to 24 degrees Celsius.

- EPA method 7196A is a colorimetric method with detection by UV-VIS spectrophotometry. It is widely used, although not completely specific for hexavalent chromium. EPA method 7199 separates the hexavalent chromium via ion chromatography, followed by the colorimetric detection. This should minimize interferences from other colored species.

Validated Sample Summary

A summary of validated samples and qualifiers added as a result of the validation is provided below:

Sample ID	Total Cr (ppm)	Lab Qual	Val Qual	7196 Cr^{6+} (ppm)	Lab Qual	Val Qual	7199 Cr^{6+} (ppm)	Lab Qual	Val Qual
C10-GS2-SO-HE2-.5	32			0.40	U		0.42	J	
C10-GS2-SO-HN2-.5	74			0.31	U		1.1		
C10-GS2-SO-Dup (HN2-.5)	280			0.32	U		1.2		
C10-GS2-SO-HN2-1.5	16			0.25	U		0.49	J	
C10-GS2-SO-HS2-.5	190			0.32	U		0.41	U	
C10-GS2-SO-HW2-.5	210			0.36	U		0.41	U	
C10-GS2-SO-PN2-.5	170			0.27	U		2.4		J
C10-GS2-SO-PS2-.5	170			0.30	U		5		J
C10-GS2-SO-PW2-.5	13			0.30	U		0.61	J	
C10-GS2-SO-SOE2-.5	17			0.28	U		0.94	J	

APPENDIX B
REVISED PROUCL OUTPUTS

APPENDIX B-1

REVISED RISK CALCULATIONS

TABLE B-2.1
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY - SURFACE SOIL - RESIDENTIAL

Scenario Timeframe: Future-Residential
Medium: Surface soil
Exposure Medium: Surface soil
Exposure Point: EU8

CAS Number	Chemical	Minimum [1] Concentration	Minimum Qualifier	Maximum [1] Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
EXPLOSIVES																	
99-35-4	1,3,5-TRINITROBENZENE	1.10E-01	J	4.50E+01	J	mg/kg	C2-OXY-SO-P22-2	15/37	3.00E-01 - 2.80E+00	4.50E+01	NA	2.20E+02	N	NA	NA	No	BSL
99-65-0	**1,3-DINITROBENZENE**	**1.30E-01**	**J**	**3.30E+00**		**mg/kg**	**C2-OXY-HW-1**	**7/37**	**3.00E-01 - 2.80E+00**	**3.30E+00**	**NA**	**6.10E-01**	**N**	**NA**	**NA**	**Yes**	**ASL**
118-96-7	**2,4,6-TRINITROTOLUENE**	**2.50E-01**	**J**	**1.90E+04**	**J**	**mg/kg**	**C2-OXY-SO-P22-2**	**17/37**	**3.00E-01 - 7.30E+01**	**1.90E+04**	**NA**	**3.60E+00**	**N**	**NA**	**NA**	**Yes**	**ASL**
121-14-2	**2,4-DINITROTOLUENE**	**2.20E-01**	**NJ**	**2.60E+01**	**J**	**mg/kg**	**C2-OXY-SO-P22-2**	**21/37**	**3.00E-01 - 2.80E+00**	**2.60E+01**	**NA**	**1.60E+00**	**C**	**NA**	**NA**	**Yes**	**ASL**
606-20-2	**2,6-DINITROTOLUENE**	**1.50E-01**	**J**	**2.20E+01**	**J**	**mg/kg**	**C2-OXY-SO-P22-2**	**19/36**	**3.00E-01 - 1.00E+01**	**2.20E+01**	**NA**	**6.10E+00**	**N**	**NA**	**NA**	**Yes**	**ASL**
35572-78-2	**2-AMINO-4,6-DINITROTOLUENE**	**6.80E-02**	**NJ**	**1.70E+02**	**J**	**mg/kg**	**C2-OXY-SO-P22-2**	**19/37**	**3.00E-01 - 1.00E+01**	**1.70E+02**	**NA**	**1.50E+01**	**N**	**NA**	**NA**	**Yes**	**ASL**
88-72-2	**2-NITROTOLUENE**	**1.00E-01**	**J**	**1.40E+01**	**NJ**	**mg/kg**	**C2-OXY-HN-0.5**	**5/37**	**3.00E-01 - 2.80E+00**	**1.40E+01**	**NA**	**2.90E+00**	**C**	**NA**	**NA**	**Yes**	**ASL**
99-08-1	3-NITROTOLUENE	1.60E-01	NJ	1.60E-01	NJ	mg/kg	C2-OXY-HW-0.5	1/37	3.00E-01 - 2.80E+00	1.60E-01	NA	6.10E-01	N	NA	NA	No	BSL
19406-51-0	**4-AMINO-2,6-DINITROTOLUENE**	**2.00E-01**	**J / NJ**	**1.30E+02**		**mg/kg**	**C2-OXY-HN-0.5**	**14/37**	**3.60E-01 - 1.00E+01**	**1.30E+02**	**NA**	**1.50E+01**	**N**	**NA**	**NA**	**Yes**	**ASL**
99-99-0	4-NITROTOLUENE	1.10E-01	J	2.86E-01	J	mg/kg	C10-GS2-SO-5-1	2/37	3.00E-01 - 2.80E+00	2.86E-01	NA	2.40E+01	N	NA	NA	No	BSL
2691-41-0	HMX	6.70E-02	NJ	5.60E+01	J	mg/kg	C2-OXY-HE-0.5	7/37	3.00E-01 - 2.80E+00	5.60E+01	NA	3.80E+02	N	NA	NA	No	BSL
121-82-4	**RDX**	**2.70E-01**	**NJ / J**	**6.30E+00**	**J**	**mg/kg**	**C2-OXY-HW-1**	**5/37**	**3.00E-01 - 2.80E+00**	**6.30E+00**	**NA**	**5.60E+00**	**C**	**NA**	**NA**	**Yes**	**ASL**
479-45-8	TETRYL	8.50E+00	J	8.50E+00	J	mg/kg	C2-OXY-HW-1	1/36	3.00E-01 - 2.85E+00	8.50E+00	NA	2.40E+01	N	NA	NA	No	BSL
INORGANICS																	
7429-90-5	**ALUMINUM**	**1.31E+03**		**3.28E+04**		**mg/kg**	**C10-GS2-SO-2-1**	**37/37**	**5.00E+00 - 1.25E+02**	**3.28E+04**	**NA**	**7.70E+03**	**N**	**NA**	**NA**	**Yes**	**ASL**
7440-36-0	**ANTIMONY**	**3.60E-01**		**1.01E+01**		**mg/kg**	**C2-OXY-SO-P21-1**	**15/37**	**4.70E-01 - 1.25E+01**	**1.01E+01**	**NA**	**3.10E+00**	**N**	**NA**	**NA**	**Yes**	**ASL**
7440-38-2	**ARSENIC**	**1.10E+00**	**J**	**2.71E+01**		**mg/kg**	**C2-OXY-SO-PN-1**	**36/37**	**9.40E-01 - 2.50E+01**	**2.71E+01**	**NA**	**3.90E-01**	**C**	**NA**	**NA**	**Yes**	**ASL**
7440-39-3	**BARIUM**	**5.40E+00**	**J**	**9.71E+03**		**mg/kg**	**C2-OXY-HW-1**	**37/37**	**4.70E-01 - 1.00E+02**	**9.71E+03**	**NA**	**1.50E+03**	**N**	**NA**	**NA**	**Yes**	**ASL**
7440-41-7	BERYLLIUM	6.00E-02	J	4.30E+00		mg/kg	C10-GS2-SO-2-1	28/37	1.00E-01 - 2.90E+00	4.30E+00	NA	1.60E+01	N	NA	NA	No	BSL
7440-42-8	BORON	4.10E+00	B	5.72E+01	J	mg/kg	C2-OXY-SO-SIN-1	4/37	1.00E+01 - 2.50E+02	5.72E+01	NA	1.60E+03	N	NA	NA	No	BSL
7440-43-9	**CADMIUM**	**1.10E-01**		**1.84E+02**	**J**	**mg/kg**	**C10-GS2-SO-10-0.5**	**27/37**	**5.00E-02 - 1.80E+00**	**1.84E+02**	**NA**	**7.00E+00**	**N**	**NA**	**NA**	**Yes**	**ASL**
7440-47-3	CHROMIUM, TOTAL	6.20E+00	J	4.96E+03	J	mg/kg	C2-OXY-HW-1	36/37	1.00E+00 - 9.50E+01	4.96E+03	NA	1.20E+04	N	NA	NA	No	BSL
18540-29-9	**CHROMIUM (HEXAVALENT)**	**4.20E-01**	**J**	**5.80E+00**		**mg/kg**	**C2-OXY-SO-SIN-1**	**21/25**	**4.80E-01 - 7.70E-01**	**5.80E+00**	**NA**	**2.90E-01**	**C**	**NA**	**NA**	**Yes**	**ASL**
7440-48-4	**COBALT**	**2.00E+00**		**4.33E+01**		**mg/kg**	**C10-GS2-SO-10-0.5**	**36/37**	**2.00E-01 - 1.80E+01**	**4.33E+01**	**NA**	**2.30E+00**	**N**	**NA**	**NA**	**Yes**	**ASL**
7440-50-8	**COPPER**	**3.30E+00**		**4.79E+03**		**mg/kg**	**C2-OXY-SO-P21-1**	**37/37**	**9.40E-01 - 3.60E+01**	**4.79E+03**	**NA**	**3.10E+02**	**N**	**NA**	**NA**	**Yes**	**ASL**
7439-89-6	**IRON**	**4.48E+03**		**1.82E+05**		**mg/kg**	**C2-OXY-SO-PN-1**	**37/37**	**5.00E+00 - 5.40E+02**	**1.82E+05**	**NA**	**5.50E+03**	**N**	**NA**	**NA**	**Yes**	**ASL**
7439-92-1	**LEAD**	**9.90E-01**	**J**	**2.76E+03**	**J**	**mg/kg**	**C10-GS2-SO-10-0.5**	**37/37**	**3.00E-01 - 7.50E+00**	**2.76E+03**	**NA**	**4.00E+02**	**N**	**NA**	**NA**	**Yes**	**ASL**
7439-93-2	**LITHIUM**	**5.30E-01**	**J**	**3.63E+01**	**J**	**mg/kg**	**C10-GS2-SO-4-1**	**35/37**	**4.70E-01 - 2.50E+01**	**3.63E+01**	**NA**	**1.60E+01**	**N**	**NA**	**NA**	**Yes**	**ASL**
7439-96-5	**MANGANESE**	**1.85E+01**		**1.39E+03**		**mg/kg**	**C10-GS2-SO-2-1**	**37/37**	**2.00E-01 - 8.80E+00**	**1.39E+03**	**NA**	**1.80E+02**	**N**	**NA**	**NA**	**Yes**	**ASL**
7439-97-6	MERCURY	1.40E-02	J	6.20E-01	B	mg/kg	C2-OXY-SO-SIN-1	27/37	3.30E-02 - 2.30E-01	6.20E-01	NA	1.00E+00	N	NA	NA	No	BSL
7440-02-0	**NICKEL**	**6.80E+00**	**J**	**6.99E+02**	**J**	**mg/kg**	**C10-GS2-SO-BP1**	**36/37**	**5.00E-01 - 1.25E+01**	**6.99E+02**	**NA**	**1.50E+02**	**N**	**NA**	**NA**	**Yes**	**ASL**
7782-49-2	SELENIUM	2.90E-01	J	2.40E+01	J	mg/kg	C10-GS2-SO-10-0.5	25/37	4.70E-01 - 1.25E+01	2.40E+01	NA	3.90E+01	N	NA	NA	No	BSL
7440-22-4	SILVER	3.70E-02	J	1.60E+00		mg/kg	C2-OXY-SO-P22-2	23/37	2.00E-01 - 5.00E+00	1.60E+00	NA	3.90E+01	N	NA	NA	No	BSL
7440-28-0	**THALLIUM**	**6.30E-02**	**B**	**1.80E+00**	**J**	**mg/kg**	**C2-OXY-SO-P21-1**	**5/37**	**2.00E-01 - 5.00E+00**	**1.80E+00**	**NA**	**7.80E-02**	**N**	**NA**	**NA**	**Yes**	**ASL**
7440-62-2	**VANADIUM**	**4.00E+00**	**J**	**2.20E+02**	**J**	**mg/kg**	**C10-GS2-SO-BP1**	**34/37**	**4.70E-01 - 2.50E+01**	**2.20E+02**	**NA**	**3.90E+01**	**N**	**NA**	**NA**	**Yes**	**ASL**
7440-66-6	**ZINC**	**9.30E+00**	**J**	**5.23E+04**	**J**	**mg/kg**	**C2-OXY-HE-1**	**36/37**	**9.40E-01 - 2.00E+02**	**5.23E+04**	**NA**	**2.30E+03**	**N**	**NA**	**NA**	**Yes**	**ASL**
PAHS																	
50-32-8	**BENZO[A]PYRENE**	**1.79E-01**		**1.79E-01**		**mg/kg**	**C10-GS2-SO-10-0.5**	**1/11**	**7.80E-02 - 1.20E+01**	**1.79E-01**	**NA**	**1.50E-02**	**C**	**NA**	**NA**	**Yes**	**ASL**
205-99-2	BENZO[B]FLUORANTHENE	9.94E-02	J	9.94E-02	J	mg/kg	C10-GS2-SO-10-0.5	1/11	7.80E-02 - 1.20E+01	9.94E-02	NA	1.50E-01	C	NA	NA	No	BSL
191-24-2	BENZO[G,H,I]PERYLENE	1.84E-01		1.84E-01		mg/kg	C10-GS2-SO-10-0.5	1/11	7.80E-02 - 1.20E+01	1.84E-01	NA	1.70E+02	N	NA	NA	No	BSL
193-39-5	INDENO[1,2,3-C,D]PYRENE	1.24E-01	J	1.24E-01	J	mg/kg	C10-GS2-SO-10-0.5	1/11	7.80E-02 - 1.20E+01	1.24E-01	NA	1.50E-01	C	NA	NA	No	BSL
PESTICIDES/PCBS																	
50-29-3	4,4-DDT	7.10E-03	J	8.14E-02	J	mg/kg	C10-GS2-SO-10-0.5	2/11	3.90E-03 - 5.00E-01	8.14E-02	NA	1.70E+00	C	NA	NA	No	BSL
SEMI-VOLATILE ORGANIC COMPOUNDS																	
85-68-7	BENZYL BUTYL PHTHALATE	2.17E-01		2.81E-01	J	mg/kg	C10-GS2-SO-10-0.5	2/11	1.90E-01 - 2.50E+00	2.81E-01	NA	2.60E+02	C	NA	NA	No	BSL
117-81-7	BIS(2-ETHYLHEXYL) PHTHALATE	1.29E-01	J	3.22E-01		mg/kg	C10-GS2-SO-3-1	3/11	1.90E-01 - 2.50E+00	3.22E-01	NA	3.50E+01	C	NA	NA	No	BSL

TABLE B-2.1
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY - SURFACE SOIL - RESIDENTIAL

Scenario Timeframe: Future-Residential
Medium: Surface soil
Exposure Medium: Surface soil
Exposure Point: EU8

CAS Number	Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration (2) Used for Screening	Background (3) Value	Screening (4) Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for (5) Contaminant Deletion or Selection
VOLATILE ORGANIC COMPOUNDS																
78-93-3	2-BUTANONE	4.08E-02	J	4.08E-02	J	mg/kg	C10-GS2-SO-10-0.5	1/11	1.00E-02 - 5.50E-02	4.08E-02	NA	2.80E+03 N	NA	NA	No	BSL
67-64-1	ACETONE	6.02E-02	J	2.38E+00	J	mg/kg	C10-GS2-SO-7-1	11/11	5.00E-02 - 3.20E+00	2.38E+00	NA	6.10E+03 N	NA	NA	No	BSL
100-42-5	STYRENE	5.90E-03		1.03E-02		mg/kg	C10-GS2-SO-7-1	2/11	5.00E-03 - 2.80E-02	1.03E-02	NA	6.30E+02 N	NA	NA	No	BSL

(1) Minimum/maximum detected concentration.
(2) Maximum concentration used as screening value.
(3) Background values are not included as part of the COPC selection process.

(4) USEPA Regional Screening Levels, USEPA, April 2012. For non-carcinogens, value shown is equal to 1/10 the residential soil value. For carcinogens the value shown is equal to the residential soil value.
(5) Rationale Codes
Selection Reason: ASL = Above Screening Toxicity Level
NSL = No Screening Level
Deletion Reason: BSL = Below Screening Toxicity Level
NUT = Nutrient

Gray shading identifies COPCs.
Surrogates used: pyrene for benzo[g,h,i]perylene.

Definitions:
ARAR = Applicable or Relevant and Appropriate
C = Carcinogenic
COPC = Constituent of Potential Concern

mg/kg = milligrams per kilogram
N = Non-Carcinogenic
NA = Not Applicable
PAHs = Polynuclear Aromatic Hydrocarbons
PCBs = Polychlorinated Bipheyls
TBC = To Be Considered

Data Qualifiers:
B = Detected between the method detection limit and the detection limit.
J = Value is estimated.
NJ = Identificationof chemical questionable, Inorganic

TABLE B-2.2
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY- SURFACE SOIL - INDUSTRIAL

Scenario Timeframe: Current/Future-Industrial
Medium: Surface soil
Exposure Medium: Surface soil
Exposure Point: EU8

CAS Number	Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration (2) Used for Screening	Background (3) Value	Screening (4) Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for (5) Contaminant Deletion or Selection
EXPLOSIVES																
99-35-4	1,3,5-TRINITROBENZENE	1.10E-01	J	4.50E+01	J	mg/kg	C2-OXY-SO-P22-2	15/37	3.00E-01 - 2.80E+00	4.50E+01	NA	2.70E+03 N	NA	NA	No	BSL
99-65-0	1,3-DINITROBENZENE	1.30E-01	J	3.30E+00		mg/kg	C2-OXY-HW-1	7/37	3.00E-01 - 2.80E+00	3.30E+00	NA	6.20E+00 N	NA	NA	No	BSL
118-96-7	**2,4,6-TRINITROTOLUENE**	**2.50E-01**	**J**	**1.90E+04**	**J**	**mg/kg**	**C2-OXY-SO-P22-2**	**17/37**	**3.00E-01 - 7.30E+01**	**1.90E+04**	**NA**	**4.20E+01 N**	**NA**	**NA**	**Yes**	**ASL**
121-14-2	**2,4-DINITROTOLUENE**	**2.20E-01**	**NJ**	**2.60E+01**	**J**	**mg/kg**	**C2-OXY-SO-P22-2**	**21/37**	**3.00E-01 - 2.80E+00**	**2.60E+01**	**NA**	**5.50E+00 C**	**NA**	**NA**	**Yes**	**ASL**
606-20-2	2,6-DINITROTOLUENE	1.50E-01	J	2.20E+01	J	mg/kg	C2-OXY-SO-P22-2	19/36	3.00E-01 - 1.00E+01	2.20E+01	NA	6.20E+01 N	NA	NA	No	BSL
35572-78-2	2-AMINO-4,6-DINITROTOLUENE	6.80E-02	NJ	1.70E+02	J	mg/kg	C2-OXY-SO-P22-2	19/37	3.00E-01 - 1.00E+01	1.70E+02	NA	2.00E+02 N	NA	NA	No	BSL
88-72-2	**2-NITROTOLUENE**	**1.00E-01**	**J**	**1.40E+01**	**NJ**	**mg/kg**	**C2-OXY-HN-0.5**	**5/37**	**3.00E-01 - 2.80E+00**	**1.40E+01**	**NA**	**1.30E+01 C**	**NA**	**NA**	**Yes**	**ASL**
99-08-1	3-NITROTOLUENE	1.60E-01	NJ	1.60E-01	NJ	mg/kg	C2-OXY-HW-0.5	1/37	3.00E-01 - 2.80E+00	1.60E-01	NA	6.20E+00 N	NA	NA	No	BSL
19406-51-0	4-AMINO-2,6-DINITROTOLUENE	2.00E-01	J / NJ	1.30E+02		mg/kg	C2-OXY-HN-0.5	14/37	3.60E-01 - 1.00E+01	1.30E+02	NA	1.90E+02 N	NA	NA	No	BSL
99-99-0	4-NITROTOLUENE	1.10E-01	J	2.86E-01	J	mg/kg	C10-GS2-SO-5-1	2/37	3.00E-01 - 2.80E+00	2.86E-01	NA	1.10E+02 C	NA	NA	No	BSL
2691-41-0	HMX	6.70E-02	NJ	5.60E+01	J	mg/kg	C2-OXY-HE-0.5	7/37	3.00E-01 - 2.80E+00	5.60E+01	NA	4.90E+03 N	NA	NA	No	BSL
121-82-4	RDX	2.70E-01	NJ / J	6.30E+00	J	mg/kg	C2-OXY-HW-1	5/37	3.00E-01 - 2.80E+00	6.30E+00	NA	2.40E+01 C	NA	NA	No	BSL
479-45-8	TETRYL	8.50E+00	J	8.50E+00	J	mg/kg	C2-OXY-HW-1	1/36	3.00E-01 - 2.85E+00	8.50E+00	NA	2.50E+02 N	NA	NA	No	BSL
INORGANICS																
7429-90-5	ALUMINUM	1.31E+03		3.28E+04		mg/kg	C10-GS2-SO-2-1	37/37	5.00E+00 - 1.25E+02	3.28E+04	NA	9.90E+04 N	NA	NA	No	BSL
7440-36-0	ANTIMONY	3.60E-01		1.01E+01		mg/kg	C2-OXY-SO-P21-1	15/37	4.70E-01 - 1.25E+01	1.01E+01	NA	4.10E+01 N	NA	NA	No	BSL
7440-38-2	**ARSENIC**	**1.10E+00**	**J**	**2.71E+01**		**mg/kg**	**C2-OXY-SO-PN-1**	**36/37**	**9.40E-01 - 2.50E+01**	**2.71E+01**	**NA**	**1.60E+00 C**	**NA**	**NA**	**Yes**	**ASL**
7440-39-3	BARIUM	5.40E+00	J	9.71E+03		mg/kg	C2-OXY-HW-1	37/37	4.70E-01 - 1.00E+02	9.71E+03	NA	1.90E+04 N	NA	NA	No	BSL
7440-41-7	BERYLLIUM	6.00E-02	J	4.30E+00		mg/kg	C10-GS2-SO-2-1	28/37	1.00E-01 - 2.90E+00	4.30E+00	NA	2.00E+02 N	NA	NA	No	BSL
7440-42-8	BORON	4.10E+00	B	5.72E+01	J	mg/kg	C2-OXY-SO-SIN-1	4/37	1.00E+01 - 2.50E+02	5.72E+01	NA	2.00E+04 N	NA	NA	No	BSL
7440-43-9	**CADMIUM**	**1.10E-01**		**1.84E+02**	**J**	**mg/kg**	**C10-GS2-SO-10-0.5**	**27/37**	**5.00E-02 - 1.80E+00**	**1.84E+02**	**NA**	**8.00E+01 N**	**NA**	**NA**	**Yes**	**ASL**
7440-47-3	CHROMIUM, TOTAL	6.20E+00	J	4.96E+03	J	mg/kg	C2-OXY-HW-1	36/37	1.00E+00 - 9.50E+01	4.96E+03	NA	1.50E+05 N	NA	NA	No	BSL
18540-29-9	**CHROMIUM (HEXAVALENT)**	**4.20E-01**	**J**	**5.80E+00**		**mg/kg**	**C2-OXY-SO-SIN-1**	**21/25**	**4.80E-01 - 7.70E-01**	**5.80E+00**	**NA**	**5.60E+00 C**	**NA**	**NA**	**Yes**	**ASL**
7440-48-4	**COBALT**	**2.00E+00**		**4.33E+01**		**mg/kg**	**C10-GS2-SO-10-0.5**	**36/37**	**2.00E-01 - 1.80E+01**	**4.33E+01**	**NA**	**3.00E+01 N**	**NA**	**NA**	**Yes**	**ASL**
7440-50-8	**COPPER**	**3.30E+00**		**4.79E+03**		**mg/kg**	**C2-OXY-SO-P21-1**	**37/37**	**9.40E-01 - 3.60E+01**	**4.79E+03**	**NA**	**4.10E+03 N**	**NA**	**NA**	**Yes**	**ASL**
7439-89-6	**IRON**	**4.48E+03**		**1.82E+05**		**mg/kg**	**C2-OXY-SO-PN-1**	**37/37**	**5.00E+00 - 5.40E+02**	**1.82E+05**	**NA**	**7.20E+04 N**	**NA**	**NA**	**Yes**	**ASL**
7439-92-1	**LEAD**	**9.90E-01**	**J**	**2.76E+03**	**J**	**mg/kg**	**C10-GS2-SO-10-0.5**	**37/37**	**3.00E-01 - 7.50E+00**	**2.76E+03**	**NA**	**8.00E+02 N**	**NA**	**NA**	**Yes**	**ASL**
7439-93-2	LITHIUM	5.30E-01	J	3.63E+01	J	mg/kg	C10-GS2-SO-4-1	35/37	4.70E-01 - 2.50E+01	3.63E+01	NA	2.00E+02 N	NA	NA	No	BSL
7439-96-5	MANGANESE	1.85E+01		1.39E+03		mg/kg	C10-GS2-SO-2-1	37/37	2.00E-01 - 8.80E+00	1.39E+03	NA	2.30E+03 N	NA	NA	No	BSL
7439-97-6	MERCURY	1.40E-02	J	6.20E-01	B	mg/kg	C2-OXY-SO-SIN-1	27/37	3.30E-02 - 2.30E-01	6.20E-01	NA	4.30E+00 N	NA	NA	No	BSL
7440-02-0	NICKEL	6.80E+00	J	6.99E+02	J	mg/kg	C10-GS2-SO-BP1	36/37	5.00E-01 - 1.25E+01	6.99E+02	NA	2.00E+03 N	NA	NA	No	BSL
7782-49-2	SELENIUM	2.90E-01	J	2.40E+01	J	mg/kg	C10-GS2-SO-10-0.5	25/37	4.70E-01 - 1.25E+01	2.40E+01	NA	5.10E+02 N	NA	NA	No	BSL
7440-22-4	SILVER	3.70E-02	J	1.60E+00		mg/kg	C2-OXY-SO-P22-2	23/37	2.00E-01 - 5.00E+00	1.60E+00	NA	5.10E+02 N	NA	NA	No	BSL
7440-28-0	**THALLIUM**	**6.30E-02**	**B**	**1.80E+00**	**J**	**mg/kg**	**C2-OXY-SO-P21-1**	**5/37**	**2.00E-01 - 5.00E+00**	**1.80E+00**	**NA**	**1.00E+00 N**	**NA**	**NA**	**Yes**	**ASL**
7440-62-2	VANADIUM	4.00E+00	J	2.20E+02	J	mg/kg	C10-GS2-SO-BP1	34/37	4.70E-01 - 2.50E+01	2.20E+02	NA	5.20E+02 N	NA	NA	No	BSL
7440-66-6	**ZINC**	**9.30E+00**	**J**	**5.23E+04**	**J**	**mg/kg**	**C2-OXY-HE-1**	**36/37**	**9.40E-01 - 2.00E+02**	**5.23E+04**	**NA**	**3.10E+04 N**	**NA**	**NA**	**Yes**	**ASL**
PAHS																
50-32-8	BENZO[A]PYRENE	1.79E-01		1.79E-01		mg/kg	C10-GS2-SO-10-0.5	1/11	7.80E-02 - 1.20E+01	1.79E-01	NA	2.10E-01 C	NA	NA	No	BSL
205-99-2	BENZO[B]FLUORANTHENE	9.94E-02	J	9.94E-02	J	mg/kg	C10-GS2-SO-10-0.5	1/11	7.80E-02 - 1.20E+01	9.94E-02	NA	2.10E+00 C	NA	NA	No	BSL
191-24-2	BENZO[G,H,I]PERYLENE	1.84E-01		1.84E-01		mg/kg	C10-GS2-SO-10-0.5	1/11	7.80E-02 - 1.20E+01	1.84E-01	NA	1.70E+03 N	NA	NA	No	BSL
193-39-5	INDENO[1,2,3-C,D]PYRENE	1.24E-01	J	1.24E-01	J	mg/kg	C10-GS2-SO-10-0.5	1/11	7.80E-02 - 1.20E+01	1.24E-01	NA	2.10E+00 C	NA	NA	No	BSL
PESTICIDES/PCBS																
50-29-3	4,4-DDT	7.10E-03	J	8.14E-02	J	mg/kg	C10-GS2-SO-10-0.5	2/11	3.90E-03 - 5.00E-01	8.14E-02	NA	7.00E+00 C	NA	NA	No	BSL
SEMI-VOLATILE ORGANIC COMPOUNDS																
85-68-7	BENZYL BUTYL PHTHALATE	2.17E-01		2.81E-01	J	mg/kg	C10-GS2-SO-10-0.5	2/11	1.90E-01 - 2.50E+00	2.81E-01	NA	9.10E+02 C	NA	NA	No	BSL
117-81-7	BIS(2-ETHYLHEXYL) PHTHALATE	1.29E-01	J	3.22E-01		mg/kg	C10-GS2-SO-3-1	3/11	1.90E-01 - 2.50E+00	3.22E-01	NA	1.20E+02 C	NA	NA	No	BSL

TABLE B-2.2
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY- SURFACE SOIL - INDUSTRIAL

Scenario Timeframe: Current/Future-Industrial
Medium: Surface soil
Exposure Medium: Surface soil
Exposure Point: EU8

CAS Number	Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration (2) Used for Screening	Background (3) Value	Screening (4) Toxicity Value		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for (5) Contaminant Deletion or Selection
VOLATILE ORGANIC COMPOUNDS																	
78-93-3	2-BUTANONE	4.08E-02	J	4.08E-02	J	mg/kg	C10-GS2-SO-10-0.5	1/11	1.00E-02 - 5.50E-02	4.08E-02	NA	2.00E+04	N	NA	NA	No	BSL
67-64-1	ACETONE	6.02E-02	J	2.38E+00	J	mg/kg	C10-GS2-SO-7-1	11/11	5.00E-02 - 3.20E+00	2.38E+00	NA	6.30E+04	N	NA	NA	No	BSL
100-42-5	STYRENE	5.90E-03		1.03E-02		mg/kg	C10-GS2-SO-7-1	2/11	5.00E-03 - 2.80E-02	1.03E-02	NA	3.60E+03	N	NA	NA	No	BSL

(1) Minimum/maximum detected concentration.
(2) Maximum concentration used as screening value.
(3) Background values are not included as part of the COPC selection process.

(4) USEPA Regional Screening Levels, USEPA, April 2012. For non-carcinogens, value shown is equal to 1/10 the industrial soil value. For carcinogens the value shown is equal to the industrial soil value.
(5) Rationale Codes
Selection Reason: ASL = Above Screening Toxicity Level
NSL = No Screening Level
Deletion Reason: BSL = Below Screening Toxicity Level
NUT = Nutrient

Gray shading identifies COPCs.
Surrogates used: pyrene for benzo[g,h,i]perylene.

Definitions:
ARAR = Applicable or Relevant and Appropriate
C = Carcinogenic
COPC = Constituent of Potential Concern

mg/kg = milligrams per kilogram
N = Non-Carcinogenic
NA = Not Applicable
PAHs = Polynuclear Aromatic Hydrocarbons
PCBs = Polychlorinated Bipheyls
TBC = To Be Considered

Data Qualifiers:
B = Detected between the method detection limit and the detection limit.
J = Value is estimated.
NJ = Identificationof chemical questionable, Inorganic

TABLE B-2.3
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY- SUBSURFACE SOIL - RESIDENTIAL

Scenario Timeframe: Future-Residential
Medium: Subsurface soil
Exposure Medium: Subsurface soil
Exposure Point: EU8

CAS Number	Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration (2) Used for Screening	Background (3) Value	Screening (4) Toxicity Value		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for (5) Contaminant Deletion or Selection
EXPLOSIVES																	
99-35-4	1,3,5-TRINITROBENZENE	1.30E-01	J	4.10E-01		mg/kg	C2-OXY-SO-SIS-3	4/17	2.90E-01 - 5.00E-01	4.10E-01	NA	2.20E+02	N	NA	NA	No	BSL
99-65-0	1,3-DINITROBENZENE	5.50E-02	J	1.50E-01	J	mg/kg	C2-OXY-SO-SIS-3	2/17	2.90E-01 - 5.00E-01	1.50E-01	NA	6.10E-01	N	NA	NA	No	BSL
118-96-7	**2,4,6-TRINITROTOLUENE**	**7.00E-02**	**J**	**2.30E+01**		**mg/kg**	**C2-OXY-SO-P22-3**	**6/17**	**2.90E-01 - 5.00E-01**	**2.30E+01**	**NA**	**3.60E+00**	**N**	**NA**	**NA**	**Yes**	**ASL**
121-14-2	2,4-DINITROTOLUENE	1.30E-01	J	8.40E-01		mg/kg	C2-OXY-SO-P23-3	3/17	2.90E-01 - 5.00E-01	8.40E-01	NA	1.60E+00	C	NA	NA	No	BSL
606-20-2	2,6-DINITROTOLUENE	2.90E-01	J	3.70E-01		mg/kg	C2-OXY-SO-P23-3	2/17	2.90E-01 - 5.00E-01	3.70E-01	NA	6.10E+00	N	NA	NA	No	BSL
35572-78-2	2-AMINO-4,6-DINITROTOLUENE	3.57E-01	J	3.10E+00		mg/kg	C2-OXY-SO-P22-3	4/17	2.90E-01 - 5.00E-01	3.10E+00	NA	1.50E+01	N	NA	NA	No	BSL
19406-51-0	4-AMINO-2,6-DINITROTOLUENE	2.71E-01	J	2.10E+00		mg/kg	C2-OXY-SO-P22-3	4/17	3.40E-01 - 5.00E-01	2.10E+00	NA	1.50E+01	N	NA	NA	No	BSL
INORGANICS																	
7429-90-5	**ALUMINUM**	**5.16E+03**		**1.77E+04**		**mg/kg**	**C10-GS2-SO-4-5**	**18/18**	**5.00E+00 - 5.30E+01**	**1.77E+04**	**NA**	**7.70E+03**	**N**	**NA**	**NA**	**Yes**	**ASL**
7440-38-2	**ARSENIC**	**1.00E+00**		**5.20E+00**		**mg/kg**	**C2-OXY-SO-P24-3**	**18/18**	**9.60E-01 - 5.00E+00**	**5.20E+00**	**NA**	**3.90E-01**	**C**	**NA**	**NA**	**Yes**	**ASL**
7440-39-3	BARIUM	6.08E+01	J	1.68E+02		mg/kg	C2-OXY-SO-SIW-3	18/18	4.80E-01 - 1.00E+01	1.68E+02	NA	1.50E+03	N	NA	NA	No	BSL
7440-41-7	BERYLLIUM	2.60E-01	J	7.30E-01	J	mg/kg	C2-OXY-SO-P22-3	12/18	1.00E-01 - 2.70E+00	7.30E-01	NA	1.60E+01	N	NA	NA	No	BSL
7440-42-8	BORON	3.40E+00	B	1.92E+01	B	mg/kg	C2-OXY-SO-P24-3	5/18	1.00E+01 - 5.00E+01	1.92E+01	NA	1.60E+03	N	NA	NA	No	BSL
7440-43-9	CADMIUM	5.30E-02	J	1.50E+00		mg/kg	C2-OXY-SO-SOE-3	9/18	5.00E-02 - 5.30E-01	1.50E+00	NA	7.00E+00	N	NA	NA	No	BSL
7440-47-3	CHROMIUM, TOTAL	8.70E+00		3.19E+02		mg/kg	C10-GS2-SO-1-7	17/18	1.00E+00 - 1.60E+01	3.19E+02	NA	1.20E+04	N	NA	NA	No	BSL
18540-29-9	**CHROMIUM (HEXAVALENT)**	**1.70E-01**	**J**	**6.10E-01**		**mg/kg**	**C2-OXY-SO-SOE-3**	**2/9**	**4.60E-01 - 4.90E-01**	**6.10E-01**	**NA**	**2.90E-01**	**C**	**NA**	**NA**	**Yes**	**ASL**
7440-48-4	**COBALT**	**3.70E+00**		**1.29E+01**		**mg/kg**	**C10-GS2-SO-5-7**	**18/18**	**2.00E-01 - 5.30E+00**	**1.29E+01**	**NA**	**2.30E+00**	**N**	**NA**	**NA**	**Yes**	**ASL**
7440-50-8	COPPER	1.59E+01		3.85E+01		mg/kg	C10-GS2-SO-1-7	18/18	1.00E+00 - 1.10E+01	3.85E+01	NA	3.10E+02	N	NA	NA	No	BSL
7439-89-6	**IRON**	**7.83E+03**		**2.97E+04**		**mg/kg**	**C10-GS2-SO-9-6**	**18/18**	**5.00E+00 - 1.60E+02**	**2.97E+04**	**NA**	**5.50E+03**	**N**	**NA**	**NA**	**Yes**	**ASL**
7439-92-1	LEAD	3.00E+00	J	2.92E+01		mg/kg	C2-OXY-SO-SOE-3	18/18	3.00E-01 - 1.50E+00	2.92E+01	NA	4.00E+02	N	NA	NA	No	BSL
7439-93-2	**LITHIUM**	**1.05E+01**		**2.33E+01**	**J**	**mg/kg**	**C10-GS2-SO-4-5**	**18/18**	**4.80E-01 - 5.00E+00**	**2.33E+01**	**NA**	**1.60E+01**	**N**	**NA**	**NA**	**Yes**	**ASL**
7439-96-5	**MANGANESE**	**7.40E+01**	**J**	**1.79E+03**	**J**	**mg/kg**	**C2-OXY-SO-SIW-3**	**18/18**	**2.00E-01 - 1.60E+01**	**1.79E+03**	**NA**	**1.80E+02**	**N**	**NA**	**NA**	**Yes**	**ASL**
7439-97-6	MERCURY	8.10E-03	B	7.00E-02	B	mg/kg	C2-OXY-SO-SOE-3	9/18	3.30E-02 - 7.60E-02	7.00E-02	NA	1.00E+00	N	NA	NA	No	BSL
7440-02-0	NICKEL	9.80E+00	J	2.34E+01		mg/kg	C2-OXY-SO-SIN-3	18/18	5.00E-01 - 2.50E+00	2.34E+01	NA	1.50E+02	N	NA	NA	No	BSL
7782-49-2	SELENIUM	9.00E-01	J	1.60E+00		mg/kg	C2-OXY-SO-SOE-3	9/18	4.80E-01 - 2.50E+00	1.60E+00	NA	3.90E+01	N	NA	NA	No	BSL
7440-22-4	SILVER	2.70E-02	J / J	1.20E-01	J	mg/kg	C2-OXY-SO-SOE-3	8/18	2.00E-01 - 1.10E+00	1.20E-01	NA	3.90E+01	N	NA	NA	No	BSL
7440-28-0	**THALLIUM**	**6.40E-02**	**B**	**6.70E-01**		**mg/kg**	**C10-GS2-SO-2-7**	**8/18**	**2.00E-01 - 1.00E+00**	**6.70E-01**	**NA**	**7.80E-02**	**N**	**NA**	**NA**	**Yes**	**ASL**
7440-62-2	VANADIUM	1.16E+01		3.51E+01		mg/kg	C10-GS2-SO-4-5	18/18	4.80E-01 - 5.00E+00	3.51E+01	NA	3.90E+01	N	NA	NA	No	BSL
7440-66-6	ZINC	2.69E+01	J	3.54E+02	J	mg/kg	C10-GS2-SO-4-5	18/18	9.60E-01 - 1.00E+01	3.54E+02	NA	2.30E+03	N	NA	NA	No	BSL
SEMI-VOLATILE ORGANIC COMPOUNDS																	
85-68-7	BENZYL BUTYL PHTHALATE	1.27E-01	J	5.07E-01		mg/kg	C10-GS2-SO-3-5	2/9	1.80E-01 - 2.00E-01	5.07E-01	NA	2.60E+02	C	NA	NA	No	BSL
117-81-7	BIS(2-ETHYLHEXYL) PHTHALATE	1.63E-01	J	1.60E+00		mg/kg	C10-GS2-SO-7-13	4/9	1.80E-01 - 2.00E-01	1.60E+00	NA	3.50E+01	C	NA	NA	No	BSL
VOLATILE ORGANIC COMPOUNDS																	
67-64-1	ACETONE	6.49E-02		1.62E+00	J	mg/kg	C10-GS2-SO-7-13	9/9	4.60E-02 - 2.30E+00	1.62E+00	NA	6.10E+03	N	NA	NA	No	BSL
100-42-5	STYRENE	4.60E-03	J	6.20E-03	J	mg/kg	C10-GS2-SO-6-25	2/9	4.60E-03 - 6.00E-03	6.20E-03	NA	6.30E+02	N	NA	NA	No	BSL

(1) Minimum/maximum detected concentration.
(2) Maximum concentration used as screening value.
(3) Background values are not included as part of the COPC selection process.

(4) USEPA Regional Screening Levels, USEPA, April 2012. For non-carcinogens, value shown is equal to 1/10 the residential soil value. For carcinogens the value shown is equal to the residential soil value.
(5) Rationale Codes

Selection Reason: ASL = Above Screening Toxicity Level
NSL = No Screening Level
Deletion Reason: BSL = Below Screening Toxicity Level
NUT = Nutrient

Gray shading identifies COPCs.

Definitions:
ARAR = Applicable or Relevant and Appropriate
C = Carcinogenic
COPC = Constituent of Potential Concern
mg/kg = milligrams per kilogram
N = Non-Carcinogenic
NA = Not Applicable
PAHs = Polynuclear Aromatic Hydrocarbons
PCBs = Polychlorinated Bipheyls
TBC = To Be Considered

Data Qualifiers:
B = Detected between the method detection limit and the detection limit.
J = Value is estimated.

TABLE B-2.4
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY - SUBSURFACE SOIL - INDUSTRIAL

Scenario Timeframe: Current/Future-Industrial
Medium: Subsurface soil
Exposure Medium: Subsurface soil
Exposure Point: EU8

CAS Number	Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration (2) Used for Screening	Background (3) Value	Screening (4) Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for (5) Contaminant Deletion or Selection
EXPLOSIVES																
99-35-4	1,3,5-TRINITROBENZENE	1.30E-01	J	4.10E-01		mg/kg	C2-OXY-SO-SIS-3	4/17	2.90E-01 - 5.00E-01	4.10E-01	NA	2.70E+03 N	NA	NA	No	BSL
99-65-0	1,3-DINITROBENZENE	5.50E-02	J	1.50E-01	J	mg/kg	C2-OXY-SO-SIS-3	2/17	2.90E-01 - 5.00E-01	1.50E-01	NA	6.20E+00 N	NA	NA	No	BSL
118-96-7	2,4,6-TRINITROTOLUENE	7.00E-02	J	2.30E+01		mg/kg	C2-OXY-SO-P22-3	6/17	2.90E-01 - 5.00E-01	2.30E+01	NA	4.20E+01 N	NA	NA	No	BSL
121-14-2	2,4-DINITROTOLUENE	1.30E-01	J	8.40E-01		mg/kg	C2-OXY-SO-P23-3	3/17	2.90E-01 - 5.00E-01	8.40E-01	NA	5.50E+00 C	NA	NA	No	BSL
606-20-2	2,6-DINITROTOLUENE	2.90E-01	J	3.70E-01		mg/kg	C2-OXY-SO-P23-3	2/17	2.90E-01 - 5.00E-01	3.70E-01	NA	6.20E+01 N	NA	NA	No	BSL
35572-78-2	2-AMINO-4,6-DINITROTOLUENE	3.57E-01	J	3.10E+00		mg/kg	C2-OXY-SO-P22-3	4/17	2.90E-01 - 5.00E-01	3.10E+00	NA	2.00E+02 N	NA	NA	No	BSL
19406-51-0	4-AMINO-2,6-DINITROTOLUENE	2.71E-01	J	2.10E+00		mg/kg	C2-OXY-SO-P22-3	4/17	3.40E-01 - 5.00E-01	2.10E+00	NA	1.90E+02 N	NA	NA	No	BSL
INORGANICS																
7429-90-5	ALUMINUM	5.16E+03		1.77E+04		mg/kg	C10-GS2-SO-4-5	18/18	5.00E+00 - 5.30E+01	1.77E+04	NA	9.90E+04 N	NA	NA	No	BSL
7440-38-2	**ARSENIC**	**1.00E+00**		**5.20E+00**		**mg/kg**	**C2-OXY-SO-P24-3**	**18/18**	**9.60E-01 - 5.00E+00**	**5.20E+00**	**NA**	**1.60E+00 C**	**NA**	**NA**	**Yes**	**ASL**
7440-39-3	BARIUM	6.08E+01	J	1.68E+02		mg/kg	C2-OXY-SO-SIW-3	18/18	4.80E-01 - 1.00E+01	1.68E+02	NA	1.90E+04 N	NA	NA	No	BSL
7440-41-7	BERYLLIUM	2.60E-01	J	7.30E-01	J	mg/kg	C2-OXY-SO-P22-3	12/18	1.00E-01 - 2.70E+00	7.30E-01	NA	2.00E+02 N	NA	NA	No	BSL
7440-42-8	BORON	3.40E+00	B	1.92E+01	B	mg/kg	C2-OXY-SO-P24-3	5/18	1.00E+01 - 5.00E+01	1.92E+01	NA	2.00E+04 N	NA	NA	No	BSL
7440-43-9	CADMIUM	5.30E-02	J	1.50E+00		mg/kg	C2-OXY-SO-SOE-3	9/18	5.00E-02 - 5.30E-01	1.50E+00	NA	8.00E+01 N	NA	NA	No	BSL
7440-47-3	CHROMIUM, TOTAL	8.70E+00		3.19E+02		mg/kg	C10-GS2-SO-1-7	17/18	1.00E+00 - 1.60E+01	3.19E+02	NA	1.50E+05 N	NA	NA	No	BSL
18540-29-9	CHROMIUM (HEXAVALENT)	1.70E-01	J	6.10E-01		mg/kg	C2-OXY-SO-SOE-3	2/9	4.60E-01 - 4.90E-01	6.10E-01	NA	5.60E+00 C	NA	NA	No	BSL
7440-48-4	COBALT	3.70E+00		1.29E+01		mg/kg	C10-GS2-SO-5-7	18/18	2.00E-01 - 5.30E+00	1.29E+01	NA	3.00E+01 N	NA	NA	No	BSL
7440-50-8	COPPER	1.59E+01		3.85E+01		mg/kg	C10-GS2-SO-1-7	18/18	1.00E+00 - 1.10E+01	3.85E+01	NA	4.10E+03 N	NA	NA	No	BSL
7439-89-6	IRON	7.83E+03		2.97E+04		mg/kg	C10-GS2-SO-9-6	18/18	5.00E+00 - 1.60E+02	2.97E+04	NA	7.20E+04 N	NA	NA	No	BSL
7439-92-1	LEAD	3.00E+00	J	2.92E+01		mg/kg	C2-OXY-SO-SOE-3	18/18	3.00E-01 - 1.50E+00	2.92E+01	NA	8.00E+02 N	NA	NA	No	BSL
7439-93-2	LITHIUM	1.05E+01		2.33E+01	J	mg/kg	C10-GS2-SO-4-5	18/18	4.80E-01 - 5.00E+00	2.33E+01	NA	2.00E+02 N	NA	NA	No	BSL
7439-96-5	MANGANESE	7.40E+01	J	1.79E+03	J	mg/kg	C2-OXY-SO-SIW-3	18/18	2.00E-01 - 1.60E+01	1.79E+03	NA	2.30E+03 N	NA	NA	No	BSL
7439-97-6	MERCURY	8.10E-03	B	7.00E-02	B	mg/kg	C2-OXY-SO-SOE-3	9/18	3.30E-02 - 7.60E-02	7.00E-02	NA	4.30E+00 N	NA	NA	No	BSL
7440-02-0	NICKEL	9.80E+00	J	2.34E+01		mg/kg	C2-OXY-SO-SIN-3	18/18	5.00E-01 - 2.50E+00	2.34E+01	NA	2.00E+03 N	NA	NA	No	BSL
7782-49-2	SELENIUM	9.00E-01	J	1.60E+00		mg/kg	C2-OXY-SO-SOE-3	9/18	4.80E-01 - 2.50E+00	1.60E+00	NA	5.10E+02 N	NA	NA	No	BSL
7440-22-4	SILVER	2.70E-02	J / J	1.20E-01	J	mg/kg	C2-OXY-SO-SOE-3	8/18	2.00E-01 - 1.10E+00	1.20E-01	NA	5.10E+02 N	NA	NA	No	BSL
7440-28-0	THALLIUM	6.40E-02	B	6.70E-01		mg/kg	C10-GS2-SO-2-7	8/18	2.00E-01 - 1.00E+00	6.70E-01	NA	1.00E+00 N	NA	NA	No	BSL
7440-62-2	VANADIUM	1.16E+01		3.51E+01		mg/kg	C10-GS2-SO-4-5	18/18	4.80E-01 - 5.00E+00	3.51E+01	NA	5.20E+02 N	NA	NA	No	BSL
7440-66-6	ZINC	2.69E+01	J	3.54E+02	J	mg/kg	C10-GS2-SO-4-5	18/18	9.60E-01 - 1.00E+01	3.54E+02	NA	3.10E+04 N	NA	NA	No	BSL
SEMI-VOLATILE ORGANIC COMPOUNDS																
85-68-7	BENZYL BUTYL PHTHALATE	1.27E-01	J	5.07E-01		mg/kg	C10-GS2-SO-3-5	2/9	1.80E-01 - 2.00E-01	5.07E-01	NA	9.10E+02 C	NA	NA	No	BSL
117-81-7	BIS(2-ETHYLHEXYL) PHTHALATE	1.63E-01	J	1.60E+00		mg/kg	C10-GS2-SO-7-13	4/9	1.80E-01 - 2.00E-01	1.60E+00	NA	1.20E+02 C	NA	NA	No	BSL
VOLATILE ORGANIC COMPOUNDS																
67-64-1	ACETONE	6.49E-02		1.62E+00	J	mg/kg	C10-GS2-SO-7-13	9/9	4.60E-02 - 2.30E+00	1.62E+00	NA	6.30E+04 N	NA	NA	No	BSL
100-42-5	STYRENE	4.60E-03	J	6.20E-03	J	mg/kg	C10-GS2-SO-6-25	2/9	4.60E-03 - 6.00E-03	6.20E-03	NA	3.60E+03 N	NA	NA	No	BSL

(1) Minimum/maximum detected concentration.
(2) Maximum concentration used as screening value.
(3) Background values are not included as part of the COPC selection process.

(4) USEPA Regional Screening Levels, USEPA, April 2012. For non-carcinogens, value shown is equal to 1/10 the industrial soil value. For carcinogens the value shown is equal to the industrial soil value.
(5) Rationale Codes
Selection Reason: ASL = Above Screening Toxicity Level
NSL = No Screening Level
Deletion Reason: BSL = Below Screening Toxicity Level
NUT = Nutrient

Gray shading identifies COPCs.

Definitions:
ARAR = Applicable or Relevant and Appropriate
C = Carcinogenic
COPC = Constituent of Potential Concern
mg/kg = milligrams per kilogram
N = Non-Carcinogenic
NA = Not Applicable
PAHs = Polynuclear Aromatic Hydrocarbons
PCBs = Polychlorinated Bipheyls
TBC = To Be Considered

Data Qualifiers:
B = Detected between the method detection limit and the detection limit.
J = Value is estimated.

TABLE B-2.5
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY - TOTAL SOIL - RESIDENTIAL

Scenario Timeframe: Future-Residential
Medium: Total soil
Exposure Medium: Total soil
Exposure Point: EU8

CAS Number	Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration (2) Used for Screening	Background (3) Value	Screening (4) Toxicity Value		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for (5) Contaminant Deletion or Selection
EXPLOSIVES																	
99-35-4	1,3,5-TRINITROBENZENE	1.10E-01	J	4.50E+01	J	mg/kg	C2-OXY-SO-P22-2	19/54	2.90E-01 - 2.80E+00	4.50E+01	NA	2.20E+02	N	NA	NA	No	BSL
99-65-0	**1,3-DINITROBENZENE**	**5.50E-02**	**J**	**3.30E+00**		**mg/kg**	**C2-OXY-HW-1**	**9/54**	**2.90E-01 - 2.80E+00**	**3.30E+00**	**NA**	**6.10E-01**	**N**	**NA**	**NA**	**Yes**	**ASL**
118-96-7	**2,4,6-TRINITROTOLUENE**	**7.00E-02**	**J**	**1.90E+04**	**J**	**mg/kg**	**C2-OXY-SO-P22-2**	**23/54**	**2.90E-01 - 7.30E+01**	**1.90E+04**	**NA**	**3.60E+00**	**N**	**NA**	**NA**	**Yes**	**ASL**
121-14-2	**2,4-DINITROTOLUENE**	**1.30E-01**	**J**	**2.60E+01**	**J**	**mg/kg**	**C2-OXY-SO-P22-2**	**24/54**	**2.90E-01 - 2.80E+00**	**2.60E+01**	**NA**	**1.60E+00**	**C**	**NA**	**NA**	**Yes**	**ASL**
606-20-2	**2,6-DINITROTOLUENE**	**1.50E-01**	**J**	**2.20E+01**	**J**	**mg/kg**	**C2-OXY-SO-P22-2**	**21/53**	**2.90E-01 - 1.00E+01**	**2.20E+01**	**NA**	**6.10E+00**	**N**	**NA**	**NA**	**Yes**	**ASL**
35572-78-2	**2-AMINO-4,6-DINITROTOLUENE**	**6.80E-02**	**NJ**	**1.70E+02**	**J**	**mg/kg**	**C2-OXY-SO-P22-2**	**23/54**	**2.90E-01 - 1.00E+01**	**1.70E+02**	**NA**	**1.50E+01**	**N**	**NA**	**NA**	**Yes**	**ASL**
88-72-2	**2-NITROTOLUENE**	**1.00E-01**	**J**	**1.40E+01**	**NJ**	**mg/kg**	**C2-OXY-HN-0.5**	**5/54**	**2.90E-01 - 2.80E+00**	**1.40E+01**	**NA**	**2.90E+00**	**C**	**NA**	**NA**	**Yes**	**ASL**
99-08-1	3-NITROTOLUENE	1.60E-01	NJ	1.60E-01	NJ	mg/kg	C2-OXY-HW-0.5	1/54	2.90E-01 - 2.80E+00	1.60E-01	NA	6.10E-01	N	NA	NA	No	BSL
19406-51-0	**4-AMINO-2,6-DINITROTOLUENE**	**2.00E-01**	**J / NJ**	**1.30E+02**		**mg/kg**	**C2-OXY-HN-0.5**	**18/54**	**3.40E-01 - 1.00E+01**	**1.30E+02**	**NA**	**1.50E+01**	**N**	**NA**	**NA**	**Yes**	**ASL**
99-99-0	4-NITROTOLUENE	1.10E-01	J	2.86E-01	J	mg/kg	C10-GS2-SO-5-1	2/54	2.90E-01 - 2.80E+00	2.86E-01	NA	2.40E+01	N	NA	NA	No	BSL
2691-41-0	HMX	6.70E-02	NJ	5.60E+01	J	mg/kg	C2-OXY-HE-0.5	7/54	2.90E-01 - 2.80E+00	5.60E+01	NA	3.80E+02	N	NA	NA	No	BSL
121-82-4	**RDX**	**2.70E-01**	**NJ / J**	**6.30E+00**	**J**	**mg/kg**	**C2-OXY-HW-1**	**5/54**	**2.90E-01 - 2.80E+00**	**6.30E+00**	**NA**	**5.60E+00**	**C**	**NA**	**NA**	**Yes**	**ASL**
479-45-8	TETRYL	8.50E+00	J	8.50E+00	J	mg/kg	C2-OXY-HW-1	1/53	2.90E-01 - 2.85E+00	8.50E+00	NA	2.40E+01	N	NA	NA	No	BSL
INORGANICS																	
7429-90-5	**ALUMINUM**	**1.31E+03**		**3.28E+04**		**mg/kg**	**C10-GS2-SO-2-1**	**55/55**	**5.00E+00 - 1.25E+02**	**3.28E+04**	**NA**	**7.70E+03**	**N**	**NA**	**NA**	**Yes**	**ASL**
7440-36-0	**ANTIMONY**	**3.60E-01**		**1.01E+01**		**mg/kg**	**C2-OXY-SO-P21-1**	**15/55**	**4.70E-01 - 1.25E+01**	**1.01E+01**	**NA**	**3.10E+00**	**N**	**NA**	**NA**	**Yes**	**ASL**
7440-38-2	**ARSENIC**	**1.00E+00**		**2.71E+01**		**mg/kg**	**C2-OXY-SO-PN-1**	**54/55**	**9.40E-01 - 2.50E+01**	**2.71E+01**	**NA**	**3.90E-01**	**C**	**NA**	**NA**	**Yes**	**ASL**
7440-39-3	**BARIUM**	**5.40E+00**	**J**	**9.71E+03**		**mg/kg**	**C2-OXY-HW-1**	**55/55**	**4.70E-01 - 1.00E+02**	**9.71E+03**	**NA**	**1.50E+03**	**N**	**NA**	**NA**	**Yes**	**ASL**
7440-41-7	BERYLLIUM	6.00E-02	J	4.30E+00		mg/kg	C10-GS2-SO-2-1	40/55	1.00E-01 - 2.90E+00	4.30E+00	NA	1.60E+01	N	NA	NA	No	BSL
7440-42-8	BORON	3.40E+00	B	5.72E+01	J	mg/kg	C2-OXY-SO-SIN-1	9/55	1.00E+01 - 2.50E+02	5.72E+01	NA	1.60E+03	N	NA	NA	No	BSL
7440-43-9	**CADMIUM**	**5.30E-02**	**J**	**1.84E+02**	**J**	**mg/kg**	**C10-GS2-SO-10-0.5**	**36/55**	**5.00E-02 - 1.80E+00**	**1.84E+02**	**NA**	**7.00E+00**	**N**	**NA**	**NA**	**Yes**	**ASL**
7440-47-3	CHROMIUM, TOTAL	6.20E+00	J	4.96E+03	J	mg/kg	C2-OXY-HW-1	53/55	1.00E+00 - 9.50E+01	4.96E+03	NA	1.20E+04	N	NA	NA	No	BSL
18540-29-9	**CHROMIUM (HEXAVALENT)**	**1.70E-01**	**J**	**5.80E+00**		**mg/kg**	**C2-OXY-SO-SIN-1**	**22/34**	**4.80E-01 - 7.70E-01**	**5.80E+00**	**NA**	**2.90E-01**	**C**	**NA**	**NA**	**Yes**	**ASL**
7440-48-4	**COBALT**	**2.00E+00**		**4.33E+01**		**mg/kg**	**C10-GS2-SO-10-0.5**	**54/55**	**2.00E-01 - 1.80E+01**	**4.33E+01**	**NA**	**2.30E+00**	**N**	**NA**	**NA**	**Yes**	**ASL**
7440-50-8	**COPPER**	**3.30E+00**		**4.79E+03**		**mg/kg**	**C2-OXY-SO-P21-1**	**55/55**	**9.40E-01 - 3.60E+01**	**4.79E+03**	**NA**	**3.10E+02**	**N**	**NA**	**NA**	**Yes**	**ASL**
7439-89-6	**IRON**	**4.48E+03**		**1.82E+05**		**mg/kg**	**C2-OXY-SO-PN-1**	**55/55**	**5.00E+00 - 5.40E+02**	**1.82E+05**	**NA**	**5.50E+03**	**N**	**NA**	**NA**	**Yes**	**ASL**
7439-92-1	**LEAD**	**9.90E-01**	**J**	**2.76E+03**	**J**	**mg/kg**	**C10-GS2-SO-10-0.5**	**55/55**	**3.00E-01 - 7.50E+00**	**2.76E+03**	**NA**	**4.00E+02**	**N**	**NA**	**NA**	**Yes**	**ASL**
7439-93-2	**LITHIUM**	**5.30E-01**	**J**	**3.63E+01**	**J**	**mg/kg**	**C10-GS2-SO-4-1**	**53/55**	**4.70E-01 - 2.50E+01**	**3.63E+01**	**NA**	**1.60E+01**	**N**	**NA**	**NA**	**Yes**	**ASL**
7439-96-5	**MANGANESE**	**1.85E+01**		**1.79E+03**	**J**	**mg/kg**	**C2-OXY-SO-SIW-3**	**55/55**	**2.00E-01 - 1.60E+01**	**1.79E+03**	**NA**	**1.80E+02**	**N**	**NA**	**NA**	**Yes**	**ASL**
7439-97-6	MERCURY	8.10E-03	B	6.20E-01	B	mg/kg	C2-OXY-SO-SIN-1	36/55	3.30E-02 - 2.30E-01	6.20E-01	NA	1.00E+00	N	NA	NA	No	BSL
7440-02-0	**NICKEL**	**6.80E+00**	**J**	**6.99E+02**	**J**	**mg/kg**	**C10-GS2-SO-BP1**	**54/55**	**5.00E-01 - 1.25E+01**	**6.99E+02**	**NA**	**1.50E+02**	**N**	**NA**	**NA**	**Yes**	**ASL**
7782-49-2	SELENIUM	2.90E-01	J	2.40E+01	J	mg/kg	C10-GS2-SO-10-0.5	34/55	4.70E-01 - 1.25E+01	2.40E+01	NA	3.90E+01	N	NA	NA	No	BSL
7440-22-4	SILVER	2.70E-02	J / J	1.60E+00		mg/kg	C2-OXY-SO-P22-2	31/55	2.00E-01 - 5.00E+00	1.60E+00	NA	3.90E+01	N	NA	NA	No	BSL
7440-28-0	**THALLIUM**	**6.30E-02**	**B**	**1.80E+00**	**J**	**mg/kg**	**C2-OXY-SO-P21-1**	**13/55**	**2.00E-01 - 5.00E+00**	**1.80E+00**	**NA**	**7.80E-02**	**N**	**NA**	**NA**	**Yes**	**ASL**
7440-62-2	**VANADIUM**	**4.00E+00**	**J**	**2.20E+02**	**J**	**mg/kg**	**C10-GS2-SO-BP1**	**52/55**	**4.70E-01 - 2.50E+01**	**2.20E+02**	**NA**	**3.90E+01**	**N**	**NA**	**NA**	**Yes**	**ASL**
7440-66-6	**ZINC**	**9.30E+00**	**J**	**5.23E+04**	**J**	**mg/kg**	**C2-OXY-HE-1**	**54/55**	**9.40E-01 - 2.00E+02**	**5.23E+04**	**NA**	**2.30E+03**	**N**	**NA**	**NA**	**Yes**	**ASL**
PAHS																	
50-32-8	**BENZO[A]PYRENE**	**1.79E-01**		**1.79E-01**		**mg/kg**	**C10-GS2-SO-10-0.5**	**1/20**	**7.50E-02 - 1.20E+01**	**1.79E-01**	**NA**	**1.50E-02**	**C**	**NA**	**NA**	**Yes**	**ASL**
205-99-2	BENZO[B]FLUORANTHENE	9.94E-02	J	9.94E-02	J	mg/kg	C10-GS2-SO-10-0.5	1/20	7.50E-02 - 1.20E+01	9.94E-02	NA	1.50E-01	C	NA	NA	No	BSL
191-24-2	BENZO[G,H,I]PERYLENE	1.84E-01		1.84E-01		mg/kg	C10-GS2-SO-10-0.5	1/20	7.50E-02 - 1.20E+01	1.84E-01	NA	1.70E+02	N	NA	NA	No	BSL
193-39-5	INDENO[1,2,3-C,D]PYRENE	1.24E-01	J	1.24E-01	J	mg/kg	C10-GS2-SO-10-0.5	1/20	7.50E-02 - 1.20E+01	1.24E-01	NA	1.50E-01	C	NA	NA	No	BSL
PESTICIDES/PCBS																	
50-29-3	4,4-DDT	7.10E-03	J	8.14E-02	J	mg/kg	C10-GS2-SO-10-0.5	2/20	3.50E-03 - 5.00E-01	8.14E-02	NA	1.70E+00	C	NA	NA	No	BSL
SEMI-VOLATILE ORGANIC COMPOUNDS																	
85-68-7	BENZYL BUTYL PHTHALATE	1.27E-01	J	5.07E-01		mg/kg	C10-GS2-SO-3-5	4/20	1.80E-01 - 2.50E+00	5.07E-01	NA	2.60E+02	C	NA	NA	No	BSL
117-81-7	BIS(2-ETHYLHEXYL) PHTHALATE	1.29E-01	J	1.60E+00		mg/kg	C10-GS2-SO-7-13	7/20	1.80E-01 - 2.50E+00	1.60E+00	NA	3.50E+01	C	NA	NA	No	BSL

TABLE B-2.5
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY - TOTAL SOIL - RESIDENTIAL

Scenario Timeframe: Future-Residential
Medium: Total soil
Exposure Medium: Total soil
Exposure Point: EU8

CAS Number	Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration (2) Used for Screening	Background (3) Value	Screening (4) Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for (5) Contaminant Deletion or Selection
VOLATILE ORGANIC COMPOUNDS																
78-93-3	2-BUTANONE	4.08E-02	J	4.08E-02	J	mg/kg	C10-GS2-SO-10-0.5	1/20	9.20E-03 - 5.50E-02	4.08E-02	NA	2.80E+03 N	NA	NA	No	BSL
67-64-1	ACETONE	6.02E-02	J	2.38E+00	J	mg/kg	C10-GS2-SO-7-1	20/20	4.60E-02 - 3.20E+00	2.38E+00	NA	6.10E+03 N	NA	NA	No	BSL
100-42-5	STYRENE	4.60E-03	J	1.03E-02		mg/kg	C10-GS2-SO-7-1	4/20	4.60E-03 - 2.80E-02	1.03E-02	NA	6.30E+02 N	NA	NA	No	BSL

(1) Minimum/maximum detected concentration.
(2) Maximum concentration used as screening value.
(3) Background values are not included as part of the COPC selection process.

(4) USEPA Regional Screening Levels, USEPA, April 2012. For non-carcinogens, value shown is equal to 1/10 the residential soil value. For carcinogens the value shown is equal to the residential soil value.
(5) Rationale Codes
Selection Reason: ASL = Above Screening Toxicity Level
NSL = No Screening Level
Deletion Reason: BSL = Below Screening Toxicity Level
NUT = Nutrient

Gray shading identifies COPCs.
Surrogates used: pyrene for benzo[g,h,i]perylene.

Definitions:
ARAR = Applicable or Relevant and Appropriate
C = Carcinogenic
COPC = Constituent of Potential Concern

mg/kg = milligrams per kilogram
N = Non-Carcinogenic
NA = Not Applicable
PAHs = Polynuclear Aromatic Hydrocarbons
PCBs = Polychlorinated Bipheyls
TBC = To Be Considered

Data Qualifiers:
B = Detected between the method detection limit and the detection limit.
J = Value is estimated.
NJ = Identificationof chemical questionable, Inorganic

TABLE B-2.6
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY - TOTAL SOIL - INDUSTRIAL

Scenario Timeframe: Current/Future-Industrial
Medium: Total soil
Exposure Medium: Total soil
Exposure Point: EU8

CAS Number	Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration (2) Used for Screening	Background (3) Value	Screening (4) Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for (5) Contaminant Deletion or Selection
EXPLOSIVES																
99-35-4	1,3,5-TRINITROBENZENE	1.10E-01	J	4.50E+01	J	mg/kg	C2-OXY-SO-P22-2	19/54	2.90E-01 - 2.80E+00	4.50E+01	NA	2.70E+03 N	NA	NA	No	BSL
99-65-0	1,3-DINITROBENZENE	5.50E-02	J	3.30E+00		mg/kg	C2-OXY-HW-1	9/54	2.90E-01 - 2.80E+00	3.30E+00	NA	6.20E+00 N	NA	NA	No	BSL
118-96-7	**2,4,6-TRINITROTOLUENE**	**7.00E-02**	**J**	**1.90E+04**	**J**	**mg/kg**	**C2-OXY-SO-P22-2**	**23/54**	**2.90E-01 - 7.30E+01**	**1.90E+04**	**NA**	**4.20E+01 N**	**NA**	**NA**	**Yes**	**ASL**
121-14-2	**2,4-DINITROTOLUENE**	**1.30E-01**	**J**	**2.60E+01**	**J**	**mg/kg**	**C2-OXY-SO-P22-2**	**24/54**	**2.90E-01 - 2.80E+00**	**2.60E+01**	**NA**	**5.50E+00 C**	**NA**	**NA**	**Yes**	**ASL**
606-20-2	2,6-DINITROTOLUENE	1.50E-01	J	2.20E+01	J	mg/kg	C2-OXY-SO-P22-2	21/53	2.90E-01 - 1.00E+01	2.20E+01	NA	6.20E+01 N	NA	NA	No	BSL
35572-78-2	2-AMINO-4,6-DINITROTOLUENE	6.80E-02	NJ	1.70E+02	J	mg/kg	C2-OXY-SO-P22-2	23/54	2.90E-01 - 1.00E+01	1.70E+02	NA	2.00E+02 N	NA	NA	No	BSL
88-72-2	**2-NITROTOLUENE**	**1.00E-01**	**J**	**1.40E+01**	**NJ**	**mg/kg**	**C2-OXY-HN-0.5**	**5/54**	**2.90E-01 - 2.80E+00**	**1.40E+01**	**NA**	**1.30E+01 C**	**NA**	**NA**	**Yes**	**ASL**
99-08-1	3-NITROTOLUENE	1.60E-01	NJ	1.60E-01	NJ	mg/kg	C2-OXY-HW-0.5	1/54	2.90E-01 - 2.80E+00	1.60E-01	NA	6.20E+00 N	NA	NA	No	BSL
19406-51-0	4-AMINO-2,6-DINITROTOLUENE	2.00E-01	J / NJ	1.30E+02		mg/kg	C2-OXY-HN-0.5	18/54	3.40E-01 - 1.00E+01	1.30E+02	NA	1.90E+02 N	NA	NA	No	BSL
99-99-0	4-NITROTOLUENE	1.10E-01	J	2.86E-01	J	mg/kg	C10-GS2-SO-5-1	2/54	2.90E-01 - 2.80E+00	2.86E-01	NA	1.10E+02 C	NA	NA	No	BSL
2691-41-0	HMX	6.70E-02	NJ	5.60E+01	J	mg/kg	C2-OXY-HE-0.5	7/54	2.90E-01 - 2.80E+00	5.60E+01	NA	4.90E+03 N	NA	NA	No	BSL
121-82-4	RDX	2.70E-01	NJ / J	6.30E+00	J	mg/kg	C2-OXY-HW-1	5/54	2.90E-01 - 2.80E+00	6.30E+00	NA	2.40E+01 C	NA	NA	No	BSL
479-45-8	TETRYL	8.50E+00	J	8.50E+00	J	mg/kg	C2-OXY-HW-1	1/53	2.90E-01 - 2.85E+00	8.50E+00	NA	2.50E+02 N	NA	NA	No	BSL
INORGANICS																
7429-90-5	ALUMINUM	1.31E+03		3.28E+04		mg/kg	C10-GS2-SO-2-1	55/55	5.00E+00 - 1.25E+02	3.28E+04	NA	9.90E+04 N	NA	NA	No	BSL
7440-36-0	ANTIMONY	3.60E-01		1.01E+01		mg/kg	C2-OXY-SO-P21-1	15/55	4.70E-01 - 1.25E+01	1.01E+01	NA	4.10E+01 N	NA	NA	No	BSL
7440-38-2	**ARSENIC**	**1.00E+00**		**2.71E+01**		**mg/kg**	**C2-OXY-SO-PN-1**	**54/55**	**9.40E-01 - 2.50E+01**	**2.71E+01**	**NA**	**1.60E+00 C**	**NA**	**NA**	**Yes**	**ASL**
7440-39-3	BARIUM	5.40E+00	J	9.71E+03		mg/kg	C2-OXY-HW-1	55/55	4.70E-01 - 1.00E+02	9.71E+03	NA	1.90E+04 N	NA	NA	No	BSL
7440-41-7	BERYLLIUM	6.00E-02	J	4.30E+00		mg/kg	C10-GS2-SO-2-1	40/55	1.00E-01 - 2.90E+00	4.30E+00	NA	2.00E+02 N	NA	NA	No	BSL
7440-42-8	BORON	3.40E+00	B	5.72E+01	J	mg/kg	C2-OXY-SO-SIN-1	9/55	1.00E+01 - 2.50E+02	5.72E+01	NA	2.00E+04 N	NA	NA	No	BSL
7440-43-9	**CADMIUM**	**5.30E-02**	**J**	**1.84E+02**	**J**	**mg/kg**	**C10-GS2-SO-10-0.5**	**36/55**	**5.00E-02 - 1.80E+00**	**1.84E+02**	**NA**	**8.00E+01 N**	**NA**	**NA**	**Yes**	**ASL**
7440-47-3	CHROMIUM, TOTAL	6.20E+00	J	4.96E+03	J	mg/kg	C2-OXY-HW-1	53/55	1.00E+00 - 9.50E+01	4.96E+03	NA	1.50E+05 N	NA	NA	No	BSL
18540-29-9	**CHROMIUM (HEXAVALENT)**	**1.70E-01**	**J**	**5.80E+00**		**mg/kg**	**C2-OXY-SO-SIN-1**	**22/34**	**4.80E-01 - 7.70E-01**	**5.80E+00**	**NA**	**5.60E+00 C**	**NA**	**NA**	**Yes**	**ASL**
7440-48-4	**COBALT**	**2.00E+00**		**4.33E+01**		**mg/kg**	**C10-GS2-SO-10-0.5**	**54/55**	**2.00E-01 - 1.80E+01**	**4.33E+01**	**NA**	**3.00E+01 N**	**NA**	**NA**	**Yes**	**ASL**
7440-50-8	**COPPER**	**3.30E+00**		**4.79E+03**		**mg/kg**	**C2-OXY-SO-P21-1**	**55/55**	**9.40E-01 - 3.60E+01**	**4.79E+03**	**NA**	**4.10E+03 N**	**NA**	**NA**	**Yes**	**ASL**
7439-89-6	**IRON**	**4.48E+03**		**1.82E+05**		**mg/kg**	**C2-OXY-SO-PN-1**	**55/55**	**5.00E+00 - 5.40E+02**	**1.82E+05**	**NA**	**7.20E+04 N**	**NA**	**NA**	**Yes**	**ASL**
7439-92-1	**LEAD**	**9.90E-01**	**J**	**2.76E+03**	**J**	**mg/kg**	**C10-GS2-SO-10-0.5**	**55/55**	**3.00E-01 - 7.50E+00**	**2.76E+03**	**NA**	**8.00E+02 N**	**NA**	**NA**	**Yes**	**ASL**
7439-93-2	LITHIUM	5.30E-01	J	3.63E+01	J	mg/kg	C10-GS2-SO-4-1	53/55	4.70E-01 - 2.50E+01	3.63E+01	NA	2.00E+02 N	NA	NA	No	BSL
7439-96-5	MANGANESE	1.85E+01		1.79E+03	J	mg/kg	C2-OXY-SO-SIW-3	55/55	2.00E-01 - 1.60E+01	1.79E+03	NA	2.30E+03 N	NA	NA	No	BSL
7439-97-6	MERCURY	8.10E-03	B	6.20E-01	B	mg/kg	C2-OXY-SO-SIN-1	36/55	3.30E-02 - 2.30E-01	6.20E-01	NA	4.30E+00 N	NA	NA	No	BSL
7440-02-0	NICKEL	6.80E+00	J	6.99E+02	J	mg/kg	C10-GS2-SO-BP1	54/55	5.00E-01 - 1.25E+01	6.99E+02	NA	2.00E+03 N	NA	NA	No	BSL
7782-49-2	SELENIUM	2.90E-01	J	2.40E+01	J	mg/kg	C10-GS2-SO-10-0.5	34/55	4.70E-01 - 1.25E+01	2.40E+01	NA	5.10E+02 N	NA	NA	No	BSL
7440-22-4	SILVER	2.70E-02	J / J	1.60E+00		mg/kg	C2-OXY-SO-P22-2	31/55	2.00E-01 - 5.00E+00	1.60E+00	NA	5.10E+02 N	NA	NA	No	BSL
7440-28-0	**THALLIUM**	**6.30E-02**	**B**	**1.80E+00**	**J**	**mg/kg**	**C2-OXY-SO-P21-1**	**13/55**	**2.00E-01 - 5.00E+00**	**1.80E+00**	**NA**	**1.00E+00 N**	**NA**	**NA**	**Yes**	**ASL**
7440-62-2	VANADIUM	4.00E+00	J	2.20E+02	J	mg/kg	C10-GS2-SO-BP1	52/55	4.70E-01 - 2.50E+01	2.20E+02	NA	5.20E+02 N	NA	NA	No	BSL
7440-66-6	**ZINC**	**9.30E+00**	**J**	**5.23E+04**	**J**	**mg/kg**	**C2-OXY-HE-1**	**54/55**	**9.40E-01 - 2.00E+02**	**5.23E+04**	**NA**	**3.10E+04 N**	**NA**	**NA**	**Yes**	**ASL**
PAHS																
50-32-8	BENZO[A]PYRENE	1.79E-01		1.79E-01		mg/kg	C10-GS2-SO-10-0.5	1/20	7.50E-02 - 1.20E+01	1.79E-01	NA	2.10E-01 C	NA	NA	No	BSL
205-99-2	BENZO[B]FLUORANTHENE	9.94E-02	J	9.94E-02	J	mg/kg	C10-GS2-SO-10-0.5	1/20	7.50E-02 - 1.20E+01	9.94E-02	NA	2.10E+00 C	NA	NA	No	BSL
191-24-2	BENZO[G,H,I]PERYLENE	1.84E-01		1.84E-01		mg/kg	C10-GS2-SO-10-0.5	1/20	7.50E-02 - 1.20E+01	1.84E-01	NA	1.70E+03 N	NA	NA	No	BSL
193-39-5	INDENO[1,2,3-C,D]PYRENE	1.24E-01	J	1.24E-01	J	mg/kg	C10-GS2-SO-10-0.5	1/20	7.50E-02 - 1.20E+01	1.24E-01	NA	2.10E+00 C	NA	NA	No	BSL
PESTICIDES/PCBS																
50-29-3	4,4-DDT	7.10E-03	J	8.14E-02	J	mg/kg	C10-GS2-SO-10-0.5	2/20	3.50E-03 - 5.00E-01	8.14E-02	NA	7.00E+00 C	NA	NA	No	BSL
SEMI-VOLATILE ORGANIC COMPOUNDS																
85-68-7	BENZYL BUTYL PHTHALATE	1.27E-01	J	5.07E-01		mg/kg	C10-GS2-SO-3-5	4/20	1.80E-01 - 2.50E+00	5.07E-01	NA	9.10E+02 C	NA	NA	No	BSL
117-81-7	BIS(2-ETHYLHEXYL) PHTHALATE	1.29E-01	J	1.60E+00		mg/kg	C10-GS2-SO-7-13	7/20	1.80E-01 - 2.50E+00	1.60E+00	NA	1.20E+02 C	NA	NA	No	BSL

TABLE B-2.6
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY - TOTAL SOIL - INDUSTRIAL

Scenario Timeframe: Current/Future-Industrial
Medium: Total soil
Exposure Medium: Total soil
Exposure Point: EU8

CAS Number	Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration (2) Used for Screening	Background (3) Value	Screening (4) Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for (5) Contaminant Deletion or Selection
VOLATILE ORGANIC COMPOUNDS																
78-93-3	2-BUTANONE	4.08E-02	J	4.08E-02	J	mg/kg	C10-GS2-SO-10-0.5	1/20	9.20E-03 - 5.50E-02	4.08E-02	NA	2.00E+04 N	NA	NA	No	BSL
67-64-1	ACETONE	6.02E-02	J	2.38E+00	J	mg/kg	C10-GS2-SO-7-1	20/20	4.60E-02 - 3.20E+00	2.38E+00	NA	6.30E+04 N	NA	NA	No	BSL
100-42-5	STYRENE	4.60E-03	J	1.03E-02		mg/kg	C10-GS2-SO-7-1	4/20	4.60E-03 - 2.80E-02	1.03E-02	NA	3.60E+03 N	NA	NA	No	BSL

(1) Minimum/maximum detected concentration.
(2) Maximum concentration used as screening value.
(3) Background values are not included as part of the COPC selection process.

(4) USEPA Regional Screening Levels, USEPA, April 2012. For non-carcinogens, value shown is equal to 1/10 the industrial soil value. For carcinogens the value shown is equal to the industrial soil value.
(5) Rationale Codes
Selection Reason: ASL = Above Screening Toxicity Level
NSL = No Screening Level
Deletion Reason: BSL = Below Screening Toxicity Level
NUT = Nutrient

Gray shading identifies COPCs.
Surrogates used: pyrene for benzo[g,h,i]perylene.

Definitions:
ARAR = Applicable or Relevant and Appropriate
C = Carcinogenic
COPC = Constituent of Potential Concern

mg/kg = milligrams per kilogram
N = Non-Carcinogenic
NA = Not Applicable
PAHs = Polynuclear Aromatic Hydrocarbons
PCBs = Polychlorinated Bipheyls
TBC = To Be Considered

Data Qualifiers:
B = Detected between the method detection limit and the detection limit.
J = Value is estimated.
NJ = Identificationof chemical questionable, Inorganic

TABLE B-3.1
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY - SURFACE SOIL - RESIDENTIAL

Scenario Timeframe: Future-Residential
Medium: Surface soil
Exposure Medium: Surface soil
Exposure Point: EU8

Constituent of Potential Concern	Units	Arithmetic Mean	95% UCL	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
EXPLOSIVES									
1,3-DINITROBENZENE	mg/kg	1.03E+00	6.79E-01	3.30E+00		mg/kg	6.79E-01	95%UCLM-KMp	USEPA ProUCL
2,4,6-TRINITROTOLUENE	mg/kg	1.43E+03	6.00E+03	1.90E+04	J	mg/kg	6.00E+03	95%UCLM-KMC	USEPA ProUCL
2,4-DINITROTOLUENE	mg/kg	3.25E+00	7.03E+00	2.60E+01	J	mg/kg	7.03E+00	95%UCLM-KMC	USEPA ProUCL
2,6-DINITROTOLUENE	mg/kg	3.14E+00	3.08E+00	2.20E+01	J	mg/kg	3.08E+00	95%UCLM-BCA	USEPA ProUCL
2-AMINO-4,6-DINITROTOLUENE	mg/kg	2.33E+01	6.79E+01	1.70E+02	J	mg/kg	6.79E+01	95%UCLM-KMC	USEPA ProUCL
2-NITROTOLUENE	mg/kg	2.99E+00	3.09E+00	1.40E+01	NJ	mg/kg	3.09E+00	95%UCLM-KMC	USEPA ProUCL
4-AMINO-2,6-DINITROTOLUENE	mg/kg	1.89E+01	4.84E+01	1.30E+02		mg/kg	4.84E+01	95%UCLM-KMC	USEPA ProUCL
RDX	mg/kg	1.69E+00	7.70E-01	6.30E+00	J	mg/kg	7.70E-01	95%UCLM-KMt	USEPA ProUCL
INORGANICS									
BARIUM	mg/kg	1.37E+03	2.85E+03	9.71E+03		mg/kg	2.85E+03	95%UCLM-C	USEPA ProUCL
CADMIUM	mg/kg	1.52E+01	6.27E+01	1.84E+02	J	mg/kg	6.27E+01	95%UCLM-KMC	USEPA ProUCL
CHROMIUM (HEXAVALENT)	mg/kg	1.57E+00	1.91E+00	5.80E+00	J	mg/kg	1.91E+00	95%UCLM-KMC	USEPA ProUCL
COPPER	mg/kg	3.59E+02	9.60E+02	4.79E+03		mg/kg	9.60E+02	95%UCLM-BCA	USEPA ProUCL
LEAD	mg/kg	4.96E+02	1.30E+03	2.76E+03	J	mg/kg	4.96E+02	Mean	USEPA 1994
NICKEL	mg/kg	6.10E+01	1.86E+02	6.99E+02	J	mg/kg	1.86E+02	95%UCLM-KMC	USEPA ProUCL
THALLIUM	mg/kg	7.63E-01	7.50E-01	1.80E+00	J	mg/kg	7.50E-01	95%UCLM-KMp	USEPA ProUCL
ZINC	mg/kg	8.64E+03	2.96E+04	5.23E+04	J	mg/kg	2.96E+04	95%UCLM-KMC	USEPA ProUCL
PAHS									
BENZO[A]PYRENE	mg/kg	NA	NA	1.79E-01		mg/kg	1.79E-01	Maximum	Low %Detects

Note: EPC statistics are presented in Attachment 3.
95%UCLM-BCA indicates that the 95 percent upper confidence limit on the mean is based on the Kaplan-Meier (KM) Bias-Corrected Accelerated (BCA) percentile bootstrap test.
95%UCLM-C indicates that the 95 percent upper confidence limit on the mean is based on the non-parametric Chebyshev test.
95%UCLM-KMC indicates that the 95 percent upper confidence limit on the mean is based on the non-parametric Kaplan-Meier (KM) Chebyshev test.
95%UCLM-KMp indicates that the 95 percent upper confidence limit on the mean is based on the non-parametric Kaplan-Meier (KM) percentile boostrap test.
95%UCLM-KMt indicates that the 95 percent upper confidence limit on the mean is based on the non-parametric Kaplan-Meier (KM) student's t-test.
Low %Detects indicates low percentage of detects.
USEPA 1994 = Mean concentration used for lead EPC in accordance with USEPA, 1994. Guidance Manual for the Integrated Exposure Uptake Biokinetic Model for Lead in Children. Office of Emergency and Remedial Response, Washington, D.C. USEPA/540/R-93/081. February
EPC = Exposure Point Concentration
J = Value is estimated.
mg/kg = milligrams per kilogram
NA = Not Applicable
NJ = Identification of Chemical Questionable, Inorganics
PAHs = Polynuclear Aromatic Hydrocarbons
UCL = Upper Confidence Limit

TABLE B-3.2
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY- SURFACE SOIL - INDUSTRIAL

Scenario Timeframe: Current/Future-Industrial
Medium: Surface soil
Exposure Medium: Surface soil
Exposure Point: EU8

Constituent of Potential Concern	Units	Arithmetic Mean	95% UCL	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
EXPLOSIVES									
2,4,6-TRINITROTOLUENE	mg/kg	1.43E+03	6.00E+03	1.90E+04	J	mg/kg	6.00E+03	95%UCLM-KMC	USEPA ProUCL
2,4-DINITROTOLUENE	mg/kg	3.25E+00	7.03E+00	2.60E+01	J	mg/kg	7.03E+00	95%UCLM-KMC	USEPA ProUCL
2-NITROTOLUENE	mg/kg	2.99E+00	3.09E+00	1.40E+01	NJ	mg/kg	3.09E+00	95%UCLM-KMC	USEPA ProUCL
INORGANICS									
CHROMIUM (HEXAVALENT)	mg/kg	1.57E+00	1.91E+00	5.80E+00	J	mg/kg	1.91E+00	95%UCLM-KMC	USEPA ProUCL
COPPER	mg/kg	3.59E+02	9.60E+02	4.79E+03		mg/kg	9.60E+02	95%UCLM-C	USEPA ProUCL
LEAD	mg/kg	4.96E+02	1.30E+03	2.76E+03	J	mg/kg	4.96E+02	Mean	USEPA 1994
ZINC	mg/kg	8.64E+03	2.96E+04	5.23E+04	J	mg/kg	2.96E+04	95%UCLM-KMC	USEPA ProUCL

Note: EPC statistics are presented in Attachment 3.
95%UCLM-C indicates that the 95 percent upper confidence limit on the mean is based on the non-parametric Chebyshev test.
95%UCLM-KMC indicates that the 95 percent upper confidence limit on the mean is based on the non-parametric Kaplan-Meier (KM) Chebyshev test.
USEPA 1994 = Mean concentration used for lead EPC in accordance with USEPA, 1994. Guidance Manual for the Integrated Exposure Uptake Biokinetic Model for Lead in Children. Office of Emergency and Remedial Response, Washington, D.C. USEPA/540/R-93/081. February
EPC = Exposure Point Concentration
J = Value is estimated.
mg/kg = milligrams per kilogram
NA = Not Applicable
NJ = Identification of Chemical Questionable, Inorganics
UCL = Upper Confidence Limit

TABLE B-3.3
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY - SUBSURFACE SOIL - RESIDENTIAL

Scenario Timeframe: Future-Residential
Medium: Subsurface soil
Exposure Medium: Subsurface soil
Exposure Point: EU8

Constituent of Potential Concern	Units	Arithmetic Mean	95% UCL	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
EXPLOSIVES									
2,4,6-TRINITROTOLUENE	mg/kg	4.68E+00	4.24E+00	2.30E+01		mg/kg	4.24E+00	95%UCLM-KMt	USEPA ProUCL
INORGANICS									
CHROMIUM (HEXAVALENT)	mg/kg	3.90E-01	6.10E-01	6.10E-01		mg/kg	6.10E-01	95%UCLM-KMp	USEPA ProUCL
THALLIUM	mg/kg	3.32E-01	3.27E-01	6.70E-01		mg/kg	3.27E-01	95%UCLM-KMt	USEPA ProUCL

Note: EPC statistics are presented in Attachment 3.
95%UCLM-KMt indicates that the 95 percent upper confidence limit on the mean is based on the non-parametric Kaplan-Meier (KM) student's t-test.
95%UCLM-KMp indicates that the 95 percent upper confidence limit on the mean is based on the non-parametric Kaplan-Meier (KM) percentile boostrap test.
EPC = Exposure Point Concentration
J = Value is estimated.
mg/kg = milligrams per kilogram
NA = Not Applicable
UCL = Upper Confidence Limit

TABLE B-3.4
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY - SUBSURFACE SOIL - INDUSTRIAL

Scenario Timeframe: Current/Future-Industrial
Medium: Subsurface soil
Exposure Medium: Subsurface soil
Exposure Point: EU8

Constituent of Potential Concern	Units	Arithmetic Mean	95% UCL	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
No COPCs									

EPC = Exposure Point Concentration
mg/kg = milligrams per kilogram
UCL = Upper Confidence Limit

TABLE B-3.5
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY - TOTAL SOIL - RESIDENTIAL

Scenario Timeframe: Future-Residential
Medium: Total soil
Exposure Medium: Total soil
Exposure Point: EU8

Constituent of Potential Concern	Units	Arithmetic Mean	95% UCL	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
EXPLOSIVES									
1,3-DINITROBENZENE	mg/kg	8.22E-01	3.48E-01	3.30E+00		mg/kg	3.48E-01	95%UCLM-KMt	USEPA ProUCL
2,4,6-TRINITROTOLUENE	mg/kg	1.06E+03	4.11E+03	1.90E+04	J	mg/kg	4.11E+03	95%UCLM-KMC	USEPA ProUCL
2,4-DINITROTOLUENE	mg/kg	2.91E+00	2.56E+00	2.60E+01	J	mg/kg	2.56E+00	95%UCLM-BCA	USEPA ProUCL
2,6-DINITROTOLUENE	mg/kg	2.87E+00	2.05E+00	2.20E+01	J	mg/kg	2.05E+00	95%UCLM-KMt	USEPA ProUCL
2-AMINO-4,6-DINITROTOLUENE	mg/kg	1.95E+01	4.72E+01	1.70E+02	J	mg/kg	4.72E+01	95%UCLM-KMC	USEPA ProUCL
2-NITROTOLUENE	mg/kg	2.99E+00	1.63E+00	1.40E+01	NJ	mg/kg	1.63E+00	95%UCLM-KMC	USEPA ProUCL
4-AMINO-2,6-DINITROTOLUENE	mg/kg	1.49E+01	3.34E+01	1.30E+02		mg/kg	3.34E+01	95%UCLM-KMC	USEPA ProUCL
RDX	mg/kg	1.69E+00	6.12E-01	6.30E+00	J	mg/kg	6.12E-01	95%UCLM-KMt	USEPA ProUCL
INORGANICS									
BARIUM	mg/kg	9.54E+02	2.01E+03	9.71E+03		mg/kg	2.01E+03	95%UCLM-C	USEPA ProUCL
CADMIUM	mg/kg	1.15E+01	4.28E+01	1.84E+02	J	mg/kg	4.28E+01	95%UCLM-KMC	USEPA ProUCL
CHROMIUM (HEXAVALENT)	mg/kg	1.52E+00	1.49E+00	5.80E+00		mg/kg	1.49E+00	95%UCLM-BCA	USEPA ProUCL
COPPER	mg/kg	2.51E+02	6.64E+02	4.79E+03		mg/kg	6.64E+02	95%UCLM-C	USEPA ProUCL
IRON	mg/kg	2.78E+04	4.69E+04	1.82E+05		mg/kg	4.69E+04	95%UCLM-C	USEPA ProUCL
LEAD	mg/kg	3.36E+02	7.34E+02	2.76E+03	J	mg/kg	3.36E+02	Mean	USEPA 1994
NICKEL	mg/kg	4.65E+01	1.06E+02	6.99E+02	J	mg/kg	1.06E+02	95%UCLM-KMC	USEPA ProUCL
THALLIUM	mg/kg	4.97E-01	3.31E-01	1.80E+00	J	mg/kg	3.31E-01	95%UCLM-KMt	USEPA ProUCL
ZINC	mg/kg	5.78E+03	2.08E+04	5.23E+04	J	mg/kg	2.08E+04	95%UCLM-KMC	USEPA ProUCL
PAHS									
BENZO[A]PYRENE	mg/kg	NA	NA	1.79E-01		mg/kg	1.79E-01	Maximum	Low %Detects

TABLE B-3.5
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY - TOTAL SOIL - RESIDENTIAL

Note: EPC statistics are presented in Attachment 3.
95%UCLM-BCA indicates that the 95 percent upper confidence limit on the mean is based on the Kaplan-Meier (KM) Bias-Corrected Accelerated (BCA) percentile bootstrap test.
95%UCLM-C indicates that the 95 percent upper confidence limit on the mean is based on the non-parametric Chebyshev test.
95%UCLM-KMC indicates that the 95 percent upper confidence limit on the mean is based on the non-parametric Kaplan-Meier (KM) Chebyshev test.
95%UCLM-KMt indicates that the 95 percent upper confidence limit on the mean is based on the non-parametric Kaplan-Meier (KM) student's t-test.
Low %Detects indicates low percentage of detects.
USEPA 1994 = Mean concentration used for lead EPC in accordance with USEPA, 1994. Guidance Manual for the Integrated Exposure Uptake Biokinetic Model for Lead in Children. Office of Emergency and Remedial Response, Washington, D.C. USEPA/540/R-93/081. February
EPC = Exposure Point Concentration
J = Value is estimated.
mg/kg = milligrams per kilogram
NA = Not Applicable
NJ = Identification of Chemical Questionable, Inorganics
PAHs = Polynuclear Aromatic Hydrocarbons
UCL = Upper Confidence Limit

TABLE B-3.6
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY - TOTAL SOIL - INDUSTRIAL

Scenario Timeframe: Current/Future-Industrial
Medium: Total soil
Exposure Medium: Total soil
Exposure Point: EU8

Constituent of Potential Concern	Units	Arithmetic Mean	95% UCL	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
EXPLOSIVES									
2,4,6-TRINITROTOLUENE	mg/kg	1.06E+03	4.11E+03	1.90E+04	J	mg/kg	4.11E+03	95%UCLM-KMC	USEPA ProUCL
2,4-DINITROTOLUENE	mg/kg	2.91E+00	2.56E+00	2.60E+01	J	mg/kg	2.56E+00	95%UCLM-BCA	USEPA ProUCL
2-NITROTOLUENE	mg/kg	2.99E+00	1.63E+00	1.40E+01	NJ	mg/kg	1.63E+00	95%UCLM-KMC	USEPA ProUCL
INORGANICS									
CADMIUM	mg/kg	1.15E+01	4.28E+01	1.84E+02	J	mg/kg	4.28E+01	95%UCLM-KMC	USEPA ProUCL
CHROMIUM (HEXAVALENT)	mg/kg	1.52E+00	1.49E+00	5.80E+00		mg/kg	1.49E+00	95%UCLM-BCA	USEPA ProUCL
COPPER	mg/kg	2.51E+02	6.64E+02	4.79E+03		mg/kg	6.64E+02	95%UCLM-C	USEPA ProUCL
IRON	mg/kg	2.78E+04	4.69E+04	1.82E+05		mg/kg	4.69E+04	95%UCLM-C	USEPA ProUCL
LEAD	mg/kg	3.36E+02	7.34E+02	2.76E+03	J	mg/kg	3.36E+02	Mean	USEPA 1994
ZINC	mg/kg	5.78E+03	2.08E+04	5.23E+04	J	mg/kg	2.08E+04	95%UCLM-KMC	USEPA ProUCL

Note: EPC statistics are presented in Attachment 3.
95%UCLM-BCA indicates that the 95 percent upper confidence limit on the mean is based on the Kaplan-Meier (KM) Bias-Corrected Accelerated (BCA) percentile bootstrap test.
95%UCLM-C indicates that the 95 percent upper confidence limit on the mean is based on the non-parametric Chebyshev test.
95%UCLM-KMC indicates that the 95 percent upper confidence limit on the mean is based on the non-parametric Kaplan-Meier (KM) Chebyshev test.
95%UCLM-KMt indicates that the 95 percent upper confidence limit on the mean is based on the non-parametric Kaplan-Meier (KM) student's t-test.
USEPA 1994 = Mean concentration used for lead EPC in accordance with USEPA, 1994. Guidance Manual for the Integrated Exposure Uptake Biokinetic Model for Lead in Children. Office of Emergency and Remedial Response, Washington, D.C. USEPA/540/R-93/081. February
EPC = Exposure Point Concentration
J = Value is estimated.
mg/kg = milligrams per kilogram
NJ = Identification of Chemical Questionable, Inorganics
UCL = Upper Confidence Limit

TABLE B-4.1
VALUES USED FOR RESIDENT ADULT DAILY SOIL INTAKE EQUATIONS
OCCIDENTAL CHEMICAL CORPORATION PROPERTY
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Total Soil, Air
Exposure Point: OCCP Property
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/Reference	Equation / Model Name
Ingestion	CS	Chemical Concentration in Soil	mg/kg	Chemical-Specific	Chemical-Specific	Chronic Daily Intake (CDI) (mg/kg/day) =
	CR	Ingestion Rate	mg/day	50	U.S. EPA 2011a	CS x CR x EF x ED x CF / (BW x AT)
	EF	Exposure Frequency	day/yr	350	U.S. EPA 1991a,b	
	IFSMadj	Mutagenic Ingestion Rate	(mg-yr)/(kg-day)	31	U.S. EPA 2012a	
	ED-NC	Exposure Duration - Noncancer	yr	30	U.S. EPA 1991a,b	Mutagenic Chronic Daily Intake (MCDI) (mg/kg/day) =
	ED-C	Exposure Duration-Cancer	yr	24	U.S. EPA 1991a,b	CS x EF x ([(ED$_{6-16}$ x CR x 3) + (ED$_{16-30}$ x CR x 1)]/BW) x CF / (AT)
	BW	Body Weight	kg	70	U.S. EPA 1991a,b	
	AT-NC	Averaging Time - Noncancer	days	10,950	U.S. EPA 1989	
	AT-C	Averaging Time - Cancer	days	25,550	U.S. EPA 1989	
	CF	Conversion Factor	kg/mg	1.0E-06	U.S. EPA 1989	
Dermal	CS	Chemical Concentration in Soil	mg/kg	Chemical-Specific	Chemical-Specific	CDI (mg/kg/day) =
	SA	Surface Area for Contact	cm^2/event	5,700	U.S. EPA 2004	CS x SA x AF x ABS x EF x ED x CF / (BW x AT)
	ABS	Dermal Absorption Fractions	unitless	Chemical-Specific	U.S. EPA 2004	
	AF	Adherence Factor	mg/cm^2	0.07	U.S. EPA 2004	
	EF	Exposure Frequency	event/yr	350	U.S. EPA 1991a,b	
	DFSMadj	Mutagenic Dermal Contact Factor	(mg-yr)/(kg-day)	251	U.S. EPA 2012a	Mutagenic Chronic Daily Intake (MCDI) (mg/kg/day) =
	ED-NC	Exposure Duration - Noncancer	yr	30	U.S. EPA 1991a,b	CS x EF x ABS x ([(ED$_{6-16}$ x SA x AF x 3) + (ED$_{16-30}$ x SA x AF x 1)]/BW) x CF / (AT)
	ED-C	Exposure Duration - Cancer	yr	24	U.S. EPA 1991a,b	
	CF	Conversion Factor	kg/mg	1.0E-06	U.S. EPA 1989	
	BW	Body Weight	kg	70	U.S. EPA 1989	
	AT-NC	Averaging Time - Noncancer	days	10,950	U.S. EPA 1989	
	AT-C	Averaging Time - Cancer	days	25,550	U.S. EPA 1989	
Inhalation	CA	Chemical Concentration in Air	mg/m^3	Chemical-Specific	Chemical-Specific	Exposure Concentration (mg/m^3) =
	ET	Exposure Time	hours/day	24	U.S. EPA 1991a,b	CA x CF$_1$ x ET x EF x ED / AT x CF$_2$
	CF$_1$	Conversion Factor	ug/mg	1,000	U.S. EPA 2009a	Note: CF$_1$ is only used in carcinogenic exposure concentration calculations
	CF$_2$	Conversion Factor	hr/day	24	U.S. EPA 2009a	
	EF	Exposure Frequency	day/yr	350	U.S. EPA 1991a,b	
	INHMadj	Mutagenic Inhalation Adjustment	yr	44	U.S. EPA 2012a	Mutagenic Exposure Concentration (mg/m^3) =
	ED-NC	Exposure Duration - Noncancer	yr	30	U.S. EPA 1991a,b	CA x ET x EF x CF$_1$ x [(ED$_{6-16}$ x 3) + (ED$_{16-30}$ x 1)] / (AT x CF$_2$)
	ED-C	Exposure Duration - Cancer	yr	24	U.S. EPA 1991a,b	
	AT-NC	Averaging Time - Noncancer	days	10,950	U.S. EPA 2009a	
	AT-C	Averaging Time - Cancer	days	25,550	U.S. EPA 2009a	

Notes: The resident adult receptor takes into account age-adjusted factors to account for an exposure over a 30 year period. Therefore, the adult resident includes age range of 6 to 30 years of age to account for all exposures beyond the resident child. For the mutagenic Chronic Daily Intake (MCDI), the following adjustments are applied according to age range evaluated:
1) For exposures between 6 and <16 years of age, a 3-fold adjustment.
2) For exposures after 16 years of age, no adjustment.

TABLE B-4.2
VALUES USED FOR RESIDENT CHILD DAILY SOIL INTAKE EQUATIONS
OCCIDENTAL CHEMICAL CORPORATION PROPERTY
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Total Soil, Air
Exposure Point: OCCP Property
Receptor Population: Resident
Receptor Age: Child

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/Reference	Equation / Model Name
Ingestion	CS	Chemical Concentration in Soil	mg/kg	Chemical-Specific	Chemical-Specific	CDI (mg/kg/day) =
	CR	Ingestion Rate	mg/day	200	U.S. EPA 2011a	CS x CR x EF x ED x CF / (BW x AT)
	EF	Exposure Frequency	day/yr	350	U.S. EPA 1991a,b	
	IFSMadj	Mutagenic Ingestion Rate	(mg-yr)/(kg-day)	427	U.S. EPA 2012a	
	ED	Exposure Duration	yr	6	U.S. EPA 1991	Mutagenic Chronic Daily Intake (MCDI) (mg/kg/day) =
	BW	Body Weight	kg	15	U.S. EPA 1991	CS x EF x ([(ED_{0-2} x CR x 10) + (ED_{2-6} x CR x 3)]/BW) x CF / (AT)
	AT-NC	Averaging Time - Noncancer	days	2,190	U.S. EPA 1989	
	AT-C	Averaging Time - Cancer	days	25,550	U.S. EPA 1989	
	CF	Conversion Factor	kg/mg	1.0E-06	U.S. EPA 1989	
Dermal	CS	Chemical Concentration in Soil	mg/kg	Chemical-Specific	Chemical-Specific	CDI (mg/kg/day) =
	SA	Surface Area for Contact	cm^2/event	2,800	U.S. EPA 2004	CS x SA x AF x ABS x EF x ED x CF / (BW x AT)
	ABS	Dermal Absorption Fractions	unitless	Chemical-Specific	U.S. EPA 2004	
	AF	Adherence Factor	mg/cm^2	0.2	U.S. EPA 2004	Mutagenic Chronic Daily Intake (MCDI) (mg/kg/day) =
	EF	Exposure Frequency	event/yr	350	U.S. EPA 1991a,b	CS x EF x ABS x ([(ED_{0-2} x SA x AF x 10) + (ED_{2-6} x SA x AF x 3)]/BW) x CF / (AT)
	DFSMadj	Mutagenic Dermal Contact Factor	(mg-yr)/(kg-day)	1,195	U.S. EPA 2012a	
	ED	Exposure Duration	yr	6	U.S. EPA 1991a,b	
	CF	Conversion Factor	kg/mg	1.0E-06	U.S. EPA 1989	
	BW	Body Weight	kg	15	U.S. EPA 1989	
	AT-NC	Averaging Time - Noncancer	days	2,190	U.S. EPA 1989	
	AT-C	Averaging Time - Cancer	days	25,550	U.S. EPA 1989	
Inhalation	CA	Chemical Concentration in Air	mg/m^3	Chemical-Specific	Chemical-Specific	Exposure Concentration (mg/m^3) =
	ET	Exposure Time	hours/day	24	U.S. EPA 1991a,b	CA x CF_1 x ET x EF x ED / AT x CF_2
	CF_1	Conversion Factor	ug/mg	1,000	U.S. EPA 2009a	Note: CF_1 is only used in carcinogenic exposure concentration calculations
	CF_2	Conversion Factor	hr/day	24	U.S. EPA 2009a	
	EF	Exposure Frequency	day/yr	350	U.S. EPA 1991a,b	
	INHMadj	Mutagenic Inhalation Adjustment	yr	32	U.S. EPA 2012a	Mutagenic Exposure Concentration (mg/m^3) =
	ED	Exposure Duration	yr	6	U.S. EPA 1991a,b	CA x ET x CF_1 x EF x [(ED_{0-2} x 10) + (ED_{2-6} x 3)] / (AT x CF_2)
	AT-NC	Averaging Time - Noncancer	days	2,190	U.S. EPA 2009a	
	AT-C	Averaging Time - Cancer	days	25,550	U.S. EPA 2009a	

Notes: For the mutagenic Chronic Daily Intake (MCDI), the following adjustments are applied according to age range evaluated:
1) For exposures before 2 years of age, a 10-fold adjustment.
2) For exposures between 2 and <6 years of age, a 3-fold adjustment.

TABLE B-4.3
VALUES USED FOR ADULT TRESPASSER DAILY SURFACE SOIL INTAKE EQUATIONS
OCCIDENTAL CHEMICAL CORPORATION PROPERTY
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)

Scenario Timeframe: Current/Future
Medium: Soil
Exposure Medium: Surface Soil, Air
Exposure Point: OCCP Property
Receptor Population: Trespasser
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/Reference	Equation / Model Name
Ingestion	CS	Chemical Concentration in Soil	mg/kg	Chemical-Specific	Chemical-Specific	CDI (mg/kg/day) =
	CR	Ingestion Rate	mg/day	50	U.S. EPA 2011a (1)	CS x CR x EF x ED x CF / (BW x AT)
	EF	Exposure Frequency	day/yr	52	BPJ(2)	
	ED	Exposure Duration	yr	30	BPJ(1)	
	BW	Body Weight	kg	70	U.S. EPA 1989	
	AT-NC	Averaging Time - Noncancer	days	10,950	U.S. EPA 1989	
	AT-C	Averaging Time - Cancer	days	25,550	U.S. EPA 1989	
	CF	Conversion Factor	kg/mg	1.0E-06	U.S. EPA 1989	
Dermal	CS	Chemical Concentration in Soil	mg/kg	Chemical-Specific	Chemical-Specific	CDI (mg/kg/day) =
	SA	Surface Area for Contact	cm^2/event	5,700	U.S. EPA 2004	CS x SA x AF x ABS x EF x ED x CF / (BW x AT)
	ABS	Dermal Absorption Fractions	unitless	Chemical-Specific	U.S. EPA 2004	
	AF	Adherence Factor	mg/cm^2	0.07	U.S. EPA 2004	
	EF	Exposure Frequency	event/yr	52	BPJ(2)	
	ED	Exposure Duration	yr	30	BPJ(1)	
	CF	Conversion Factor	kg/mg	1.0E-06	U.S. EPA 1989	
	BW	Body Weight	kg	70	U.S. EPA 1989	
	AT-NC	Averaging Time - Noncancer	days	10,950	U.S. EPA 1989	
	AT-C	Averaging Time - Cancer	days	2.6E+04	U.S. EPA 1989	
Inhalation	CA	Chemical Concentration in Air	mg/m^3	Chemical-Specific	Chemical-Specific	Exposure Concentration (mg/m^3) =
	ET	Exposure Time	hours/day	2	BPJ	CA x CF_1 x ET x EF x ED / AT x CF_2
	CF_1	Conversion Factor	ug/mg	1,000	U.S. EPA 2009a	Note: CF_1 is only used in carcinogenic exposure concentration calculations
	CF_2	Conversion Factor	hr/day	24	U.S. EPA 2009a	
	EF	Exposure Frequency	day/yr	52	BPJ(2)	
	ED	Exposure Duration	yr	30	BPJ(1)	
	AT-NC	Averaging Time - Noncancer	days	3,650	U.S. EPA 2009a	
	AT-C	Averaging Time - Cancer	days	25,550	U.S. EPA 2009a	

Notes:
Adult Trespasser is exposed to surface soil only.
BPJ = Best Professional Judgement
(1) The ingestion rate, exposure duration, skin surface area, and adherence factor for the adult trespasser was conservatively set at the same rate as an adult resident.
(2) Assumed exposure at 1 day/week.
(3) No mutagenic adjustment factors are applied to this receptor due to an age range of >16 years.

TABLE B-4.4
VALUES USED FOR ADOLESCENT TRESPASSER DAILY SURFACE SOIL INTAKE EQUATIONS
OCCIDENTAL CHEMICAL CORPORATION PROPERTY
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)

Scenario Timeframe: Current/Future
Medium: Soil
Exposure Medium: Surface Soil, Air
Exposure Point: OCCP Property
Receptor Population: Trespasser
Receptor Age: Adolescent

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/Reference	Equation / Model Name
Ingestion	CS	Chemical Concentration in Soil	mg/kg	Chemical-Specific	Chemical-Specific	CDI (mg/kg/day) =
	CR	Ingestion Rate	mg/day	100	U.S. EPA 2011a (1)	CS x CR x EF x ED x CF / (BW x AT)
	EF	Exposure Frequency	day/yr	52	BPJ(2)	
	IFSMadj	Mutagenic Ingestion Rate	unitless	3	U.S. EPA 2005a,b	
	ED	Exposure Duration	yr	10	BPJ(3)	Mutagenic Chronic Daily Intake (MCDI) (mg/kg/day) =
	BW	Body Weight	kg	45	U.S. EPA 2011a (4)	CS x CR x EF x ED x CF x IFSMadj / (BW x AT)
	AT-NC	Averaging Time - Noncancer	days	3,650	U.S. EPA 1989	
	AT-C	Averaging Time - Cancer	days	25,550	U.S. EPA 1989	
	CF	Conversion Factor	kg/mg	1.0E-06	U.S. EPA 1989	
Dermal	CS	Chemical Concentration in Soil	mg/kg	Chemical-Specific	Chemical-Specific	CDI (mg/kg/day) =
	SA	Surface Area for Contact	cm^2/event	3,700	U.S. EPA 2011a (5)	CS x SA x AF x ABS x EF x ED x CF / (BW x AT)
	ABS	Dermal Absorption Fractions	unitless	Chemical-Specific	U.S. EPA 2004	
	AF	Adherence Factor	mg/cm^2	0.2	U.S. EPA 2004 (6)	
	EF	Exposure Frequency	event/yr	52	BPJ(2)	
	DFSMadj	Mutagenic Dermal Contact Factor	unitless	3	U.S. EPA 2005a,b	Mutagenic Chronic Daily Intake (MCDI) (mg/kg/day) =
	ED	Exposure Duration	yr	10	BPJ(3)	CS x SA x AF x ABS x EF x ED x CF x DFSMadj / (BW x AT)
	CF	Conversion Factor	kg/mg	1.0E-06	U.S. EPA 1989	
	BW	Body Weight	kg	45	U.S. EPA 2011a (4)	
	AT-NC	Averaging Time - Noncancer	days	3,650	U.S. EPA 1989	
	AT-C	Averaging Time - Cancer	days	25,550	U.S. EPA 1989	
Inhalation	CA	Chemical Concentration in Air	mg/m^3	Chemical-Specific	Chemical-Specific	Exposure Concentration (mg/m^3) =
	ET	Exposure Time	hours/day	2	BPJ	CA x CF_1 x ET x EF x ED / AT x CF_2
	CF_1	Conversion Factor	ug/mg	1,000	U.S. EPA 2009a	Note: CF_1 is only used in carcinogenic exposure concentration calculations
	CF_2	Conversion Factor	hr/day	24	U.S. EPA 2009a	
	EF	Exposure Frequency	day/yr	52	BPJ(2)	
	INHMadj	Mutagenic Inhalation Adjustment	unitless	3	U.S. EPA 2005a,b	Mutagenic Exposure Concentration (mg/m^3) =
	ED	Exposure Duration	yr	10	BPJ(3)	CA x CF_1 x ET x EF x ED x INHMadj / AT x CF_2
	AT-NC	Averaging Time - Noncancer	days	3,650	U.S. EPA 2009a	
	AT-C	Averaging Time - Cancer	days	25,550	U.S. EPA 2009a	

Notes:
Adolescent Trespasser is exposed to surface soil only.
BPJ = Best Professional Judgement
(1) The ingestion rate is taken from Table 5-1 of USEPA 2011a, for age range 6 to <21 years.
(2) Assumes 2 days/week during warm months (6 months).
(3) Assumed adolescent trespasser from ages 6 to 16.
(4) Taken from Table 8-1 of USEPA 2011a, equal to the average of two age ranges: 6 to <11 years and 11 to <16 years.
(5) Taken from Table 7-2 of USEPA 2011a, equal to the average of two age ranges: 6 to <11 years and 11 to <16 years. Assuming head, hands, forearms, and lower legs are exposed.
(6) The adherence factor is conservatively equal to that of a resident child.
For the mutagenic Chronic Daily Intake (MCDI), the following adjustments are applied according to age range evaluated:
1) For exposures between 7 and <16 years of age, a 3-fold adjustment.

TABLE B-4.5
VALUES USED FOR MAINTENANCE WORKER DAILY SOIL INTAKE EQUATIONS
OCCIDENTAL CHEMICAL CORPORATION PROPERTY
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Surface Soil, Air
Exposure Point: OCCP Property
Receptor Population: Maintenance Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/Reference	Equation / Model Name
Ingestion	CS	Chemical Concentration in Soil	mg/kg	Chemical-Specific	Chemical-Specific	CDI (mg/kg/day) =
	CR	Ingestion Rate	mg/day	100	U.S. EPA 1991a,b	CS x CR x EF x ED x CF / (BW x AT)
	EF	Exposure Frequency	day/yr	250	U.S. EPA 1991a,b	
	ED	Exposure Duration	yr	25	U.S. EPA 1991a,b	
	BW	Body Weight	kg	70	U.S. EPA 1989	
	AT-NC	Averaging Time - Noncancer	days	9,125	U.S. EPA 1989	
	AT-C	Averaging Time - Cancer	days	25,550	U.S. EPA 1989	
	CF	Conversion Factor	kg/mg	1.0E-06	U.S. EPA 1989	
Dermal	CS	Chemical Concentration in Soil	mg/kg	Chemical-Specific	Chemical-Specific	CDI (mg/kg/day) =
	SA	Surface Area for Contact	cm^2/event	3,300	U.S. EPA 2004 (1)	CS x SA x AF x ABS x EF x ED x CF / (BW x AT)
	ABS	Dermal Absorption Fractions	unitless	Chemical-Specific	U.S. EPA 2004	
	AF	Adherence Factor	mg/cm^2	0.07	U.S. EPA 2004	
	EF	Exposure Frequency	event/yr	250	U.S. EPA 1991a,b	
	ED	Exposure Duration	yr	25	U.S. EPA 1991a,b	
	CF	Conversion Factor	kg/mg	1.0E-06	U.S. EPA 1989	
	BW	Body Weight	kg	70	U.S. EPA 1989	
	AT-NC	Averaging Time - Noncancer	days	9,125	U.S. EPA 1989	
	AT-C	Averaging Time - Cancer	days	25,550	U.S. EPA 1989	
Inhalation	CA	Chemical Concentration in Air	mg/m^3	Chemical-Specific	Chemical-Specific	Exposure Concentration (mg/m^3) =
	ET	Exposure Time	hours/day	8	U.S. EPA 1991a,b	CA x CF_1 x ET x EF x ED / AT x CF_2
	CF_1	Conversion Factor	ug/mg	1,000	U.S. EPA 2009a	Note: CF_1 is only used in carcinogenic exposure concentration calculations
	CF_2	Conversion Factor	hr/day	24	U.S. EPA 2009a	
	EF	Exposure Frequency	day/yr	250	U.S. EPA 1991a,b	
	ED	Exposure Duration	yr	25	U.S. EPA 1991a,b	
	AT-NC	Averaging Time - Noncancer	days	9,125	U.S. EPA 2009a	
	AT-C	Averaging Time - Cancer	days	25,550	U.S. EPA 2009a	

Notes: Operations/Maintenance Worker is exposed to surface soil only. No mutagenic adjustment factors are applied to this receptor due to an age range of >16 years.
(1) Assumes only head, hands, and forearms are exposed

TABLE B-4.6
VALUES USED FOR COMMERCIAL WORKER DAILY SOIL INTAKE EQUATIONS
OCCIDENTAL CHEMICAL CORPORATION PROPERTY
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Surface Soil, Air
Exposure Point: OCCP Property
Receptor Population: Commercial Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/Reference	Equation / Model Name
Ingestion	CS	Chemical Concentration in Soil	mg/kg	Chemical-Specific	Chemical-Specific	CDI (mg/kg/day) =
	CR	Ingestion Rate	mg/day	50	U.S. EPA 2011a	CS x CR x EF x ED x CF / (BW x AT)
	EF	Exposure Frequency	day/yr	250	U.S. EPA 1991a,b	
	ED	Exposure Duration	yr	25	U.S. EPA 1991a,b	
	BW	Body Weight	kg	70	U.S. EPA 1989	
	AT-NC	Averaging Time - Noncancer	days	9,125	U.S. EPA 1989	
	AT-C	Averaging Time - Cancer	days	25,550	U.S. EPA 1989	
	CF	Conversion Factor	kg/mg	1.E-06	U.S. EPA 1989	
Dermal	CS	Chemical Concentration in Soil	mg/kg	Chemical-Specific	Chemical-Specific	CDI (mg/kg/day) =
	SA	Surface Area for Contact	cm^2/event	3,300	U.S. EPA 2004	CS x SA x AF x ABS x EF x ED x CF / (BW x AT)
	ABS	Dermal Absorption Fractions	unitless	Chemical-Specific	U.S. EPA 2004	
	AF	Adherence Factor	mg/cm^2	0.02	U.S. EPA 2004	
	EF	Exposure Frequency	event/yr	250	U.S. EPA 1991a,b	
	ED	Exposure Duration	yr	25	U.S. EPA 1991a,b	
	CF	Conversion Factor	kg/mg	1.E-06	U.S. EPA 1989	
	BW	Body Weight	kg	70	U.S. EPA 1989	
	AT-NC	Averaging Time - Noncancer	days	9,125	U.S. EPA 1989	
	AT-C	Averaging Time - Cancer	days	25,550	U.S. EPA 1989	
Inhalation	CA	Chemical Concentration in Air	mg/m^3	Chemical-Specific	Chemical-Specific	Exposure Concentration (mg/m^3) =
	ET	Exposure Time	hours/day	1	BPJ	CA x CF_1 x ET x EF x ED / AT x CF_2
	CF_1	Conversion Factor	ug/mg	1,000	U.S. EPA 2009a	Note: CF_1 is only used in carcinogenic exposure concentration calculations
	CF_2	Conversion Factor	hr/day	24	U.S. EPA 2009a	
	EF	Exposure Frequency	day/yr	250	U.S. EPA 1991a,b	
	ED	Exposure Duration	yr	25	U.S. EPA 1991a,b	
	AT-NC	Averaging Time - Noncancer	days	9,125	U.S. EPA 2009a	
	AT-C	Averaging Time - Cancer	days	25,550	U.S. EPA 2009a	

Notes: Commercial Worker is exposed to surface soil only.
(1) No mutagenic adjustment factors are applied to this receptor due to an age range of >16 years.

TABLE B-4.7
VALUES USED FOR CONSTRUCTION WORKER DAILY SOIL INTAKE EQUATIONS
OCCIDENTAL CHEMICAL CORPORATION PROPERTY
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Total Soil, Air
Exposure Point: OCCP Property
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/Reference	Equation / Model Name
Ingestion	CS	Chemical Concentration in Soil	mg/kg	Chemical-Specific	Chemical-Specific	CDI (mg/kg/day) =
	CR	Ingestion Rate	mg/day	480	U.S. EPA 1991a,b	CS x CR x EF x ED x CF / (BW x AT)
	EF	Exposure Frequency	day/yr	250	U.S. EPA 1991a,b	
	ED	Exposure Duration	yr	1	BPJ (1)	
	BW	Body Weight	kg	70	U.S. EPA 1989	
	AT-NC	Averaging Time - Noncancer	days	365	U.S. EPA 1989	
	AT-C	Averaging Time - Cancer	days	25,550	U.S. EPA 1989	
	CF	Conversion Factor	kg/mg	1.0E-06	U.S. EPA 1989	
Dermal	CS	Chemical Concentration in Soil	mg/kg	Chemical-Specific	Chemical-Specific	CDI (mg/kg/day) =
	SA	Surface Area for Contact	cm^2/event	3,300	U.S. EPA 2004 (2)	CS x SA x AF x ABS x EF x ED x CF / (BW x AT)
	ABS	Dermal Absorption Fractions	unitless	Chemical-Specific	U.S. EPA 2004	
	AF	Adherence Factor	mg/cm^2	0.2	U.S. EPA 2004	
	EF	Exposure Frequency	event/yr	250	U.S. EPA 1991a,b	
	ED	Exposure Duration	yr	1	BPJ (1)	
	CF	Conversion Factor	kg/mg	1.0E-06	U.S. EPA 1989	
	BW	Body Weight	kg	70	U.S. EPA 1989	
	AT-NC	Averaging Time - Noncancer	days	365	U.S. EPA 1989	
	AT-C	Averaging Time - Cancer	days	25,550	U.S. EPA 1989	
Inhalation	CA	Chemical Concentration in Air	mg/m^3	Chemical-Specific	Chemical-Specific	Exposure Concentration (mg/m^3) =
	ET	Exposure Time	hours/day	8	BPJ	CA x CF_1 x ET x EF x ED / AT x CF_2
	CF_1	Conversion Factor	ug/mg	1,000	U.S. EPA 2009a	Note: CF_1 is only used in carcinogenic exposure concentration calculations
	CF_2	Conversion Factor	hr/day	24	U.S. EPA 2009a	
	EF	Exposure Frequency	day/yr	250	U.S. EPA 1991a,b	
	ED	Exposure Duration	yr	1	BPJ (1)	
	AT-NC	Averaging Time - Noncancer	days	365	U.S. EPA 2009a	
	AT-C	Averaging Time - Cancer	days	25,550	U.S. EPA 2009a	

Notes: BPJ = Best Professional Judgement. No mutagenic adjustment factors are applied to this receptor due to an age range of >16 years.
(1) Construction events are assumed to extend for up to one year total in duration.
(2) Assumes only head, hands, and forearms are exposed

TABLE B-4.8
VALUES USED FOR DAILY FOOD EXPOSURE INTAKE EQUATIONS
OCCIDENTAL CHEMICAL CORPORATION PROPERTY
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)

Scenario Timeframe: Future
Medium: All
Exposure Medium: Game
Exposure Point: OCCP Property
Receptor Population: Resident, Trespasser
Receptor Age: Adult, Adolescent, Child

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value Resident Adult	RME Value Resident Child	RME Value Trespasser Adult	RME Value Trespasser Adolescent	RME Rationale/Reference	Equation / Model Name
Ingestion	CF	Contaminant Concentration in food	mg/kg	chemical-specific	chemical-specific	chemical-specific	chemical-specific		CDI for Home-grown produce (mg/kg/day) =
	EFg	Exposure Frequency for game meat	meals/yr	48	48	48	48	BPJ (1)	CF x FVc x EFf x CFpf x ED / (BW x AT)
	EFf	Exposure Frequency for food	meals/yr	1,050	1,050	NA	NA	BPJ (2)	
	FVc	Fruit and Veg consumption	kg/meal	0.5	0.1	NA	NA	U.S. EPA 1997 and 2011a (3)	CDI for Game Meat (mg/kg/day) =
	Gc	Game (deer) consumption	kg/meal	0.17	0.057	0.17	0.17	BPJ (4)	CF x Gc x CFm x EFg x ED / (BW x AT)
	CFpf	Contamination fraction of plant food	unitless	0.05	0.05	NA	NA	U.S. EPA 1997 (5)	
	CFm	Fraction of time spent at site	unitless	0.009	0.009	0.009	0.009	BPJ (6)	
	ED	Exposure Duration	years	30	6	30	10	U.S. EPA 1991	
	BW	Body Weight	kg	70	15	70	45	U.S. EPA 1991	
	AT-NC	Averaging Time - Non-carcinogen	days	10,950	2,190	10,950	3,650	U.S. EPA 1989	
	AT-C	Averaging Time - Carcinogen	days	25,550	25,550	25,550	25,550	U.S. EPA 1989	

Notes:
(1) Exposure frequency for game meat is assumed at 4 meals of game meat per month.
(2) Assumes 3 meals per day at 350 days/year.
(3) RME rate of 22.4 g/kg-day (12.4 for fruit and 10 for vegetables) for total intake of fruit and vegetables converted for 70 kg adult and 15 kg child (U.S. EPA 1997, Table 1-2).
(4) Ingestion of deer meat is assumed at a rate of 6 ounces/meal for an adult and an adolescent and 2 ounces/meal for the child based on a dry weight (cooked) basis.
(5) Suburban rate for fruit and vegetables, Table 13-71 of USEPA 1997, approximately 5%.
(6) The home range for a white-tailed deer in northern New York State is approximately 233 hectares to 135 hectares, depending upon the season and sex of the deer. The size of areas of concern in the Occidental Property are approximately 3 acres. Based upon the home range of the deer and the area of the site, the expected time spent at the site is approximately 0.5% to 1%.

TABLE B-5.1
NON-CANCER TOXICITY DATA - ORAL/DERMAL
OCCIDENTAL CHEMICAL CORPORATION PROPERTY
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)

Constituent of Potential Concern	Chronic/ Subchronic	Oral RfD Value (mg/kg-day)	Oral to Dermal Adjustment Factor (GI ABS) (3)	Adjusted Dermal RfD (4) (mg/kg bw-day)	Primary Target Organ	Combined Uncertainty/ Modifying Factors	Sources of RfD: Target Organ (5)	Dates of RfD: Target Organ (5) (mm/dd/yy)
Explosives								
2-AMINO-4,6-DINITROTOLUENE(1)	Chronic	2.0E-03	1	2.0E-03	CNS, Digestive System	100/1	IRIS	4/16/2012
4-AMINO-2,6-DINITROTOLUENE(1)	Chronic	2.0E-03	1	2.0E-03	CNS, Digestive System	100/1	IRIS	4/16/2012
2,4-DINITROTOLUENE	Chronic	2.0E-03	1	2.0E-03	CNS, Digestive System	100/1	IRIS	4/16/2012
2,6-DINITROTOLUENE	Chronic	1.0E-03	1	1.0E-03	CNS, Liver, and Blood	300/1	PPRTV	12/13/2004
RDX	Chronic	3.0E-03	1	3.0E-03	Prostate	100/1	IRIS	4/16/2012
1,3-DINITROBENZENE	Chronic	1.0E-04	1	1.0E-04	Spleen	1000/1	IRIS	4/16/2012
2,4,6-TRINITROTOLUENE	Chronic	5.0E-04	1	5.0E-04	Liver	1000/1	IRIS	4/16/2012
2-NITROTOLUENE	Chronic	9.0E-04	1	9.0E-04	Bone Marrow	1000/1	PPRTV	8/15/2008
Inorganics								
ARSENIC	Chronic	3.0E-04	1	3.0E-04	Skin	3/1	IRIS	4/16/2012
BARIUM	Chronic	2.0E-01	0.07	1.4E-02	Kidneys	300/1	IRIS	4/16/2012
CADMIUM	Chronic	1.0E-03	0.025	2.5E-05	Kidneys	10/1	IRIS	4/16/2012
CHROMIUM (HEXAVALENT)	Chronic	3.0E-03	0.025	7.5E-05	None	300/1	IRIS	4/16/2012
COPPER	Chronic	4.0E-02	1	4.0E-02	Liver and Kidneys	1000/1	HEAST	1997
IRON	Chronic	7.0E-01	1	7.0E-01	Gastrointestinal System	1.5/1	PPRTV	9/11/2006
MERCURY (2)	Chronic	1.0E-04	0.07	7.0E-06	CNS	10/1	IRIS	4/16/2012
NICKEL	Chronic	2.0E-02	0.04	8.0E-04	Body Weight	300/1	IRIS	4/16/2012
ZINC	Chronic	3.0E-01	1	3.0E-01	Blood	3/1	IRIS	4/16/2012
PAHs								
BENZO(A)PYRENE	NA	NA	1	NA	NA	NA/NA	IRIS	4/16/2012
Pesticides/PCBs								
4,4'-DDT	Chronic	5.0E-04	1	5.0E-04	Liver	100/1	IRIS	4/16/2012

GI ABS = Gastrointestional Absorption factors
RfD = Reference Dose
PAHs = Polynuclear Aromatic Hydrocarbons
PCBs = Polychlorinated Biphenyls
CNS = Central Nervous System
NA = Not Applicable
(1) Toxicity values taken from 2,4-Dinitrotoluene as a surrogate in accordance with USEPA guidance (USEPA 2011a).
(2) Toxicity values for ingestion of mercury assume methylmercury.
(3) Taken from USEPA 2004 Guidance.
(4) Dermal toxicological values adjusted from oral values using USEPA 2004 recommended chemical-specific GI ABS. RfDs are multiplied by the GI ABS.
(5) IRIS - Integrated Risk Information System. For IRIS values, the date IRIS was searched is provided.
HEAST - Health Effects Assessment Summary Tables.
PPRTV - Provisional Peer-Reviewed Toxicity Value, Date of the PPRTV Support Paper is provided.

TABLE B-5.2
NON-CANCER TOXICITY DATA - INHALATION
OCCIDENTAL CHEMICAL CORPORATION PROPERTY
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)

Constituent of Potential Concern	Chronic/ Subchronic	Value Inhalation (RfC) (mg/m^3)	Primary Target Organ	Combined Uncertainty/ Modifying Factors	Sources of RfC: Target Organ (2)	Dates (2) (mm/dd/yy)
Explosives						
2-AMINO-4,6-DINITROTOLUENE(1)	NA	NA	NA	NA	IRIS	4/16/2012
4-AMINO-2,6-DINITROTOLUENE(1)	NA	NA	NA	NA	IRIS	4/16/2012
2,4-DINITROTOLUENE	NA	NA	NA	NA	IRIS	4/16/2012
2,6-DINITROTOLUENE	NA	NA	NA	NA	IRIS	4/16/2012
RDX	NA	NA	NA	NA	IRIS	4/16/2012
1,3-DINITROBENZENE	NA	NA	NA	NA	IRIS	4/16/2012
2,4,6-TRINITROTOLUENE	NA	NA	NA	NA	IRIS	4/16/2012
2-NITROTOLUENE	NA	NA	NA	NA	PPRTV	8/15/2008
Inorganics						
ARSENIC	Chronic	1.50E-05	Developmental, Cardiovascular System	30/1	CalEPA	4/16/2012
BARIUM	Chronic	5.0E-04	Reproductive System	1000/1	HEAST	1997
CADMIUM	Chronic	2.0E-05	Kidneys	30/1	CalEPA	12/1/2000
CHROMIUM (HEXAVALENT)	Chronic	1.0E-04	Lungs and Blood	300/1	IRIS	4/16/2012
COPPER	NA	NA	NA	NA	IRIS	4/16/2012
IRON	NA	NA	NA	NA/NA	PPRTV	9/11/2006
MERCURY	Chronic	3.0E-04	CNS	30/1	IRIS	4/16/2012
NICKEL	Chronic	9.0E-05	Respiratory System	30/1	ATSDR	4/16/2012
ZINC	NA	NA	NA	NA	IRIS	4/16/2012
PAHs						
BENZO(A)PYRENE	NA	NA	NA	NA	IRIS	4/16/2012
Pesticides/PCBs						
4,4'-DDT	NA	NA	NA	NA	IRIS	4/16/2012

RfC = Reference Concentration
PAHs = Polynuclear Aromatic Hydrocarbons
PCBs = Polychlorinated Biphenyls Polychlorinated Biphenyls
NA = Not Applicable
CNS = Central Nervous System
(1) Toxicity values taken from 2,4-Dinitrotoluene as a surrogate in accordance with USEPA guidance (USEPA 2011a).
(2) ATSDR - Agency for Toxic Substances and Disease Registry, Minimal Risk Levels (February 2012)
IRIS - Integrated Risk Information System. For IRIS values, the date IRIS was searched is provided.
HEAST - Health Effects Assessment Summary Tables
PPRTV - Provisional Peer-Reviewed Toxicity Value, Date of the PPRTV Support Paper is provided.
CalEPA - California Environmental Protection Agency,

TABLE B-5.3
CHEMICAL-SPECIFIC PARAMETERS
OCCIDENTAL CHEMICAL CORPORATION PROPERTY
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)

Constituent of Potential Concern	Absorption Factor	Reference	GI ABS	Reference
Explosives				
2-AMINO-4,6-DINITROTOLUENE	0.006	U.S. EPA, 2004	1	U.S. EPA, 2004
4-AMINO-2,6-DINITROTOLUENE	0.009	U.S. EPA, 2004	1	U.S. EPA, 2004
2,4-DINITROTOLUENE	0.102	U.S. EPA, 2004	1	U.S. EPA, 2004
2,6-DINITROTOLUENE	0.099	U.S. EPA, 2004	1	U.S. EPA, 2004
RDX	0.015	U.S. EPA, 2004	1	U.S. EPA, 2004
1,3-DINITROBENZENE	0.1	U.S. EPA, 2004	1	U.S. EPA, 2004
2,4,6-TRINITROTOLUENE	0.1	U.S. EPA, 2004	1	U.S. EPA, 2004
2-NITROTOLUENE	0.1	U.S. EPA, 2004	1	U.S. EPA, 2004
Inorganics				
ARSENIC	0.03	U.S. EPA, 2004	1	U.S. EPA, 2004
BARIUM	NA	U.S. EPA, 2004	0.07	U.S. EPA, 2004
CADMIUM	0.001	U.S. EPA, 2004	0.025	U.S. EPA, 2004
CHROMIUM (HEXAVALENT)	NA	U.S. EPA, 2004	0.025	U.S. EPA, 2004
COPPER	NA	U.S. EPA, 2004	1	U.S. EPA, 2004
IRON	NA	U.S. EPA, 2004	1	U.S. EPA, 2004
MERCURY	NA	U.S. EPA, 2004	0.07	U.S. EPA, 2004
NICKEL	NA	U.S. EPA, 2004	0.04	U.S. EPA, 2004
ZINC	NA	U.S. EPA, 2004	1	U.S. EPA, 2004
PAHs				
BENZO(A)PYRENE	0.13	U.S. EPA, 2004	1	U.S. EPA, 2004
Pesticides/PCBs				
4,4'-DDT	0.03	U.S. EPA, 2004	1	U.S. EPA, 2004

GI ABS = Gastrointestional Absorption factors
NA = Data not available.
PAHs = Polynuclear Aromatic Hydrocarbons
PCBs = Polychlorinated Biphenyls
U.S. EPA, 2004 = U.S. Environmental Protection Agency, 2004. Risk Assessment Guidance for Superfund. Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). Final Guidance.

TABLE B-6.1
CANCER TOXICITY DATA - ORAL/DERMAL
OCCIDENTAL CHEMICAL CORPORATION PROPERTY
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)

Constituent of Potential Concern	Oral Cancer Slope Factor	Oral Absorption Efficiency for Dermal (GI ABS)(1)	Absorbed Cancer Slope Factor for Dermal (2)	Units	Weight of Evidence/ Cancer Guideline Description	Mutagenic Compound	Source	Date (3) (mm/dd/yy)
Explosives								
2-AMINO-4,6-DINITROTOLUENE	NA	1	NA	per (mg/kg-day)	D		PPRTV	5/17/2005
4-AMINO-2,6-DINITROTOLUENE	NA	1	NA	per (mg/kg-day)	D		PPRTV	5/17/2005
2,4-DINITROTOLUENE	3.1E-01	1	3.1E-01	per (mg/kg-day)	B2		CalEPA	5/1/2009
2,6-DINITROTOLUENE (4)	6.8E-01	1	6.8E-01	per (mg/kg-day)	B2		IRIS	4/16/2012
RDX	1.1E-01	1	1.1E-01	per (mg/kg-day)	C		IRIS	4/16/2012
1,3-DINITROBENZENE	NA	1	NA	per (mg/kg-day)	D		IRIS	4/16/2012
2,4,6-TRINITROTOLUENE	3.0E-02	1	3.0E-02	per (mg/kg-day)	C		IRIS	4/16/2012
2-NITROTOLUENE	2.2E-01	1	2.2E-01	per (mg/kg-day)	B2		PPRTV	8/15/2008
Inorganics								
ARSENIC	1.5E+00	1	1.5E+00	per (mg/kg-day)	A		IRIS	4/16/2012
BARIUM	NA	0.07	NA	per (mg/kg-day)	D		IRIS	4/16/2012
CADMIUM	NA	0.025	NA	per (mg/kg-day)	B1		IRIS	4/16/2012
CHROMIUM (HEXAVALENT)	5.0E-01	0.025	2.0E+01	per (mg/kg-day)	B2	M	NJDEP	5/8/2009
COPPER	NA	1	NA	per (mg/kg-day)	D		IRIS	4/16/2012
IRON	NA	1	NA	per (mg/kg-day)	NA		PPRTV	9/11/2006
MERCURY	NA	0.07	NA	per (mg/kg-day)	D		IRIS	4/16/2012
NICKEL	NA	0.04	NA	per (mg/kg-day)	NA		IRIS	4/16/2012
ZINC	NA	1	NA	per (mg/kg-day)	D		IRIS	4/16/2012
PAHs								
BENZO(A)PYRENE	7.3E+00	1	7.3E+00	per (mg/kg-day)	B2	M	IRIS	4/16/2012
Pesticides/PCBs								
4,4'-DDT	3.4E-01	1	3.4E-01	per (mg/kg-day)	B2		IRIS	4/16/2012

GI ABS = Gastrointestional Absorption factors
M = Chemical has been identified as having a mutagenic mode of action
NA = Not Applicable
PAHs = Polynuclear Aromatic Hydrocarbons
PCBs = Polychlorinated Biphenyls
(1) Taken from USEPA 2004 Guidance.
(2) Dermal Toxicological values adjusted from oral values using USEPA 2004 recommended chemical-specific GI ABS. CSFs are divided by the GI ABS.
(3) IRIS - Integrated Risk Information System. For IRIS values, the date IRIS was searched is provided.
PPRTV - Provisional Peer-Reviewed Toxicity Value, Date of the PPRTV Support Paper is provided.
NJDEP - New Jersey Department of Environmental Protection
CAL EPA - California Environmental Protection Agency, Date of Technical Support Document is provided.
(4) Oral Cancer Slope Factor assumed for a 2,4-dinitrotoluene/2,6-dinitrotoluene mixture.

Weight of Evidence: A - Human carcinogen
B1 - Probable human carcinogen - indicates that limited human data are available
B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
C - Possible human carcinogen
D - Not classifiable as a human carcinogen
E - Evidence of noncarcinogenicity

TABLE B-6.2
CANCER TOXICITY DATA - INHALATION
OCCIDENTAL CHEMICAL CORPORATION PROPERTY
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)

Constituent of Potential Concern	Unit Risk		Weight of Evidence/ Cancer Guideline Description	Mutagenic Compound	Unit Risk Reference	
	Value	Units			Source	Date (1)
Explosives						
2-AMINO-4,6-DINITROTOLUENE	NA	per ug/m^3	D		PPRTV	5/17/20025
4-AMINO-2,6-DINITROTOLUENE	NA	per ug/m^3	D		PPRTV	5/17/2005
2,4-DINITROTOLUENE	8.9E-05	per ug/m^3	B2		CalEPA	5/1/2009
2,6-DINITROTOLUENE	NA	per ug/m^3	B2		IRIS	4/16/2012
RDX	NA	per ug/m^3	C		IRIS	4/16/2012
1,3-DINITROBENZENE	NA	per ug/m^3	D		IRIS	4/16/2012
2,4,6-TRINITROTOLUENE	NA	per ug/m^3	C		IRIS	4/16/2012
2-NITROTOLUENE	NA	per ug/m^3	B2		PPRTV	8/15/2008
Inorganics						
ARSENIC	4.3E-03	per ug/m^3	A		IRIS	4/16/2012
BARIUM	NA	per ug/m^3	D		IRIS	4/16/2012
CADMIUM	1.8E-03	per ug/m^3	B1		IRIS	4/16/2012
CHROMIUM (HEXAVALENT)	8.4E-02	per ug/m^3	A		IRIS	4/16/2012
COPPER	NA	per ug/m^3	D		IRIS	4/16/2012
IRON	NA	per ug/m^3	NA		PPRTV	9/11/2006
MERCURY	NA	per ug/m^3	D		IRIS	4/16/2012
NICKEL	2.6E-04	per ug/m^3	A		CalEPA	5/1/2009
ZINC	NA	per ug/m^3	D		IRIS	4/16/2012
PAHs						
BENZO(A)PYRENE	1.1E-03	per ug/m^3	B2	M	CalEPA	5/1/2009
Pesticides/PCBs						
4,4'-DDT	9.7E-05	per ug/m^3	B2		IRIS	4/16/2012

M = Chemical has been identified as having a mutagenic mode of action
PAHs = Polynuclear Aromatic Hydrocarbons
PCBs = Polychlorinated Biphenyls
NA = Not Applicable
(1) IRIS - Integrated Risk Information System, the date IRIS was searched is provided.
PPRTV - Provisional Peer-Reviewed Toxicity Value, Date of the PPRTV Support Paper is provided.
CAL EPA - California Environmental Protection Agency, Date of Technical Support Document is provided.

Weight of Evidence:
A - Human carcinogen
B1 - Probable human carcinogen - indicates that limited human data are available
B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
C - Possible human carcinogen
D - Not classifiable as a human carcinogen
E - Evidence of noncarcinogenicity

TABLE B-7.1
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU 8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY

Scenario Timeframe: Current/Future
Receptor Population: Trespasser
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Constituent of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	EU 8	Ingestion	**Explosives**												
				2-AMINO-4,6-DINITROTOLUENE	6.8E+01	(mg/kg)	3.0E-06	(mg/kg-day)	NA	per (mg/kg-day)	--	6.9E-06	(mg/kg-day)	2.0E-03	(mg/kg-day)	3.5E-03
				4-AMINO-2,6-DINITROTOLUENE	4.8E+01	(mg/kg)	2.1E-06	(mg/kg-day)	NA	per (mg/kg-day)	--	4.9E-06	(mg/kg-day)	2.0E-03	(mg/kg-day)	2.5E-03
				2,4-DINITROTOLUENE	7.0E+00	(mg/kg)	3.1E-07	(mg/kg-day)	3.1E-01	per (mg/kg-day)	9.5E-08	7.2E-07	(mg/kg-day)	2.0E-03	(mg/kg-day)	3.6E-04
				2,6-DINITROTOLUENE	3.1E+00	(mg/kg)	1.3E-07	(mg/kg-day)	6.8E-01	per (mg/kg-day)	9.1E-08	3.1E-07	(mg/kg-day)	1.0E-03	(mg/kg-day)	3.1E-04
				RDX	7.7E-01	(mg/kg)	3.4E-08	(mg/kg-day)	1.1E-01	per (mg/kg-day)	3.7E-09	7.8E-08	(mg/kg-day)	3.0E-03	(mg/kg-day)	2.6E-05
				1,3-DINITROBENZENE	6.8E-01	(mg/kg)	3.0E-08	(mg/kg-day)	NA	per (mg/kg-day)	--	6.9E-08	(mg/kg-day)	1.0E-04	(mg/kg-day)	6.9E-04
				2,4,6-TRINITROTOLUENE	6.0E+03	(mg/kg)	2.6E-04	(mg/kg-day)	3.0E-02	per (mg/kg-day)	7.9E-06	6.1E-04	(mg/kg-day)	5.0E-04	(mg/kg-day)	1.2E+00
				2-NITROTOLUENE	3.1E+00	(mg/kg)	1.3E-07	(mg/kg-day)	2.2E-01	per (mg/kg-day)	3.0E-08	3.1E-07	(mg/kg-day)	9.0E-04	(mg/kg-day)	3.5E-04
				Inorganics												
				BARIUM	2.8E+03	(mg/kg)	1.2E-04	(mg/kg-day)	NA	per (mg/kg-day)	--	2.9E-04	(mg/kg-day)	2.0E-01	(mg/kg-day)	1.4E-03
				CADMIUM	6.3E+01	(mg/kg)	2.7E-06	(mg/kg-day)	NA	per (mg/kg-day)	--	6.4E-06	(mg/kg-day)	1.0E-03	(mg/kg-day)	6.4E-03
				CHROMIUM (HEXAVALENT)	1.9E+00	(mg/kg)	8.3E-08	(mg/kg-day)	5.0E-01	per (mg/kg-day)	4.2E-08	1.9E-07	(mg/kg-day)	3.0E-03	(mg/kg-day)	6.5E-05
				COPPER	9.6E+02	(mg/kg)	4.2E-05	(mg/kg-day)	NA	per (mg/kg-day)	--	9.8E-05	(mg/kg-day)	4.0E-02	(mg/kg-day)	2.4E-03
				NICKEL	1.9E+02	(mg/kg)	8.1E-06	(mg/kg-day)	NA	per (mg/kg-day)	--	1.9E-05	(mg/kg-day)	2.0E-02	(mg/kg-day)	9.5E-04
				ZINC	3.0E+04	(mg/kg)	1.3E-03	(mg/kg-day)	NA	per (mg/kg-day)	--	3.0E-03	(mg/kg-day)	3.0E-01	(mg/kg-day)	1.0E-02
				PAHs												
				BENZO(A)PYRENE	1.8E-01	(mg/kg)	7.8E-09	(mg/kg-day)	7.3E+00	per (mg/kg-day)	5.7E-08	1.8E-08	(mg/kg-day)	NA	(mg/kg-day)	--
			Exp. Route Total								**8.2E-06**					**1.3E+00**
			Dermal[1]	**Explosives**												
				2-AMINO-4,6-DINITROTOLUENE	6.8E+01	(mg/kg)	1.4E-07	(mg/kg-day)	NA	per (mg/kg-day)	--	3.3E-07	(mg/kg-day)	2.0E-03	(mg/kg-day)	1.7E-04
				4-AMINO-2,6-DINITROTOLUENE	4.8E+01	(mg/kg)	1.5E-07	(mg/kg-day)	NA	per (mg/kg-day)	--	3.5E-07	(mg/kg-day)	2.0E-03	(mg/kg-day)	1.8E-04
				2,4-DINITROTOLUENE	7.0E+00	(mg/kg)	2.5E-07	(mg/kg-day)	3.1E-01	per (mg/kg-day)	7.7E-08	5.8E-07	(mg/kg-day)	2.0E-03	(mg/kg-day)	2.9E-04
				2,6-DINITROTOLUENE	3.1E+00	(mg/kg)	1.1E-07	(mg/kg-day)	6.8E-01	per (mg/kg-day)	7.2E-08	2.5E-07	(mg/kg-day)	1.0E-03	(mg/kg-day)	2.5E-04
				RDX	7.7E-01	(mg/kg)	4.0E-09	(mg/kg-day)	1.1E-01	per (mg/kg-day)	4.4E-10	9.4E-09	(mg/kg-day)	3.0E-03	(mg/kg-day)	3.1E-06
				1,3-DINITROBENZENE	6.8E-01	(mg/kg)	2.4E-08	(mg/kg-day)	NA	per (mg/kg-day)	--	5.5E-08	(mg/kg-day)	1.0E-04	(mg/kg-day)	5.5E-04
				2,4,6-TRINITROTOLUENE	6.0E+03	(mg/kg)	2.1E-04	(mg/kg-day)	3.0E-02	per (mg/kg-day)	6.3E-06	4.9E-04	(mg/kg-day)	5.0E-04	(mg/kg-day)	9.7E-01
				2-NITROTOLUENE	3.1E+00	(mg/kg)	1.1E-07	(mg/kg-day)	2.2E-01	per (mg/kg-day)	2.4E-08	2.5E-07	(mg/kg-day)	9.0E-04	(mg/kg-day)	2.8E-04
				Inorganics												
				BARIUM	2.8E+03	(mg/kg)	NA	(mg/kg-day)	NA	per (mg/kg-day)	--	NA	(mg/kg-day)	1.4E-02	(mg/kg-day)	--
				CADMIUM	6.3E+01	(mg/kg)	2.2E-08	(mg/kg-day)	NA	per (mg/kg-day)	--	5.1E-08	(mg/kg-day)	2.5E-05	(mg/kg-day)	2.0E-03
				CHROMIUM (HEXAVALENT)	1.9E+00	(mg/kg)	NA	(mg/kg-day)	2.0E+01	per (mg/kg-day)	--	NA	(mg/kg-day)	7.5E-05	(mg/kg-day)	--
				COPPER	9.6E+02	(mg/kg)	NA	(mg/kg-day)	NA	per (mg/kg-day)	--	NA	(mg/kg-day)	4.0E-02	(mg/kg-day)	--
				NICKEL	1.9E+02	(mg/kg)	NA	(mg/kg-day)	NA	per (mg/kg-day)	--	NA	(mg/kg-day)	8.0E-04	(mg/kg-day)	--
				ZINC	3.0E+04	(mg/kg)	NA	(mg/kg-day)	NA	per (mg/kg-day)	--	NA	(mg/kg-day)	3.0E-01	(mg/kg-day)	--
				PAHs												
				BENZO(A)PYRENE	1.8E-01	(mg/kg)	8.1E-09	(mg/kg-day)	7.3E+00	per (mg/kg-day)	5.9E-08	1.9E-08	(mg/kg-day)	NA	(mg/kg-day)	--
			Exp. Route Total								**6.5E-06**					**9.8E-01**
		Exposure Point Total									**1.5E-05**					**2.2E+00**
	Exposure Medium (Surface Soil) Total										**1.5E-05**					**2.2E+00**

TABLE B-7.1
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU 8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY

Scenario Timeframe: Current/Future
Receptor Population: Trespasser
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Constituent of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Air	EU 8	Inhalation	**Explosives**												
				2-AMINO-4,6-DINITROTOLUENE	5.6E-08	(mg/m^3)	2.9E-07	(ug/m^3)	NA	per (ug/m^3)	--	6.7E-10	(mg/m^3)	NA	(mg/m^3)	--
				4-AMINO-2,6-DINITROTOLUENE	4.0E-08	(mg/m^3)	2.0E-07	(ug/m^3)	NA	per (ug/m^3)	--	4.7E-10	(mg/m^3)	NA	(mg/m^3)	--
				2,4-DINITROTOLUENE	5.8E-09	(mg/m^3)	3.0E-08	(ug/m^3)	8.9E-05	per (ug/m^3)	2.6E-12	6.9E-11	(mg/m^3)	NA	(mg/m^3)	--
				2,6-DINITROTOLUENE	2.5E-09	(mg/m^3)	1.3E-08	(ug/m^3)	NA	per (ug/m^3)	--	3.0E-11	(mg/m^3)	NA	(mg/m^3)	--
				RDX	6.4E-10	(mg/m^3)	3.2E-09	(ug/m^3)	NA	per (ug/m^3)	--	7.6E-12	(mg/m^3)	NA	(mg/m^3)	--
				1,3-DINITROBENZENE	5.6E-10	(mg/m^3)	2.9E-09	(ug/m^3)	NA	per (ug/m^3)	--	6.7E-12	(mg/m^3)	NA	(mg/m^3)	--
				2,4,6-TRINITROTOLUENE	5.0E-06	(mg/m^3)	2.5E-05	(ug/m^3)	NA	per (ug/m^3)	--	5.9E-08	(mg/m^3)	NA	(mg/m^3)	--
				2-NITROTOLUENE	2.6E-09	(mg/m^3)	1.3E-08	(ug/m^3)	NA	per (ug/m^3)	--	3.0E-11	(mg/m^3)	NA	(mg/m^3)	--
				Inorganics												
				BARIUM	2.4E-06	(mg/m^3)	1.2E-05	(ug/m^3)	NA	per (ug/m^3)	--	2.8E-08	(mg/m^3)	5.0E-04	(mg/m^3)	5.6E-05
				CADMIUM	5.2E-08	(mg/m^3)	2.6E-07	(ug/m^3)	1.8E-03	per (ug/m^3)	4.7E-10	6.2E-10	(mg/m^3)	2.0E-05	(mg/m^3)	3.1E-05
				CHROMIUM (HEXAVALENT)	1.6E-09	(mg/m^3)	8.0E-09	(ug/m^3)	8.4E-02	per (ug/m^3)	6.7E-10	1.9E-11	(mg/m^3)	1.0E-04	(mg/m^3)	1.9E-07
				COPPER	7.9E-07	(mg/m^3)	4.0E-06	(ug/m^3)	NA	per (ug/m^3)	--	9.4E-09	(mg/m^3)	NA	(mg/m^3)	--
				NICKEL	1.5E-07	(mg/m^3)	7.8E-07	(ug/m^3)	2.6E-04	per (ug/m^3)	2.0E-10	1.8E-09	(mg/m^3)	9.0E-05	(mg/m^3)	2.0E-05
				ZINC	2.4E-05	(mg/m^3)	1.2E-04	(ug/m^3)	NA	per (ug/m^3)	--	2.9E-07	(mg/m^3)	NA	(mg/m^3)	--
				PAHs												
				BENZO(A)PYRENE	1.5E-10	(mg/m^3)	7.5E-10	(ug/m^3)	1.1E-03	per (ug/m^3)	8.3E-13	1.8E-12	(mg/m^3)	NA	(mg/m^3)	--
			Exp. Route Total								**1.4E-09**					**1.1E-04**
		Exposure Point Total									**1.4E-09**					**1.1E-04**
	Exposure Medium (Air) Total										**1.4E-09**					**1.1E-04**
	Game Meat	EU 8	Ingestion	**Explosives**												
				RDX	6.4E-08	(mg/kg)	7.9E-14	(mg/kg-day)	1.1E-01	per (mg/kg-day)	8.7E-15	1.8E-13	(mg/kg-day)	3.0E-03	(mg/kg-day)	6.1E-11
				Inorganics												
				BARIUM	7.1E-03	(mg/kg)	8.8E-09	(mg/kg-day)	NA	per (mg/kg-day)	--	2.0E-08	(mg/kg-day)	2.0E-01	(mg/kg-day)	1.0E-07
				CADMIUM	1.6E-04	(mg/kg)	2.0E-10	(mg/kg-day)	NA	per (mg/kg-day)	--	4.6E-10	(mg/kg-day)	1.0E-03	(mg/kg-day)	4.6E-07
				CHROMIUM (HEXAVALENT)	1.7E-04	(mg/kg)	2.1E-10	(mg/kg-day)	5.0E-01	per (mg/kg-day)	1.1E-10	4.9E-10	(mg/kg-day)	3.0E-03	(mg/kg-day)	1.6E-07
				COPPER	1.9E-01	(mg/kg)	2.3E-07	(mg/kg-day)	NA	per (mg/kg-day)	--	5.4E-07	(mg/kg-day)	4.0E-02	(mg/kg-day)	1.4E-05
				MERCURY	8.3E-06	(mg/kg)	1.0E-11	(mg/kg-day)	NA	per (mg/kg-day)	--	2.4E-11	(mg/kg-day)	1.0E-04	(mg/kg-day)	2.4E-07
				NICKEL	2.0E-02	(mg/kg)	2.5E-08	(mg/kg-day)	NA	per (mg/kg-day)	--	5.8E-08	(mg/kg-day)	2.0E-02	(mg/kg-day)	2.9E-06
				ZINC	5.2E-02	(mg/kg)	6.4E-08	(mg/kg-day)	NA	per (mg/kg-day)	--	1.5E-07	(mg/kg-day)	3.0E-01	(mg/kg-day)	5.0E-07
				PAHs												
				BENZO(A)PYRENE	1.1E-02	(mg/kg)	1.4E-08	(mg/kg-day)	7.3E+00	per (mg/kg-day)	1.0E-07	3.2E-08	(mg/kg-day)	NA	(mg/kg-day)	--
				Pesticides/PCBs												
				4,4'-DDT	4.3E-03	(mg/kg)	5.3E-09	(mg/kg-day)	3.4E-01	per (mg/kg-day)	1.8E-09	1.2E-08	(mg/kg-day)	5.0E-04	(mg/kg-day)	2.5E-05
			Exp. Route Total								**1.0E-07**					**4.3E-05**
		Exposure Point Total									**1.0E-07**					**4.3E-05**
	Exposure Medium (Game Meat) Total										**1.0E-07**					**4.3E-05**
Soil Total											**1.E-05**					**2**
										Total of Receptor Risks Across All Media	**1.E-05**				Total of Receptor Hazards Across All Media	**2**

1) Dermal carcinogenic and non-carcinogenic intakes equal "NA" due to no published Dermal Absorption Fraction (ABS) values for this COPC. Please see U.S. EPA 2004 guidance and Table H-5.3.
-- = No risk is calculated due to a lack of toxicity values.
CSF = Cancer Slope Factor
EPC = Exposure Point Concentration
NA = Not Available
PAHs = Polynuclear Aromatic Hydrocarbons
PCBs = Polychlorinated Bipheyls
RfC = Reference Concentration
RfD = Reference Dose

TABLE B-7.2
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU 8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY

Scenario Timeframe: Current/Future
Receptor Population: Trespasser
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Exposure Route	Constituent of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	EU 8	Ingestion	**Explosives**												
				2-AMINO-4,6-DINITROTOLUENE	6.8E+01	(mg/kg)	3.1E-06	(mg/kg-day)	NA	per (mg/kg-day)	--	2.2E-05	(mg/kg-day)	2.0E-03	(mg/kg-day)	1.1E-02
				4-AMINO-2,6-DINITROTOLUENE	4.8E+01	(mg/kg)	2.2E-06	(mg/kg-day)	NA	per (mg/kg-day)	--	1.5E-05	(mg/kg-day)	2.0E-03	(mg/kg-day)	7.7E-03
				2,4-DINITROTOLUENE	7.0E+00	(mg/kg)	3.2E-07	(mg/kg-day)	3.1E-01	per (mg/kg-day)	9.9E-08	2.2E-06	(mg/kg-day)	2.0E-03	(mg/kg-day)	1.1E-03
				2,6-DINITROTOLUENE	3.1E+00	(mg/kg)	1.4E-07	(mg/kg-day)	6.8E-01	per (mg/kg-day)	9.5E-08	9.8E-07	(mg/kg-day)	1.0E-03	(mg/kg-day)	9.8E-04
				RDX	7.7E-01	(mg/kg)	3.5E-08	(mg/kg-day)	1.1E-01	per (mg/kg-day)	3.8E-09	2.4E-07	(mg/kg-day)	3.0E-03	(mg/kg-day)	8.1E-05
				1,3-DINITROBENZENE	6.8E-01	(mg/kg)	3.1E-08	(mg/kg-day)	NA	per (mg/kg-day)	--	2.1E-07	(mg/kg-day)	1.0E-04	(mg/kg-day)	2.1E-03
				2,4,6-TRINITROTOLUENE	6.0E+03	(mg/kg)	2.7E-04	(mg/kg-day)	3.0E-02	per (mg/kg-day)	8.1E-06	1.9E-03	(mg/kg-day)	5.0E-04	(mg/kg-day)	3.8E+00
				2-NITROTOLUENE	3.1E+00	(mg/kg)	1.4E-07	(mg/kg-day)	2.2E-01	per (mg/kg-day)	3.1E-08	9.8E-07	(mg/kg-day)	9.0E-04	(mg/kg-day)	1.1E-03
				Inorganics												
				BARIUM	2.8E+03	(mg/kg)	1.3E-04	(mg/kg-day)	NA	per (mg/kg-day)	--	9.0E-04	(mg/kg-day)	2.0E-01	(mg/kg-day)	4.5E-03
				CADMIUM	6.3E+01	(mg/kg)	2.8E-06	(mg/kg-day)	NA	per (mg/kg-day)	--	2.0E-05	(mg/kg-day)	1.0E-03	(mg/kg-day)	2.0E-02
				CHROMIUM (HEXAVALENT)	1.9E+00	(mg/kg)	2.6E-07	(mg/kg-day)	5.0E-01	per (mg/kg-day)	1.3E-07	6.0E-07	(mg/kg-day)	3.0E-03	(mg/kg-day)	2.0E-04
				COPPER	9.6E+02	(mg/kg)	4.3E-05	(mg/kg-day)	NA	per (mg/kg-day)	--	3.0E-04	(mg/kg-day)	4.0E-02	(mg/kg-day)	7.6E-03
				NICKEL	1.9E+02	(mg/kg)	8.4E-06	(mg/kg-day)	NA	per (mg/kg-day)	--	5.9E-05	(mg/kg-day)	2.0E-02	(mg/kg-day)	2.9E-03
				ZINC	3.0E+04	(mg/kg)	1.3E-03	(mg/kg-day)	NA	per (mg/kg-day)	--	9.4E-03	(mg/kg-day)	3.0E-01	(mg/kg-day)	3.1E-02
				PAHs												
				BENZO(A)PYRENE	1.8E-01	(mg/kg)	2.4E-08	(mg/kg-day)	7.3E+00	per (mg/kg-day)	1.8E-07	5.7E-08	(mg/kg-day)	NA	(mg/kg-day)	--
			Exp. Route Total								**8.7E-06**					**3.9E+00**
			Dermal[1]	**Explosives**												
				2-AMINO-4,6-DINITROTOLUENE	6.8E+01	(mg/kg)	1.4E-07	(mg/kg-day)	NA	per (mg/kg-day)	--	9.5E-07	(mg/kg-day)	2.0E-03	(mg/kg-day)	4.8E-04
				4-AMINO-2,6-DINITROTOLUENE	4.8E+01	(mg/kg)	1.5E-07	(mg/kg-day)	NA	per (mg/kg-day)	--	1.0E-06	(mg/kg-day)	2.0E-03	(mg/kg-day)	5.1E-04
				2,4-DINITROTOLUENE	7.0E+00	(mg/kg)	2.4E-07	(mg/kg-day)	3.1E-01	per (mg/kg-day)	7.4E-08	1.7E-06	(mg/kg-day)	2.0E-03	(mg/kg-day)	8.4E-04
				2,6-DINITROTOLUENE	3.1E+00	(mg/kg)	1.0E-07	(mg/kg-day)	6.8E-01	per (mg/kg-day)	6.9E-08	7.1E-07	(mg/kg-day)	1.0E-03	(mg/kg-day)	7.1E-04
				RDX	7.7E-01	(mg/kg)	3.9E-09	(mg/kg-day)	1.1E-01	per (mg/kg-day)	4.3E-10	2.7E-08	(mg/kg-day)	3.0E-03	(mg/kg-day)	9.0E-06
				1,3-DINITROBENZENE	6.8E-01	(mg/kg)	2.3E-08	(mg/kg-day)	NA	per (mg/kg-day)	--	1.6E-07	(mg/kg-day)	1.0E-04	(mg/kg-day)	1.6E-03
				2,4,6-TRINITROTOLUENE	6.0E+03	(mg/kg)	2.0E-04	(mg/kg-day)	3.0E-02	per (mg/kg-day)	6.0E-06	1.4E-03	(mg/kg-day)	5.0E-04	(mg/kg-day)	2.8E+00
				2-NITROTOLUENE	3.1E+00	(mg/kg)	1.0E-07	(mg/kg-day)	2.2E-01	per (mg/kg-day)	2.3E-08	7.2E-07	(mg/kg-day)	9.0E-04	(mg/kg-day)	8.0E-04
				Inorganics												
				BARIUM	2.8E+03	(mg/kg)	NA	(mg/kg-day)	NA	per (mg/kg-day)	--	NA	(mg/kg-day)	1.4E-02	(mg/kg-day)	--
				CADMIUM	6.3E+01	(mg/kg)	2.1E-08	(mg/kg-day)	NA	per (mg/kg-day)	--	1.5E-07	(mg/kg-day)	2.5E-05	(mg/kg-day)	5.9E-03
				CHROMIUM (HEXAVALENT)	1.9E+00	(mg/kg)	NA	(mg/kg-day)	2.0E+01	per (mg/kg-day)	--	NA	(mg/kg-day)	7.5E-05	(mg/kg-day)	--
				COPPER	9.6E+02	(mg/kg)	NA	(mg/kg-day)	NA	per (mg/kg-day)	--	NA	(mg/kg-day)	4.0E-02	(mg/kg-day)	--
				NICKEL	1.9E+02	(mg/kg)	NA	(mg/kg-day)	NA	per (mg/kg-day)	--	NA	(mg/kg-day)	8.0E-04	(mg/kg-day)	--
				ZINC	3.0E+04	(mg/kg)	NA	(mg/kg-day)	NA	per (mg/kg-day)	--	NA	(mg/kg-day)	3.0E-01	(mg/kg-day)	--
				PAHs												
				BENZO(A)PYRENE	1.8E-01	(mg/kg)	2.3E-08	(mg/kg-day)	7.3E+00	per (mg/kg-day)	1.7E-07	5.5E-08	(mg/kg-day)	NA	(mg/kg-day)	--
			Exp. Route Total								**6.4E-06**					**2.8E+00**
		Exposure Point Total									**1.5E-05**					**6.7E+00**
	Exposure Medium (Surface Soil) Total										**1.5E-05**					**6.7E+00**

TABLE B-7.2
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU 8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY

Scenario Timeframe: Current/Future
Receptor Population: Trespasser
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Exposure Route	Constituent of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Air	EU 8	Inhalation	**Explosives**												
				2-AMINO-4,6-DINITROTOLUENE	5.6E-08	(mg/m^3)	9.5E-08	(ug/m^3)	NA	per (ug/m^3)	--	6.7E-10	(mg/m^3)	NA	(mg/m^3)	--
				4-AMINO-2,6-DINITROTOLUENE	4.0E-08	(mg/m^3)	6.8E-08	(ug/m^3)	NA	per (ug/m^3)	--	4.7E-10	(mg/m^3)	NA	(mg/m^3)	--
				2,4-DINITROTOLUENE	5.8E-09	(mg/m^3)	9.9E-09	(ug/m^3)	8.9E-05	per (ug/m^3)	8.8E-13	6.9E-11	(mg/m^3)	NA	(mg/m^3)	--
				2,6-DINITROTOLUENE	2.5E-09	(mg/m^3)	4.3E-09	(ug/m^3)	NA	per (ug/m^3)	--	3.0E-11	(mg/m^3)	NA	(mg/m^3)	--
				RDX	6.4E-10	(mg/m^3)	1.1E-09	(ug/m^3)	NA	per (ug/m^3)	--	7.6E-12	(mg/m^3)	NA	(mg/m^3)	--
				1,3-DINITROBENZENE	5.6E-10	(mg/m^3)	9.5E-10	(ug/m^3)	NA	per (ug/m^3)	--	6.7E-12	(mg/m^3)	NA	(mg/m^3)	--
				2,4,6-TRINITROTOLUENE	5.0E-06	(mg/m^3)	8.4E-06	(ug/m^3)	NA	per (ug/m^3)	--	5.9E-08	(mg/m^3)	NA	(mg/m^3)	--
				2-NITROTOLUENE	2.6E-09	(mg/m^3)	4.3E-09	(ug/m^3)	NA	per (ug/m^3)	--	3.0E-11	(mg/m^3)	NA	(mg/m^3)	--
				Inorganics												
				BARIUM	2.4E-06	(mg/m^3)	4.0E-06	(ug/m^3)	NA	per (ug/m^3)	--	2.8E-08	(mg/m^3)	5.0E-04	(mg/m^3)	5.6E-05
				CADMIUM	5.2E-08	(mg/m^3)	8.8E-08	(ug/m^3)	1.8E-03	per (ug/m^3)	1.6E-10	6.2E-10	(mg/m^3)	2.0E-05	(mg/m^3)	3.1E-05
				CHROMIUM (HEXAVALENT)	1.6E-09	(mg/m^3)	2.7E-09	(ug/m^3)	8.4E-02	per (ug/m^3)	2.2E-10	1.9E-11	(mg/m^3)	1.0E-04	(mg/m^3)	1.9E-07
				COPPER	7.9E-07	(mg/m^3)	1.3E-06	(ug/m^3)	NA	per (ug/m^3)	--	9.4E-09	(mg/m^3)	NA	(mg/m^3)	--
				NICKEL	1.5E-07	(mg/m^3)	2.6E-07	(ug/m^3)	2.6E-04	per (ug/m^3)	6.8E-11	1.8E-09	(mg/m^3)	9.0E-05	(mg/m^3)	2.0E-05
				ZINC	2.4E-05	(mg/m^3)	4.1E-05	(ug/m^3)	NA	per (ug/m^3)	--	2.9E-07	(mg/m^3)	NA	(mg/m^3)	--
				PAHs												
				BENZO(A)PYRENE	1.5E-10	(mg/m^3)	7.5E-10	(ug/m^3)	1.1E-03	per (ug/m^3)	8.3E-13	1.8E-12	(mg/m^3)	NA	(mg/m^3)	--
			Exp. Route Total								**4.5E-10**					**1.1E-04**
		Exposure Point Total									**4.5E-10**					**1.1E-04**
	Exposure Medium (Air) Total										**4.5E-10**					**1.1E-04**
	Game Meat	EU 8	Ingestion	**Explosives**												
				RDX	6.4E-08	(mg/kg)	4.1E-14	(mg/kg-day)	1.1E-01	per (mg/kg-day)	4.5E-15	2.9E-13	(mg/kg-day)	3.0E-03	(mg/kg-day)	9.5E-11
				Inorganics												
				BARIUM	7.1E-03	(mg/kg)	4.5E-09	(mg/kg-day)	NA	per (mg/kg-day)	--	3.2E-08	(mg/kg-day)	2.0E-01	(mg/kg-day)	1.6E-07
				CADMIUM	1.6E-04	(mg/kg)	1.0E-10	(mg/kg-day)	NA	per (mg/kg-day)	--	7.2E-10	(mg/kg-day)	1.0E-03	(mg/kg-day)	7.2E-07
				CHROMIUM (HEXAVALENT)	1.7E-04	(mg/kg)	3.3E-10	(mg/kg-day)	5.0E-01	per (mg/kg-day)	1.6E-10	7.6E-10	(mg/kg-day)	3.0E-03	(mg/kg-day)	2.5E-07
				COPPER	1.9E-01	(mg/kg)	1.2E-07	(mg/kg-day)	NA	per (mg/kg-day)	--	8.4E-07	(mg/kg-day)	4.0E-02	(mg/kg-day)	2.1E-05
				MERCURY	8.3E-06	(mg/kg)	5.3E-12	(mg/kg-day)	NA	per (mg/kg-day)	--	3.7E-11	(mg/kg-day)	1.0E-04	(mg/kg-day)	3.7E-07
				NICKEL	2.0E-02	(mg/kg)	1.3E-08	(mg/kg-day)	NA	per (mg/kg-day)	--	9.1E-08	(mg/kg-day)	2.0E-02	(mg/kg-day)	4.5E-06
				ZINC	5.2E-02	(mg/kg)	3.3E-08	(mg/kg-day)	NA	per (mg/kg-day)	--	2.3E-07	(mg/kg-day)	3.0E-01	(mg/kg-day)	7.7E-07
				PAHs												
				BENZO(A)PYRENE	1.1E-02	(mg/kg)	2.1E-08	(mg/kg-day)	2.2E+01	per (mg/kg-day)	4.7E-07	5.0E-08	(mg/kg-day)	NA	(mg/kg-day)	--
				Pesticides/PCBs												
				4,4'-DDT	4.3E-03	(mg/kg)	2.8E-09	(mg/kg-day)	3.4E-01	per (mg/kg-day)	9.4E-10	1.9E-08	(mg/kg-day)	5.0E-04	(mg/kg-day)	3.9E-05
			Exp. Route Total								**4.7E-07**					**6.7E-05**
		Exposure Point Total									**4.7E-07**					**6.7E-05**
	Exposure Medium (Game Meat) Total										**4.7E-07**					**6.7E-05**
Soil Total											**2.E-05**					**7**
										Total of Receptor Risks Across All Media	**2.E-05**				Total of Receptor Hazards Across All Media	**7**

1) Dermal carcinogenic and non-carcinogenic intakes equal "NA" due to no published Dermal Absorption Fraction (ABS) values for this COPC. Please see U.S. EPA 2004 guidance and Table H-5.3.
-- = No risk is calculated due to a lack of toxicity values.
CSF = Cancer Slope Factor
EPC = Exposure Point Concentration
NA = Not Available
PAHs = Polynuclear Aromatic Hydrocarbons
PCBs = Polychlorinated Bipheyls
RfC = Reference Concentration
RfD = Reference Dose

TABLE B-7.3
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU 8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY

Scenario Timeframe: Future
Receptor Population: Maintenance Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Constituent of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	EU 8	Ingestion	**Explosives**												
				2,4-DINITROTOLUENE	7.0E+00	(mg/kg)	1.2E-06	(mg/kg-day)	3.1E-01	per (mg/kg-day)	3.8E-07	3.4E-06	(mg/kg-day)	2.0E-03	(mg/kg-day)	1.7E-03
				2,4,6-TRINITROTOLUENE	6.0E+03	(mg/kg)	1.0E-03	(mg/kg-day)	3.0E-02	per (mg/kg-day)	3.1E-05	2.9E-03	(mg/kg-day)	5.0E-04	(mg/kg-day)	5.9E+00
				2-NITROTOLUENE	3.1E+00	(mg/kg)	5.4E-07	(mg/kg-day)	2.2E-01	per (mg/kg-day)	1.2E-07	1.5E-06	(mg/kg-day)	9.0E-04	(mg/kg-day)	1.7E-03
				Inorganics												
				CHROMIUM (HEXAVALENT)	1.9E+00	(mg/kg)	6.7E-07	(mg/kg-day)	5.0E-01	per (mg/kg-day)	3.3E-07	1.9E-06	(mg/kg-day)	3.0E-03	(mg/kg-day)	6.2E-04
				COPPER	9.6E+02	(mg/kg)	3.4E-04	(mg/kg-day)	NA	per (mg/kg-day)	--	9.4E-04	(mg/kg-day)	4.0E-02	(mg/kg-day)	2.3E-02
				ZINC	3.0E+04	(mg/kg)	1.0E-02	(mg/kg-day)	NA	per (mg/kg-day)	--	2.9E-02	(mg/kg-day)	3.0E-01	(mg/kg-day)	9.6E-02
			Exp. Route Total								**3.2E-05**					**6.0E+00**
			Dermal[1]	**Explosives**												
				2,4-DINITROTOLUENE	7.0E+00	(mg/kg)	5.8E-07	(mg/kg-day)	3.1E-01	per (mg/kg-day)	1.8E-07	1.6E-06	(mg/kg-day)	2.0E-03	(mg/kg-day)	8.1E-04
				2,4,6-TRINITROTOLUENE	6.0E+03	(mg/kg)	4.8E-04	(mg/kg-day)	3.0E-02	per (mg/kg-day)	1.5E-05	1.4E-03	(mg/kg-day)	5.0E-04	(mg/kg-day)	2.7E+00
				2-NITROTOLUENE	3.1E+00	(mg/kg)	2.5E-07	(mg/kg-day)	2.2E-01	per (mg/kg-day)	5.5E-08	7.0E-07	(mg/kg-day)	9.0E-04	(mg/kg-day)	7.8E-04
				Inorganics												
				CHROMIUM (HEXAVALENT)	1.9E+00	(mg/kg)	NA	(mg/kg-day)	2.0E+01	per (mg/kg-day)	--	NA	(mg/kg-day)	7.5E-05	(mg/kg-day)	--
				COPPER	9.6E+02	(mg/kg)	NA	(mg/kg-day)	NA	per (mg/kg-day)	--	NA	(mg/kg-day)	4.0E-02	(mg/kg-day)	--
				ZINC	3.0E+04	(mg/kg)	NA	(mg/kg-day)	NA	per (mg/kg-day)	--	NA	(mg/kg-day)	3.0E-01	(mg/kg-day)	--
			Exp. Route Total								**1.5E-05**					**2.7E+00**
		Exposure Point Total									**4.7E-05**					**8.7E+00**
	Exposure Medium (Surface Soil) Total										**4.7E-05**					**8.7E+00**
	Air	EU 8	Inhalation	**Explosives**												
				2,4-DINITROTOLUENE	5.8E-09	(mg/m^3)	4.7E-07	(ug/m^3)	8.9E-05	per (ug/m^3)	4.2E-11	1.3E-09	(mg/m^3)	NA	(mg/m^3)	--
				2,4,6-TRINITROTOLUENE	5.0E-06	(mg/m^3)	4.0E-04	(ug/m^3)	NA	per (ug/m^3)	--	1.1E-06	(mg/m^3)	NA	(mg/m^3)	--
				2-NITROTOLUENE	2.6E-09	(mg/m^3)	2.1E-07	(ug/m^3)	NA	per (ug/m^3)	--	5.8E-10	(mg/m^3)	NA	(mg/m^3)	--
				Inorganics												
				CHROMIUM (HEXAVALENT)	1.6E-09	(mg/m^3)	1.3E-07	(ug/m^3)	8.4E-02	per (ug/m^3)	1.1E-08	3.6E-10	(mg/m^3)	1.0E-04	(mg/m^3)	3.6E-06
				COPPER	7.9E-07	(mg/m^3)	6.5E-05	(ug/m^3)	NA	per (ug/m^3)	--	1.8E-07	(mg/m^3)	NA	(mg/m^3)	--
				ZINC	2.4E-05	(mg/m^3)	2.0E-03	(ug/m^3)	NA	per (ug/m^3)	--	5.6E-06	(mg/m^3)	NA	(mg/m^3)	--
			Exp. Route Total								**1.1E-08**					**3.6E-06**
		Exposure Point Total									**1.1E-08**					**3.6E-06**
	Exposure Medium (Air) Total										**1.1E-08**					**3.6E-06**
Soil Total											**5.E-05**					**9**
										Total of Receptor Risks Across All Media	**5.E-05**				Total of Receptor Hazards Across All Media	**9**

1) Dermal carcinogenic and non-carcinogenic intakes equal "NA" due to no published Dermal Absorption Fraction (ABS) values for this COPC. Please see U.S. EPA 2004 guidance and Table H-5.3.
-- = No risk is calculated due to a lack of toxicity values.
CSF = Cancer Slope Factor
EPC = Exposure Point Concentration
NA = Not Available
PAHs = Polynuclear Aromatic Hydrocarbons
PCBs = Polychlorinated Bipheyls
RfC = Reference Concentration
RfD = Reference Dose

TABLE B-7.4
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU 8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY

Scenario Timeframe: Future
Receptor Population: Commercial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Constituent of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	EU 8	Ingestion	**Explosives**												
				2,4-DINITROTOLUENE	7.0E+00	(mg/kg)	1.2E-06	(mg/kg-day)	3.1E-01	per (mg/kg-day)	3.8E-07	3.4E-06	(mg/kg-day)	2.0E-03	(mg/kg-day)	1.7E-03
				2,4,6-TRINITROTOLUENE	6.0E+03	(mg/kg)	1.0E-03	(mg/kg-day)	3.0E-02	per (mg/kg-day)	3.1E-05	2.9E-03	(mg/kg-day)	5.0E-04	(mg/kg-day)	5.9E+00
				2-NITROTOLUENE	3.1E+00	(mg/kg)	5.4E-07	(mg/kg-day)	2.2E-01	per (mg/kg-day)	1.2E-07	1.5E-06	(mg/kg-day)	9.0E-04	(mg/kg-day)	1.7E-03
				Inorganics												
				CHROMIUM (HEXAVALENT)	1.9E+00	(mg/kg)	3.3E-07	(mg/kg-day)	5.0E-01	per (mg/kg-day)	1.7E-07	9.3E-07	(mg/kg-day)	3.0E-03	(mg/kg-day)	3.1E-04
				COPPER	9.6E+02	(mg/kg)	1.7E-04	(mg/kg-day)	NA	per (mg/kg-day)	--	4.7E-04	(mg/kg-day)	4.0E-02	(mg/kg-day)	1.2E-02
				ZINC	3.0E+04	(mg/kg)	5.2E-03	(mg/kg-day)	NA	per (mg/kg-day)	--	1.4E-02	(mg/kg-day)	3.0E-01	(mg/kg-day)	4.8E-02
			Exp. Route Total								**3.2E-05**					**5.9E+00**
			Dermal[1]	**Explosives**												
				2,4-DINITROTOLUENE	7.0E+00	(mg/kg)	1.7E-07	(mg/kg-day)	3.1E-01	per (mg/kg-day)	5.1E-08	4.6E-07	(mg/kg-day)	2.0E-03	(mg/kg-day)	2.3E-04
				2,4,6-TRINITROTOLUENE	6.0E+03	(mg/kg)	1.4E-04	(mg/kg-day)	3.0E-02	per (mg/kg-day)	4.2E-06	3.9E-04	(mg/kg-day)	5.0E-04	(mg/kg-day)	7.7E-01
				2-NITROTOLUENE	3.1E+00	(mg/kg)	7.1E-08	(mg/kg-day)	2.2E-01	per (mg/kg-day)	1.6E-08	2.0E-07	(mg/kg-day)	9.0E-04	(mg/kg-day)	2.2E-04
				Inorganics												
				CHROMIUM (HEXAVALENT)	1.9E+00	(mg/kg)	NA	(mg/kg-day)	2.0E+01	per (mg/kg-day)	--	NA	(mg/kg-day)	7.5E-05	(mg/kg-day)	--
				COPPER	9.6E+02	(mg/kg)	NA	(mg/kg-day)	NA	per (mg/kg-day)	--	NA	(mg/kg-day)	4.0E-02	(mg/kg-day)	--
				ZINC	3.0E+04	(mg/kg)	NA	(mg/kg-day)	NA	per (mg/kg-day)	--	NA	(mg/kg-day)	3.0E-01	(mg/kg-day)	--
			Exp. Route Total								**4.2E-06**					**7.8E-01**
		Exposure Point Total									**3.6E-05**					**6.7E+00**
	Exposure Medium (Surface Soil) Total										**3.6E-05**					**6.7E+00**
	Air	EU 8	Inhalation	**Explosives**												
				2,4-DINITROTOLUENE	5.8E-09	(mg/m^3)	5.9E-08	(ug/m^3)	8.9E-05	per (ug/m^3)	5.3E-12	1.7E-10	(mg/m^3)	NA	(mg/m^3)	--
				2,4,6-TRINITROTOLUENE	5.0E-06	(mg/m^3)	5.1E-05	(ug/m^3)	NA	per (ug/m^3)	--	1.4E-07	(mg/m^3)	NA	(mg/m^3)	--
				2-NITROTOLUENE	2.6E-09	(mg/m^3)	2.6E-08	(ug/m^3)	NA	per (ug/m^3)	--	7.3E-11	(mg/m^3)	NA	(mg/m^3)	--
				Inorganics												
				CHROMIUM (HEXAVALENT)	1.6E-09	(mg/m^3)	1.6E-08	(ug/m^3)	8.4E-02	per (ug/m^3)	1.4E-09	4.5E-11	(mg/m^3)	1.0E-04	(mg/m^3)	4.5E-07
				COPPER	7.9E-07	(mg/m^3)	8.1E-06	(ug/m^3)	NA	per (ug/m^3)	--	2.3E-08	(mg/m^3)	NA	(mg/m^3)	--
				ZINC	2.4E-05	(mg/m^3)	2.5E-04	(ug/m^3)	NA	per (ug/m^3)	--	7.0E-07	(mg/m^3)	NA	(mg/m^3)	--
			Exp. Route Total								**1.4E-09**					**4.5E-07**
		Exposure Point Total									**1.4E-09**					**4.5E-07**
	Exposure Medium (Air) Total										**1.4E-09**					**4.5E-07**
Soil Total											**4.E-05**					**7**
										Total of Receptor Risks Across All Media	**4.E-05**				Total of Receptor Hazards Across All Media	**7**

1) Dermal carcinogenic and non-carcinogenic intakes equal "NA" due to no published Dermal Absorption Fraction (ABS) values for this COPC. Please see U.S. EPA 2004 guidance and Table H-5.3.
-- = No risk is calculated due to a lack of toxicity values.
CSF = Cancer Slope Factor
EPC = Exposure Point Concentration
NA = Not Available
PAHs = Polynuclear Aromatic Hydrocarbons
PCBs = Polychlorinated Bipheyls
RfC = Reference Concentration
RfD = Reference Dose

TABLE B-7.5
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU 8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Constituent of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Total Soil	EU 8	Ingestion	**Explosives**												
				2,4-DINITROTOLUENE	2.6E+00	(mg/kg)	1.7E-07	(mg/kg-day)	3.1E-01	per (mg/kg-day)	5.3E-08	1.2E-05	(mg/kg-day)	2.0E-03	(mg/kg-day)	6.0E-03
				2,4,6-TRINITROTOLUENE	4.1E+03	(mg/kg)	2.8E-04	(mg/kg-day)	3.0E-02	per (mg/kg-day)	8.3E-06	1.9E-02	(mg/kg-day)	5.0E-04	(mg/kg-day)	3.9E+01
				2-NITROTOLUENE	1.6E+00	(mg/kg)	1.1E-07	(mg/kg-day)	2.2E-01	per (mg/kg-day)	2.4E-08	7.7E-06	(mg/kg-day)	9.0E-04	(mg/kg-day)	8.5E-03
				Inorganics												
				CADMIUM	4.3E+01	(mg/kg)	2.9E-06	(mg/kg-day)	NA	per (mg/kg-day)	--	2.0E-04	(mg/kg-day)	1.0E-03	(mg/kg-day)	2.0E-01
				CHROMIUM (HEXAVALENT)	1.5E+00	(mg/kg)	1.0E-07	(mg/kg-day)	5.0E-01	per (mg/kg-day)	5.0E-08	7.0E-06	(mg/kg-day)	3.0E-03	(mg/kg-day)	2.3E-03
				COPPER	6.6E+02	(mg/kg)	4.5E-05	(mg/kg-day)	NA	per (mg/kg-day)	--	3.1E-03	(mg/kg-day)	4.0E-02	(mg/kg-day)	7.8E-02
				IRON	4.7E+04	(mg/kg)	3.1E-03	(mg/kg-day)	NA	per (mg/kg-day)	--	2.2E-01	(mg/kg-day)	7.0E-01	(mg/kg-day)	3.1E-01
				ZINC	2.1E+04	(mg/kg)	1.4E-03	(mg/kg-day)	NA	per (mg/kg-day)	--	9.8E-02	(mg/kg-day)	3.0E-01	(mg/kg-day)	3.3E-01
			Exp. Route Total								**8.4E-06**					**4.0E+01**
			Dermal[1]	**Explosives**												
				2,4-DINITROTOLUENE	2.6E+00	(mg/kg)	2.4E-08	(mg/kg-day)	3.1E-01	per (mg/kg-day)	7.5E-09	1.7E-06	(mg/kg-day)	2.0E-03	(mg/kg-day)	8.4E-04
				2,4,6-TRINITROTOLUENE	4.1E+03	(mg/kg)	3.8E-05	(mg/kg-day)	3.0E-02	per (mg/kg-day)	1.1E-06	2.7E-03	(mg/kg-day)	5.0E-04	(mg/kg-day)	5.3E+00
				2-NITROTOLUENE	1.6E+00	(mg/kg)	1.5E-08	(mg/kg-day)	2.2E-01	per (mg/kg-day)	3.3E-09	1.1E-06	(mg/kg-day)	9.0E-04	(mg/kg-day)	1.2E-03
				Inorganics												
				CADMIUM	4.3E+01	(mg/kg)	3.9E-09	(mg/kg-day)	NA	per (mg/kg-day)	--	2.8E-07	(mg/kg-day)	2.5E-05	(mg/kg-day)	1.1E-02
				CHROMIUM (HEXAVALENT)	1.5E+00	(mg/kg)	NA	(mg/kg-day)	2.0E+01	per (mg/kg-day)	--	NA	(mg/kg-day)	7.5E-05	(mg/kg-day)	--
				COPPER	6.6E+02	(mg/kg)	NA	(mg/kg-day)	NA	per (mg/kg-day)	--	NA	(mg/kg-day)	4.0E-02	(mg/kg-day)	--
				IRON	4.7E+04	(mg/kg)	NA	(mg/kg-day)	NA	per (mg/kg-day)	--	NA	(mg/kg-day)	7.0E-01	(mg/kg-day)	--
				ZINC	2.1E+04	(mg/kg)	NA	(mg/kg-day)	NA	per (mg/kg-day)	--	NA	(mg/kg-day)	3.0E-01	(mg/kg-day)	--
			Exp. Route Total								**1.1E-06**					**5.3E+00**
		Exposure Point Total									**9.5E-06**					**4.5E+01**
	Exposure Medium (Total Soil) Total										**9.5E-06**					**4.5E+01**
	Air	EU 8	Inhalation	**Explosives**												
				2,4-DINITROTOLUENE	2.1E-09	(mg/m^3)	6.9E-09	(ug/m^3)	8.9E-05	per (ug/m^3)	6.1E-13	4.8E-10	(mg/m^3)	NA	(mg/m^3)	--
				2,4,6-TRINITROTOLUENE	3.4E-06	(mg/m^3)	1.1E-05	(ug/m^3)	NA	per (ug/m^3)	--	7.8E-07	(mg/m^3)	NA	(mg/m^3)	--
				2-NITROTOLUENE	1.3E-09	(mg/m^3)	4.4E-09	(ug/m^3)	NA	per (ug/m^3)	--	3.1E-10	(mg/m^3)	NA	(mg/m^3)	--
				Inorganics												
				CADMIUM	3.5E-08	(mg/m^3)	1.2E-07	(ug/m^3)	1.8E-03	per (ug/m^3)	2.1E-10	8.1E-09	(mg/m^3)	2.0E-05	(mg/m^3)	4.0E-04
				CHROMIUM (HEXAVALENT)	1.2E-09	(mg/m^3)	4.0E-09	(ug/m^3)	8.4E-02	per (ug/m^3)	3.4E-10	2.8E-10	(mg/m^3)	1.0E-04	(mg/m^3)	2.8E-06
				COPPER	5.5E-07	(mg/m^3)	1.8E-06	(ug/m^3)	NA	per (ug/m^3)	--	1.3E-07	(mg/m^3)	NA	(mg/m^3)	--
				IRON	3.9E-05	(mg/m^3)	1.3E-04	(ug/m^3)	NA	per (ug/m^3)	--	8.8E-06	(mg/m^3)	NA	(mg/m^3)	--
				ZINC	1.7E-05	(mg/m^3)	5.6E-05	(ug/m^3)	NA	per (ug/m^3)	--	3.9E-06	(mg/m^3)	NA	(mg/m^3)	--
			Exp. Route Total								**5.5E-10**					**4.1E-04**
		Exposure Point Total									**5.5E-10**					**4.1E-04**
	Exposure Medium (Air) Total										**5.5E-10**					**4.1E-04**
Soil Total											**1.E-05**					**44.9**
										Total of Receptor Risks Across All Media	**1.E-05**				Total of Receptor Hazards Across All Media	**44.9**

1) Dermal carcinogenic and non-carcinogenic intakes equal "NA" due to no published Dermal Absorption Fraction (ABS) values for this COPC. Please see U.S. EPA 2004 guidance and Table H-5.3.
-- = No risk is calculated due to a lack of toxicity values.
CSF = Cancer Slope Factor
EPC = Exposure Point Concentration
NA = Not Available
PAHs = Polynuclear Aromatic Hydrocarbons
PCBs = Polychlorinated Bipheyls
RfC = Reference Concentration
RfD = Reference Dose

TABLE B-7.6
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU 8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Constituent of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Total Soil	EU 8	Ingestion	**Explosives**												
				2-AMINO-4,6-DINITROTOLUENE	4.7E+01	(mg/kg)	1.1E-05	(mg/kg-day)	NA	per (mg/kg-day)	--	3.2E-05	(mg/kg-day)	2.0E-03	(mg/kg-day)	1.6E-02
				4-AMINO-2,6-DINITROTOLUENE	3.3E+01	(mg/kg)	7.8E-06	(mg/kg-day)	NA	per (mg/kg-day)	--	2.3E-05	(mg/kg-day)	2.0E-03	(mg/kg-day)	1.1E-02
				2,4-DINITROTOLUENE	2.6E+00	(mg/kg)	6.0E-07	(mg/kg-day)	3.1E-01	per (mg/kg-day)	1.9E-07	1.8E-06	(mg/kg-day)	2.0E-03	(mg/kg-day)	8.8E-04
				2,6-DINITROTOLUENE	2.1E+00	(mg/kg)	4.8E-07	(mg/kg-day)	6.8E-01	per (mg/kg-day)	3.3E-07	1.4E-06	(mg/kg-day)	1.0E-03	(mg/kg-day)	1.4E-03
				RDX	6.1E-01	(mg/kg)	1.4E-07	(mg/kg-day)	1.1E-01	per (mg/kg-day)	1.6E-08	4.2E-07	(mg/kg-day)	3.0E-03	(mg/kg-day)	1.4E-04
				1,3-DINITROBENZENE	3.5E-01	(mg/kg)	8.2E-08	(mg/kg-day)	NA	per (mg/kg-day)	--	2.4E-07	(mg/kg-day)	1.0E-04	(mg/kg-day)	2.4E-03
				2,4,6-TRINITROTOLUENE	4.1E+03	(mg/kg)	9.7E-04	(mg/kg-day)	3.0E-02	per (mg/kg-day)	2.9E-05	2.8E-03	(mg/kg-day)	5.0E-04	(mg/kg-day)	5.6E+00
				2-NITROTOLUENE	1.6E+00	(mg/kg)	3.8E-07	(mg/kg-day)	2.2E-01	per (mg/kg-day)	8.4E-08	1.1E-06	(mg/kg-day)	9.0E-04	(mg/kg-day)	1.2E-03
				Inorganics												
				BARIUM	2.0E+03	(mg/kg)	4.7E-04	(mg/kg-day)	NA	per (mg/kg-day)	--	1.4E-03	(mg/kg-day)	2.0E-01	(mg/kg-day)	6.9E-03
				CADMIUM	4.3E+01	(mg/kg)	1.0E-05	(mg/kg-day)	NA	per (mg/kg-day)	--	2.9E-05	(mg/kg-day)	1.0E-03	(mg/kg-day)	2.9E-02
				CHROMIUM (HEXAVALENT)	1.5E+00	(mg/kg)	6.4E-07	(mg/kg-day)	5.0E-01	per (mg/kg-day)	3.2E-07	1.0E-06	(mg/kg-day)	3.0E-03	(mg/kg-day)	3.4E-04
				COPPER	6.6E+02	(mg/kg)	1.6E-04	(mg/kg-day)	NA	per (mg/kg-day)	--	4.5E-04	(mg/kg-day)	4.0E-02	(mg/kg-day)	1.1E-02
				IRON	4.7E+04	(mg/kg)	1.1E-02	(mg/kg-day)	NA	per (mg/kg-day)	--	3.2E-02	(mg/kg-day)	7.0E-01	(mg/kg-day)	4.6E-02
				NICKEL	1.1E+02	(mg/kg)	2.5E-05	(mg/kg-day)	NA	per (mg/kg-day)	--	7.3E-05	(mg/kg-day)	2.0E-02	(mg/kg-day)	3.6E-03
				ZINC	2.1E+04	(mg/kg)	4.9E-03	(mg/kg-day)	NA	per (mg/kg-day)	--	1.4E-02	(mg/kg-day)	3.0E-01	(mg/kg-day)	4.7E-02
				PAHs												
				BENZO(A)PYRENE	1.8E-01	(mg/kg)	7.7E-08	(mg/kg-day)	7.3E+00	per (mg/kg-day)	5.6E-07	1.2E-07	(mg/kg-day)	NA	(mg/kg-day)	--
			Exp. Route Total								**3.0E-05**					**5.8E+00**
			Dermal[1]	**Explosives**												
				2-AMINO-4,6-DINITROTOLUENE	4.7E+01	(mg/kg)	5.3E-07	(mg/kg-day)	NA	per (mg/kg-day)	--	1.5E-06	(mg/kg-day)	2.0E-03	(mg/kg-day)	7.7E-04
				4-AMINO-2,6-DINITROTOLUENE	3.3E+01	(mg/kg)	5.6E-07	(mg/kg-day)	NA	per (mg/kg-day)	--	1.6E-06	(mg/kg-day)	2.0E-03	(mg/kg-day)	8.2E-04
				2,4-DINITROTOLUENE	2.6E+00	(mg/kg)	4.9E-07	(mg/kg-day)	3.1E-01	per (mg/kg-day)	1.5E-07	1.4E-06	(mg/kg-day)	2.0E-03	(mg/kg-day)	7.1E-04
				2,6-DINITROTOLUENE	2.1E+00	(mg/kg)	3.8E-07	(mg/kg-day)	6.8E-01	per (mg/kg-day)	2.6E-07	1.1E-06	(mg/kg-day)	1.0E-03	(mg/kg-day)	1.1E-03
				RDX	6.1E-01	(mg/kg)	1.7E-08	(mg/kg-day)	1.1E-01	per (mg/kg-day)	1.9E-09	5.0E-08	(mg/kg-day)	3.0E-03	(mg/kg-day)	1.7E-05
				1,3-DINITROBENZENE	3.5E-01	(mg/kg)	6.5E-08	(mg/kg-day)	NA	per (mg/kg-day)	--	1.9E-07	(mg/kg-day)	1.0E-04	(mg/kg-day)	1.9E-03
				2,4,6-TRINITROTOLUENE	4.1E+03	(mg/kg)	7.7E-04	(mg/kg-day)	3.0E-02	per (mg/kg-day)	2.3E-05	2.2E-03	(mg/kg-day)	5.0E-04	(mg/kg-day)	4.5E+00
				2-NITROTOLUENE	1.6E+00	(mg/kg)	3.1E-07	(mg/kg-day)	2.2E-01	per (mg/kg-day)	6.7E-08	8.9E-07	(mg/kg-day)	9.0E-04	(mg/kg-day)	9.9E-04
				Inorganics												
				BARIUM	2.0E+03	(mg/kg)	NA	(mg/kg-day)	NA	per (mg/kg-day)	--	NA	(mg/kg-day)	1.4E-02	(mg/kg-day)	--
				CADMIUM	4.3E+01	(mg/kg)	1.5E-07	(mg/kg-day)	NA	per (mg/kg-day)	--	2.3E-07	(mg/kg-day)	2.5E-05	(mg/kg-day)	9.4E-03
				CHROMIUM (HEXAVALENT)	1.5E+00	(mg/kg)	NA	(mg/kg-day)	2.0E+01	per (mg/kg-day)	--	NA	(mg/kg-day)	7.5E-05	(mg/kg-day)	--
				COPPER	6.6E+02	(mg/kg)	NA	(mg/kg-day)	NA	per (mg/kg-day)	--	NA	(mg/kg-day)	4.0E-02	(mg/kg-day)	--
				IRON	4.7E+04	(mg/kg)	NA	(mg/kg-day)	NA	per (mg/kg-day)	--	NA	(mg/kg-day)	7.0E-01	(mg/kg-day)	--
				NICKEL	1.1E+02	(mg/kg)	NA	(mg/kg-day)	NA	per (mg/kg-day)	--	NA	(mg/kg-day)	8.0E-04	(mg/kg-day)	--
				ZINC	2.1E+04	(mg/kg)	NA	(mg/kg-day)	NA	per (mg/kg-day)	--	NA	(mg/kg-day)	3.0E-01	(mg/kg-day)	--
				PAHs												
				BENZO(A)PYRENE	1.8E-01	(mg/kg)	8.0E-08	(mg/kg-day)	7.3E+00	per (mg/kg-day)	5.8E-07	1.3E-07	(mg/kg-day)	NA	(mg/kg-day)	--
			Exp. Route Total								**2.4E-05**					**4.5E+00**
		Exposure Point Total									**5.5E-05**					**1.0E+01**
	Exposure Medium (Total Soil) Total										**5.5E-05**					**1.0E+01**

TABLE B-7.6
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU 8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Constituent of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Air	EU 8	Inhalation	**Explosives**												
				2-AMINO-4,6-DINITROTOLUENE	3.9E-08	(mg/m^3)	1.3E-05	(ug/m^3)	NA	per (ug/m^3)	--	3.7E-08	(mg/m^3)	NA	(mg/m^3)	--
				4-AMINO-2,6-DINITROTOLUENE	2.8E-08	(mg/m^3)	9.1E-06	(ug/m^3)	NA	per (ug/m^3)	--	2.6E-08	(mg/m^3)	NA	(mg/m^3)	--
				2,4-DINITROTOLUENE	2.1E-09	(mg/m^3)	6.9E-07	(ug/m^3)	8.9E-05	per (ug/m^3)	6.2E-11	2.0E-09	(mg/m^3)	NA	(mg/m^3)	--
				2,6-DINITROTOLUENE	1.7E-09	(mg/m^3)	5.6E-07	(ug/m^3)	NA	per (ug/m^3)	--	1.6E-09	(mg/m^3)	NA	(mg/m^3)	--
				RDX	5.1E-10	(mg/m^3)	1.7E-07	(ug/m^3)	NA	per (ug/m^3)	--	4.8E-10	(mg/m^3)	NA	(mg/m^3)	--
				1,3-DINITROBENZENE	2.9E-10	(mg/m^3)	9.5E-08	(ug/m^3)	NA	per (ug/m^3)	--	2.8E-10	(mg/m^3)	NA	(mg/m^3)	--
				2,4,6-TRINITROTOLUENE	3.4E-06	(mg/m^3)	1.1E-03	(ug/m^3)	NA	per (ug/m^3)	--	3.3E-06	(mg/m^3)	NA	(mg/m^3)	--
				2-NITROTOLUENE	1.3E-09	(mg/m^3)	4.4E-07	(ug/m^3)	NA	per (ug/m^3)	--	1.3E-09	(mg/m^3)	NA	(mg/m^3)	--
				Inorganics												
				BARIUM	1.7E-06	(mg/m^3)	5.5E-04	(ug/m^3)	NA	per (ug/m^3)	--	1.6E-06	(mg/m^3)	5.0E-04	(mg/m^3)	3.2E-03
				CADMIUM	3.5E-08	(mg/m^3)	1.2E-05	(ug/m^3)	1.8E-03	per (ug/m^3)	2.1E-08	3.4E-08	(mg/m^3)	2.0E-05	(mg/m^3)	1.7E-03
				CHROMIUM (HEXAVALENT)	1.2E-09	(mg/m^3)	4.1E-07	(ug/m^3)	8.4E-02	per (ug/m^3)	3.4E-08	1.2E-09	(mg/m^3)	1.0E-04	(mg/m^3)	1.2E-05
				COPPER	5.5E-07	(mg/m^3)	1.8E-04	(ug/m^3)	NA	per (ug/m^3)	--	5.3E-07	(mg/m^3)	NA	(mg/m^3)	--
				IRON	3.9E-05	(mg/m^3)	1.3E-02	(ug/m^3)	NA	per (ug/m^3)	--	3.7E-05	(mg/m^3)	NA	(mg/m^3)	--
				NICKEL	8.8E-08	(mg/m^3)	2.9E-05	(ug/m^3)	2.6E-04	per (ug/m^3)	7.5E-09	8.4E-08	(mg/m^3)	9.0E-05	(mg/m^3)	9.3E-04
				ZINC	1.7E-05	(mg/m^3)	5.7E-03	(ug/m^3)	NA	per (ug/m^3)	--	1.6E-05	(mg/m^3)	NA	(mg/m^3)	--
				PAHs												
				BENZO(A)PYRENE	1.5E-10	(mg/m^3)	8.9E-08	(ug/m^3)	1.1E-03	per (ug/m^3)	9.8E-11	1.4E-10	(mg/m^3)	NA	(mg/m^3)	--
			Exp. Route Total								**6.3E-08**					**5.8E-03**
		Exposure Point Total									**6.3E-08**					**5.8E-03**
	Exposure Medium (Air) Total										**6.3E-08**					**5.8E-03**
	Home Grown Produce	EU 8	Ingestion	**Explosives**												
				RDX	1.1E+00	(mg/kg)	4.1E-04	(mg/kg-day)	1.1E-01	per (mg/kg-day)	4.5E-05	1.2E-03	(mg/kg-day)	3.0E-03	(mg/kg-day)	4.0E-01
				Inorganics												
				BARIUM	5.1E+00	(mg/kg)	1.9E-03	(mg/kg-day)	NA	per (mg/kg-day)	--	5.5E-03	(mg/kg-day)	2.0E-01	(mg/kg-day)	2.7E-02
				CADMIUM	1.1E+00	(mg/kg)	4.1E-04	(mg/kg-day)	NA	per (mg/kg-day)	--	1.2E-03	(mg/kg-day)	1.0E-03	(mg/kg-day)	1.2E+00
				CHROMIUM (HEXAVALENT)	1.0E-03	(mg/kg)	6.8E-07	(mg/kg-day)	5.0E-01	per (mg/kg-day)	3.4E-07	1.1E-06	(mg/kg-day)	3.0E-03	(mg/kg-day)	3.7E-04
				COPPER	1.2E+01	(mg/kg)	4.2E-03	(mg/kg-day)	NA	per (mg/kg-day)	--	1.2E-02	(mg/kg-day)	4.0E-02	(mg/kg-day)	3.1E-01
				MERCURY	2.2E-03	(mg/kg)	8.0E-07	(mg/kg-day)	NA	per (mg/kg-day)	--	2.3E-06	(mg/kg-day)	1.0E-04	(mg/kg-day)	2.3E-02
				NICKEL	1.3E+00	(mg/kg)	4.9E-04	(mg/kg-day)	NA	per (mg/kg-day)	--	1.4E-03	(mg/kg-day)	2.0E-02	(mg/kg-day)	7.1E-02
				ZINC	3.4E+02	(mg/kg)	1.3E-01	(mg/kg-day)	NA	per (mg/kg-day)	--	3.7E-01	(mg/kg-day)	3.0E-01	(mg/kg-day)	1.2E+00
				PAHs												
				BENZO(A)PYRENE	2.8E-04	(mg/kg)	1.9E-07	(mg/kg-day)	7.3E+00	per (mg/kg-day)	1.4E-06	3.0E-07	(mg/kg-day)	NA	(mg/kg-day)	--
				Pesticides/PCBs												
				4,4'-DDT	7.6E-05	(mg/kg)	2.8E-08	(mg/kg-day)	3.4E-01	per (mg/kg-day)	9.4E-09	8.1E-08	(mg/kg-day)	5.0E-04	(mg/kg-day)	1.6E-04
			Exp. Route Total								**4.7E-05**					**3.3E+00**
		Exposure Point Total									**4.7E-05**					**3.3E+00**
	Exposure Medium (Home Grown Produce) Total										**4.7E-05**					**3.3E+00**

TABLE B-7.6
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU 8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Constituent of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Game Meat	EU 8	Ingestion	**Explosives**												
				RDX	6.4E-08	(mg/kg)	6.3E-14	(mg/kg-day)	1.1E-01	per (mg/kg-day)	6.9E-15	1.8E-13	(mg/kg-day)	3.0E-03	(mg/kg-day)	6.1E-11
				1,3-DINITROBENZENE	NA	(mg/kg)	NA	(mg/kg-day)	2.2E-01	per (mg/kg-day)	--	NA	(mg/kg-day)	9.0E-04	(mg/kg-day)	--
				2,4,6-TRINITROTOLUENE	NA	(mg/kg)	NA	(mg/kg-day)	0.0E+00	per (mg/kg-day)	--	NA	(mg/kg-day)	0.0E+00	(mg/kg-day)	--
				2-NITROTOLUENE	NA	(mg/kg)	NA	(mg/kg-day)	NA	per (mg/kg-day)	--	NA	(mg/kg-day)	1.0E+00	(mg/kg-day)	--
				Inorganics												
				BARIUM	7.1E-03	(mg/kg)	7.0E-09	(mg/kg-day)	NA	per (mg/kg-day)	--	2.0E-08	(mg/kg-day)	2.0E-01	(mg/kg-day)	1.0E-07
				CADMIUM	1.6E-04	(mg/kg)	1.6E-10	(mg/kg-day)	NA	per (mg/kg-day)	--	4.6E-10	(mg/kg-day)	1.0E-03	(mg/kg-day)	4.6E-07
				CHROMIUM (HEXAVALENT)	1.7E-04	(mg/kg)	3.0E-10	(mg/kg-day)	5.0E-01	per (mg/kg-day)	1.5E-10	4.9E-10	(mg/kg-day)	3.0E-03	(mg/kg-day)	1.6E-07
				COPPER	1.9E-01	(mg/kg)	1.9E-07	(mg/kg-day)	NA	per (mg/kg-day)	--	5.4E-07	(mg/kg-day)	4.0E-02	(mg/kg-day)	1.4E-05
				MERCURY	8.3E-06	(mg/kg)	8.2E-12	(mg/kg-day)	NA	per (mg/kg-day)	--	2.4E-11	(mg/kg-day)	1.0E-04	(mg/kg-day)	2.4E-07
				NICKEL	2.0E-02	(mg/kg)	2.0E-08	(mg/kg-day)	NA	per (mg/kg-day)	--	5.8E-08	(mg/kg-day)	2.0E-02	(mg/kg-day)	2.9E-06
				ZINC	5.2E-02	(mg/kg)	5.1E-08	(mg/kg-day)	NA	per (mg/kg-day)	--	1.5E-07	(mg/kg-day)	3.0E-01	(mg/kg-day)	5.0E-07
				PAHs												
				BENZO(A)PYRENE	1.1E-02	(mg/kg)	2.0E-08	(mg/kg-day)	7.3E+00	per (mg/kg-day)	1.4E-07	3.2E-08	(mg/kg-day)	NA	(mg/kg-day)	--
				Pesticides/PCBs												
				4,4'-DDT	4.3E-03	(mg/kg)	4.3E-09	(mg/kg-day)	3.4E-01	per (mg/kg-day)	1.5E-09	1.2E-08	(mg/kg-day)	5.0E-04	(mg/kg-day)	2.5E-05
			Exp. Route Total								**1.5E-07**					**4.3E-05**
		Exposure Point Total									**1.5E-07**					**4.3E-05**
	Exposure Medium (Game Meat) Total										**1.5E-07**					**4.3E-05**
Soil Total											**1.E-04**					**14**
										Total of Receptor Risks Across All Media	**1.E-04**				Total of Receptor Hazards Across All Media	**14**

1) Dermal carcinogenic and non-carcinogenic intakes equal "NA" due to no published Dermal Absorption Fraction (ABS) values for this COPC. Please see U.S. EPA 2004 guidance and Table H-5.3.
-- = No risk is calculated due to a lack of toxicity values.
CSF = Cancer Slope Factor
EPC = Exposure Point Concentration
NA = Not Available
PAHs = Polynuclear Aromatic Hydrocarbons
PCBs = Polychlorinated Bipheyls
RfC = Reference Concentration
RfD = Reference Dose

TABLE B-7.7
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU 8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Constituent of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Total Soil	EU 8	Ingestion	**Explosives**												
				2-AMINO-4,6-DINITROTOLUENE	4.7E+01	(mg/kg)	5.2E-05	(mg/kg-day)	NA	per (mg/kg-day)	--	6.0E-04	(mg/kg-day)	2.0E-03	(mg/kg-day)	3.0E-01
				4-AMINO-2,6-DINITROTOLUENE	3.3E+01	(mg/kg)	3.7E-05	(mg/kg-day)	NA	per (mg/kg-day)	--	4.3E-04	(mg/kg-day)	2.0E-03	(mg/kg-day)	2.1E-01
				2,4-DINITROTOLUENE	2.6E+00	(mg/kg)	2.8E-06	(mg/kg-day)	3.1E-01	per (mg/kg-day)	8.7E-07	3.3E-05	(mg/kg-day)	2.0E-03	(mg/kg-day)	1.6E-02
				2,6-DINITROTOLUENE	2.1E+00	(mg/kg)	2.2E-06	(mg/kg-day)	6.8E-01	per (mg/kg-day)	1.5E-06	2.6E-05	(mg/kg-day)	1.0E-03	(mg/kg-day)	2.6E-02
				RDX	6.1E-01	(mg/kg)	6.7E-07	(mg/kg-day)	1.1E-01	per (mg/kg-day)	7.4E-08	7.8E-06	(mg/kg-day)	3.0E-03	(mg/kg-day)	2.6E-03
				1,3-DINITROBENZENE	3.5E-01	(mg/kg)	3.8E-07	(mg/kg-day)	NA	per (mg/kg-day)	--	4.4E-06	(mg/kg-day)	1.0E-04	(mg/kg-day)	4.4E-02
				2,4,6-TRINITROTOLUENE	4.1E+03	(mg/kg)	4.5E-03	(mg/kg-day)	3.0E-02	per (mg/kg-day)	1.4E-04	5.3E-02	(mg/kg-day)	5.0E-04	(mg/kg-day)	1.1E+02
				2-NITROTOLUENE	1.6E+00	(mg/kg)	1.8E-06	(mg/kg-day)	2.2E-01	per (mg/kg-day)	3.9E-07	2.1E-05	(mg/kg-day)	9.0E-04	(mg/kg-day)	2.3E-02
				Inorganics												
				BARIUM	2.0E+03	(mg/kg)	2.2E-03	(mg/kg-day)	NA	per (mg/kg-day)	--	2.6E-02	(mg/kg-day)	2.0E-01	(mg/kg-day)	1.3E-01
				CADMIUM	4.3E+01	(mg/kg)	4.7E-05	(mg/kg-day)	NA	per (mg/kg-day)	--	5.5E-04	(mg/kg-day)	1.0E-03	(mg/kg-day)	5.5E-01
				CHROMIUM (HEXAVALENT)	1.5E+00	(mg/kg)	8.7E-06	(mg/kg-day)	5.0E-01	per (mg/kg-day)	4.4E-06	1.9E-05	(mg/kg-day)	3.0E-03	(mg/kg-day)	6.4E-03
				COPPER	6.6E+02	(mg/kg)	7.3E-04	(mg/kg-day)	NA	per (mg/kg-day)	--	8.5E-03	(mg/kg-day)	4.0E-02	(mg/kg-day)	2.1E-01
				IRON	4.7E+04	(mg/kg)	5.1E-02	(mg/kg-day)	NA	per (mg/kg-day)	--	6.0E-01	(mg/kg-day)	7.0E-01	(mg/kg-day)	8.6E-01
				NICKEL	1.1E+02	(mg/kg)	1.2E-04	(mg/kg-day)	NA	per (mg/kg-day)	--	1.4E-03	(mg/kg-day)	2.0E-02	(mg/kg-day)	6.8E-02
				ZINC	2.1E+04	(mg/kg)	2.3E-02	(mg/kg-day)	NA	per (mg/kg-day)	--	2.7E-01	(mg/kg-day)	3.0E-01	(mg/kg-day)	8.9E-01
				PAHs												
				BENZO(A)PYRENE	1.8E-01	(mg/kg)	1.0E-06	(mg/kg-day)	7.3E+00	per (mg/kg-day)	7.6E-06	2.3E-06	(mg/kg-day)	NA	(mg/kg-day)	--
			Exp. Route Total								**1.5E-04**					**1.1E+02**
			Dermal[1]	**Explosives**												
				2-AMINO-4,6-DINITROTOLUENE	4.7E+01	(mg/kg)	8.7E-07	(mg/kg-day)	NA	per (mg/kg-day)	--	1.0E-05	(mg/kg-day)	2.0E-03	(mg/kg-day)	5.1E-03
				4-AMINO-2,6-DINITROTOLUENE	3.3E+01	(mg/kg)	9.2E-07	(mg/kg-day)	NA	per (mg/kg-day)	--	1.1E-05	(mg/kg-day)	2.0E-03	(mg/kg-day)	5.4E-03
				2,4-DINITROTOLUENE	2.6E+00	(mg/kg)	8.0E-07	(mg/kg-day)	3.1E-01	per (mg/kg-day)	2.5E-07	9.3E-06	(mg/kg-day)	2.0E-03	(mg/kg-day)	4.7E-03
				2,6-DINITROTOLUENE	2.1E+00	(mg/kg)	6.2E-07	(mg/kg-day)	6.8E-01	per (mg/kg-day)	4.2E-07	7.3E-06	(mg/kg-day)	1.0E-03	(mg/kg-day)	7.3E-03
				RDX	6.1E-01	(mg/kg)	2.8E-08	(mg/kg-day)	1.1E-01	per (mg/kg-day)	3.1E-09	3.3E-07	(mg/kg-day)	3.0E-03	(mg/kg-day)	1.1E-04
				1,3-DINITROBENZENE	3.5E-01	(mg/kg)	1.1E-07	(mg/kg-day)	NA	per (mg/kg-day)	--	1.2E-06	(mg/kg-day)	1.0E-04	(mg/kg-day)	1.2E-02
				2,4,6-TRINITROTOLUENE	4.1E+03	(mg/kg)	1.3E-03	(mg/kg-day)	3.0E-02	per (mg/kg-day)	3.8E-05	1.5E-02	(mg/kg-day)	5.0E-04	(mg/kg-day)	2.9E+01
				2-NITROTOLUENE	1.6E+00	(mg/kg)	5.0E-07	(mg/kg-day)	2.2E-01	per (mg/kg-day)	1.1E-07	5.8E-06	(mg/kg-day)	9.0E-04	(mg/kg-day)	6.5E-03
				Inorganics												
				BARIUM	2.0E+03	(mg/kg)	NA	(mg/kg-day)	NA	per (mg/kg-day)	--	NA	(mg/kg-day)	1.4E-02	(mg/kg-day)	--
				CADMIUM	4.3E+01	(mg/kg)	1.3E-07	(mg/kg-day)	NA	per (mg/kg-day)	--	1.5E-06	(mg/kg-day)	2.5E-05	(mg/kg-day)	6.1E-02
				CHROMIUM (HEXAVALENT)	1.5E+00	(mg/kg)	NA	(mg/kg-day)	2.0E+01	per (mg/kg-day)	--	NA	(mg/kg-day)	7.5E-05	(mg/kg-day)	--
				COPPER	6.6E+02	(mg/kg)	NA	(mg/kg-day)	NA	per (mg/kg-day)	--	NA	(mg/kg-day)	4.0E-02	(mg/kg-day)	--
				IRON	4.7E+04	(mg/kg)	NA	(mg/kg-day)	NA	per (mg/kg-day)	--	NA	(mg/kg-day)	7.0E-01	(mg/kg-day)	--
				NICKEL	1.1E+02	(mg/kg)	NA	(mg/kg-day)	NA	per (mg/kg-day)	--	NA	(mg/kg-day)	8.0E-04	(mg/kg-day)	--
				ZINC	2.1E+04	(mg/kg)	NA	(mg/kg-day)	NA	per (mg/kg-day)	--	NA	(mg/kg-day)	3.0E-01	(mg/kg-day)	--
				PAHs												
				BENZO(A)PYRENE	1.8E-01	(mg/kg)	3.8E-07	(mg/kg-day)	7.3E+00	per (mg/kg-day)	2.8E-06	8.3E-07	(mg/kg-day)	NA	(mg/kg-day)	--
			Exp. Route Total								**4.1E-05**					**3.0E+01**
		Exposure Point Total									**1.9E-04**					**1.4E+02**
	Exposure Medium (Total Soil) Total										**1.9E-04**					**1.4E+02**

TABLE B-7.7
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU 8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Constituent of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Air	EU 8	Inhalation	**Explosives**												
				2-AMINO-4,6-DINITROTOLUENE	3.9E-08	(mg/m^3)	3.2E-06	(ug/m^3)	NA	per (ug/m^3)	--	3.7E-08	(mg/m^3)	NA	(mg/m^3)	--
				4-AMINO-2,6-DINITROTOLUENE	2.8E-08	(mg/m^3)	2.3E-06	(ug/m^3)	NA	per (ug/m^3)	--	2.6E-08	(mg/m^3)	NA	(mg/m^3)	--
				2,4-DINITROTOLUENE	2.1E-09	(mg/m^3)	1.7E-07	(ug/m^3)	8.9E-05	per (ug/m^3)	1.5E-11	2.0E-09	(mg/m^3)	NA	(mg/m^3)	--
				2,6-DINITROTOLUENE	1.7E-09	(mg/m^3)	1.4E-07	(ug/m^3)	NA	per (ug/m^3)	--	1.6E-09	(mg/m^3)	NA	(mg/m^3)	--
				RDX	5.1E-10	(mg/m^3)	4.2E-08	(ug/m^3)	NA	per (ug/m^3)	--	4.8E-10	(mg/m^3)	NA	(mg/m^3)	--
				1,3-DINITROBENZENE	2.9E-10	(mg/m^3)	2.4E-08	(ug/m^3)	NA	per (ug/m^3)	--	2.8E-10	(mg/m^3)	NA	(mg/m^3)	--
				2,4,6-TRINITROTOLUENE	3.4E-06	(mg/m^3)	2.8E-04	(ug/m^3)	NA	per (ug/m^3)	--	3.3E-06	(mg/m^3)	NA	(mg/m^3)	--
				2-NITROTOLUENE	1.3E-09	(mg/m^3)	1.1E-07	(ug/m^3)	NA	per (ug/m^3)	--	1.3E-09	(mg/m^3)	NA	(mg/m^3)	--
				Inorganics												
				BARIUM	1.7E-06	(mg/m^3)	1.4E-04	(ug/m^3)	NA	per (ug/m^3)	--	1.6E-06	(mg/m^3)	5.0E-04	(mg/m^3)	3.2E-03
				CADMIUM	3.5E-08	(mg/m^3)	2.9E-06	(ug/m^3)	1.8E-03	per (ug/m^3)	5.2E-09	3.4E-08	(mg/m^3)	2.0E-05	(mg/m^3)	1.7E-03
				CHROMIUM (HEXAVALENT)	1.2E-09	(mg/m^3)	1.0E-07	(ug/m^3)	8.4E-02	per (ug/m^3)	8.5E-09	1.2E-09	(mg/m^3)	1.0E-04	(mg/m^3)	1.2E-05
				COPPER	5.5E-07	(mg/m^3)	4.5E-05	(ug/m^3)	NA	per (ug/m^3)	--	5.3E-07	(mg/m^3)	NA	(mg/m^3)	--
				IRON	3.9E-05	(mg/m^3)	3.2E-03	(ug/m^3)	NA	per (ug/m^3)	--	3.7E-05	(mg/m^3)	NA	(mg/m^3)	--
				NICKEL	8.8E-08	(mg/m^3)	7.2E-06	(ug/m^3)	2.6E-04	per (ug/m^3)	1.9E-09	8.4E-08	(mg/m^3)	9.0E-05	(mg/m^3)	9.3E-04
				ZINC	1.7E-05	(mg/m^3)	1.4E-03	(ug/m^3)	NA	per (ug/m^3)	--	1.6E-05	(mg/m^3)	NA	(mg/m^3)	--
				PAHs												
				BENZO(A)PYRENE	1.5E-10	(mg/m^3)	6.5E-08	(ug/m^3)	1.1E-03	per (ug/m^3)	7.1E-11	1.4E-10	(mg/m^3)	NA	(mg/m^3)	--
			Exp. Route Total								**1.6E-08**					**5.8E-03**
		Exposure Point Total									**1.6E-08**					**5.8E-03**
	Exposure Medium (Air) Total										**1.6E-08**					**5.8E-03**
	Home Grown Produce	EU 8	Ingestion	**Explosives**												
				RDX	1.1E+00	(mg/kg)	1.0E-04	(mg/kg-day)	1.1E-01	per (mg/kg-day)	1.1E-05	1.2E-03	(mg/kg-day)	3.0E-03	(mg/kg-day)	4.0E-01
				Inorganics												
				BARIUM	5.1E+00	(mg/kg)	4.6E-04	(mg/kg-day)	NA	per (mg/kg-day)	--	5.4E-03	(mg/kg-day)	2.0E-01	(mg/kg-day)	2.7E-02
				CADMIUM	1.1E+00	(mg/kg)	1.0E-04	(mg/kg-day)	NA	per (mg/kg-day)	--	1.2E-03	(mg/kg-day)	1.0E-03	(mg/kg-day)	1.2E+00
				CHROMIUM (HEXAVALENT)	1.0E-03	(mg/kg)	4.9E-07	(mg/kg-day)	5.0E-01	per (mg/kg-day)	2.5E-07	1.1E-06	(mg/kg-day)	3.0E-03	(mg/kg-day)	3.6E-04
				COPPER	1.2E+01	(mg/kg)	1.0E-03	(mg/kg-day)	NA	per (mg/kg-day)	--	1.2E-02	(mg/kg-day)	4.0E-02	(mg/kg-day)	3.0E-01
				MERCURY	2.2E-03	(mg/kg)	2.0E-07	(mg/kg-day)	NA	per (mg/kg-day)	--	2.3E-06	(mg/kg-day)	1.0E-04	(mg/kg-day)	2.3E-02
				NICKEL	1.3E+00	(mg/kg)	1.2E-04	(mg/kg-day)	NA	per (mg/kg-day)	--	1.4E-03	(mg/kg-day)	2.0E-02	(mg/kg-day)	7.1E-02
				ZINC	3.4E+02	(mg/kg)	3.1E-02	(mg/kg-day)	NA	per (mg/kg-day)	--	3.6E-01	(mg/kg-day)	3.0E-01	(mg/kg-day)	1.2E+00
				PAHs												
				BENZO(A)PYRENE	2.8E-04	(mg/kg)	1.4E-07	(mg/kg-day)	7.3E+00	per (mg/kg-day)	9.9E-07	3.0E-07	(mg/kg-day)	NA	(mg/kg-day)	--
				Pesticides/PCBs												
				4,4'-DDT	7.6E-05	(mg/kg)	6.8E-09	(mg/kg-day)	3.4E-01	per (mg/kg-day)	2.3E-09	8.0E-08	(mg/kg-day)	5.0E-04	(mg/kg-day)	1.6E-04
			Exp. Route Total								**1.2E-05**					**3.2E+00**
		Exposure Point Total									**1.2E-05**					**3.2E+00**
	Exposure Medium (Home Grown Produce) Total										**1.2E-05**					**3.2E+00**

TABLE B-7.7
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU 8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Constituent of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Game Meat	EU 8	Ingestion	**Explosives**												
				RDX	6.4E-08	(mg/kg)	2.5E-14	(mg/kg-day)	NA	per (mg/kg-day)	--	2.9E-13	(mg/kg-day)	2.0E-03	(mg/kg-day)	1.4E-10
				Inorganics												
				BARIUM	7.1E-03	(mg/kg)	2.7E-09	(mg/kg-day)	NA	per (mg/kg-day)	--	3.2E-08	(mg/kg-day)	2.0E-01	(mg/kg-day)	1.6E-07
				CADMIUM	1.6E-04	(mg/kg)	6.2E-11	(mg/kg-day)	NA	per (mg/kg-day)	--	7.2E-10	(mg/kg-day)	1.0E-03	(mg/kg-day)	7.2E-07
				CHROMIUM (HEXAVALENT)	1.7E-04	(mg/kg)	3.5E-10	(mg/kg-day)	5.0E-01	per (mg/kg-day)	1.7E-10	7.7E-10	(mg/kg-day)	3.0E-03	(mg/kg-day)	2.6E-07
				COPPER	1.9E-01	(mg/kg)	7.3E-08	(mg/kg-day)	NA	per (mg/kg-day)	--	8.5E-07	(mg/kg-day)	4.0E-02	(mg/kg-day)	2.1E-05
				MERCURY	8.3E-06	(mg/kg)	3.2E-12	(mg/kg-day)	NA	per (mg/kg-day)	--	3.7E-11	(mg/kg-day)	1.0E-04	(mg/kg-day)	3.7E-07
				NICKEL	2.0E-02	(mg/kg)	7.8E-09	(mg/kg-day)	NA	per (mg/kg-day)	--	9.1E-08	(mg/kg-day)	2.0E-02	(mg/kg-day)	4.6E-06
				ZINC	5.2E-02	(mg/kg)	2.0E-08	(mg/kg-day)	NA	per (mg/kg-day)	--	2.3E-07	(mg/kg-day)	3.0E-01	(mg/kg-day)	7.8E-07
				PAHs												
				BENZO(A)PYRENE	1.1E-02	(mg/kg)	2.3E-08	(mg/kg-day)	7.3E+00	per (mg/kg-day)	1.7E-07	5.0E-08	(mg/kg-day)	NA	(mg/kg-day)	--
				Pesticides/PCBs												
				4,4'-DDT	4.3E-03	(mg/kg)	1.7E-09	(mg/kg-day)	3.4E-01	per (mg/kg-day)	5.7E-10	1.9E-08	(mg/kg-day)	5.0E-04	(mg/kg-day)	3.9E-05
			Exp. Route Total								**1.7E-07**					**6.7E-05**
		Exposure Point Total									**1.7E-07**					**6.7E-05**
	Exposure Medium (Game Meat) Total										**1.7E-07**					**6.7E-05**
Soil Total											**2.E-04**					**141**
										Total of Receptor Risks Across All Media	**2.E-04**				Total of Receptor Hazards Across All Media	**141**

1) Dermal carcinogenic and non-carcinogenic intakes equal "NA" due to no published Dermal Absorption Fraction (ABS) values for this COPC. Please see U.S. EPA 2004 guidance and Table H-5.3.
-- = No risk is calculated due to a lack of toxicity values.
CSF = Cancer Slope Factor
EPC = Exposure Point Concentration
NA = Not Available
PAHs = Polynuclear Aromatic Hydrocarbons
PCBs = Polychlorinated Bipheyls
RfC = Reference Concentration
RfD = Reference Dose

TABLE B-7.8

CALCULATIONS OF AIR CONCENTRATIONS DUE TO DUST ENTRAINMENT FROM SOIL

FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)

EU 8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY

Model Equations:

Particulate Emmision Factor	PEF = Q/C x [(3,600 s/h)/(.36 x (1- V) x $(Um/Ut)^3$ x F(x))] =	1.21E+09
Air Concentration	Cair = Csoil/PEF	m^3/kg

Model Constants:				
	Q/C	8.35E+01	g/m2-s per kg/m3	Averaged Q/C for Cleveland, Harrisburg, Hartford, and Philadelphia. NYSDEC 2006.
	V	5.00E-01	unitless	Default, U.S. EPA 1996 and NYSDEC 2006.
	Um	4.69E+00	m/s	Mean annual wind speed, U.S.EPA 1996 and NYSDEC 2006.
	Ut	1.13E+01	m/s	Equivalent thresghold value of windspeed at 7 m, U.S.EPA 1996 and NYSDEC 2006.
	F(x)	1.94E-01	unitless	Default, U.S.EPA 1996 and NYSDEC 2006.

Reference for the model: USEPA Soil Screening Guidance: Technical Background Document. Office of Emergency and Remedial Response. U.S. EPA 1996.

Constituent of Potential Concern	**Csoil, Surface Soil**	**Csoil, Total Soil**	**Cair, Surface Soil Particulate**	**Cair, Total Soil Particulate**
	RME EPC	RME EPC	RME EPC	RME EPC
	mg/kg	mg/kg	mg/m^3	mg/m^3
Explosives				
2-AMINO-4,6-DINITROTOLUENE	6.79E+01	4.72E+01	5.61E-08	3.90E-08
4-AMINO-2,6-DINITROTOLUENE	4.84E+01	3.34E+01	4.00E-08	2.76E-08
2,4-DINITROTOLUENE	7.03E+00	2.56E+00	5.81E-09	2.11E-09
2,6-DINITROTOLUENE	3.08E+00	2.05E+00	2.55E-09	1.70E-09
RDX	7.70E-01	6.12E-01	6.36E-10	5.06E-10
1,3-DINITROBENZENE	6.79E-01	3.48E-01	5.61E-10	2.88E-10
2,4,6-TRINITROTOLUENE	6.00E+03	4.11E+03	4.96E-06	3.40E-06
2-NITROTOLUENE	3.09E+00	1.63E+00	2.55E-09	1.35E-09
Inorganics				
BARIUM	2.85E+03	2.01E+03	2.35E-06	1.66E-06
CADMIUM	6.27E+01	4.28E+01	5.18E-08	3.53E-08
CHROMIUM (HEXAVALENT)	1.91E+00	1.49E+00	1.58E-09	1.23E-09
COPPER	9.60E+02	6.64E+02	7.94E-07	5.49E-07
IRON	NA	4.69E+04	NA	3.87E-05
NICKEL	1.86E+02	1.06E+02	1.54E-07	8.75E-08
ZINC	2.96E+04	2.08E+04	2.44E-05	1.72E-05
PAHs				
BENZO(A)PYRENE	1.79E-01	1.79E-01	1.48E-10	1.48E-10

NA = Not applicable because the chemical is not a COPC in this media.

TABLE B-7.9
CALCULATIONS OF CONTAMINANT CONCENTRATIONS IN HOME GROWN PRODUCE
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)

EU 8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY

Model Equations:

$Pr = Cs * Br_{ag} * 0.12$ mg/kg — Concentration of COPC in plant due to root uptake

Model Constants:

C_s chemical-specific mg/kg — COPC concentration in soil (mg/kg).

Br_{ag} = chemical-specific unitless — Plant to soil bioconcentration factor (unitless), above ground produce and forage

Reference for the model: Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities. U.S. EPA 2005.

Constituent of Potential Concern	Cs, Surface Soil RME EPC mg/kg	Br_{ag} (1) unitless	Reference	P_r RME EPC mg/kg
Explosives				
RDX	7.70E-01	1.22E+01	U.S. EPA 2005	1.12E+00
Inorganics				
BARIUM	2.85E+03	1.50E-02	U.S. EPA 2005	5.13E+00
CADMIUM	6.27E+01	1.50E-01	U.S. EPA 2005	1.13E+00
CHROMIUM (HEXAVALENT)	1.91E+00	4.50E-03	U.S. EPA 2005	1.03E-03
COPPER	9.60E+02	1.00E-01	U.S. DOE 2012	1.15E+01
MERCURY	6.20E-01	2.94E-02	U.S. EPA 2005	2.19E-03
NICKEL	1.86E+02	6.00E-02	U.S. EPA 2005	1.34E+00
ZINC	2.96E+04	9.70E-02	U.S. EPA 2005	3.44E+02
PAHs				
BENZO(A)PYRENE	1.79E-01	1.32E-02	U.S. EPA 2005	2.84E-04
Pesticides/PCBs				
4,4'-DDT	8.14E-02	7.74E-03	U.S. EPA 2005	7.56E-05

References:

U. S. EPA, 2005. *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, Final, EPA/530/R-05/006, Washington, D.C.
U.S. DOE, 2012. *Risk Assessment Information System*, online database available at: http://rais.ornl.gov. Assuming soil-to-wet plant uptake.

TABLE B-7.10
CALCULATIONS OF CONTAMINANT CONCENTRATIONS IN DEER MEAT
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)

EU 8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY

Model Equations:

$$CM = (F_i * Q_{p(forage,\ deer)} * P_i + Q_{soil(deer)} * C_s * B_S) * Ba_{deer} * MF$$

Model Constants:				
	F_i	1	unitless	Fraction of plant type grown on contaminated soil and ingested by deer, assume deer only consume forage grown on contaminated soil.
	$Q_{p(forage,deer)}$	1.463	kg/day	Quantity of forage ingested by deer per day. Higley and Kuperman, 1996
	P_i	calculated	mg/kg	Concentration of COPC in plant ingested by deer. $Cs * Br_{ag}$ Cs = COPC concentration in soil (mg/kg). Br_{ag} = plant to soil bioconcentration factor (unitless)
	$Q_{soil(deer)}$	0.08	kg/day	Quantity of soil ingested by deer.
	C_s	chemical-specific	mg/kg	Surface soil concentration
	B_s	1	unitless	Soil bioavailability factor.
	$B_{a,beef}$	chemical-specific	day/kg	Biotransfer factor for beef.
	$B_{a,deer}$	calculated	day/kg	Biotransfer factor for venison.
	MF	1	unitless	Metabolism factor for all constituents, except bis(2-ethylhexyl)phthalate = 0.01

Reference for the model: Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities. U.S. EPA 2005.

Constituent of Potential Concern	**Cs, Surface Soil** RME EPC mg/kg	**Br_{ag} (1)** unitless	**P_i** mg/kg	**$B_{a,beef}$** day/kg	**$B_{a,deer}$** day/kg	**CM** RME EPC mg/kg
Explosives						
RDX	7.70E-01	1.22E+01	1.12E+00	1.86E-07	3.75E-08	6.40E-08
Inorganics						
BARIUM	2.85E+03	1.50E-02	5.13E+00	1.50E-04	3.02E-05	7.11E-03
CADMIUM	6.27E+01	1.50E-01	1.13E+00	1.20E-04	2.42E-05	1.61E-04
CHROMIUM (HEXAVALENT)	1.91E+00	4.50E-03	1.03E-03	5.50E-03	1.11E-03	1.71E-04
COPPER	9.60E+02	1.00E-01	1.15E+01	1.00E-02	2.01E-03	1.89E-01
MERCURY	6.20E-01	2.94E-02	2.19E-03	7.80E-04	1.57E-04	8.29E-06
NICKEL	1.86E+02	6.00E-02	1.34E+00	6.00E-03	1.21E-03	2.03E-02
ZINC	2.96E+04	9.70E-02	3.44E+02	9.00E-05	1.81E-05	5.20E-02
PAHs						
BENZO(A)PYRENE	1.79E-01	1.32E-02	2.84E-04	3.75E+00	7.55E-01	1.11E-02
Pesticides/PCBs						
4,4'-DDT	8.14E-02	7.74E-03	7.56E-05	3.25E+00	6.54E-01	4.33E-03

(1) Br_{ag} shown on Table I-7.9.

(2) Ba,deer taken from USEPA, 2005. *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities* , Final, EPA/530/R-05/006, Washington, D.C. The Ba,deer is calculated from uptake factors for beef, assuming a venison to beef fat content ratio of 2.9/14.4. Therefore, log (Ba,beef) = (-7.6 + log Kow).

TABLE B-9.1
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU 8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY

Location: Former Lake Ontario Ordnance Works
Scenario Timeframe: Current/Future
Receptor Population: Trespasser
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Constituent of Potential Concern	Carcinogenic Risk				Constituent of Potential Concern	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Soil	Surface Soil	EU 8	**Explosives**					**Explosives**					
			2-AMINO-4,6-DINITROTOLUENE	--	--	--	NA	2-AMINO-4,6-DINITROTOLUENE	CNS, Digestive System	3.5E-03	1.7E-04	--	3.6E-03
			4-AMINO-2,6-DINITROTOLUENE	--	--	--	NA	4-AMINO-2,6-DINITROTOLUENE	CNS, Digestive System	2.5E-03	1.8E-04	--	2.6E-03
			2,4-DINITROTOLUENE	9.5E-08	7.7E-08	2.6E-12	1.7E-07	2,4-DINITROTOLUENE	CNS, Digestive System	3.6E-04	2.9E-04	--	6.5E-04
			2,6-DINITROTOLUENE	9.1E-08	7.2E-08	--	1.6E-07	2,6-DINITROTOLUENE	CNS, Liver, and Blood	3.1E-04	2.5E-04	--	5.6E-04
			RDX	3.7E-09	4.4E-10	--	4.1E-09	RDX	Prostate	2.6E-05	3.1E-06	--	2.9E-05
			1,3-DINITROBENZENE	--	--	--	NA	1,3-DINITROBENZENE	Spleen	6.9E-04	5.5E-04	--	1.2E-03
			2,4,6-TRINITROTOLUENE	7.9E-06	6.3E-06	--	1.4E-05	2,4,6-TRINITROTOLUENE	Liver	1.2E+00	9.7E-01	--	2.2E+00
			2-NITROTOLUENE	3.0E-08	2.4E-08	--	5.3E-08	2-NITROTOLUENE	Bone Marrow	3.5E-04	2.8E-04	--	6.3E-04
			Inorganics					**Inorganics**					
			BARIUM	--	--	--	NA	BARIUM	Kidneys	1.4E-03	--	5.6E-05	1.5E-03
			CADMIUM	--	--	4.7E-10	4.7E-10	CADMIUM	Kidneys	6.4E-03	2.0E-03	3.1E-05	8.4E-03
			CHROMIUM (HEXAVALENT)	4.2E-08	--	6.7E-10	4.2E-08	CHROMIUM (HEXAVALENT)	None	6.5E-05	--	1.9E-07	6.5E-05
			COPPER	--	--	--	NA	COPPER	Liver and Kidneys	2.4E-03	--	--	2.4E-03
			NICKEL	--	--	2.0E-10	2.0E-10	NICKEL	Body Weight	9.5E-04	--	2.0E-05	9.7E-04
			ZINC	--	--	--	NA	ZINC	Blood	1.0E-02	--	--	1.0E-02
			PAHs					**PAHs**					
			BENZO(A)PYRENE	5.7E-08	5.9E-08	8.3E-13	1.2E-07	BENZO(A)PYRENE	NA	--	--	--	NA
			(Total)	8.2E-06	6.5E-06	1.4E-09	1.5E-05		(Total)	1.3	0.98	0.00011	2.2
	Game Meat	EU 8	**Explosives**					**Explosives**					
			RDX	8.7E-15	--	--	8.7E-15	RDX	Prostate	6.1E-11	--	--	6.1E-11
			Inorganics					**Inorganics**					
			BARIUM	--	--	--	NA	BARIUM	Kidneys	1.0E-07	--	--	1.0E-07
			CADMIUM	--	--	--	NA	CADMIUM	Kidneys	4.6E-07	--	--	4.6E-07
			CHROMIUM (HEXAVALENT)	1.1E-10	--	--	1.1E-10	CHROMIUM (HEXAVALENT)	None	1.6E-07	--	--	1.6E-07
			COPPER	--	--	--	NA	COPPER	Liver and Kidneys	1.4E-05	--	--	1.4E-05
			MERCURY	--	--	--	NA	MERCURY	Central Nervous System	2.4E-07	--	--	2.4E-07
			NICKEL	--	--	--	NA	NICKEL	Body Weight	2.9E-06	--	--	2.9E-06
			ZINC	--	--	--	NA	ZINC	Blood	5.0E-07	--	--	5.0E-07
			PAHs					**PAHs**					
			BENZO(A)PYRENE	1.0E-07	--	--	1.0E-07	BENZO(A)PYRENE	NA	--	--	--	NA
			Pesticides/PCBs					**Pesticides/PCBs**					
			4,4'-DDT	1.8E-09	--	--	1.8E-09	4,4'-DDT	NA	2.5E-05	--	--	2.5E-05
			(Total)	1.0E-07	---	---	1.0E-07		(Total)	0.0000	---	---	0.0000
					Total Risk Across Surface Soil		**1.E-05**				**Total Hazard Index Across Surface Soil**		**2**
					Total Risk Across All Media and All Exposure Routes		**1.E-05**				**Total Hazard Index Across All Media and All Exposure Routes**		**2**

TABLE B-9.1
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU 8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY

Location: Former Lake Ontario Ordnance Works
Scenario Timeframe: Current/Future
Receptor Population: Trespasser
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Constituent of Potential Concern	Carcinogenic Risk				Constituent of Potential Concern	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total

NA = Not Applicable due to no toxicity values
-- = No risks calculated for this exposure pathway

Total Hazard Index Liver, Across All Media and All Exposure Routes	**2**
Total Hazard Index Blood, Across All Media and All Exposure Routes	**0.01**
Total Hazard Index CNS, Across All Media and All Exposure Routes	**0.007**
Total Hazard Index Kidneys, Across All Media and All Exposure Routes	**0.01**
Total Hazard Index Prostate, Across All Media and All Exposure Routes	**0.00003**
Total Hazard Index Digestive System, Across All Media and All Exposure Routes	**0.007**
Total Hazard Index Spleen, Across All Media and All Exposure Routes	**0.001**
Total Hazard Index Bone Marrow, Across All Media and All Exposure Routes	**0.0006**
Total Hazard Index Body Weight, Across All Media and All Exposure Routes	**0.0010**

TABLE B-9.2
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU 8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY

Location: Former Lake Ontario Ordnance Works
Scenario Timeframe: Current/Future
Receptor Population: Trespasser
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Constituent of Potential Concern	Carcinogenic Risk				Constituent of Potential Concern	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Soil	Surface Soil	EU 8	**Explosives**					**Explosives**					
			2-AMINO-4,6-DINITROTOLUENE	--	--	--	NA	2-AMINO-4,6-DINITROTOLUENE	CNS, Digestive System	1.1E-02	4.8E-04	--	1.1E-02
			4-AMINO-2,6-DINITROTOLUENE	--	--	--	NA	4-AMINO-2,6-DINITROTOLUENE	CNS, Digestive System	7.7E-03	5.1E-04	--	8.2E-03
			2,4-DINITROTOLUENE	9.9E-08	7.4E-08	8.8E-13	1.7E-07	2,4-DINITROTOLUENE	CNS, Digestive System	1.1E-03	8.4E-04	--	2.0E-03
			2,6-DINITROTOLUENE	9.5E-08	6.9E-08	--	1.6E-07	2,6-DINITROTOLUENE	CNS, Liver, and Blood	9.8E-04	7.1E-04	--	1.7E-03
			RDX	3.8E-09	4.3E-10	--	4.3E-09	RDX	Prostate	8.1E-05	9.0E-06	--	9.0E-05
			1,3-DINITROBENZENE	--	--	--	NA	1,3-DINITROBENZENE	Spleen	2.1E-03	1.6E-03	--	3.7E-03
			2,4,6-TRINITROTOLUENE	8.1E-06	6.0E-06	--	1.4E-05	2,4,6-TRINITROTOLUENE	Liver	3.8E+00	2.8E+00	--	6.6E+00
			2-NITROTOLUENE	3.1E-08	2.3E-08	--	5.3E-08	2-NITROTOLUENE	Bone Marrow	1.1E-03	8.0E-04	--	1.9E-03
			Inorganics					**Inorganics**					
			BARIUM	--	--	--	NA	BARIUM	Kidneys	4.5E-03	--	5.6E-05	4.6E-03
			CADMIUM	--	--	1.6E-10	1.6E-10	CADMIUM	Kidneys	2.0E-02	5.9E-03	3.1E-05	2.6E-02
			CHROMIUM (HEXAVALENT)	1.3E-07	--	2.2E-10	1.3E-07	CHROMIUM (HEXAVALENT)	None	2.0E-04	--	1.9E-07	2.0E-04
			COPPER	--	--	--	NA	COPPER	Liver and Kidneys	7.6E-03	--	--	7.6E-03
			NICKEL	--	--	6.8E-11	6.8E-11	NICKEL	Body Weight	2.9E-03	--	2.0E-05	3.0E-03
			ZINC	--	--	--	NA	ZINC	Blood	3.1E-02	--	--	3.1E-02
			PAHs					**PAHs**					
			BENZO(A)PYRENE	1.8E-07	1.7E-07	8.3E-13	3.5E-07	BENZO(A)PYRENE	NA	--	--	--	NA
			(Total)	8.7E-06	6.4E-06	4.5E-10	1.5E-05		(Total)	3.9	2.8	0.00011	6.7
	Game Meat	EU 8	**Explosives**					**Explosives**					
			RDX	4.5E-15	--	--	4.5E-15	RDX	0.0E+00	9.5E-11	--	--	9.5E-11
			Inorganics					**Inorganics**					
			BARIUM	--	--	--	NA	BARIUM	Kidneys	1.6E-07	--	--	1.6E-07
			CADMIUM	--	--	--	NA	CADMIUM	Kidneys	7.2E-07	--	--	7.2E-07
			CHROMIUM (HEXAVALENT)	1.6E-10	--	--	1.6E-10	CHROMIUM (HEXAVALENT)	None	2.5E-07	--	--	2.5E-07
			COPPER	--	--	--	NA	COPPER	Liver and Kidneys	2.1E-05	--	--	2.1E-05
			MERCURY	--	--	--	NA	MERCURY	Central Nervous System	3.7E-07	--	--	3.7E-07
			NICKEL	--	--	--	NA	NICKEL	Body Weight	4.5E-06	--	--	4.5E-06
			ZINC	--	--	--	NA	ZINC	Blood	7.7E-07	--	--	7.7E-07
			PAHs					**PAHs**					
			BENZO(A)PYRENE	4.7E-07	--	--	4.7E-07	BENZO(A)PYRENE	NA	--	--	--	NA
			Pesticides/PCBs					**Pesticides/PCBs**					
			4,4'-DDT	9.4E-10	--	--	9.4E-10	4,4'-DDT	NA	3.9E-05	--	--	3.9E-05
			(Total)	4.7E-07	---	---	4.7E-07		(Total)	0.0001	---	---	0.0001
						Total Risk Across Surface Soil	**2.E-05**					**Total Hazard Index Across Surface Soil**	**7**
						Total Risk Across All Media and All Exposure Routes	**2.E-05**					**Total Hazard Index Across All Media and All Exposure Routes**	**7**

TABLE B-9.2
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU 8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY

Location: Former Lake Ontario Ordnance Works

Scenario Timeframe: Current/Future
Receptor Population: Trespasser
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Constituent of Potential Concern	Carcinogenic Risk				Constituent of Potential Concern	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total

NA = Not Applicable due to no toxicity values

-- = No risks calculated for this exposure pathway

Total Hazard Index Liver, Across All Media and All Exposure Routes	**7**
Total Hazard Index Blood, Across All Media and All Exposure Routes	**0.03**
Total Hazard Index CNS, Across All Media and All Exposure Routes	**0.02**
Total Hazard Index Kidneys, Across All Media and All Exposure Routes	**0.04**
Total Hazard Index Prostate, Across All Media and All Exposure Routes	**0.00009**
Total Hazard Index Digestive System, Across All Media and All Exposure Routes	**0.02**
Total Hazard Index Spleen, Across All Media and All Exposure Routes	**0.004**
Total Hazard Index Bone Marrow, Across All Media and All Exposure Routes	**0.002**
Total Hazard Index Body Weight, Across All Media and All Exposure Routes	**0.0030**

TABLE B-9.3
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU 8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY

Location: Former Lake Ontario Ordnance Works
Scenario Timeframe: Future
Receptor Population: Maintenance Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Constituent of Potential Concern	Carcinogenic Risk				Constituent of Potential Concern	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Soil	Surface Soil	EU 8	**Explosives**					**Explosives**					
			2,4-DINITROTOLUENE	3.8E-07	1.8E-07	4.2E-11	5.6E-07	2,4-DINITROTOLUENE	CNS, Digestive System	1.7E-03	8.1E-04	--	2.5E-03
			2,4,6-TRINITROTOLUENE	3.1E-05	1.5E-05	--	4.6E-05	2,4,6-TRINITROTOLUENE	Liver	5.9E+00	2.7E+00	--	8.6E+00
			2-NITROTOLUENE	1.2E-07	5.5E-08	--	1.7E-07	2-NITROTOLUENE	Bone Marrow	1.7E-03	7.8E-04	--	2.5E-03
			Inorganics					**Inorganics**					
			CHROMIUM (HEXAVALENT)	3.3E-07	--	1.1E-08	3.4E-07	CHROMIUM (HEXAVALENT)	None	6.2E-04	--	3.6E-06	6.3E-04
			COPPER	--	--	--	NA	COPPER	Liver and Kidneys	2.3E-02	--	--	2.3E-02
			ZINC	--	--	--	NA	ZINC	Blood	9.6E-02	--	--	9.6E-02
			(Total)	3.2E-05	1.5E-05	1.1E-08	4.7E-05		(Total)	6.0	2.7	0.0000	8.7
					Total Risk Across Surface Soil		**5.E-05**				**Total Hazard Index Across Surface Soil**		**9**
						Total Risk Across All Media and All Exposure Routes	**5.E-05**					**Total Hazard Index Across All Media and All Exposure Routes**	**9**

NA = Not Applicable due to no toxicity values
-- = No risks calculated for this exposure pathway

Total Hazard Index Liver, Across All Media and All Exposure Routes	**9**
Total Hazard Index Blood, Across All Media and All Exposure Routes	**0.1**
Total Hazard Index CNS, Across All Media and All Exposure Routes	**0.003**
Total Hazard Index Kidneys, Across All Media and All Exposure Routes	**0.02**
Total Hazard Index Digestive System, Across All Media and All Exposure Routes	**0.003**
Total Hazard Index Bone Marrow, Across All Media and All Exposure Routes	**0.002**

TABLE B-9.4
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU 8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY

Location: Former Lake Ontario Ordnance Works
Scenario Timeframe: Future
Receptor Population: Commercial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Constituent of Potential Concern	Carcinogenic Risk				Constituent of Potential Concern	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Soil	Surface Soil	EU 8	**Explosives**					**Explosives**					
			2,4-DINITROTOLUENE	3.8E-07	5.1E-08	5.3E-12	4.3E-07	2,4-DINITROTOLUENE	CNS, Digestive System	1.7E-03	2.3E-04	--	2.0E-03
			2,4,6-TRINITROTOLUENE	3.1E-05	4.2E-06	--	3.6E-05	2,4,6-TRINITROTOLUENE	Liver	5.9E+00	7.7E-01	--	6.6E+00
			2-NITROTOLUENE	1.2E-07	1.6E-08	--	1.3E-07	2-NITROTOLUENE	Bone Marrow	1.7E-03	2.2E-04	--	1.9E-03
			Inorganics					**Inorganics**					
			CHROMIUM (HEXAVALENT)	1.7E-07	--	1.4E-09	1.7E-07	CHROMIUM (HEXAVALENT)	None	3.1E-04	--	4.5E-07	3.1E-04
			COPPER	--	--	--	NA	COPPER	Liver and Kidneys	1.2E-02	--	--	1.2E-02
			ZINC	--	--	--	NA	ZINC	Blood	4.8E-02	--	--	4.8E-02
			(Total)	3.2E-05	4.2E-06	1.4E-09	3.6E-05		(Total)	5.9	0.8	0.00000	6.7
						Total Risk Across Surface Soil	**4.E-05**					**Total Hazard Index Across Surface Soil**	**7**
						Total Risk Across All Media and All Exposure Routes	**4.E-05**					**Total Hazard Index Across All Media and All Exposure Routes**	**7**

NA = Not Applicable due to no toxicity values
-- = No risks calculated for this exposure pathway

Total Hazard Index Liver, Across All Media and All Exposure Routes	**7**
Total Hazard Index Blood, Across All Media and All Exposure Routes	**0.05**
Total Hazard Index CNS, Across All Media and All Exposure Routes	**0.002**
Total Hazard Index Kidneys, Across All Media and All Exposure Routes	**0.01**
Total Hazard Index Digestive System, Across All Media and All Exposure Routes	**0.002**
Total Hazard Index Bone Marrow, Across All Media and All Exposure Routes	**0.002**

TABLE B-9.5
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU 8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY

Location: Former Lake Ontario Ordnance Works

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Constituent of Potential Concern	Carcinogenic Risk				Constituent of Potential Concern	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Soil	Total Soil	EU 8	**Explosives**					**Explosives**					
			2,4-DINITROTOLUENE	5.3E-08	7.5E-09	6.1E-13	6.1E-08	2,4-DINITROTOLUENE	CNS, Digestive System	6.0E-03	8.4E-04	--	6.8E-03
			2,4,6-TRINITROTOLUENE	8.3E-06	1.1E-06	--	9.4E-06	2,4,6-TRINITROTOLUENE	Liver	3.9E+01	5.3E+00	--	4.4E+01
			2-NITROTOLUENE	2.4E-08	3.3E-09	--	2.7E-08	2-NITROTOLUENE	Bone Marrow	8.5E-03	1.2E-03	--	9.7E-03
			Inorganics					**Inorganics**					
			CADMIUM	--	--	2.1E-10	2.1E-10	CADMIUM	Kidneys	2.0E-01	1.1E-02	4.0E-04	2.1E-01
			CHROMIUM (HEXAVALENT)	5.0E-08	--	3.4E-10	5.0E-08	CHROMIUM (HEXAVALENT)	None	2.3E-03	--	2.8E-06	2.3E-03
			COPPER	--	--	--	NA	COPPER	Liver and Kidneys	7.8E-02	--	--	7.8E-02
			IRON	--	--	--	NA	IRON	Gastrointestinal System	3.1E-01	--	--	3.1E-01
			ZINC	--	--	--	NA	ZINC	Blood	3.3E-01	--	--	3.3E-01
			(Total)	8.4E-06	1.1E-06	5.5E-10	9.5E-06		(Total)	39.5	5.3	0.0004	45
						Total Risk Across Total Soil	**1.E-05**					**Total Hazard Index Across Total Soil**	**45**
						Total Risk Across All Media and All Exposure Routes	**1.E-05**					**Total Hazard Index Across All Media and All Exposure Routes**	**45**

Total Hazard Index Liver, Across All Media and All Exposure Routes	**44**
Total Hazard Index Blood, Across All Media and All Exposure Routes	**0.3**
Total Hazard Index CNS, Across All Media and All Exposure Routes	**0.007**
Total Hazard Index Kidneys, Across All Media and All Exposure Routes	**0.3**

NA = Not Applicable due to no toxicity values
-- = No risks calculated for this exposure pathway

TABLE B-9.6
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU 8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY

Location: Former Lake Ontario Ordnance Works
Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child and Adult

Medium	Exposure Medium	Exposure Point	Constituent of Potential Concern	Carcinogenic Risk				Constituent of Potential Concern	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Soil	Total Soil Child	EU 8	**Explosives**					**Explosives**					
			2-AMINO-4,6-DINITROTOLUENE	--	--	--	NA	2-AMINO-4,6-DINITROTOLUENE	CNS, Digestive System	3.0E-01	5.1E-03	--	3.1E-01
			4-AMINO-2,6-DINITROTOLUENE	--	--	--	NA	4-AMINO-2,6-DINITROTOLUENE	CNS, Digestive System	2.1E-01	5.4E-03	--	2.2E-01
			2,4-DINITROTOLUENE	8.7E-07	2.5E-07	1.5E-11	1.1E-06	2,4-DINITROTOLUENE	CNS, Digestive System	1.6E-02	4.7E-03	--	2.1E-02
			2,6-DINITROTOLUENE	1.5E-06	4.2E-07	--	2.0E-06	2,6-DINITROTOLUENE	CNS, Liver, and Blood	2.6E-02	7.3E-03	--	3.3E-02
			RDX	7.4E-08	3.1E-09	--	7.7E-08	RDX	Prostate	2.6E-03	1.1E-04	--	2.7E-03
			1,3-DINITROBENZENE	--	--	--	NA	1,3-DINITROBENZENE	Spleen	4.4E-02	1.2E-02	--	5.7E-02
			2,4,6-TRINITROTOLUENE	1.4E-04	3.8E-05	--	1.7E-04	2,4,6-TRINITROTOLUENE	Liver	1.1E+02	2.9E+01	--	1.3E+02
			2-NITROTOLUENE	3.9E-07	1.1E-07	--	5.0E-07	2-NITROTOLUENE	Bone Marrow	2.3E-02	6.5E-03	--	3.0E-02
			Inorganics					**Inorganics**					
			BARIUM	--	--	--	NA	BARIUM	Kidneys	1.3E-01	--	3.2E-03	1.3E-01
			CADMIUM	--	--	5.2E-09	5.2E-09	CADMIUM	Kidneys	5.5E-01	6.1E-02	1.7E-03	6.1E-01
			CHROMIUM (HEXAVALENT)	4.4E-06	--	8.5E-09	4.4E-06	CHROMIUM (HEXAVALENT)	None	6.4E-03	--	1.2E-05	6.4E-03
			COPPER	--	--	--	NA	COPPER	Liver and Kidneys	2.1E-01	--	--	2.1E-01
			IRON	--	--	--	NA	IRON	Gastrointestinal System	8.6E-01	--	--	8.6E-01
			NICKEL	--	--	1.9E-09	1.9E-09	NICKEL	Body Weight	6.8E-02	--	9.3E-04	6.9E-02
			ZINC	--	--	--	NA	ZINC	Blood	8.9E-01	--	--	8.9E-01
			PAHs					**PAHs**					
			BENZO(A)PYRENE	7.6E-06	2.8E-06	7.1E-11	1.0E-05	BENZO(A)PYRENE	NA	--	--	--	NA
			(Total for Child)	1.5E-04	4.1E-05	1.6E-08	1.9E-04		(Total for Child)	108	30	0.006	138
	Total Soil Adult	EU 8	**Explosives**					**Explosives**					
			2-AMINO-4,6-DINITROTOLUENE	--	--	--	NA	2-AMINO-4,6-DINITROTOLUENE	CNS, Digestive System	1.6E-02	7.7E-04	--	1.7E-02
			4-AMINO-2,6-DINITROTOLUENE	--	--	--	NA	4-AMINO-2,6-DINITROTOLUENE	CNS, Digestive System	1.1E-02	8.2E-04	--	1.2E-02
			2,4-DINITROTOLUENE	1.9E-07	1.5E-07	6.2E-11	3.4E-07	2,4-DINITROTOLUENE	CNS, Digestive System	8.8E-04	7.1E-04	--	1.6E-03
			2,6-DINITROTOLUENE	3.3E-07	2.6E-07	--	5.9E-07	2,6-DINITROTOLUENE	CNS, Liver, and Blood	1.4E-03	1.1E-03	--	2.5E-03
			RDX	1.6E-08	1.9E-09	--	1.8E-08	RDX	Prostate	1.4E-04	1.7E-05	--	1.6E-04
			1,3-DINITROBENZENE	--	--	--	NA	1,3-DINITROBENZENE	Spleen	2.4E-03	1.9E-03	--	4.3E-03
			2,4,6-TRINITROTOLUENE	2.9E-05	2.3E-05	--	5.2E-05	2,4,6-TRINITROTOLUENE	Liver	5.6E+00	4.5E+00	--	1.0E+01
			2-NITROTOLUENE	8.4E-08	6.7E-08	--	1.5E-07	2-NITROTOLUENE	Bone Marrow	1.2E-03	9.9E-04	--	2.2E-03
			Inorganics					**Inorganics**					
			BARIUM	--	--	--	NA	BARIUM	Kidneys	6.9E-03	--	3.2E-03	1.0E-02
			CADMIUM	--	--	2.1E-08	NA	CADMIUM	Kidneys	2.9E-02	9.4E-03	1.7E-03	4.0E-02
			CHROMIUM (HEXAVALENT)	3.2E-07	--	3.4E-08	3.5E-07	CHROMIUM (HEXAVALENT)	None	3.4E-04	--	1.2E-05	3.5E-04
			COPPER	--	--	--	NA	COPPER	Liver and Kidneys	1.1E-02	--	--	1.1E-02
			IRON	--	--	--	NA	IRON	Gastrointestinal System	4.6E-02	--	--	4.6E-02
			NICKEL	--	--	7.5E-09	NA	NICKEL	Body Weight	3.6E-03	--	9.3E-04	4.6E-03
			ZINC	--	--	--	NA	ZINC	Blood	4.7E-02	--	--	4.7E-02
			PAHs					**PAHs**					
			BENZO(A)PYRENE	5.6E-07	5.8E-07	9.8E-11	1.1E-06	BENZO(A)PYRENE	NA	--	--	--	NA
			(Total for Adult)	3.E-05	2.E-05	6.E-08	5.E-05		(Total for Adult)	5.8	4.5	0.006	10.3

TABLE B-9.6
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU 8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY

Location: Former Lake Ontario Ordnance Works
Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child and Adult

Medium	Exposure Medium	Exposure Point	Constituent of Potential Concern	Carcinogenic Risk				Constituent of Potential Concern	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Soil	Total Soil Adult + Child	EU 8	**Explosives**										
			2-AMINO-4,6-DINITROTOLUENE	NA	NA	NA	NA						
			4-AMINO-2,6-DINITROTOLUENE	NA	NA	NA	NA						
			2,4-DINITROTOLUENE	1.1E-06	4.0E-07	7.7E-11	1.5E-06						
			2,6-DINITROTOLUENE	1.9E-06	6.8E-07	NA	2.5E-06						
			RDX	9.0E-08	5.0E-09	NA	9.5E-08						
			1,3-DINITROBENZENE	NA	NA	NA	NA						
			2,4,6-TRINITROTOLUENE	1.6E-04	6.1E-05	NA	2.3E-04						
			2-NITROTOLUENE	4.8E-07	1.8E-07	NA	6.5E-07						
			Inorganics										
			BARIUM	NA	NA	NA	NA						
			CADMIUM	NA	NA	2.6E-08	5.2E-09						
			CHROMIUM (HEXAVALENT)	4.7E-06	NA	4.3E-08	4.7E-06						
			COPPER	NA	NA	NA	NA						
			IRON	NA	NA	NA	NA						
			NICKEL	NA	NA	9.4E-09	1.9E-09						
			ZINC	NA	NA	NA	NA						
			PAHs										
			BENZO(A)PYRENE	8.2E-06	3.4E-06	1.7E-10	1.2E-05						
			(Total for Adult + Child)	1.8E-04	6.6E-05	7.8E-08	2.5E-04					**Total Hazard Index Across Total Soil (Child)**	**138**
				Total Risk Across Total Soil			**2.E-04**					**Total Hazard Index Across Total Soil (Adult)**	**10.3**
Surface Soil	Home Grown Produce Child	EU 8	**Explosives**					**Explosives**					
			RDX	1.1E-05	--	--	1.1E-05	RDX	Prostate	4.0E-01	--	--	4.0E-01
			Inorganics					**Inorganics**					
			BARIUM	--	--	--	NA	BARIUM	Kidneys	2.7E-02	--	--	2.7E-02
			CADMIUM	--	--	--	NA	CADMIUM	Kidneys	1.2E+00	--	--	1.2E+00
			CHROMIUM (HEXAVALENT)	2.5E-07	--	--	2.5E-07	CHROMIUM (HEXAVALENT)	None	3.6E-04	--	--	3.6E-04
			COPPER	--	--	--	NA	COPPER	Liver and Kidneys	3.0E-01	--	--	3.0E-01
			MERCURY	--	--	--	NA	MERCURY	CNS	2.3E-02	--	--	2.3E-02
			NICKEL	--	--	--	NA	NICKEL	Body Weight	7.1E-02	--	--	7.1E-02
			ZINC	--	--	--	NA	ZINC	Blood	1.2E+00	--	--	1.2E+00
			PAHs					**PAHs**					
			BENZO(A)PYRENE	9.9E-07	--	--	9.9E-07	BENZO(A)PYRENE	NA	--	--	--	NA
			Pesticides/PCBs			--		**Pesticides/PCBs**					
			4,4'-DDT	2.3.E-09	--	--	2.3.E-09	4,4'-DDT	Liver	1.6E-04	--	--	1.6E-04
			(Total for Child)	1.2.E-05	---	---	1.2.E-05		(Total for Child)	3	---	---	3
	Home Grown Produce Adult	EU 8	**Explosives**					**Explosives**					
			RDX	4.5E-05	--	--	4.5E-05	RDX	Prostate	4.0E-01	--	--	4.0E-01
			Inorganics					**Inorganics**					
			BARIUM	--	--	--	NA	BARIUM	Kidneys	2.7E-02	--	--	2.7E-02
			CADMIUM	--	--	--	NA	CADMIUM	Kidneys	1.2E+00	--	--	1.2E+00
			CHROMIUM (HEXAVALENT)	3.4E-07	--	--	3.4E-07	CHROMIUM (HEXAVALENT)	None	3.7E-04	--	--	3.7E-04
			COPPER	--	--	--	NA	COPPER	Liver and Kidneys	3.1E-01	--	--	3.1E-01
			MERCURY	--	--	--	NA	MERCURY	CNS	2.3E-02	--	--	2.3E-02
			NICKEL	--	--	--	NA	NICKEL	Body Weight	7.1E-02	--	--	7.1E-02
			ZINC	--	--	--	NA	ZINC	Blood	1.2E+00	--	--	1.2E+00
			PAHs					**PAHs**					
			BENZO(A)PYRENE	1.4E-06	--	--	1.4E-06	BENZO(A)PYRENE	NA	--	--	--	NA
			Pesticides/PCBs					**Pesticides/PCBs**					
			4,4'-DDT	9.4.E-09	--	--	9.4.E-09	4,4'-DDT	Liver	1.6E-04	--	--	1.6E-04
			(Total for Adult)	4.7.E-05	---	--	4.7.E-05		(Total for Adult)	3	---	---	3

TABLE B-9.6
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU 8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY

Location: Former Lake Ontario Ordnance Works
Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child and Adult

Medium	Exposure Medium	Exposure Point	Constituent of Potential Concern	Carcinogenic Risk				Constituent of Potential Concern	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Soil	Home Grown Produce Adult + Child	EU 8	**Explosives**										
			RDX	5.6E-05	NA	NA	5.6E-05						
			Inorganics										
			BARIUM	NA	NA	NA	NA						
			CADMIUM	NA	NA	NA	NA						
			CHROMIUM (HEXAVALENT)	5.9E-07	NA	NA	5.9E-07						
			COPPER	NA	NA	NA	NA						
			MERCURY	NA	NA	NA	NA						
			NICKEL	NA	NA	NA	NA						
			ZINC	NA	NA	NA	NA						
			PAHs										
			BENZO(A)PYRENE	2.4.E-06	NA	NA	2.4.E-06						
			Pesticides/PCBs										
			4,4'-DDT	1.2.E-08	NA	NA	1.2.E-08						
			(Total for Child + Adult)	5.9.E-05	NA	NA	5.9.E-05					**Total Hazard Index Across Home Grown Produce (Child)**	**3**
			Total Risk Across Home Grown Produce (Adult + Child)				**6.E-05**					**Total Hazard Index Across Home Grown Produce (Adult)**	**3**
	Game Meat Child	EU 8	**Explosives**					**Explosives**					
			RDX		--	--	NA	RDX	Prostate		--	--	NA
			Inorganics					**Inorganics**					
			BARIUM	--	--	--	NA	BARIUM	Kidneys	1.6E-07	--	--	1.6E-07
			CADMIUM	--	--	--	NA	CADMIUM	Kidneys	7.2E-07	--	--	7.2E-07
			CHROMIUM (HEXAVALENT)	1.7E-10	--	--	1.7E-10	CHROMIUM (HEXAVALENT)	None	2.6E-07	--	--	2.6E-07
			COPPER	--	--	--	NA	COPPER	Liver and Kidneys	2.1E-05	--	--	2.1E-05
			MERCURY	--	--	--	NA	MERCURY	CNS	3.7E-07	--	--	3.7E-07
			NICKEL	--	--	--	NA	NICKEL	Body Weight	4.6E-06	--	--	4.6E-06
			ZINC	--	--	--	NA	ZINC	Blood	7.8E-07	--	--	7.8E-07
			PAHs					**PAHs**					
			BENZO(A)PYRENE	1.7E-07	--	--	1.7E-07	BENZO(A)PYRENE	NA	--	--	--	NA
			Pesticides/PCBs			--		**Pesticides/PCBs**					
			4,4'-DDT	5.7E-10	--	--	5.7E-10	4,4'-DDT	Liver	3.9E-05	--	--	3.9E-05
			(Total for Child)	2.E-07	---	---	2.E-07		(Total for Child)	0.0001	---	---	0.0001
	Game Meat Adult	EU 8	**Explosives**					**Explosives**					
			RDX		--	--	NA	RDX	Prostate	6.1E-11	--	--	6.1E-11
			Inorganics					**Inorganics**					
			BARIUM	--	--	--	NA	BARIUM	Kidneys	1.0E-07	--	--	1.0E-07
			CADMIUM	--	--	--	NA	CADMIUM	Kidneys	4.6E-07	--	--	4.6E-07
			CHROMIUM (HEXAVALENT)	1.5E-10	--	--	1.5E-10	CHROMIUM (HEXAVALENT)	None	1.6E-07	--	--	1.6E-07
			COPPER	--	--	--	NA	COPPER	Liver and Kidneys	1.4E-05	--	--	1.4E-05
			MERCURY	--	--	--	NA	MERCURY	CNS	2.4E-07	--	--	2.4E-07
			NICKEL	--	--	--	NA	NICKEL	Body Weight	2.9E-06	--	--	2.9E-06
			ZINC	--	--	--	NA	ZINC	Blood	5.0E-07	--	--	5.0E-07
			PAHs					**PAHs**					
			BENZO(A)PYRENE	1.4E-07	--	--	1.4E-07	BENZO(A)PYRENE	NA	--	--	--	NA
			Pesticides/PCBs					**Pesticides/PCBs**					
			4,4'-DDT	1.5E-09	--	--	1.5E-09	4,4'-DDT	Liver	2.5E-05	--	--	2.5E-05
			(Total for Adult)	1.5E-07	---	---	1.5E-07		(Total for Adult)	0.0000	---	---	0.0000

TABLE B-9.6
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU 8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY

Location: Former Lake Ontario Ordnance Works
Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child and Adult

Medium	Exposure Medium	Exposure Point	Constituent of Potential Concern	Carcinogenic Risk			
				Ingestion	Dermal	Inhalation	Exposure Routes Total
Soil	Game Meat Adult + Child	EU 8	**Explosives**				
			RDX	NA	NA	NA	NA
			Inorganics				
			BARIUM	NA	NA	NA	NA
			CADMIUM	NA	NA	NA	NA
			CHROMIUM (HEXAVALENT)	3.3E-10	NA	NA	3.3E-10
			COPPER	NA	NA	NA	NA
			MERCURY	NA	NA	NA	NA
			NICKEL	NA	NA	NA	NA
			ZINC	NA	NA	NA	NA
			PAHs				
			BENZO(A)PYRENE	3.E-07	NA	NA	3.E-07
			Pesticides/PCBs				
			4,4'-DDT	2.E-09	NA	NA	2.E-09
			(Total for Child + Adult)	3.E-07	--	--	3.E-07
			Total Risk Across Game Meat (Adult + Child)				**3.E-07**
			Total Risk Across Surface Soil (Game Meat and Home Grown Produce) (Adult + Child)				**6.E-05**
			Total Risk Across All Soil Pathways (Adult + Child)				**3.E-04**
			Total Risk Across All Media and All Exposure Routes				**3.E-04**

Constituent of Potential Concern	Non-Carcinogenic Hazard Quotient				
	Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Total Hazard Index Across Game Meat (Child)					**0.0001**
Total Hazard Index Across Game Meat (Adult)					**0.0000**
Total Hazard Index Across Surface Soil (Game Meat and Home Grown Produce) (Child)					**3**
Total Hazard Index Across Surface Soil (Game Meat and Home Grown Produce) (Adult)					**3**
Total Hazard Index Across All Soil Pathways (Child)					**141**
Total Hazard Index Across All Soil Pathways (Adult)					**14**
Total Hazard Index Across All Media and All Exposure Routes (Child)					**141**
Total Hazard Index Across All Media and All Exposure Routes (Adult)					**14**

NA = Not Applicable due to no toxicity values
-- = No risks calculated for this exposure pathway

Total Hazard Index Liver, Across All Media and All Exposure Routes, Child	**135**
Total Hazard Index Blood, Across All Media and All Exposure Routes, Child	**2**
Total Hazard Index CNS, Across All Media and All Exposure Routes, Child	**0.6**
Total Hazard Index Kidneys, Across All Media and All Exposure Routes, Child	**2**
Total Hazard Index Prostate, Across All Media and All Exposure Routes, Child	**0.4**
Total Hazard Index Digestive System, Across All Media and All Exposure Routes, Child	**0.5**
Total Hazard Index Spleen, Across All Media and All Exposure Routes, Child	**0.06**
Total Hazard Index Bone Marrow, Across All Media and All Exposure Routes, Child	**0.03**
Total Hazard Index Gastrointestinal System, Across All Media and All Exposure Routes, Child	**0.9**
Total Hazard Index Body Weight, Across All Media and All Exposure Routes, Child	**0.1**

Total Hazard Index Liver, Across All Media and All Exposure Routes, Adult	**10**
Total Hazard Index Blood, Across All Media and All Exposure Routes, Adult	**1**
Total Hazard Index CNS, Across All Media and All Exposure Routes, Adult	**0.06**
Total Hazard Index Kidneys, Across All Media and All Exposure Routes, Adult	**2**
Total Hazard Index Prostate, Across All Media and All Exposure Routes, Adult	**0.0002**
Total Hazard Index Digestive System, Across All Media and All Exposure Routes, Adult	**0.03**
Total Hazard Index Spleen, Across All Media and All Exposure Routes, Adult	**0.004**
Total Hazard Index Bone Marrow, Across All Media and All Exposure Routes, Adult	**0.002**
Total Hazard Index Gastrointestinal System, Across All Media and All Exposure Routes, Adult	**0.05**
Total Hazard Index Body Weight, Across All Media and All Exposure Routes, Adult	**0.08**

TABLE B-10.1
SIGNIFICANT CONTRIBUTORS TO RISK
REASONABLE MAXIMUM EXPOSURE
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU 8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY

Location: Former Lake Ontario Ordnance Works
Scenario Timeframe: Current/Future
Receptor Population: Trespasser
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Soil	Surface Soil	EU 8	**Explosives**					**Explosives**					
			2,4,6-TRINITROTOLUENE	7.9E-06	6.3E-06	--	1.4E-05	2,4,6-TRINITROTOLUENE	Liver	1.2E+00	9.7E-01	--	2.2E+00
			(Total)	7.9E-06	6.3E-06	---	1.4E-05		(Total)	1.2	0.97	---	2.2
					Total Risk Across Surface Soil		**1.E-05**				**Total Hazard Index Across Surface Soil**		**2**
						Total Risk Across All Media and All Exposure Routes	**1.E-05**					**Total Hazard Index Across All Media and All Exposure Routes**	**2**

NA = Not Applicable due to no toxicity values
-- = No risks calculated for this exposure pathway

Total Hazard Index Liver, Surface Soil **2**

TABLE B-10.2
SIGNIFICANT CONTRIBUTORS TO RISK
REASONABLE MAXIMUM EXPOSURE
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU 8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY

Location: Former Lake Ontario Ordnance Works
Scenario Timeframe: Current/Future
Receptor Population: Trespasser
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Soil	Surface Soil	EU 8	**Explosives**					**Explosives**					
			2,4,6-TRINITROTOLUENE	8.1E-06	6.0E-06	--	1.4E-05	2,4,6-TRINITROTOLUENE	Liver	3.8E+00	2.8E+00	--	6.6E+00
			(Total)	8.1E-06	6.0E-06	---	1.4E-05		(Total)	3.8	2.8	---	6.6
						Total Risk Across Surface Soil	**1.E-05**					**Total Hazard Index Across Surface Soil**	**7**
						Total Risk Across All Media and All Exposure Routes	**1.E-05**					**Total Hazard Index Across All Media and All Exposure Routes**	**7**

NA = Not Applicable due to no toxicity values
-- = No risks calculated for this exposure pathway

Total Hazard Index Liver, Surface Soil **7**

TABLE B-10.3
SIGNIFICANT CONTRIBUTORS TO RISK
REASONABLE MAXIMUM EXPOSURE
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU 8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY

Location: Former Lake Ontario Ordnance Works
Scenario Timeframe: Future
Receptor Population: Maintenance Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Soil	Surface Soil	EU 8	**Explosives**					**Explosives**					
			2,4,6-TRINITROTOLUENE	3.1E-05	1.5E-05	--	4.6E-05	2,4,6-TRINITROTOLUENE	Liver	5.9E+00	2.7E+00	--	8.6E+00
			(Total)	3.1E-05	1.5E-05	---	4.6E-05		(Total)	5.9	2.7	---	8.6
					Total Risk Across Surface Soil		**5.E-05**				**Total Hazard Index Across Surface Soil**		**9**
					Total Risk Across All Media and All Exposure Routes		**5.E-05**				**Total Hazard Index Across All Media and All Exposure Routes**		**9**

NA = Not Applicable due to no toxicity values
-- = No risks calculated for this exposure pathway

Total Hazard Index Liver, Surface Soil **9**

TABLE B-10.4
SIGNIFICANT CONTRIBUTORS TO RISK
REASONABLE MAXIMUM EXPOSURE
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU 8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY

Location: Former Lake Ontario Ordnance Works
Scenario Timeframe: Future
Receptor Population: Commercial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Soil	Surface Soil	EU 8	**Explosives**					**Explosives**					
			2,4,6-TRINITROTOLUENE	3.1E-05	4.2E-06	--	3.6E-05	2,4,6-TRINITROTOLUENE	Liver	5.9E+00	7.7E-01	--	6.6E+00
			(Total)	3.1E-05	4.2E-06	---	3.6E-05		(Total)	5.9	0.8	---	6.6
						Total Risk Across Surface Soil	**4.E-05**					**Total Hazard Index Across Surface Soil**	**7**
						Total Risk Across All Media and All Exposure Routes	**4.E-05**					**Total Hazard Index Across All Media and All Exposure Routes**	**7**

NA = Not Applicable due to no toxicity values
-- = No risks calculated for this exposure pathway

Total Hazard Index Liver, Surface Soil **7**

TABLE B-10.5
SIGNIFICANT CONTRIBUTORS TO RISK
REASONABLE MAXIMUM EXPOSURE
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU 8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY

Location: Former Lake Ontario Ordnance Works

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Soil	Total Soil	EU 8	**Explosives**					**Explosives**					
			2,4,6-TRINITROTOLUENE	8.3E-06	1.1E-06	--	9.4E-06	2,4,6-TRINITROTOLUENE	Liver	3.9E+01	5.3E+00	--	4.4E+01
			Inorganics					**Inorganics**					
			CADMIUM	--	--	--	NA	CADMIUM	Kidneys	2.0E-01	1.1E-02	4.0E-04	2.1E-01
			IRON	--	--	--	NA	IRON	Gastrointestinal System	3.1E-01	--	--	3.1E-01
			ZINC	--	--	--	NA	ZINC	Blood	3.3E-01	--	--	3.3E-01
			(Total)	8.3E-06	1.1E-06	---	9.4E-06		(Total)	39.4	5.3	0.0004	45
						Total Risk Across Total Soil	**9.E-06**					**Total Hazard Index Across Total Soil**	**45**
						Total Risk Across All Media and All Exposure Routes	**9.E-06**					**Total Hazard Index Across All Media and All Exposure Routes**	**45**

NA = Not Applicable due to no toxicity values
-- = No risks calculated for this exposure pathway

Total Hazard Index Liver, Total Soil	**44**
Total Hazard Index Blood, Total Soil	**0.3**
Total Hazard Index Kidneys, Total Soil	**0.2**

TABLE B-10.6
SIGNIFICANT CONTRIBUTORS TO RISK
REASONABLE MAXIMUM EXPOSURE
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU 8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY

Location: Former Lake Ontario Ordnance Works
Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child and Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Soil	Total Soil	EU 8	**Explosives**					**Explosives**					
	Child		2-AMINO-4,6-DINITROTOLUENE	--	--	--	NA	2-AMINO-4,6-DINITROTOLUENE	CNS, Digestive System	3.0E-01	5.1E-03	--	3.1E-01
			4-AMINO-2,6-DINITROTOLUENE	--	--	--	NA	4-AMINO-2,6-DINITROTOLUENE	CNS, Digestive System	2.1E-01	5.4E-03	--	2.2E-01
			2,4-DINITROTOLUENE	8.7E-07	2.5E-07	1.5E-11	1.1E-06	2,4-DINITROTOLUENE	CNS, Digestive System	--	--	--	NA
			2,6-DINITROTOLUENE	1.5E-06	4.2E-07	--	2.0E-06	2,6-DINITROTOLUENE	CNS, Liver, and Blood	--	--	--	NA
			2,4,6-TRINITROTOLUENE	1.4E-04	3.8E-05	--	1.7E-04	2,4,6-TRINITROTOLUENE	Liver	1.1E+02	2.9E+01	--	1.3E+02
			Inorganics					**Inorganics**					
			BARIUM	--	--	--	NA	BARIUM	Kidneys	1.3E-01	--	3.2E-03	1.3E-01
			CADMIUM	--	--	--	NA	CADMIUM	Kidneys	5.5E-01	6.1E-02	1.7E-03	6.1E-01
			CHROMIUM (HEXAVALENT)	4.4E-06	--	8.5E-09	4.4E-06	CHROMIUM (HEXAVALENT)	None	6.4E-03	--	1.2E-05	6.4E-03
			COPPER	--	--	--	NA	COPPER	Liver and Kidneys	2.1E-01	--	--	2.1E-01
			IRON	--	--	--	NA	IRON	Gastrointestinal System	8.6E-01	--	--	8.6E-01
			ZINC	--	--	--	NA	ZINC	Blood	8.9E-01	--	--	8.9E-01
			PAHs					**PAHs**					
			BENZO(A)PYRENE	7.6E-06	2.8E-06	7.1E-11	1.0E-05	BENZO(A)PYRENE	NA	--	--	--	NA
			(Total for Child)	1.5E-04	4.1E-05	8.6E-09	1.9E-04		(Total for Child)	108	29	0.005	138
	Total Soil	EU 8	**Explosives**					**Explosives**					
	Adult		2,4-DINITROTOLUENE	1.9E-07	1.5E-07	6.2E-11	3.4E-07	2,4-DINITROTOLUENE	CNS, Digestive System	--	--	--	NA
			2,6-DINITROTOLUENE	3.3E-07	2.6E-07	--	5.9E-07	2,6-DINITROTOLUENE	CNS, Liver, and Blood	--	--	--	NA
			2,4,6-TRINITROTOLUENE	2.9E-05	2.3E-05	--	5.2E-05	2,4,6-TRINITROTOLUENE	Liver	5.6E+00	4.5E+00	--	1.0E+01
			Inorganics					**Inorganics**					
			CHROMIUM (HEXAVALENT)	3.2E-07	--	3.4E-08	3.5E-07	CHROMIUM (HEXAVALENT)	None	--	--	--	NA
			PAHs					**PAHs**					
			BENZO(A)PYRENE	5.6E-07	5.8E-07	9.8E-11	1.1E-06	BENZO(A)PYRENE	NA	--	--	--	NA
			(Total for Adult)	3.E-05	2.E-05	3.E-08	5.E-05		(Total for Adult)	5.6	4.5	---	10.1
Soil	Total Soil	EU 8	**Explosives**										
	Adult + Child		2,4-DINITROTOLUENE	1.1E-06	4.0E-07	7.7E-11	1.5E-06						
			2,6-DINITROTOLUENE	1.9E-06	6.8E-07	NA	2.5E-06						
			2,4,6-TRINITROTOLUENE	1.6E-04	6.1E-05	NA	2.3E-04						
			Inorganics										
			CHROMIUM (HEXAVALENT)	4.7E-06	NA	4.3E-08	4.7E-06						
			PAHs										
			BENZO(A)PYRENE	8.2E-06	3.4E-06	1.7E-10	1.2E-05						
			(Total for Adult + Child)	1.8E-04	6.5E-05	4.3E-08	2.5E-04					**Total Hazard Index Across Total Soil (Child)**	**138**
						Total Risk Across Total Soil	**2.E-04**					**Total Hazard Index Across Total Soil (Adult)**	**10.1**

TABLE B-10.6
SIGNIFICANT CONTRIBUTORS TO RISK
REASONABLE MAXIMUM EXPOSURE
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU 8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY

Location: Former Lake Ontario Ordnance Works
Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child and Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Surface Soil	Home Grown Produce Child	EU 8	**Explosives**					**Explosives**					
			RDX	1.1E-05	--	--	1.1E-05	RDX	Prostate	4.0E-01	--	--	4.0E-01
			Inorganics					**Inorganics**					
			CADMIUM	--	--	--	NA	CADMIUM	Kidneys	1.2E+00	--	--	1.2E+00
			COPPER	--	--	--	NA	COPPER	Liver and Kidneys	3.0E-01	--	--	3.0E-01
			ZINC	--	--	--	NA	ZINC	Blood	1.2E+00	--	--	1.2E+00
			PAHs					**PAHs**					
			BENZO(A)PYRENE	9.9E-07	--	--	9.9E-07	BENZO(A)PYRENE	NA	--	--	--	NA
			(Total for Child)	1.2.E-05	---	---	1.2.E-05		(Total for Child)	3	---	---	3
	Home Grown Produce Adult	EU 8	**Explosives**					**Explosives**					
			RDX	4.5E-05	--	--	4.5E-05	RDX	Prostate	4.0E-01	--	--	4.0E-01
			Inorganics					**Inorganics**					
			CADMIUM	--	--	--	NA	CADMIUM	Kidneys	1.2E+00	--	--	1.2E+00
			COPPER	--	--	--	NA	COPPER	Liver and Kidneys	3.1E-01	--	--	3.1E-01
			ZINC	--	--	--	NA	ZINC	Blood	1.2E+00	--	--	1.2E+00
			PAHs					**PAHs**					
			BENZO(A)PYRENE	1.4E-06	--	--	1.4E-06	BENZO(A)PYRENE	NA	--	--	--	NA
			(Total for Adult)	4.7.E-05	---	--	4.7.E-05		(Total for Adult)	3	---	---	3
Soil	Home Grown Produce Adult + Child	EU 8	**Explosives**										
			RDX	5.6E-05	NA	NA	5.6E-05						
			PAHs										
			BENZO(A)PYRENE	2.4.E-06	NA	NA	2.4.E-06						
			(Total for Child + Adult)	5.9.E-05	NA	NA	5.9.E-05						
			Total Risk Across Home Grown Produce (Adult + Child)				**6.E-05**		**Total Hazard Index Across Home Grown Produce (Child)**				**3**
									Total Hazard Index Across Home Grown Produce (Adult)				**3**
			(Total for Child + Adult)	---	---	---	---		**Total Hazard Index Across Game Meat (Child)**				**---**
									Total Hazard Index Across Game Meat (Adult)				**---**
			Total Risk Across Game Meat (Adult + Child)				---		**Total Hazard Index Across Surface Soil (Game Meat and Home Grown Produce) (Child)**				**3**
			Total Risk Across Surface Soil (Game Meat and Home Grown Produce) (Adult + Child)				**6.E-05**		**Total Hazard Index Across Surface Soil (Game Meat and Home Grown Produce) (Adult)**				**3**
			Total Risk Across All Soil Pathways (Adult + Child)				**3.E-04**		**Total Hazard Index Across All Soil Pathways (Child)**				**141**
									Total Hazard Index Across All Soil Pathways (Adult)				**13**
			Total Risk Across All Media and All Exposure Routes				**3.E-04**		**Total Hazard Index Across All Media and All Exposure Routes (Child)**				**141**
									Total Hazard Index Across All Media and All Exposure Routes (Adult)				**13**

TABLE B-10.6
SIGNIFICANT CONTRIBUTORS TO RISK
REASONABLE MAXIMUM EXPOSURE
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU 8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY

Location: Former Lake Ontario Ordnance Works
Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child and Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total		Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total

NA = Not Applicable due to no toxicity values
-- = No risks calculated for this exposure pathway

Total Hazard Index Liver, Soil, Child	**135**
Total Hazard Index Blood, Soil, Child	**2**
Total Hazard Index CNS, Soil, Child	**0.5**
Total Hazard Index Kidneys, Soil, Child	**2**
Total Hazard Index Prostate, Soil, Child	**0.4**
Total Hazard Index Digestive System, Soil, Child	**0.5**
Total Hazard Index Gastrointestinal System, Soil, Child	**0.9**
Total Hazard Index Body Weight, Soil, Child	**0.0**

Total Hazard Index Liver, Soil, Adult	**10**
Total Hazard Index Blood, Soil, Adult	**1**
Total Hazard Index Kidneys, Soil, Adult	**2**

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APPENDIX B-2

REVISED PROUCL OUTPUTS FOR

HEXAVALENT CHROMIUM

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HEXAVALENT CHROMIUM IN SURFACE SOIL

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	Chromium.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	10000

CHROMIUM (HEXAVALENT)

General Statistics

Number of Valid Data	25	Number of Detected Data	21
Number of Distinct Detected Data	19	Number of Non-Detect Data	4
		Percent Non-Detects	16.00%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.42	Minimum Detected	-0.868
Maximum Detected	5.8	Maximum Detected	1.758
Mean of Detected	1.569	Mean of Detected	0.109
SD of Detected	1.507	SD of Detected	0.806
Minimum Non-Detect	0.24	Minimum Non-Detect	-1.427
Maximum Non-Detect	0.41	Maximum Non-Detect	-0.892

Note: Data have multiple DLs - Use of KM Method is recommended	Number treated as Non-Detect	4
For all methods (except KM, DL/2, and ROS Methods),	Number treated as Detected	21
Observations < Largest ND are treated as NDs	Single DL Non-Detect Percentage	16.00%

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.747	Shapiro Wilk Test Statistic	0.927
5% Shapiro Wilk Critical Value	0.908	5% Shapiro Wilk Critical Value	0.908
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	1.344	Mean	-0.2
SD	1.472	SD	1.036
95% DL/2 (t) UCL	1.848	95% H-Stat (DL/2) UCL	2.398
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	1.219	Mean in Log Scale	-0.187
SD	1.602	SD in Log Scale	1.012
95% MLE (t) UCL	1.767	Mean in Original Scale	1.346
95% MLE (Tiku) UCL	1.752	SD in Original Scale	1.471
		95% t UCL	1.849
		95% Percentile Bootstrap UCL	1.845
		95% BCA Bootstrap UCL	1.98
		95% H UCL	2.325

Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	1.415	**Data Follow Appr. Gamma Distribution at 5% Significance Level**	
Theta Star	1.109		
nu star	59.42		
A-D Test Statistic	0.89	**Nonparametric Statistics**	
5% A-D Critical Value	0.757	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.757	Mean	1.385
5% K-S Critical Value	0.193	SD	1.412
Data follow Appr. Gamma Distribution at 5% Significance Level		SE of Mean	0.289
		95% KM (t) UCL	1.88
Assuming Gamma Distribution		95% KM (z) UCL	1.861
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	1.878
Minimum	0.000001	95% KM (bootstrap t) UCL	2.153
Maximum	5.8	95% KM (BCA) UCL	1.908
Mean	1.318	95% KM (Percentile Bootstrap) UCL	1.874
Median	0.71	95% KM (Chebyshev) UCL	2.646
SD	1.495	97.5% KM (Chebyshev) UCL	3.192
k star	0.282	99% KM (Chebyshev) UCL	4.264
Theta star	4.68		
Nu star	14.08	**Potential UCLs to Use**	
AppChi2	6.624	95% KM (BCA) UCL	1.908
95% Gamma Approximate UCL (Use when n >= 40)	2.8		
95% Adjusted Gamma UCL (Use when n < 40)	2.955		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

HEXAVALENT CHROMIUM IN TOTAL SOIL

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	chromium.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	10000

CHROMIUM (HEXAVALENT)

General Statistics

Number of Valid Data	34	Number of Detected Data	22
Number of Distinct Detected Data	21	Number of Non-Detect Data	12
		Percent Non-Detects	35.29%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.17	Minimum Detected	-1.772
Maximum Detected	5.8	Maximum Detected	1.758
Mean of Detected	1.518	Mean of Detected	0.0448
SD of Detected	1.493	SD of Detected	0.869
Minimum Non-Detect	0.23	Minimum Non-Detect	-1.47
Maximum Non-Detect	0.42	Maximum Non-Detect	-0.868

Note: Data have multiple DLs - Use of KM Method is recommended	Number treated as Non-Detect	13
For all methods (except KM, DL/2, and ROS Methods),	Number treated as Detected	21
Observations < Largest ND are treated as NDs	Single DL Non-Detect Percentage	38.24%

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.756	Shapiro Wilk Test Statistic	0.968
5% Shapiro Wilk Critical Value	0.911	5% Shapiro Wilk Critical Value	0.911
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	1.033	Mean	-0.67
SD	1.366	SD	1.211
95% DL/2 (t) UCL	1.429	95% H-Stat (DL/2) UCL	1.887
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.612	Mean in Log Scale	-0.612
SD	1.807	SD in Log Scale	1.152
95% MLE (t) UCL	1.137	Mean in Original Scale	1.042
95% MLE (Tiku) UCL	1.193	SD in Original Scale	1.359
		95% t UCL	1.437
		95% Percentile Bootstrap UCL	1.436
		95% BCA Bootstrap UCL	1.545
		95% H UCL	1.788

Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**
k star (bias corrected)	1.314	**Data appear Gamma Distributed at 5% Significance Level**
Theta Star	1.156	
nu star	57.8	
A-D Test Statistic	0.729	
5% A-D Critical Value	0.759	
K-S Test Statistic	0.759	
5% K-S Critical Value	0.189	
Data appear Gamma Distributed at 5% Significance Level		

Assuming Gamma Distribution		**Nonparametric Statistics**	
Gamma ROS Statistics using Extrapolated Data		Kaplan-Meier (KM) Method	
Minimum	0.000001	Mean	1.042
Maximum	5.8	SD	1.339
Mean	0.982	SE of Mean	0.235
Median	0.6	95% KM (t) UCL	1.44
SD	1.4	95% KM (z) UCL	1.429
k star	0.164	95% KM (jackknife) UCL	1.391
Theta star	6.004	95% KM (bootstrap t) UCL	1.601
Nu star	11.13	95% KM (BCA) UCL	1.586
AppChi2	4.657	95% KM (Percentile Bootstrap) UCL	1.491
95% Gamma Approximate UCL (Use when n >= 40)	2.347	95% KM (Chebyshev) UCL	2.067
95% Adjusted Gamma UCL (Use when n < 40)	2.456	97.5% KM (Chebyshev) UCL	2.51
		99% KM (Chebyshev) UCL	3.381
		Potential UCLs to Use	
		95% KM (Percentile Bootstrap) UCL	1.491

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

APPENDIX C
SUMMARY OF VS2DTI MODELING RESULTS

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TO: LOOW Team
FROM: W.T. Frederick
RE: 2,4,6-TNT Leaching Model on the LOOW Oxy Parcel
DATE: 18-JAN-2013

INTRODUCTION

To address potential groundwater contamination from near-surface soil contaminated with 2,4,6,-TNT on the Oxy property, a sampling location specific leaching model was compiled to estimate a flux to groundwater. Contaminated soil profiles were compiled from the Oxy RI data (See Tables 5-4 and 5-6 in RI Report); TNT sampling data above the detection limit were used to develop each profile. The soil data were then input to a soil-water partitioning equation to estimate a potential pore-water concentrations collocated with the soil contamination. This provides a conservative water concentration to use as a contaminated flux to the vadose zone and subsequent vertical movement to the groundwater regime.

MODELING INPUT

The USGS model VS2DTI (Variably Saturated 2-D Transport Interactive) was used to simulate the following soil and contaminant configuration:

1. Model Domain: 120 meters wide and 5 meters deep (an X-Z vertical cross-section model), with 500-centimeter (cm) wide columns and 15-cm thick rows.
2. Soil Profile:
    a. Topsoil:
        1. 1-ft (30.5 cm) thick zone of silty clay loam
        2. Porosity: 0.43
        3. Bulk Density: 1.51 g/cc
        4. Hydraulic Conductivity: 1.94E-6 cm/s
        5. 2,4,6,-TNT soil-partitioning: 9.1 mL/g from Table 3.2 in the RI (other USACE references average 20 mL/g)
        6. Vadose zone parameters: USDA generalized van Genuchten functions for silty clay loam
        7. Starting condition is 90% saturated
    b. Brown Clay Till:
        1. 15.4-ft (470-cm) thick of silty clay (reflects the average thickness of the BCT layer on the LOOW and can be altered)
        2. Porosity: 0.36
        3. Bulk Density: 1.70 g/cc
        4. Hydraulic Conductivity: 5.56E-6 cm/s
        5. 2,4,6,-TNT soil-partitioning: 9.1 mL/g from Table 3.2 in the RI (other USACE references average 20 mL/g)
        6. Vadose zone parameters: USDA generalized van Genuchten functions for silty clay
        7. Starting condition is 98% saturated (the soil readily saturated to 100% upon model activation due to high recharge)
3. Boundary Conditions: Surface recharge of 1.0 inch/yr (2.54 cm/yr) was distributed evenly over top boundary. This is a conservative value that is one to four orders of magnitude higher than values used in the NFSS modeling results. No-flow boundaries were assigned to the vertical ends of the modeling domain, thus preventing lateral losses. The basal boundary was a gravity drain boundary that promotes vertical movement into the soil profile, thereby conservatively

forcing the contamination to the groundwater regime. Basically, simulating the lithology as a soil box suspended in air (like an in-situ lysimeter).

4. Soil Concentrations: Soil concentrations for 2,4,6-TNT were obtained from the RI (Tables X and Y) and input to a spreadsheet configured to calculate a corresponding pore-water concentration in contact with the soil at various soil-partitioning coefficients (Kd). This table is presented in Attachment 1. The model simulated a cross sectional length through the sample locations, as exemplified in Figure 1; samples tightly clustered were projected onto the cross section as a connected location for conservation.
5. Groundwater Conditions: The estimated pore-concentrations using the Kd equilibrium method (Kd = 9.1 mL/g) provides a TNT loading term for the transport analysis. The soil concentration divided by the Kd provides this estimated pore-water concentration. Attachment 1 shows the inflow water concentrations for 2,4,6-TNT associated with the soil results.
6. Source Term: The influx concentrations were assigned to sample-specific depth intervals at each location according to data in Attachment 1. The concentration was injected a conservative rate of 1.0 in/yr (2.54 cm/yr, or double the recharge). The influx concentrations at locations C10-GS2-P22 and C10-GS2-HW were greater than the 2,4,6-TNT solubility limit of 0.13 g/L, thus highly conservative input to this transport model. The source terms were input as steady-state influxes throughout the 60-year simulation. Each sample location was assumed to be one-meter wide in the model; this extent had little influence on the results.
7. TNT Geochemistry: The environmental decay rate for TNT is stated in the RI as 12 hours. Additional information from the USACE EM-CX indicated rates from 672 to 4,320 hours are more acceptable. Consequently, two simulations were conducted to assess these EM-CX suggested decay periods. Since the longer decay rate is more conservative, only those results are presented herein.
8. Groundwater Observation Point: An "observation point" was placed directly below each sample location at a depth of 2 m (~6.6 ft), which is about the average depth to groundwater on the LOOW and NFSS (varies from grade to 12 ft). The point would be considered the concentration load to an average annual groundwater level.
9. Modeled Stress Period: The simulation was run for 60 years (1952-2012).

MODELING RESULTS

Two models were created to assess the potential for vertical transport from soil to groundwater below impacted soil areas on the Oxy parcel. The soil source was represented by constant-concentration pore-water influxes that then were allowed to leach vertically under gravity drainage. The simulations accounted for a range of 2,4,6-TNT decay rates and produced comparable results, indicating the silty clay soil is the limiting factor in transport.

The screening levels for LOOW contamination are listed in RI Tables 3-1 and 3-3 and the 2,4,6-TNT values are shown below:

- Surface Water = 0.76 ug/L
- Drinking Water = 5.0 ug/L

Both modeling scenarios showed minimal leaching into the lithologic profile and very low concentrations at 2 meters depth, or the depth of the water table; minimal horizontal transport occurred from soil sources. The vertical-stress model shows the MCL will be exceeded at the following two locations:

- C10-GS2-P22 to a depth of 0.9 m (3 ft), or 30 cm (~1 ft) below the high-concentration source

- C10-GS2-HW to a depth of 0.7 m (2.3 ft) , or 24 cm (~10 inches) below the high-concentration source
- Both locations showed about 50 cm (~1.6 ft) of horizontal dispersions from the soil sources

DISCUSSION

The concentrations at two meters below each sample location are shown on Figure 2 and the extent of vadose-zone/groundwater impacts are illustrated in Figure 3. Basically, the TNT does not contribute contamination to the groundwater within the brown clay till during the 60-year simulation. Since the surface and subsurface soils are started at 90% and 98% saturation and become fully saturated during the simulation, the model predicts a conservative transport condition (i.e., transport is not limited by unsaturated diffusivity and has a preferential downward flux).

The simulation of the Oxy-specific soil screening limit (SSL) for 2,4,6-TNT of 45.9 ug/g is protective of groundwater and does not promote pore-water concentration increases (i.e., soil partitioning and chemical decay attenuates potential pore-water impacts).

These results together indicate that transport from the contaminant source is limited to the surrounding soils with minimal migration, up to 1 foot vertically and 1.6 feet horizontally at the two high-concentration locations (C10-GS2-P22 and C10-GS2-HW).

CONCLUSION

By comparing the conservative model results with the exposure screening levels for 2,4,6-TNT in groundwater, the drinking water standard would not violated in the brown clay till underlying the Oxy dump site. Since the upper brown clay till does not yield sustainable domestic supply rates and the ambient water quality is poor (equivalent to a NYS-DEC GSA designation), the TNT impacted locations can be remediated without future risk from groundwater ingestion. Consequently, source removal, including up to 2 feet of buffer soil, would mitigate all risk to groundwater and that any 2,4,6-TNT residuals would adsorb to soil, decay in the subsurface, and not cause an MCL violation in the underlying groundwater.

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Table 1. Soil-water partioning Equlibrium Assessment

Sample Location	Soil Compartment Interval (ft bgs)		Maximum Soil Concentration 2,4,6-TNT	Kd Specific Pore water Concentration	Kd Specific Pore-water Concentration	Kd Specific Pore-water Concentration	Kd Specific Pore-water Concentration	Kd Specific Pore-water Concentration	Kd Specific Pore-water Concentration	Kd Specific Pore-water Concentration	Kd Specific Pore-water Concentration	Kd Specific Pore-water Concentration	Kd Specific Pore-water Concentration
	Top	Bottom	ug/g	ug/L	ug/L	ug/L	ug/L	ug/L	mg/cc or mg/mL	mg/cc or mg/mL	mg/cc or mg/mL	mg/cc or mg/mL	mg/cc or mg/mL
Kd (mL/g) ->				9.1	20	50	100	200	9.1	20	50	100	200
C10-GS2-3	0.0	1.0	0.67	74	34	13	7	3	7.38E-05	3.36E-05	1.34E-05	6.72E-06	3.36E-06
C10-GS2-SIN	0.5	1.0	0.33	36	17	7	3	2	3.63E-05	1.65E-05	6.60E-06	3.30E-06	1.65E-06
	2.5	3.0	0.07	8	4	1	1	0	7.69E-06	3.50E-06	1.40E-06	7.00E-07	3.50E-07
C10-GS2-5	1.0	1.5	1.84	202	92	37	18	9	2.02E-04	9.20E-05	3.68E-05	1.84E-05	9.20E-06
C10-GS2-SIW	0.5	1.0	0.25	27	13	5	3	1	2.75E-05	1.25E-05	5.00E-06	2.50E-06	1.25E-06
C10-GS2-P22	1.5	2.0	19,000.00	2,087,912	950,000	380,000	190,000	95,000	2.09E+00	9.50E-01	3.80E-01	1.90E-01	9.50E-02
	2.5	3.0	23.00	2,527	1,150	460	230	115	2.53E-03	1.15E-03	4.60E-04	2.30E-04	1.15E-04
C10-GS2-4	4.0	5.0	0.12	14	6	2	1	1	1.36E-05	6.20E-06	2.48E-06	1.24E-06	6.20E-07
C10-GS2-P23	0.5	1.0	1.40	154	70	28	14	7	1.54E-04	7.00E-05			
	2.5	3.0	0.24	26	12	5	2	1	2.64E-05	1.20E-05	4.80E-06	2.40E-06	1.20E-06
C10-GS2-HW	0.0	0.5	3.00	330	150	60	30	15	3.30E-04	1.50E-04	6.00E-05	3.00E-05	1.50E-05
	1.0	1.5	5,200.00	571,429	260,000	104,000	52,000	26,000	5.71E-01	2.60E-01	1.04E-01	5.20E-02	2.60E-02
C10-GS2-10	0.0	0.5	22.40	2,462	1,120	448	224	112	2.46E-03	1.12E-03	4.48E-04	2.24E-04	1.12E-04
	0.5	1.0	4.35	478	218	87	44	22	4.78E-04	2.18E-04	8.70E-05	4.35E-05	2.18E-05
C10-GS2-P21	1.0	1.5	0.79	87	40	16	8	4	8.68E-05	3.95E-05	1.58E-05	7.90E-06	3.95E-06
C10-GS2-HS	1.0	1.5	0.78	86	39	16	8	4	8.57E-05	3.90E-05	1.56E-05	7.80E-06	3.90E-06
C10-GS2-HN	0.0	0.5	9.60	1,055	480	192	96	48	1.05E-03	4.80E-04	1.92E-04	9.60E-05	4.80E-05
	1.0	1.5	8.80	967	440	176	88	44	9.67E-04	4.40E-04	1.76E-04	8.80E-05	4.40E-05
C10-GS2-HE	1.0	1.5	50.00	5,495	2,500	1,000	500	250	5.49E-03	2.50E-03	1.00E-03	5.00E-04	2.50E-04
C10-GS2-PE	0.0	0.5	4.20	462	210	84	42	21	4.62E-04	2.10E-04	8.40E-05	4.20E-05	2.10E-05
	1.0	1.5	0.76	84	38	15	8	4	8.35E-05	3.80E-05	1.52E-05	7.60E-06	3.80E-06
C10-GS2-SOE	0.5	1.0	1.00	110	50	20	10	5	1.10E-04	5.00E-05	2.00E-05	1.00E-05	5.00E-06
	2.5	3.0	0.14	15	7	3	1	1	1.54E-05	7.00E-06	2.80E-06	1.40E-06	7.00E-07
C10-GS2-SIS	0.5	1.0	3.40	374	170	68	34	17	3.74E-04	1.70E-04	6.80E-05	3.40E-05	1.70E-05
	2.5	3.0	4.50	495	225	90	45	23	4.95E-04	2.25E-04	9.00E-05	4.50E-05	2.25E-05
SSLOxy			45.9	5,044	2,295	918	459	230	5.04E-03	2.30E-03	9.18E-04	4.59E-04	2.30E-04
EPA RSL			4	396	180	72	36	18	3.96E-04	1.80E-04	7.20E-05	3.60E-05	1.80E-05
SSL EPA Res			19	2,088	950	380	190	95	2.09E-03	9.50E-04	3.80E-04	1.90E-04	9.50E-05
SSL EPA Ind			79	8,681	3,950	1,580	790	395	8.68E-03	3.95E-03	1.58E-03	7.90E-04	3.95E-04

Kd Based Concentration Used in VS2DTI (converted to model units)

TNT Kd value common to USACE documentation in clayey media.

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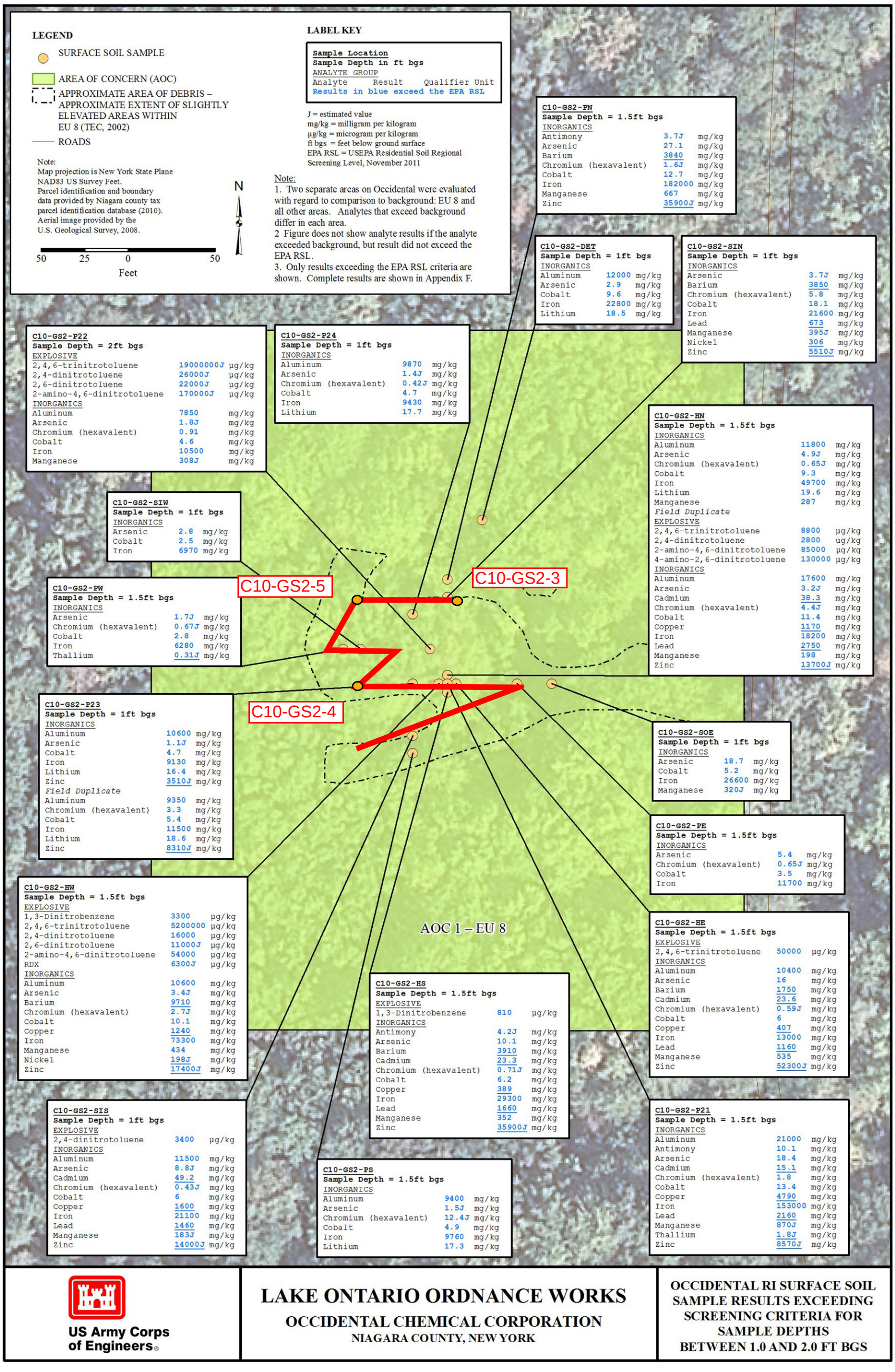

Figure 1. Cross Section of 2,4,6-TNT Impacted Sample Locations in Model

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Figure 2
2,4,6-TNT Conccentration (ug/L) At Water Table

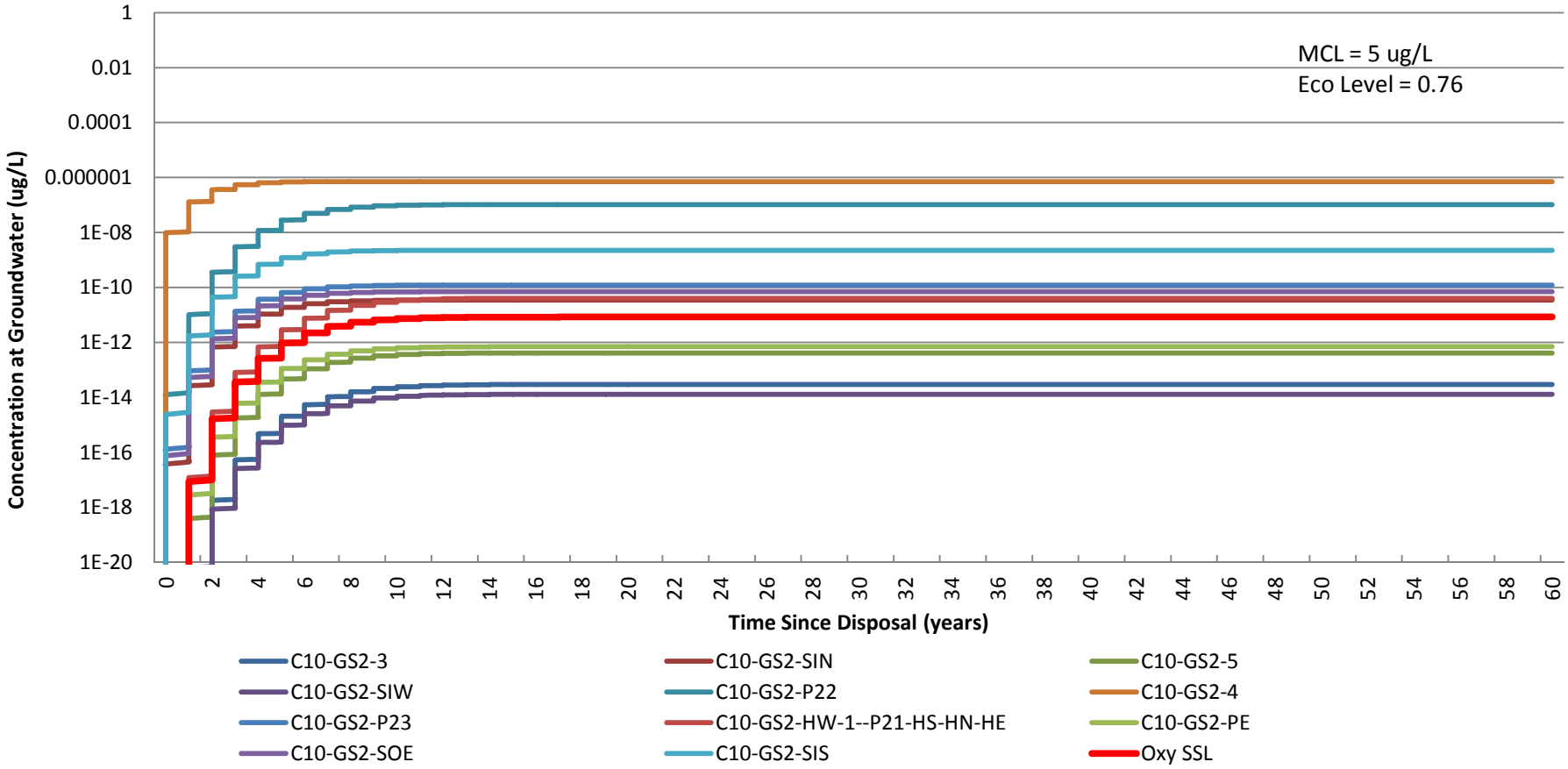

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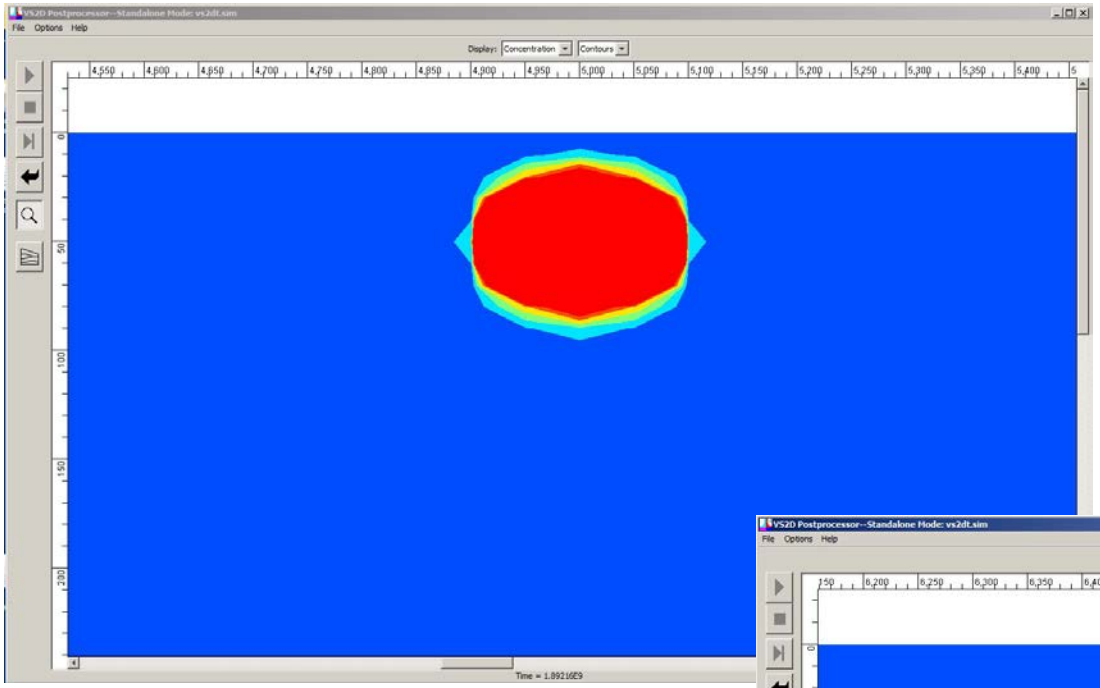
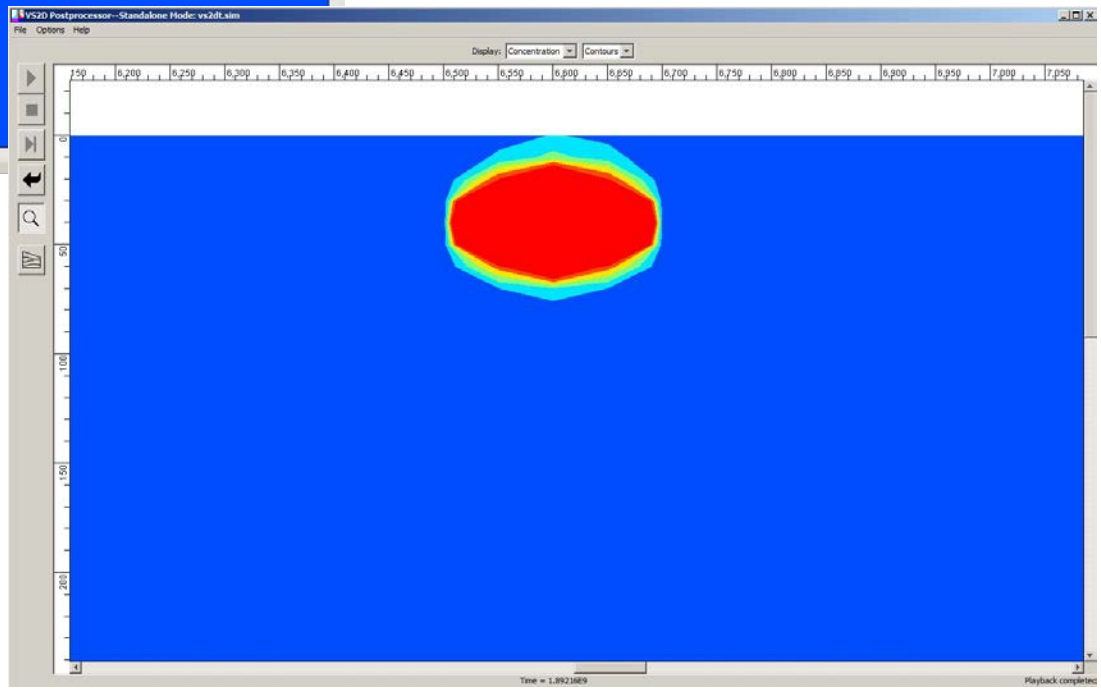
Figure 3. Delineation of 2,4,6-TNT Impacts Above 5 µg/L



Screenshot of VS2DTI Simulation of C10-GS2-P22 Location

Red ≥ 5 ug/L
Balance of color range is 4 ug/L to 0 ug/L



Screenshot of VS2DTI Simulation of C10-GS2-HW Location

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APPENDIX D
PRG CALCULATIONS

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TABLE 1
CALCULATION OF PRELIMINARY REMEDIATION GOALS
REASONABLE MAXIMUM EXPOSURE
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU 8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY

Location: Former Lake Ontario Ordnance Works
Scenario Timeframe: Current/Future
Receptor Population: Trespasser
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Exposure Point Concentration (mg/kg)	Carcinogenic Risk-Based Calculations				Chemical of Concern	Non-Carcinogenic Risk-Based Calculations			
					Exposure Routes Total	Preliminary Remediation Goal (mg/kg)				Primary Target Organ	Exposure Routes Total	Preliminary Remediation Goal (mg/kg)	
						Risk = 10^{-6}	Risk = 10^{-5}	Risk = 10^{-4}				HI = 0.1	HI = 1.0
Soil	Surface Soil	EU 8	**Explosives**						**Explosives**				
			2,4,6-TRINITROTOLUENE	6,004	1.4E-05	425	4,254	42,538	2,4,6-TRINITROTOLUENE	Liver	2.2	273	2,735

-- = No risks calculated for this exposure pathway

TABLE 2
CALCULATION OF PRELIMINARY REMEDIATION GOALS
REASONABLE MAXIMUM EXPOSURE
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU 8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY

Location: Former Lake Ontario Ordnance Works

Scenario Timeframe: Current/Future
Receptor Population: Trespasser
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Exposure Point Concentration (mg/kg)	Carcinogenic Risk-Based Calculations				Chemical of Concern	Non-Carcinogenic Risk-Based Calculations			
					Exposure Routes Total	Preliminary Remediation Goal (mg/kg)				Primary Target Organ	Exposure Routes Total	Preliminary Remediation Goal (mg/kg)	
						Risk = 10^{-6}	Risk = 10^{-5}	Risk = 10^{-4}				HI = 0.1	HI = 1.0
Soil	Surface Soil	EU 8	**Explosives**						**Explosives**				
			2,4,6-TRINITROTOLUENE	6,004	1.4E-05	424	4,239	42,386	2,4,6-TRINITROTOLUENE	Liver	6.6	91	908

-- = No risks calculated for this exposure pathway

TABLE 3
CALCULATION OF PRELIMINARY REMEDIATION GOALS
REASONABLE MAXIMUM EXPOSURE
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU 8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY

Location: Former Lake Ontario Ordnance Works

Scenario Timeframe: Future
Receptor Population: Maintenance Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Exposure Point Concentration (mg/kg)	Carcinogenic Risk-Based Calculations				Chemical of Concern	Non-Carcinogenic Risk-Based Calculations			
					Exposure Routes Total	Preliminary Remediation Goal (mg/kg)				Primary Target Organ	Exposure Routes Total	Preliminary Remediation Goal (mg/kg)	
						Risk = 10^{-6}	Risk = 10^{-5}	Risk = 10^{-4}				HI = 0.1	HI = 1.0
Soil	Surface Soil	EU 8	**Explosives**						**Explosives**				
			2,4,6-TRINITROTOLUENE	6,004	4.6E-05	131	1,306	13,057	2,4,6-TRINITROTOLUENE	Liver	8.6	70	700

-- = No risks calculated for this exposure pathway

TABLE 4
CALCULATION OF PRELIMINARY REMEDIATION GOALS
REASONABLE MAXIMUM EXPOSURE
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU 8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY

Location: Former Lake Ontario Ordnance Works

Scenario Timeframe: Future
Receptor Population: Commercial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Exposure Point Concentration (mg/kg)	Carcinogenic Risk-Based Calculations				Chemical of Concern	Non-Carcinogenic Risk-Based Calculations			
					Exposure Routes Total	Preliminary Remediation Goal (mg/kg)				Primary Target Organ	Exposure Routes Total	Preliminary Remediation Goal (mg/kg)	
						Risk = 10^{-6}	Risk = 10^{-5}	Risk = 10^{-4}				HI = 0.1	HI = 1.0
Soil	Surface Soil	EU 8	**Explosives**						**Explosives**				
			2,4,6-TRINITROTOLUENE	6,004	3.6E-05	169	1,686	16,864	2,4,6-TRINITROTOLUENE	Liver	6.6	90	903

-- = No risks calculated for this exposure pathway

TABLE 5
CALCULATION OF PRELIMINARY REMEDIATION GOALS
REASONABLE MAXIMUM EXPOSURE
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU 8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY

Location: Former Lake Ontario Ordnance Works

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Exposure Point Concentration (mg/kg)	Carcinogenic Risk-Based Calculations				Chemical of Concern	Non-Carcinogenic Risk-Based Calculations			
					Exposure Routes Total	Preliminary Remediation Goal (mg/kg)				Primary Target Organ	Exposure Routes Total	Preliminary Remediation Goal (mg/kg)	
						Risk = 10^{-6}	Risk = 10^{-5}	Risk = 10^{-4}				HI = 0.1	HI = 1.0
Soil	Total Soil	EU 8	**Explosives**						**Explosives**				
			2,4,6-TRINITROTOLUENE	4,109	9.4E-06	437	4,366	43,665	2,4,6-TRINITROTOLUENE	Liver	43.9	9	94

TABLE 6
CALCULATION OF PRELIMINARY REMEDIATION GOALS
REASONABLE MAXIMUM EXPOSURE
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU 8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY

Location: Former Lake Ontario Ordnance Works
Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child and Adult

Medium	Exposure Medium	Exposure Point	Constituent of Potential Concern	Total Soil EPC (mg/kg)	Surface Soil EPC (mg/kg)	Carcinogenic Risk								
						Ingestion	Ingestion Risk = 10^{-6}	Dermal	Dermal Risk = 10^{-6}	Inhalation	Inhalation Risk = 10^{-6}	Plant Ingestion	Plant Risk = 10^{-6}	Exposure Routes Total, Risk = 10^{-6}
Soil	Soil[1]	EU 8	**Explosives**											
	Child		2-AMINO-4,6-DINITROTOLUENE	4.72E+01	6.79E+01	--		--		--		--		NA
			4-AMINO-2,6-DINITROTOLUENE	3.34E+01	4.84E+01	--		--		--		--		NA
			2,4-DINITROTOLUENE	2.56E+00	7.03E+00	8.7E-07		2.5E-07		1.5E-11		--		1.1E-06
			2,6-DINITROTOLUENE	2.05E+00	3.08E+00	1.5E-06		4.2E-07		--		--		2.0E-06
			RDX	6.12E-01	7.70E-01	7.4E-08		3.1E-09		--		1.1E-05		1.1E-05
			2,4,6-TRINITROTOLUENE	4.11E+03	6.00E+03	1.4E-04		3.8E-05		--		--		1.7E-04
			Inorganics											
			BARIUM	2.01E+03	2.85E+03	--		--		--		--		NA
			CADMIUM	4.28E+01	6.27E+01	--		--		5.2E-09		--		5.2E-09
			COPPER	6.64E+02	9.60E+02	--		--		--		--		NA
			IRON	4.69E+04		--		--		--		--		NA
			ZINC	2.08E+04	2.96E+04	--		--		--		--		NA
	Soil[1]	EU 8	**Explosives**											
	Adult		2,4-DINITROTOLUENE	2.56E+00	7.03E+00	1.9E-07		1.5E-07		6.2E-11		--		3.4E-07
			2,6-DINITROTOLUENE	2.05E+00	3.08E+00	3.3E-07		2.6E-07		--		--		5.9E-07
			RDX	6.12E-01	7.70E-01	1.6E-08		1.9E-09		--		4.5E-05		4.5E-05
			2,4,6-TRINITROTOLUENE	4.11E+03	6.00E+03	2.9E-05		2.3E-05		--		--		5.2E-05
			Inorganics											
			CADMIUM	4.28E+01	6.27E+01	--		--		2.1E-08		--		2.1E-08
			COPPER	6.64E+02	9.60E+02	--		--		--		--		NA
			ZINC	2.08E+04	2.96E+04	--		--		--		--		NA

TABLE 6
CALCULATION OF PRELIMINARY REMEDIATION GOALS
REASONABLE MAXIMUM EXPOSURE
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU 8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY

Location: Former Lake Ontario Ordnance Works
Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child and Adult

Medium	Exposure Medium	Exposure Point	Constituent of Potential Concern	Total Soil EPC (mg/kg)	Surface Soil EPC (mg/kg)	Carcinogenic Risk								
						Ingestion	Ingestion Risk = 10^{-6}	Dermal	Dermal Risk = 10^{-6}	Inhalation	Inhalation Risk = 10^{-6}	Plant Ingestion	Plant Risk = 10^{-6}	Exposure Routes Total, Risk = 10^{-6}
Soil	Soil[1] Adult + Child	EU 8	**Explosives**											
			2,4-DINITROTOLUENE	2.56E+00	7.03E+00	1.1E-06	2.4E+00	4.0E-07	6.4E+00	7.7E-11	3.3E+04	NA	NA	1.8E+00
			2,6-DINITROTOLUENE	2.05E+00	3.08E+00	1.9E-06	1.1E+00	6.8E-07	3.0E+00	NA	NA	NA	NA	8.1E-01
			RDX	6.12E-01	7.70E-01	9.0E-08	6.8E+00	5.0E-09	1.2E+02	NA	NA	5.6E-05	1.4E-02	1.4E-02
			2,4,6-TRINITROTOLUENE	4.11E+03	6.00E+03	1.6E-04	2.5E+01	6.1E-05	6.7E+01	NA	NA	NA	NA	1.8E+01
			2-NITROTOLUENE	3.34E+01	3.09E+00	4.8E-07	7.0E+01	1.8E-07	1.9E+02	NA	NA	NA	NA	5.1E+01
			Inorganics											
			CADMIUM	4.28E+01	6.27E+01	NA	NA	NA	NA	2.6E-08	1.6E+03	NA	NA	1.6E+03
			NICKEL	1.06E+02	1.86E+02	NA	NA	NA	NA	9.4E-09	1.1E+04	NA	NA	1.1E+04
			PAHs											
			BENZO(A)PYRENE	1.79E-01	1.79E-01	8.2E-06	2.2E-02	3.4E-06	5.3E-02	1.7E-10	1.1E+03	2.4E-06	7.6E-02	1.3E-02

-- = No risks calculated for this exposure pathway

1) Ingestion, dermal contact, and inhalation exposure routes are based upon total soil; ingestion of home-grown produce is based upon surface soil.

TABLE 6
CALCULATION OF PRELIMINARY REMEDIATION GOALS
REASONABLE MAXIMUM EXPOSURE
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU 8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY

Location: Former Lake Ontario Ordnance Works
Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child and Adult

Medium	Exposure Medium	Exposure Point	Constituent of Potential Concern	Non-Carcinogenic Hazard Quotient										
				Primary Target Organ	Ingestion	Ingestion HQ	Dermal	Dermal HQ	Inhalation	Inhalation HQ	Plant Ingestion	Plant HQ	Exposure Routes Total HQ = 1	Exposure Routes Total HQ = 0.1
Soil	Soil[1]	EU 8	**Explosives**											
	Child		2-AMINO-4,6-DINITROTOLUENE	CNS, Digestive System	3.0E-01	1.6E+02	5.1E-03	9.3E+03	--	NA	--	NA	1.5E+02	1.5E+01
			4-AMINO-2,6-DINITROTOLUENE	CNS, Digestive System	2.1E-01	1.6E+02	5.4E-03	6.2E+03	--	NA	--	NA	1.5E+02	1.5E+01
			2,4-DINITROTOLUENE	CNS, Digestive System	1.6E-02	1.6E+02	4.7E-03	5.5E+02	--	NA	--	NA	1.2E+02	1.2E+01
			2,6-DINITROTOLUENE	CNS, Liver, and Blood	2.6E-02	7.8E+01	7.3E-03	2.8E+02	--	NA	--	NA	6.1E+01	6.1E+00
			RDX	Prostate	2.6E-03	2.3E+02	1.1E-04	5.6E+03	--	NA	4.0E-01	1.9E+00	1.9E+00	1.9E-01
			2,4,6-TRINITROTOLUENE	Liver	1.1E+02	3.9E+01	2.9E+01	1.4E+02	--	NA	--	NA	3.1E+01	3.1E+00
			Inorganics											
			BARIUM	Kidneys	1.3E-01	1.6E+04	--	NA	3.2E-03	6.3E+05	2.7E-02	1.1E+05	1.3E+04	1.3E+03
			CADMIUM	Kidneys	5.5E-01	7.8E+01	6.1E-02	7.0E+02	1.7E-03	2.5E+04	1.2E+00	5.3E+01	3.0E+01	3.0E+00
			COPPER	Liver and Kidneys	2.1E-01	3.1E+03	--	NA	--	NA	3.0E-01	3.2E+03	1.6E+03	1.6E+02
			IRON	Gastrointestinal System	8.6E-01	5.5E+04	--	NA	--	NA	--	NA	5.5E+04	5.5E+03
			ZINC	Blood	8.9E-01	2.3E+04	--	NA	--	NA	1.2E+00	2.4E+04	1.2E+04	1.2E+03
	Soil[1]	EU 8	**Explosives**											
	Adult		2,4-DINITROTOLUENE	CNS, Digestive System	8.8E-04	2.9E+03	7.1E-04	3.6E+03	--	NA	--	NA	1.6E+03	1.6E+02
			2,6-DINITROTOLUENE	CNS, Liver, and Blood	1.4E-03	1.5E+03	1.1E-03	1.8E+03	--	NA	--	NA	8.2E+02	8.2E+01
			RDX	Prostate	1.4E-04	4.4E+03	1.7E-05	3.7E+04	--	NA	4.0E-01	1.9E+00	1.9E+00	1.9E-01
			2,4,6-TRINITROTOLUENE	Liver	5.6E+00	7.3E+02	4.5E+00	9.1E+02	--	NA	--	NA	4.1E+02	4.1E+01
			Inorganics											
			CADMIUM	Kidneys	2.9E-02	1.5E+03	9.4E-03	4.6E+03	1.7E-03	2.5E+04	1.2E+00	5.2E+01	5.0E+01	5.0E+00
			COPPER	Liver and Kidneys	1.1E-02	5.8E+04	--	NA	--	NA	3.1E-01	3.1E+03	3.0E+03	3.0E+02
			ZINC	Blood	4.7E-02	4.4E+05	--	NA	--	NA	1.2E+00	2.4E+04	2.3E+04	2.3E+03

TABLE 6
CALCULATION OF PRELIMINARY REMEDIATION GOALS
REASONABLE MAXIMUM EXPOSURE
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)
EU 8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY

Location: Former Lake Ontario Ordnance Works
Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child and Adult

Medium	Exposure Medium	Exposure Point	Constituent of Potential Concern	Non-Carcinogenic Hazard Quotient										
				Primary Target Organ	Ingestion	Ingestion HQ	Dermal	Dermal HQ	Inhalation	Inhalation HQ	Plant Ingestion	Plant HQ	Exposure Routes Total HQ = 1	Exposure Routes Total HQ = 0.1
Soil	Soil[1] Adult + Child	EU 8												

-- = No risks calculated for this exposure pathway

1) Ingestion, dermal contact, and inhalation exposı

TABLE 7
COC CONTRIBUTION SITE RISKS - RESIDENT
EU 8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)

Receptor: Resident (Adult and Child)
Pathway: Soil

Chemical of Concern	Cancer Effects					
	Oral	Dermal	Inhalation Dust	Ingestion of Home Grown Produce	Cancer Risk Total	Percent of Total
Explosives						
2,4,6-TRINITROTOLUENE	2E-04	6E-05	NA	NA	2E-04	74%
2,4-DINITROTOLUENE	1E-06	4E-07	8E-11	NA	1E-06	0%
2,6-DINITROTOLUENE	2E-06	7E-07	NA	NA	3E-06	1%
RDX	NA	NA	NA	6E-05	6E-05	19%
Inorganics						
CHROMIUM (HEXAVALENT)	5E-06	NA	4E-08	6E-07	5E-06	2%
PAHs						
BENZO(A)PYRENE	8E-06	3E-06	2E-10	2E-06	1E-05	5%
	2E-04	**7E-05**	**4E-08**	**6E-05**	**3E-04**	

COC = Chemical of Concern
NA = Not applicable
PAHs = Polyaromatic Hydrocarbons

TABLE 8
SUMMARY OF HUMAN HEALTH PRELIMINARY REMEDIATION GOALS
SURFACE SOIL
EU 8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)

Chemical of Concern	EPC (mg/kg)	Max (mg/kg)	Target Organ	Risk-Based PRG (mg/kg)					NYSDEC SCO[a] (mg/kg)
				Risk = 10^{-6}	Risk = 10^{-5}	Risk = 10^{-4}	HI = 0.1	HI = 1	
Adult Trespasser									
Explosives									
2,4,6-TRINITROTOLUENE	6,004	19,000	Liver	425	4,254	4,254	273	2,735	NA
Adolescent Trespasser									
Explosives									
2,4,6-TRINITROTOLUENE	6,004	19,000	Liver	424	4,239	42,386	91	908	NA
Maintenance Worker									
Explosives									
2,4,6-TRINITROTOLUENE	6,004	19,000	Liver	131	1,306	13,057	70	700	NA
Commercial Worker									
Explosives									
2,4,6-TRINITROTOLUENE	6,004	19,000	Liver	169	1,686	16,864	90	903	NA

mg/kg = milligrams per kilogram
EPC = Exposure Point Concentration
Max = Maximum Detected Concentration
PRG = Preliminary Remediation Goal
HI = Hazard Index
NYSDEC SCO = New York State Department of Environmental Conservation Soil Cleanup Objective

a) NYSDEC SCO taken from Table 375-6.8(b), *Restricted Use Soil Cleanup Objectives.*

TABLE 9
SUMMARY OF HUMAN HEALTH PRELIMINARY REMEDIATION GOALS
TOTAL SOIL
EU 8 - OCCIDENTAL CHEMICAL CORPORATION PROPERTY
FORMER LAKE ONTARIO ORDNANCE WORKS (LOOW)

Chemical of Concern	EPC (mg/kg)	Max (mg/kg)	Target Organ	Risk-Based PRG (mg/kg)					NYSDEC SCO[a] (mg/kg)
				Risk = 10^{-6}	Risk = 10^{-5}	Risk = 10^{-4}	HI = 0.1	HI = 1	
Construction Worker									
Explosives									
2,4,6-TRINITROTOLUENE	4,109	19,000	Liver	437	4,366	43,665	9	94	NA
Resident Adult and Child[b]									
Explosives									
RDX[c]	0.61	6.3	Prostate	0.014	0.14	1.4	NA	NA	NA
2,4,6-TRINITROTOLUENE	4,109	19,000	Liver	18	183	1,826	NA	NA	NA
Resident Child									
Explosives									
2,6-DINITROTOLUENE	2.1	22	CNS, Liver, Blood	NA	NA	NA	6.1	61	NA
2,4,6-TRINITROTOLUENE	4,109	19,000	Liver	NA	NA	NA	3.1	31	NA
Inorganics									
BARIUM	2,007	9,710	Kidneys	NA	NA	NA	1,333	13,332	350[d]
CADMIUM	43	184	Kidneys	NA	NA	NA	3	30	2.5[d]
COPPER	664	4,790	Liver and Kidneys	NA	NA	NA	157	1,572	50
ZINC	20,800	52,300	Blood	NA	NA	NA	1,197	11,970	109[d]
Resident Adult									
Explosives									
2,6-DINITROTOLUENE	2.1	22	CNS, Liver, Blood	NA	NA	NA	82	816	NA
2,4,6-TRINITROTOLUENE	4,109	19,000	Liver	NA	NA	NA	41	406	NA
Inorganics									
CADMIUM	43	184	Kidneys	NA	NA	NA	5	50	2.5[d]
COPPER	664	4,790	Liver and Kidneys	NA	NA	NA	296	2,961	50

mg/kg = milligrams per kilogram
EPC = Exposure Point Concentration
Max = Maximum Detected Concentration
PRG = Preliminary Remediation Goal
HI = Hazard Index
NYSDEC SCO = New York State Department of Environmental Conservation Soil Cleanup Objective

a) NYSDEC SCO taken from Table 375-6.8(b), *Unrestricted and Restricted Use Soil Cleanup Objectives*. For the construction worker, the NYSDEC SCO is the restricted use, industrial worker. For the resident, the NYSDEC SCO is based upon unrestricted use.
b) Carcinogenic risks for the resident adult and child are evaluated as a cumulative lifetime exposure.
c) The site-specific PRG for RDX is selected at a risk level of 10^{-5} based upon typical level of quantitation for this chemical.
d) The NYSDEC SCO is based upon the rural soil background concentration.

APPENDIX E
SUMMARY OF ALTERNATIVE COST ESTIMATES

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Project Cost Over Time Report
(with Markups)

System:

RACER Version: RACER™ Version 11.1.12.0
Database Location: N:\Projects_Ongoing\3108- LOOW\05_EU8-OCCP_FS (2012)\02_Draft\024_Appendices\Appendix F - RACER Cost Estimates\Post 2nd Backcheck Comments\LOOW_OCCP_FS_Draft_v05_11_1.mdb

Folder:

Folder Name: Lake Ontario Ordnance Works (LOOW)

Project:

ID: OCCP (EU8)
Name: OCCP (EU8)
Category: None

Location
State / Country: NEW YORK
City: NIAGARA BUFFALO DEFENSE AREA

Location Modifier	Default	User	Reason for changes
	1.100	1.113	

Options
Database: System Costs
Cost Database Date: 2011
Report Option: Fiscal

Description
The project is a Feasibility Study for Exposure Unit 8 (EU8) at the Occidental Chemical Corporation (OCCP). The OCCP is a portion of the former Lake Ontario Ordnance Works (LOOW) installation located in

Project Cost Over Time Report
(with Markups)

Lewiston, NY.

In accordance with the Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (USEPA, 1988), cost estimates for evaluating alternatives will be based on a variety of cost estimating data, include cost curves, generic unit costs, vendor information, conventional cost-estimating guides, and prior similar estimates as modified by site-specific information. Absolute accuracy of cost estimates during evaluating is not essential. Because uncertainties associated with the definition of alternatives often remain, it may not be practicable to define the costs of alternatives with the accuracy desired for the detailed analysis (i.e., +50 percent to -30 percent). The focus should be to make comparative estimates for alternatives with relative accuracy so that cost decisions among alternatives will be sustained as the accuracy of cost estimates improves beyond the evaluating process.

Because this cost estimate will serve as the basis for a Cost and Schedule Risk Analysis, escalation has not been applied.

Site:

ID: OCCP (EU 8)
Name: Alternative #4 - Excavation and Offsite Disposal
Type: None

Media/Waste Type

Primary: Soil
Secondary: N/A

Contaminant

Primary: Ordnance (residual)
Secondary: Metals

Phase Names

SI ☐
RI/FS ☐
EE/CA ☐

Project Cost Over Time Report
(with Markups)

RD ☐
RmA-C ☐
IRA ☐
RA-C ☐
RA-O ☐
LTM ☐
PCO ☐

Documentation

Description: LOOW OCCP Feasibility Study - Alternative #4: Excavation with Offsite Disposal
Support Team: Documentation of personnel used to provide support for estimator and preparation of the estimate.
References: Documentation of reference sources used in the preparation of the estimate.

Estimator Information

Estimator Name: [redacted]
Estimator Title: Environmental Scientist
Agency/Org./Office: ERT, Inc.
Business Address: 14401 Sweitzer Lane, Suite 300
Laurel, MD 20707
Telephone Number: [redacted]
Email Address: [redacted]t@ertcorp.com
Estimate Prepared Date: 04/29/2015

Estimator Signature: _____ **Date:** _____

Reviewer Information

Reviewer Name: [redacted]
Reviewer Title: PM
Agency/Org./Office: ERT, Inc.
Business Address: 14401 Sweitzer Lane, Suite 300
Laurel, MD 20707
Telephone Number: [redacted]

Project Cost Over Time Report
(with Markups)

Email Address: [redacted]@ertcorp.com
Date Reviewed: 04/29/2015

Reviewer Signature: _____ **Date:** _____

Project Cost Over Time Report
(with Markups)

Site Name	Site Type	2014	2015	2016	2017	2018	2019
Alternative #4 - Excavation and Offsite Disposal	OCCP (EU 8)	$0	$0	$357,248	$488,797	$0	$0
Alternative #2 - Land Use Controls	OCCP (EU8)	$61,447	$0	$684,991	$270,499	$58,732	$58,732
Alternative #3 - Landfill Capping	OCCP (EU8)	$61,447	$0	$684,991	$629,793	$130,505	$130,505
Alternative #5 - Ex Situ Chemical Reduct/Oxidation	OCCP (EU8)	$158,840	$224,775	$460,216	$1,392,919	$130,505	$130,505
Total Project Cost		$281,734	$224,775	$2,187,446	$2,782,008	$319,742	$319,742

Project Cost Over Time Report
(with Markups)

Site Name	Site Type	2020	2021	2022	2023	2024	2025
Alternative #4 - Excavation and Offsite Disposal	OCCP (EU 8)	$0	$0	$0	$0	$0	$0
Alternative #2 - Land Use Controls	OCCP (EU8)	$58,732	$58,732	$102,646	$58,732	$58,732	$58,732
Alternative #3 - Landfill Capping	OCCP (EU8)	$130,505	$130,505	$177,807	$130,505	$130,505	$130,505
Alternative #5 - Ex Situ Chemical Reduct/Oxidation	OCCP (EU8)	$130,505	$130,505	$177,807	$130,505	$130,505	$130,505
Total Project Cost		$319,742	$319,742	$458,260	$319,742	$319,742	$319,742

Project Cost Over Time Report
(with Markups)

Site Name	Site Type	2026	2027	2028	2029	2030	2031
Alternative #4 - Excavation and Offsite Disposal	OCCP (EU 8)	$0	$0	$0	$0	$0	$0
Alternative #2 - Land Use Controls	OCCP (EU8)	$58,732	$102,646	$58,732	$58,732	$58,732	$58,732
Alternative #3 - Landfill Capping	OCCP (EU8)	$130,505	$177,807	$130,505	$130,505	$130,505	$130,505
Alternative #5 - Ex Situ Chemical Reduct/Oxidation	OCCP (EU8)	$130,505	$177,807	$130,505	$130,505	$130,505	$130,505
Total Project Cost		$319,742	$458,260	$319,742	$319,742	$319,742	$319,742

Project Cost Over Time Report
(with Markups)

Site Name	Site Type	2032	2033	2034	2035	2036	2037
Alternative #4 - Excavation and Offsite Disposal	OCCP (EU 8)	$0	$0	$0	$0	$0	$0
Alternative #2 - Land Use Controls	OCCP (EU8)	$102,646	$58,732	$58,732	$58,732	$58,732	$102,646
Alternative #3 - Landfill Capping	OCCP (EU8)	$177,807	$130,505	$130,505	$130,505	$130,505	$177,807
Alternative #5 - Ex Situ Chemical Reduct/Oxidation	OCCP (EU8)	$177,807	$130,505	$130,505	$130,505	$130,505	$177,807
Total Project Cost		$458,260	$319,742	$319,742	$319,742	$319,742	$458,260

Project Cost Over Time Report
(with Markups)

Site Name	Site Type	2038	2039	2040	2041	2042	2043
Alternative #4 - Excavation and Offsite Disposal	OCCP (EU 8)	$0	$0	$0	$0	$0	$0
Alternative #2 - Land Use Controls	OCCP (EU8)	$58,732	$58,732	$58,732	$58,732	$102,646	$58,732
Alternative #3 - Landfill Capping	OCCP (EU8)	$130,505	$130,505	$130,505	$130,505	$177,807	$130,505
Alternative #5 - Ex Situ Chemical Reduct/Oxidation	OCCP (EU8)	$130,505	$130,505	$130,505	$130,505	$177,807	$130,505
Total Project Cost		$319,742	$319,742	$319,742	$319,742	$458,260	$319,742

Project Cost Over Time Report
(with Markups)

Site Name	Site Type	2044	2045	2046	2047	Total	
Alternative #4 - Excavation and Offsite Disposal	OCCP (EU 8)	$0	$0	$0	$0	$846,045	
Alternative #2 - Land Use Controls	OCCP (EU8)	$58,732	$58,732	$58,732	$109,591	$3,049,326	
Alternative #3 - Landfill Capping	OCCP (EU8)	$130,505	$130,505	$130,505	$112,980	$5,510,363	
Alternative #5 - Ex Situ Chemical Reduct/Oxidation	OCCP (EU8)	$130,505	$130,505	$130,505	$112,980	$6,370,882	
Total Project Cost		$319,742	$319,742	$319,742	$335,551	$15,776,616	$0

Alternative #2:
Land-Use Controls

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Estimate Documentation Report

System:

RACER Version: RACER™ Version 11.1.12.0
Database Location: N:\Projects_Ongoing\3108- LOOW\05_EU8-OCCP_FS (2012)\02_Draft\024_Appendices\Appendix F - RACER Cost Estimates\Post 2nd Backcheck Comments\LOOW_OCCP_FS_Draft_v05_11_1.mdb

Folder:

Folder Name: Lake Ontario Ordnance Works (LOOW)

Project:

ID: OCCP (EU8)
Name: OCCP (EU8)
Category: None

Location
State / Country: NEW YORK
City: NIAGARA BUFFALO DEFENSE AREA

Location Modifier	Default	User	Reason for changes
	1.100	1.113	

Options
Database: System Costs
Cost Database Date: 2011
Report Option: Fiscal

Description

The project is a Feasibility Study for Exposure Unit 8 (EU8) at the Occidental Chemical Corporation (OCCP). The OCCP is a portion of the former Lake Ontario Ordnance Works (LOOW) installation located in Lewiston, NY.

In accordance with the Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (USEPA, 1988), cost estimates for evaluating alternatives will be based on a variety of cost estimating data, include cost curves, generic unit costs, vendor information, conventional cost-estimating guides, and prior similar estimates as modified by site-specific information. Absolute accuracy of cost estimates during evaluating is not essential. Because uncertainties associated with the definition of alternatives often remain, it may not be practicable to define the costs of alternatives with the accuracy desired for the detailed analysis (i.e., +50 percent to -30 percent). The focus should be to make comparative estimates for alternatives with relative accuracy so that cost decisions among alternatives will be sustained as the accuracy of cost estimates improves beyond the evaluating process.

Because this cost estimate will serve as the basis for a Cost and Schedule Risk Analysis, escalation has not been applied.

This report for official U.S. Government use only.

Estimate Documentation Report

Site:

ID: OCCP (EU8)
Name: Alternative #2 - Land Use Controls
Type: None

Media/Waste Type

Primary: Soil
Secondary: N/A

Contaminant

Primary: Ordnance (residual)
Secondary: Metals

Phase Names

- **SI** ☐
- **RI/FS** ☐
- **EE/CA** ☐
- **RD** ☐
- **RmA-C** ☐
- **IRA** ☐
- **RA-C** ☐
- **RA-O** ☐
- **LTM** ☐
- **PCO** ☐

Documentation

Description: LOOW OCCP Feasibility Study - Alternative #2: Land Use Controls
Support Team: Documentation of personnel used to provide support for estimator and preparation of the estimate.
References: Documentation of reference sources used in the preparation of the estimate.

Estimator Information

Estimator Name: [redacted]
Estimator Title: Environmental Scientist
Agency/Org./Office: ERT, Inc.
Business Address: 14401 Sweitzer Lane, Suite 500
Laurel, MD 20707
Telephone Number: [redacted]
Email Address: [redacted]@ertcorp.com
Estimate Prepared Date: 04/29/2015

Estimator Signature: _____ **Date:** _____

Reviewer Information

Reviewer Name: [redacted]
Reviewer Title: PM
Agency/Org./Office: ERT, Inc.
Business Address: 14401 Sweitzer Lane, Suite 500
Laurel, MD 2070

This report for official U.S. Government use only.

Estimate Documentation Report

Telephone Number: [redacted]
Email Address: [redacted]@ertcorp.com
Date Reviewed: 04/29/2015

Reviewer Signature: _____ **Date:** _____

Estimate Costs:

Phase Names	Direct Cost	Marked-Up
Remedial Action for Alt #2	$8,649.57	$12,961.38
Remedial Design for Alt #2	$61,447.00	$61,447.00
Site Closeout for Alt #2	$27,588.14	$65,677.52
O&M for Alt #2	$1,079,924.49	$2,684,465.49
USACE Project Plans	$150,000.00	$224,775.00
Total Cost:	$1,327,609.20	$3,049,326.39
Total Site Cost:	$1,327,609.20	$3,049,326.39

Phase Documentation:

Phase Type: Remedial Action
Phase Name: Remedial Action for Alt #2
Description: Land use controls - fencing

Approach: None
Start Date: January, 2017
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate

Phase Markup Template: System Defaults

Technology Markups	Markup	% Prime	% Sub.
Fencing	True	100	0

Total Marked-up Cost: $12,961.38

Technologies:

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Estimate Documentation Report

Technology Name: **Fencing (#2)**

User Name: **Fencing**

Description	Default	Value	UOM
System Definition			
Required Parameters			
Type of Fence		Boundary	n/a
Fence Length		350	LF
Safety Level		D	n/a

Comments:

Phase Documentation:

Phase Type: Design

Phase Name: Remedial Design for Alt #2

Description: It is assumed that the remedial design costs will be approximately 12 percent of the total capital costs as per Exhibit 5-8: Examples Professional Services for Professional/Technical Services Capital Costs (USEPA, 2000).

USEPA, 2000. A Guide to Developing and Documenting Cost Estimates During the Feasibility Study (EPA 540-R-00-002; OSWER 9355.0-75).

Approach: Ex Situ

Start Date: January, 2016

Labor Rate Group: System Labor Rate

Analysis Rate Group: System Analysis Rate

Phase Markup Template: System Defaults

Technology Markups	Markup	% Prime	% Sub.
Remedial Design (Percent)	False	0	0

Total Marked-up Cost: $61,447.00

Technologies:

Technology Name: **Remedial Design (Percent) (#2)**

User Name: **Remedial Design (Percent)**

Description	Default	Value	UOM
System Definition			
Required Parameters			
Phase		Remedial Action for Alt #3	n/a
Approach		None	n/a

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Estimate Documentation Report

Technology Name: **Remedial Design (Percent) (#2)**

User Name: **Remedial Design (Percent)**

Description	Default	Value	UOM
System Definition			
Secondary Parameters			
Phase Costs		222935.10	$
Calculate Design Cost			
Required Parameters			
Phase Date		2014	n/a
Design Approach		In Situ Containment	n/a
Design Percent	12.00	12.00	%
MCC		222935.10	$
Design $		61447.00	$
Year		2014	n/a

Comments:

Phase Documentation:

Phase Type: Site Closeout
Phase Name: Site Closeout for Alt #2
Description: Site closeout activities and documentation.

Approach: None
Start Date: July, 2047
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate

Phase Markup Template: System Defaults

Technology Markups	Markup	% Prime	% Sub.
Site Close-Out Documentation	True	100	0

Total Marked-up Cost: $65,677.52

Technologies:

Technology Name: **Site Close-Out Documentation (#2)**

User Name: **Site Close-Out Documentation**

Description	Default	Value	UOM
System Definition			
Required Parameters			
Meetings		True	n/a

This report for official U.S. Government use only.

Estimate Documentation Report

Technology Name: **Site Close-Out Documentation (#2)**

User Name: **Site Close-Out Documentation**

Description	Default	Value	UOM
System Definition			
Secondary Parameters			
Work Plans and Reports		False	n/a
Documents		True	n/a
Site Close-Out Complexity		High	n/a
Meetings			
Required Parameters			
Kick Off/Scoping Meetings		True	n/a
Kick Off/Scoping Meetings: Number of Meetings	1	1	EA
Kick Off/Scoping Meetings: Travel		True	n/a
Kick Off/Scoping Meetings: Travelers		2	EA
Kick Off/Scoping Meetings: Days		3	Days
Kick Off/Scoping Meetings: Air Fare		500.00	$
Review Meetings		True	n/a
Review Meetings: Number of Meetings	1	1	EA
Review Meetings: Travel		True	n/a
Review Meetings: Travelers		2	EA
Review Meetings: Days		3	Days
Review Meetings: Air Fare		500.00	$
Regulatory Review Meetings		True	n/a
Regulatory Review Meetings: Number of Meetings	1	1	EA
Regulatory Review Meetings: Travel		True	n/a
Regulatory Review Meetings: Travelers		2	EA
Regulatory Review Meetings: Days		3	Days
Regulatory Review Meetings: Air Fare		500.00	$
Documents			
Required Parameters			
Draft Decision Document		True	n/a
Draft Final Decision Document		True	n/a
Final Decision Document		True	n/a
Long Term Document Storage		False	n/a
Number of Boxes		0	EA
Duration of Storage		0	Yrs

Comments:

Phase Documentation:

Phase Type: Operations & Maintenance

Phase Name: O&M for Alt #2

Description: This alternative will not result in UU/UE. Post-Remedy O&M and Five-Year Reviews will be completed to ensure the continued effectiveness of any alternative that is not assumed to result in UU/UE.

This report for official U.S. Government use only.

Estimate Documentation Report

Approach: None
Start Date: July, 2017
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Phase Markup Template: System Defaults

Technology Markups	Markup	% Prime	% Sub.
Five-Year Review	True	100	0
POST-REMEDY O&M	True	100	0

Total Marked-up Cost: $2,684,465.49

Technologies:

Technology Name: **Administrative Land Use Controls (#2)**
User Name: **POST-REMEDY O&M**

Description	Default	Value	UOM
System Definition			
Required Parameters			
Rename Model		POST-REMEDY O&M	n/a
Planning Documents		True	n/a
Planning Documents: Start Date		2016	n/a
Implementation		True	n/a
Implementation: Start Date		2017	n/a
Monitoring & Enforcement		True	n/a
Monitoring & Enforcement: Start Date		2017	n/a
Modification/Termination		False	n/a
Modification/Termination: Start Date		2014	n/a
Type of Site		Former Government Site	n/a
Planning Documents			
Required Parameters			
LUC Assurance Plan (LUCAP)		False	n/a
LUC Implementation Plan (LUCIP)		True	n/a
LUC Implementation Plan (LUCIP): Number		1	EA
LUC Implementation Plan (LUCIP): Plan Complexity		Medium	n/a
Long-term Stewardship (LTS) Plan		False	n/a
Long-term Stewardship (LTS) Plan: Number		0	EA
Memorandum of Agreements (MOA)		True	n/a
Memorandum of Agreements (MOA): Number		1	EA
Memorandum of Agreements (MOA): Plan Complexity		Medium	n/a
Installation (or City) Master Plan		True	n/a

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Estimate Documentation Report

Technology Name: **Administrative Land Use Controls (#2)**

User Name: **POST-REMEDY O&M**

Description	Default	Value	UOM
Planning Documents			
Secondary Parameters			
Installation (or City) Master Plan: Plan Complexity		Medium	n/a
Construction Permitting		False	n/a
Construction Permitting: Number		0	EA
Geographic Information Systems (GIS)/Overlay Maps		True	n/a
Geographic Information Systems (GIS)/Overlay Maps: Number		1	EA
Geographic Information Systems (GIS)/Overlay Maps: Plan Complexity		Medium	n/a
Planning Meetings			
Required Parameters			
LUCAP: Number of Meetings		0	EA
LUCAP: Number of People		0	EA
LUCAP: Number of Days		0	EA
LUCAP: Airfare Cost		0.00	$
LUCAP: Mileage to Meeting Site		0	MI
LUCIP: Number of Meetings		2	EA
LUCIP: Number of People		2	EA
LUCIP: Number of Days		2	EA
LUCIP: Airfare Cost		500.00	$
LUCIP: Mileage to Meeting Site		10	MI
LTS: Number of Meetings		0	EA
LTS: Number of People		0	EA
LTS: Number of Days		0	EA
LTS: Airfare Cost		0.00	$
LTS: Mileage to Meeting Site		0	MI
MOA: Number of Meetings		2	EA
MOA: Number of People		2	EA
MOA: Number of Days		2	EA
MOA: Airfare Cost		500.00	$
MOA: Mileage to Meeting Site		10	MI
Master Plan: Number of Meetings		2	EA
Master Plan: Number of People		2	EA
Master Plan: Number of Days		2	EA
Master Plan: Airfare Cost		500.00	$
Master Plan: Mileage to Meeting Site		10	MI
Construction Permitting: Number of Meetings		0	EA
Construction Permitting: Number of People		0	EA
Construction Permitting: Number of Days		0	EA
Construction Permitting: Airfare Cost		0.00	$
Construction Permitting: Mileage to Meeting Site		0	MI
GIS/Overlay Maps: Number of Meetings		2	EA

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Estimate Documentation Report

Technology Name: **Administrative Land Use Controls (#2)**

User Name: **POST-REMEDY O&M**

Description	Default	Value	UOM
Planning Meetings			
Secondary Parameters			
GIS/Overlay Maps: Number of People		2	EA
GIS/Overlay Maps: Number of Days		2	EA
GIS/Overlay Maps: Airfare Cost		500.00	$
GIS/Overlay Maps: Mileage to Meeting Site		10	MI
Implementation			
Required Parameters			
Modify Installation (or City) Master Plan		True	n/a
Modify Installation (or City) Master Plan: Task Complexity		Medium	n/a
Deed Notification		True	n/a
Deed Notification: Number		1	EA
Deed Notification: Task Complexity		Medium	n/a
Negotiating Easements		False	n/a
Negotiating Easements: Number		0	EA
Restrictive Covenants		True	n/a
Restrictive Covenants: Number		1	EA
Restrictive Covenants: Task Complexity		Medium	n/a
Equitable Servitudes		False	n/a
Equitable Servitudes: Number		0	EA
Access Control Signs		True	n/a
Access Control Signs: Number		24	EA
Access Control Signs: Task Complexity		Medium	n/a
Utility Notification Service		False	n/a
Access Control Signs: Number		0	EA
Geographic Information Systems (GIS)/Overlay Maps		True	n/a
Geographic Information Systems (GIS)/Overlay Maps: Number		1	EA
Geographic Information Systems (GIS)/Overlay Maps: Task Complexity		Medium	n/a
Develop Finding of Suitability to Transfer (FOST)		False	n/a
Monitoring & Enforcement			
Required Parameters			
Duration of Monitoring/Enforcement		30	Years
Notice Letters		True	n/a
Notice Letters: Number		24	EA
Notice Letters: Frequency		Annually	n/a
Guard Service/Security		False	n/a
Guard Service/Security: Number		0	EA
Reports & Certifications		True	n/a
Reports & Certifications: Frequency		Annually	n/a
Site Visits/Inspections		True	n/a
Site Visits/Inspections: Number		1	EA

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Estimate Documentation Report

Technology Name: **Administrative Land Use Controls (#2)**

User Name: **POST-REMEDY O&M**

Description	Default	Value	UOM
Monitoring & Enforcement			
Secondary Parameters			
Site Visits/Inspections: Safety Level		D	n/a
Site Visits/Inspections: Duration		2	Days
Site Visits/Inspections: Number of People		2	EA
Site Visits/Inspections: Frequency		Annually	n/a
Site Visits/Inspections: Airfare		500	$ Per Ticket
Site Visits/Inspections: Mileage		100	MI

Comments:

Technology Name: **Five-Year Review (#2)**

User Name: **Five-Year Review**

Description	Default	Value	UOM
System Definition			
Required Parameters			
Site Complexity		Moderate	n/a
Document Review		True	n/a
Interviews		True	n/a
Site Inspection		True	n/a
Report		True	n/a
Travel		True	n/a
Rebound Study		False	n/a
No. Reviews		6	EA
Safety Level		D	n/a
Document Review			
Required Parameters			
5-Year Review Check List		True	n/a
Record of Decision		True	n/a
Remedial Action Design & Construction		True	n/a
Close-Out Report		True	n/a
Operations & Maintenance Manuals & Reports		False	n/a
Consent Decree or Settlement Records		True	n/a
Groundwater Monitoring & Reports		True	n/a
Remedial Action Required		True	n/a
Previous 5-Year Review Reports		True	n/a
Interviews			
Required Parameters			
Current and Previous Staff Management		False	n/a
Community Groups		False	n/a
State Contacts		True	n/a
Local Government Contacts		True	n/a

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Estimate Documentation Report

Technology Name: **Five-Year Review (#2)**

User Name: **Five-Year Review**

Description	Default	Value	UOM
Interviews			
Secondary Parameters			
Operations & Maintenance Contractors		True	n/a
PRPs		True	n/a
Remedial Design Consultant		False	n/a
Site Inspection			
Required Parameters			
General Site Inspection		True	n/a
Containment System Inspection		False	n/a
Monitoring Systems Inspection		True	n/a
Treatment Systems Inspection		False	n/a
Regulatory Compliance		False	n/a
Site Visit Documentation (Photos, Diagrams, etc.)		True	n/a
Report			
Required Parameters			
Introduction		True	n/a
Remedial Objectives		True	n/a
ARARs Review		True	n/a
Summary of Site Visit		True	n/a
Areas of Non Compliance		True	n/a
Technology Recommendations		True	n/a
Statement of Protectiveness		True	n/a
Next Review		True	n/a
Implementation Requirements		True	n/a
Travel			
Required Parameters			
Number of Travelers		2	EA
Number of Days		3	EA
Air Fare Ticket Price		500.00	$
Need a rental car?		True	n/a

Comments:

Phase Documentation:

Phase Type: Design
Phase Name: USACE Project Plans
Description: New Phase

Approach: Ex Situ
Start Date: January, 2016
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate

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Estimate Documentation Report

Phase Markup Template: System Defaults

Technology Markups	Markup	% Prime	% Sub.
USACE Project Plans	True	100	0

Total Marked-up Cost: $224,775.00

Technologies:

Technology Name: **User Defined Estimate (#2)**

User Name: **USACE Project Plans**

Description	Default	Value	UOM
System Definition			
Required Parameters			
Model Name		USACE Project Plans	n/a
WBS Type		HTRW	n/a
Selected WBS		333.30.91	n/a
Safety Level		E	n/a

Comments:

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Site Cost Over Time Report
(with Markups)

System:

RACER Version: RACER™ Version 11.1.12.0
Database Location: N:\Projects_Ongoing\3108- LOOW\05_EU8-OCCP_FS (2012)\02_Draft\024_Appendices\Appendix F - RACER Cost Estimates\Post 2nd Backcheck Comments\LOOW_OCCP_FS_Draft_v05_11_1.mdb

Folder:

Folder Name: Lake Ontario Ordnance Works (LOOW)

Project:

ID: OCCP (EU8)
Name: OCCP (EU8)
Category: None

Location
State / Country: NEW YORK
City: NIAGARA BUFFALO DEFENSE AREA

Location Modifier	Default	User	Reason for changes
	1.100	1.113	

Options
Database: System Costs
Cost Database Date: 2011
Report Option: Fiscal

Description
The project is a Feasibility Study for Exposure Unit 8 (EU8) at the Occidental Chemical Corporation (OCCP). The OCCP is a portion of the former Lake Ontario Ordnance Works (LOOW) installation located in

Site Cost Over Time Report
(with Markups)

Lewiston, NY.

In accordance with the Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (USEPA, 1988), cost estimates for evaluating alternatives will be based on a variety of cost estimating data, include cost curves, generic unit costs, vendor information, conventional cost-estimating guides, and prior similar estimates as modified by site-specific information. Absolute accuracy of cost estimates during evaluating is not essential. Because uncertainties associated with the definition of alternatives often remain, it may not be practicable to define the costs of alternatives with the accuracy desired for the detailed analysis (i.e., +50 percent to -30 percent). The focus should be to make comparative estimates for alternatives with relative accuracy so that cost decisions among alternatives will be sustained as the accuracy of cost estimates improves beyond the evaluating process.

Because this cost estimate will serve as the basis for a Cost and Schedule Risk Analysis, escalation has not been applied.

Site:

ID: OCCP (EU8)
Name: Alternative #2 - Land Use Controls
Type: None

Media/Waste Type

Primary: Soil
Secondary: N/A

Contaminant

Primary: Ordnance (residual)
Secondary: Metals

Phase Names

SI ☐
RI/FS ☐
EE/CA ☐

Site Cost Over Time Report
(with Markups)

RD ☐
RmA-C ☐
IRA ☐
RA-C ☐
RA-O ☐
LTM ☐
PCO ☐

Documentation

Description: LOOW OCCP Feasibility Study - Alternative #2: Land Use Controls
Support Team: Documentation of personnel used to provide support for estimator and preparation of the estimate.
References: Documentation of reference sources used in the preparation of the estimate.

Estimator Information

Estimator Name: [redacted]
Estimator Title: Environmental Scientist
Agency/Org./Office: ERT, Inc.
Business Address: 14401 Sweitzer Lane, Suite 500
Laurel, MD 20707
Telephone Number: [redacted]
Email Address: [redacted]@ertcorp.com
Estimate Prepared Date: 04/29/2015

Estimator Signature: _____ **Date:** _____

Reviewer Information

Reviewer Name: [redacted]
Reviewer Title: PM
Agency/Org./Office: ERT, Inc.
Business Address: 14401 Sweitzer Lane, Suite 500
Laurel, MD 2070
Telephone Number: [redacted]

Site Cost Over Time Report
(with Markups)

Email Address: [redacted]@ertcorp.com
Date Reviewed: 04/29/2015

Reviewer Signature: _____ **Date:** _____

Site Cost Over Time Report
(with Markups)

Phase Type	Phase Name	2014	2015	2016	2017	2018	2019
Operations & Maintenance	O&M for Alt #2	$0	$0	$460,216	$257,538	$58,732	$58,732
Remedial Action	Remedial Action for Alt #2	$0	$0	$0	$12,961	$0	$0
Design	Remedial Design for Alt #2	$61,447	$0	$0	$0	$0	$0
Site Closeout	Site Closeout for Alt #2	$0	$0	$0	$0	$0	$0
Design	USACE Project Plans	$0	$0	$224,775	$0	$0	$0
Total Site Cost		$61,447	$0	$684,991	$270,499	$58,732	$58,732

Site Cost Over Time Report
(with Markups)

Phase Type	Phase Name	2020	2021	2022	2023	2024	2025
Operations & Maintenance	O&M for Alt #2	$58,732	$58,732	$102,646	$58,732	$58,732	$58,732
Remedial Action	Remedial Action for Alt #2	$0	$0	$0	$0	$0	$0
Design	Remedial Design for Alt #2	$0	$0	$0	$0	$0	$0
Site Closeout	Site Closeout for Alt #2	$0	$0	$0	$0	$0	$0
Design	USACE Project Plans	$0	$0	$0	$0	$0	$0
Total Site Cost		$58,732	$58,732	$102,646	$58,732	$58,732	$58,732

Site Cost Over Time Report
(with Markups)

Phase Type	Phase Name	2026	2027	2028	2029	2030	2031
Operations & Maintenance	O&M for Alt #2	$58,732	$102,646	$58,732	$58,732	$58,732	$58,732
Remedial Action	Remedial Action for Alt #2	$0	$0	$0	$0	$0	$0
Design	Remedial Design for Alt #2	$0	$0	$0	$0	$0	$0
Site Closeout	Site Closeout for Alt #2	$0	$0	$0	$0	$0	$0
Design	USACE Project Plans	$0	$0	$0	$0	$0	$0
Total Site Cost		$58,732	$102,646	$58,732	$58,732	$58,732	$58,732

Site Cost Over Time Report
(with Markups)

Phase Type	Phase Name	2032	2033	2034	2035	2036	2037
Operations & Maintenance	O&M for Alt #2	$102,646	$58,732	$58,732	$58,732	$58,732	$102,646
Remedial Action	Remedial Action for Alt #2	$0	$0	$0	$0	$0	$0
Design	Remedial Design for Alt #2	$0	$0	$0	$0	$0	$0
Site Closeout	Site Closeout for Alt #2	$0	$0	$0	$0	$0	$0
Design	USACE Project Plans	$0	$0	$0	$0	$0	$0
Total Site Cost		$102,646	$58,732	$58,732	$58,732	$58,732	$102,646

Site Cost Over Time Report
(with Markups)

Phase Type	Phase Name	2038	2039	2040	2041	2042	2043
Operations & Maintenance	O&M for Alt #2	$58,732	$58,732	$58,732	$58,732	$102,646	$58,732
Remedial Action	Remedial Action for Alt #2	$0	$0	$0	$0	$0	$0
Design	Remedial Design for Alt #2	$0	$0	$0	$0	$0	$0
Site Closeout	Site Closeout for Alt #2	$0	$0	$0	$0	$0	$0
Design	USACE Project Plans	$0	$0	$0	$0	$0	$0
Total Site Cost		$58,732	$58,732	$58,732	$58,732	$102,646	$58,732

Site Cost Over Time Report
(with Markups)

Phase Type	Phase Name	2044	2045	2046	2047	Total	
Operations & Maintenance	O&M for Alt #2	$58,732	$58,732	$58,732	$43,914	$2,684,465	
Remedial Action	Remedial Action for Alt #2	$0	$0	$0	$0	$12,961	
Design	Remedial Design for Alt #2	$0	$0	$0	$0	$61,447	
Site Closeout	Site Closeout for Alt #2	$0	$0	$0	$65,678	$65,678	
Design	USACE Project Plans	$0	$0	$0	$0	$224,775	
Total Site Cost		$58,732	$58,732	$58,732	$109,591	$3,049,326	$0

OCCP (EU8) - Alternative #2 - Land Use Controls Site Assembly Level Data Report

Phase Name	Tech. Key	Technology Name	Assembly No.	Assembly Description	Qty	UOM	Materials	Labor	Equipment	SubBid	Extended Cost
Remedial Action for Alt #2	51	Fencing	18040105	Boundary Fence, 5' Galvanized	350	LF	11.92	10.54	1.82	0.00	8,498.82
Remedial Action for Alt #2	51	Fencing	18040501	Hazardous Waste Signing	2	EA	43.42	31.96	0.00	0.00	150.75
	51 Total										8,649.57
Remedial Design for Alt #2	63	Remedial Design (Percent)	32032001	Remedial Design Professional Labor	1	EA	0.00	61,447.00	0.00	0.00	61,447.00
	63 Total										61,447.00
Site Closeout for Alt #2	58	Site Close-Out Documentation	33010108	Sedan, Automobile, Rental	9	DAY	0.00	0.00	0.00	54.06	486.53
Site Closeout for Alt #2	58	Site Close-Out Documentation	33010202	Per Diem (per person)	18	DAY	0.00	0.00	0.00	154.00	2,772.00
Site Closeout for Alt #2	58	Site Close-Out Documentation	33041101	Airfare	1	LS	0.00	0.00	0.00	3,000.00	3,000.00
Site Closeout for Alt #2	58	Site Close-Out Documentation	33220101	Senior Project Manager	1	HR	0.00	93.55	0.00	0.00	93.55
Site Closeout for Alt #2	58	Site Close-Out Documentation	33220101	Senior Project Manager	3	HR	0.00	93.55	0.00	0.00	280.66
Site Closeout for Alt #2	58	Site Close-Out Documentation	33220102	Project Manager	33	HR	0.00	70.74	0.00	0.00	2,334.29
Site Closeout for Alt #2	58	Site Close-Out Documentation	33220102	Project Manager	48	HR	0.00	70.74	0.00	0.00	3,395.33
Site Closeout for Alt #2	58	Site Close-Out Documentation	33220104	Senior Staff Engineer	8	HR	0.00	93.62	0.00	0.00	748.96
Site Closeout for Alt #2	58	Site Close-Out Documentation	33220106	Staff Engineer	93	HR	0.00	83.45	0.00	0.00	7,760.60
Site Closeout for Alt #2	58	Site Close-Out Documentation	33220106	Staff Engineer	42	HR	0.00	83.45	0.00	0.00	3,504.79
Site Closeout for Alt #2	58	Site Close-Out Documentation	33220114	Word Processing/Clerical	38	HR	0.00	36.48	0.00	0.00	1,386.39
Site Closeout for Alt #2	58	Site Close-Out Documentation	33220114	Word Processing/Clerical	16	HR	0.00	36.48	0.00	0.00	583.74
Site Closeout for Alt #2	58	Site Close-Out Documentation	33220115	Draftsman/CADD	27	HR	0.00	40.04	0.00	0.00	1,081.13
Site Closeout for Alt #2	58	Site Close-Out Documentation	33220115	Draftsman/CADD	4	HR	0.00	40.04	0.00	0.00	160.17
	58 Total										27,588.14
O&M for Alt #2	59	Five-Year Review	33010108	Sedan, Automobile, Rental	3	DAY	0.00	0.00	0.00	59.32	177.97
O&M for Alt #2	59	Five-Year Review	33010202	Per Diem (per person)	6	DAY	0.00	0.00	0.00	156.00	936.00
O&M for Alt #2	59	Five-Year Review	33041101	Airfare	2	LS	0.00	0.00	0.00	500.00	1,000.00
O&M for Alt #2	59	Five-Year Review	33220102	Project Manager	12	HR	0.00	92.47	0.00	0.00	1,109.63
O&M for Alt #2	59	Five-Year Review	33220102	Project Manager	6	HR	0.00	92.47	0.00	0.00	554.81
O&M for Alt #2	59	Five-Year Review	33220102	Project Manager	12	HR	0.00	92.47	0.00	0.00	1,109.63

OCCP (EU8) - Alternative #2 - Land Use Controls Site Assembly Level Data Report

Phase Name	Tech. Key	Technology Name	Assembly No.	Assembly Description	Qty	UOM	Materials	Labor	Equipment	SubBid	Extended Cost
O&M for Alt #2	59	Five-Year Review	33220102	Project Manager	5	HR	0.00	92.47	0.00	0.00	462.35
O&M for Alt #2	59	Five-Year Review	33220105	Project Engineer	13	HR	0.00	77.23	0.00	0.00	1,003.94
O&M for Alt #2	59	Five-Year Review	33220105	Project Engineer	8	HR	0.00	77.23	0.00	0.00	617.81
O&M for Alt #2	59	Five-Year Review	33220105	Project Engineer	31	HR	0.00	77.23	0.00	0.00	2,394.00
O&M for Alt #2	59	Five-Year Review	33220108	Project Scientist	10	HR	0.00	85.43	0.00	0.00	854.31
O&M for Alt #2	59	Five-Year Review	33220108	Project Scientist	25	HR	0.00	85.43	0.00	0.00	2,135.78
O&M for Alt #2	59	Five-Year Review	33220108	Project Scientist	9	HR	0.00	85.43	0.00	0.00	768.88
O&M for Alt #2	59	Five-Year Review	33220109	Staff Scientist	21	HR	0.00	49.45	0.00	0.00	1,038.47
O&M for Alt #2	59	Five-Year Review	33220109	Staff Scientist	50	HR	0.00	49.45	0.00	0.00	2,472.54
O&M for Alt #2	59	Five-Year Review	33220109	Staff Scientist	10	HR	0.00	49.45	0.00	0.00	494.51
	59 Total										17,130.61
O&M for Alt #2	60	POST-REMEDY O&M	18010412	Construction Signs	576	SF	29.49	0.00	0.00	0.00	16,988.83
O&M for Alt #2	60	POST-REMEDY O&M	33010104	Sample collection, vehicle mileage charge, car or van	120	MI	0.00	0.00	0.00	0.51	61.20
O&M for Alt #2	60	POST-REMEDY O&M	33010104	Sample collection, vehicle mileage charge, car or van	100	MI	0.00	0.00	0.00	0.51	51.00
O&M for Alt #2	60	POST-REMEDY O&M	33010108	Sedan, Automobile, Rental	3	DAY	0.00	0.00	0.00	59.32	177.97
O&M for Alt #2	60	POST-REMEDY O&M	33010108	Sedan, Automobile, Rental	18	DAY	0.00	0.00	0.00	59.32	1,067.81
O&M for Alt #2	60	POST-REMEDY O&M	33010202	Per Diem (per person)	8	DAY	0.00	0.00	0.00	156.00	1,248.00
O&M for Alt #2	60	POST-REMEDY O&M	33010202	Per Diem (per person)	48	DAY	0.00	0.00	0.00	156.00	7,488.00
O&M for Alt #2	60	POST-REMEDY O&M	33022037	Overnight Delivery, 8 oz Letter	18	EA	0.00	0.00	0.00	20.19	363.42
O&M for Alt #2	60	POST-REMEDY O&M	33022038	Overnight delivery service, 1 lb package	12	LB	0.00	0.00	0.00	23.83	285.95
O&M for Alt #2	60	POST-REMEDY O&M	33022038	Overnight delivery service, 1 lb package	6	LB	0.00	0.00	0.00	23.83	142.98
O&M for Alt #2	60	POST-REMEDY O&M	33040671	Portable GPS Set with Mapping, 5 cm Accuracy	1	MO	2,660.07	0.00	0.00	0.00	2,660.07
O&M for Alt #2	60	POST-REMEDY O&M	33041101	Airfare	2	LS	0.00	0.00	0.00	500.00	1,000.00
O&M for Alt #2	60	POST-REMEDY O&M	33041101	Airfare	12	LS	0.00	0.00	0.00	500.00	6,000.00
O&M for Alt #2	60	POST-REMEDY O&M	33220102	Project Manager	267	HR	0.00	75.82	0.00	0.00	20,245.19

OCCP (EU8) - Alternative #2 - Land Use Controls Site Assembly Level Data Report

Phase Name	Tech. Key	Technology Name	Assembly No.	Assembly Description	Qty	UOM	Materials	Labor	Equipment	SubBid	Extended Cost
O&M for Alt #2	60	POST-REMEDY O&M	33220102	Project Manager	70	HR	0.00	75.82	0.00	0.00	5,307.73
O&M for Alt #2	60	POST-REMEDY O&M	33220102	Project Manager	62	HR	0.00	75.82	0.00	0.00	4,701.13
O&M for Alt #2	60	POST-REMEDY O&M	33220102	Project Manager	48	HR	0.00	92.47	0.00	0.00	4,438.52
O&M for Alt #2	60	POST-REMEDY O&M	33220105	Project Engineer	240	HR	0.00	63.33	0.00	0.00	15,198.03
O&M for Alt #2	60	POST-REMEDY O&M	33220105	Project Engineer	200	HR	0.00	63.33	0.00	0.00	12,665.03
O&M for Alt #2	60	POST-REMEDY O&M	33220105	Project Engineer	140	HR	0.00	63.33	0.00	0.00	8,865.52
O&M for Alt #2	60	POST-REMEDY O&M	33220106	Staff Engineer	460	HR	0.00	84.84	0.00	0.00	39,027.83
O&M for Alt #2	60	POST-REMEDY O&M	33220106	Staff Engineer	160	HR	0.00	84.84	0.00	0.00	13,574.90
O&M for Alt #2	60	POST-REMEDY O&M	33220106	Staff Engineer	110	HR	0.00	103.47	0.00	0.00	11,381.39
O&M for Alt #2	60	POST-REMEDY O&M	33220110	QA/QC Officer	40	HR	0.00	70.05	0.00	0.00	2,802.14
O&M for Alt #2	60	POST-REMEDY O&M	33220110	QA/QC Officer	7	HR	0.00	70.05	0.00	0.00	490.37
O&M for Alt #2	60	POST-REMEDY O&M	33220110	QA/QC Officer	74	HR	0.00	70.05	0.00	0.00	5,183.96
O&M for Alt #2	60	POST-REMEDY O&M	33220112	Field Technician	2	HR	0.00	42.60	0.00	0.00	85.21
O&M for Alt #2	60	POST-REMEDY O&M	33220114	Word Processing/Clerical	280	HR	0.00	37.81	0.00	0.00	10,587.94
O&M for Alt #2	60	POST-REMEDY O&M	33220114	Word Processing/Clerical	125	HR	0.00	37.81	0.00	0.00	4,726.76
O&M for Alt #2	60	POST-REMEDY O&M	33220114	Word Processing/Clerical	96	HR	0.00	37.81	0.00	0.00	3,630.15
O&M for Alt #2	60	POST-REMEDY O&M	33220114	Word Processing/Clerical	36	HR	0.00	46.11	0.00	0.00	1,660.13
O&M for Alt #2	60	POST-REMEDY O&M	33220115	Draftsman/CADD	48	HR	0.00	40.55	0.00	0.00	1,946.39
O&M for Alt #2	60	POST-REMEDY O&M	33220115	Draftsman/CADD	16	HR	0.00	40.55	0.00	0.00	648.80
O&M for Alt #2	60	POST-REMEDY O&M	33220115	Draftsman/CADD	440	HR	0.00	40.55	0.00	0.00	17,841.87
O&M for Alt #2	60	POST-REMEDY O&M	33220115	Draftsman/CADD	320	HR	0.00	40.55	0.00	0.00	12,975.91
O&M for Alt #2	60	POST-REMEDY O&M	33220119	Health and Safety Officer	17	HR	0.00	65.85	0.00	0.00	1,119.37
O&M for Alt #2	60	POST-REMEDY O&M	33220120	Computer Data Entry	200	HR	0.00	37.81	0.00	0.00	7,562.81
O&M for Alt #2	60	POST-REMEDY O&M	33220213	Surveying - 3-man Crew	4	DAY	0.00	1,523.86	15.76	0.00	6,158.49

OCCP (EU8) - Alternative #2 - Land Use Controls Site Assembly Level Data Report

Phase Name	Tech. Key	Technology Name	Assembly No.	Assembly Description	Qty	UOM	Materials	Labor	Equipment	SubBid	Extended Cost
O&M for Alt #2	60	POST-REMEDY O&M	33220503	Attorney, Partner, Real Estate	30	HR	0.00	269.36	0.00	0.00	8,080.79
O&M for Alt #2	60	POST-REMEDY O&M	33220504	Attorney, Partner, Contracts	40	HR	0.00	269.36	0.00	0.00	10,774.38
O&M for Alt #2	60	POST-REMEDY O&M	33220505	Attorney, Senior Associate, Real Estate	8	HR	0.00	233.84	0.00	0.00	1,870.69
O&M for Alt #2	60	POST-REMEDY O&M	33220507	Attorney, Associate, Real Estate	40	HR	0.00	190.05	0.00	0.00	7,602.11
O&M for Alt #2	60	POST-REMEDY O&M	33220508	Attorney, Associate, Contracts	80	HR	0.00	190.05	0.00	0.00	15,204.22
O&M for Alt #2	60	POST-REMEDY O&M	33220509	Paralegal, Real Estate	40	HR	0.00	55.29	0.00	0.00	2,211.52
O&M for Alt #2	60	POST-REMEDY O&M	33220509	Paralegal, Real Estate	8	HR	0.00	55.29	0.00	0.00	442.30
O&M for Alt #2	60	POST-REMEDY O&M	33220510	Paralegal, Contracts	80	HR	0.00	55.29	0.00	0.00	4,423.04
O&M for Alt #2	60	POST-REMEDY O&M	33240101	Other Direct Costs	1	LS	1,025.49	0.00	0.00	0.00	1,025.49
O&M for Alt #2	60	POST-REMEDY O&M	33240101	Other Direct Costs	1	LS	495.59	0.00	0.00	0.00	495.59
O&M for Alt #2	60	POST-REMEDY O&M	33240101	Other Direct Costs	1	LS	3,472.76	0.00	0.00	0.00	3,472.76
O&M for Alt #2	60	POST-REMEDY O&M	33240101	Other Direct Costs	1	LS	1,590.44	0.00	0.00	0.00	1,590.44
O&M for Alt #2	60	POST-REMEDY O&M	33990111	Local Fees	1	LS	200.00	0.00	0.00	0.00	200.00
	60 Total										307,754.10
USACE Project Plans	61	USACE Project Plans	32032001	Remedial Design Professional Labor	1	EA	0.00	150,000.00	0.00	0.00	150,000.00
	61 Total										150,000.00
	Grand Total										572,569.43

Alternative #3:
Landfill Cap

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Estimate Documentation Report

System:

RACER Version: RACER™ Version 11.1.12.0
Database Location: N:\Projects_Ongoing\3108- LOOW\05_EU8-OCCP_FS (2012)\02_Draft\024_Appendices\Appendix F - RACER Cost Estimates\Post 2nd Backcheck Comments\LOOW_OCCP_FS_Draft_v05_11_1.mdb

Folder:

Folder Name: Lake Ontario Ordnance Works (LOOW)

Project:

ID: OCCP (EU8)
Name: OCCP (EU8)
Category: None

Location
State / Country: NEW YORK
City: NIAGARA BUFFALO DEFENSE AREA

Location Modifier	Default	User	Reason for changes
	1.100	1.113	

Options
Database: System Costs
Cost Database Date: 2011
Report Option: Fiscal

Description

The project is a Feasibility Study for Exposure Unit 8 (EU8) at the Occidental Chemical Corporation (OCCP). The OCCP is a portion of the former Lake Ontario Ordnance Works (LOOW) installation located in Lewiston, NY.

In accordance with the Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (USEPA, 1988), cost estimates for evaluating alternatives will be based on a variety of cost estimating data, include cost curves, generic unit costs, vendor information, conventional cost-estimating guides, and prior similar estimates as modified by site-specific information. Absolute accuracy of cost estimates during evaluating is not essential. Because uncertainties associated with the definition of alternatives often remain, it may not be practicable to define the costs of alternatives with the accuracy desired for the detailed analysis (i.e., +50 percent to -30 percent). The focus should be to make comparative estimates for alternatives with relative accuracy so that cost decisions among alternatives will be sustained as the accuracy of cost estimates improves beyond the evaluating process.

Because this cost estimate will serve as the basis for a Cost and Schedule Risk Analysis, escalation has not been applied.

This report for official U.S. Government use only.

Estimate Documentation Report

Site:

ID: OCCP (EU8)
Name: Alternative #3 - Landfill Capping
Type: None

Media/Waste Type

Primary: Soil
Secondary: N/A

Contaminant

Primary: Ordnance (residual)
Secondary: Metals

Phase Names

- **SI** ☐
- **RI/FS** ☐
- **EE/CA** ☐
- **RD** ☐
- **RmA-C** ☐
- **IRA** ☐
- **RA-C** ☐
- **RA-O** ☐
- **LTM** ☐
- **PCO** ☐

Documentation

Description: LOOW OCCP Feasibility Study - Alternative #3: Landfill Capping
Support Team: Documentation of personnel used to provide support for estimator and preparation of the estimate.
References: Documentation of reference sources used in the preparation of the estimate.

Estimator Information

Estimator Name: [redacted]
Estimator Title: Environmental Scientist
Agency/Org./Office: ERT, Inc.
Business Address: 14401 Sweitzer Lane, Suite 500
Laurel, MD 20707
Telephone Number [redacted]
Email Address [redacted]
Estimate Prepared Date: 04/29/2015

Estimator Signature: _____ **Date:** _____

Reviewer Information

Reviewer Name: [redacted]
Reviewer Title: PM
Agency/Org./Office: ERT, Inc.
Business Address: 14401 Sweitzer Lane, Suite 500
Laurel, MD 2070

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Estimate Documentation Report

Telephone Number: [redacted]
Email Address: [redacted]
Date Reviewed: 04/29/2015

Reviewer Signature: _____ **Date:** _____

Estimate Costs:

Phase Names	Direct Cost	Marked-Up
Remedial Action for Alt #3	$148,774.82	$222,935.10
LTM for Alt #3	$934,876.23	$2,230,732.34
Remedial Design for Alt #3	$61,447.00	$61,447.00
Site Closeout for Alt #3	$27,588.14	$65,677.52
O&M for Alt #3	$1,087,234.33	$2,704,795.75
USACE Project Plans	$150,000.00	$224,775.00
Total Cost:	$2,409,920.52	$5,510,362.70
Total Site Cost:	$2,409,920.52	$5,510,362.70

Phase Documentation:

Phase Type: Remedial Action
Phase Name: Remedial Action for Alt #3
Description: Landfill capping of COC-contaminated soil with anchors keyed into native clay.
Approach: None
Start Date: January, 2017
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Phase Markup Template: System Defaults

Technology Markups	Markup	% Prime	% Sub.
Fencing	True	100	0
Cleanup and Landscaping	True	100	0
Capping	True	100	0
Clear and Grub	True	100	0

Total Marked-up Cost: $222,935.10

Technologies:

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Estimate Documentation Report

Technology Name: **Capping (#1)**

User Name: **Capping**

Description	Default	Value	UOM
System Definition			
Required Parameters			
Type of Cap		RCRA C (Hazardous Waste) Cap	n/a
Acres		0.13	AC
Length		106	FT
Width		53	FT
Safety Level		D	n/a
General			
Secondary Parameters			
Side Slope of Cap	3	3	n/a
Horizontal Projection of Side Slope	13	13	FT
Horizontal Projection of Top Slope	13	13	FT
RCRA C			
Secondary Parameters			
Surface Layer Type	Vegetated Layer	Vegetated Layer	n/a
Surface Layer Thickness	6	6	IN
Surface Layer Borrow Source	Off-Site	Off-Site	n/a
Protection Layer Thickness	24	24	IN
Protection Layer Borrow Source	Off-Site	Off-Site	n/a
Drainage Layer Type	Geocomposite	Geocomposite	n/a
Composite Barrier: Geomembrane Type	40 Mil HDPE	40 Mil HDPE	n/a
Composite Barrier: Compacted Clay Layer Type	Geosynthetic Clay Liner	Geosynthetic Clay Liner	n/a
Foundation Layer Thickness	12	12	IN
Foundation Layer Borrow Source	Off-Site	Off-Site	n/a
Gas Vent System		False	n/a
Waste Depth		0	FT

Comments:

Technology Name: **Cleanup and Landscaping (#1)**

User Name: **Cleanup and Landscaping**

Description	Default	Value	UOM
System Definition			
Required Parameters			
Type of Site Preparation		Cleanup	n/a
Preparation Area		0.13	AC
Safety Level		D	n/a
Landscaping			
Secondary Parameters			
Landscaping Type	Seeding	Seeding	n/a
Landscaping Area	0.00	0.00	%

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Estimate Documentation Report

Comments:

Technology Name: **Clear and Grub (#2)**

User Name: **Clear and Grub**

Description	Default	Value	UOM
System Definition			
Required Parameters			
Acres		1	AC
Dry Soil		80.00	%
Wet Soil		20.00	%
Include Load and Haul Costs		True	n/a
Safety Level		D	n/a
Clearing			
Secondary Parameters			
Brush Density	Medium	Medium	n/a
Debris Reduction	None	None	n/a
Trees Per Acre (<= 6")	0	60	EA/AC
Trees Per Acre (> 6" & <= 12")	100	20	EA/AC
Trees Per Acre (> 12" & <= 24")	0	20	EA/AC
Trees Per Acre (> 24" & <= 36")	0	0	EA/AC
Stumps Per Acre (<= 6")	0	60	EA/AC
Stumps Per Acre (> 6" & <= 12")	100	20	EA/AC
Stumps Per Acre (> 12" & <= 24")	0	20	EA/AC
Stumps Per Acre (> 24" & <= 36")	0	0	EA/AC
Grubbing			
Secondary Parameters			
Grubbing Depth	6	0	IN
Bulk Factor	1.2	1.2	n/a
Equipment	Dozer - 105hp	Dozer - 105hp	n/a
Soil Stripping			
Secondary Parameters			
Soil Depth	0	0	IN
Stripping Area	0.00	0.00	%
Soil Equipment	Dozer - 200hp	Dozer - 200hp	n/a
Disposal	Stockpilling	Stockpilling	n/a
Bulk Factor	1.2	1.2	n/a
Load and Haul			
Secondary Parameters			
Truck Type		Highway	n/a
Volume		4200	CY
One-way Haul Distance		10	MI
Dump Charge		15	$/CY

Comments: Volume is assumed to be 30% of the area of EU8 by 1 yard.

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Estimate Documentation Report

Technology Name: **Fencing (#1)**

User Name: **Fencing**

Description	Default	Value	UOM
System Definition			
Required Parameters			
Type of Fence		Boundary	n/a
Fence Length		350	LF
Safety Level		D	n/a

Comments:

Phase Documentation:

Phase Type: Long Term Monitoring

Phase Name: LTM for Alt #3

Description: Long term monitoring of groundwater and reporting will be completed annually to verify the long-term effectiveness of the landfill cap. Four groundwater monitoring wells will be installed and sampled annually. Annual reports presenting the groundwater analyticla data will be generated.

Approach: None

Start Date: July, 2017

Labor Rate Group: System Labor Rate

Analysis Rate Group: System Analysis Rate

Phase Markup Template: System Defaults

Technology Markups	Markup	% Prime	% Sub.
Groundwater Monitoring Well	True	100	0
ANNUAL GROUNDWATER MONITORING	True	100	0
Off-site Transportation and Waste Disposal	True	100	0
Well Abandonment	True	100	0

Total Marked-up Cost: $2,230,732.34

Technologies:

Technology Name: **Groundwater Monitoring Well (#1)**

User Name: **Groundwater Monitoring Well**

Description	Default	Value	UOM
System Definition			
Required Parameters			
Number of Aquifers		One	n/a

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Estimate Documentation Report

Technology Name: **Groundwater Monitoring Well (#1)**

User Name: **Groundwater Monitoring Well**

Description	Default	Value	UOM
System Definition			
Secondary Parameters			
Include Guard Posts		Yes	n/a
Depth to Groundwater to Aquifer One		8	FT
Number of Wells to Aquifer One		4	EA
Safety Level		D	n/a
Aquifer One			
Required Parameters			
Aquifer One: Average Well Depth		18	LF
Aquifer One: Formation Type		Unconsolidated	n/a
Aquifer One: Drilling Method		Hollow Stem	n/a
Aquifer One: Well Diameter		2 Inch	n/a
Aquifer One: Well Construction Material		PVC Schedule 40	n/a
Aquifer One: Split Spoon Sample Collection		True	n/a
Aquifer One: Average Number of Soil Samples per Well		2	EA
Aquifer One: Soil Analytical Template		System Soil - Ordnance Residual	n/a
Aquifer One: Safety Level		D	n/a

Comments:

Technology Name: **Monitoring (#1)**

User Name: **ANNUAL GROUNDWATER MONITORING**

Description	Default	Value	UOM
System Definition			
Required Parameters			
Model Name		ANNUAL GROUNDWATER MONITORING	n/a
Groundwater		True	n/a
Surface Soil		False	n/a
Surface Water		False	n/a
Subsurface Soil		False	n/a
Sediment		False	n/a
Soil Gas		False	n/a
Air		False	n/a
Site Distance (One-way)		10	MI
Safety Level		D	n/a
Groundwater			
Required Parameters			
Average Sample Depth		15	FT
Samples per Event (First Year)		4	n/a
Samples per Event (Out Years)		4	n/a

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Estimate Documentation Report

Technology Name: **Monitoring (#1)**

User Name: **ANNUAL GROUNDWATER MONITORING**

Description	Default	Value	UOM
Groundwater			
Secondary Parameters			
Number of Events (First Year)		1	n/a
Number of Events (Out Years)		1	n/a
Number of Years (Out Years)		29	n/a
Secondary Parameters			
Primary Analytical Template	System Water - Ordnance Residual	System Water - Ordnance Residual	n/a
Secondary Analytical Template	System Water - Metals	System Water - Metals	n/a
Turnaround Time	Standard (21 Days)	Standard (21 Days)	n/a
Data Package/QC	Stage 1	Stage 4	n/a
Sampling Method	Existing Wells - Low Flow Pump	Existing Wells - Low Flow Pump	n/a
Number of Wells/Day	8	4	EA
Contain Purge Water	Yes	Yes	n/a
QA/QC			
Secondary Parameters			
Split Samples	10	10	EA
Field Duplicate Samples	10	10	EA
Rinse Blanks (per Round)	1	1	EA
Trip Blanks (per Day)	0	0	EA
Matrix Spikes/Matrix Spike Duplicates	20	20	EA
Data Management			
Secondary Parameters			
Monitoring Plan	Standard	Standard	n/a
Lab Data Review	Stage 4	Stage 4	n/a
Submit Data Electronically	Yes	Yes	n/a
Monitoring Reports	Comprehensive	Comprehensive	n/a

Comments:

Technology Name: **Off-site Transportation and Waste Disposal (#1)**

User Name: **Off-site Transportation and Waste Disposal**

Description	Default	Value	UOM
System Definition			
Required Parameters			
Waste Type		Non-Hazardous	n/a
Waste Form		Liquid/Sludge	n/a
Condition of Waste		Non-leaking Drums	n/a
Quantity of Non-Leaking Drums		60	Drums
Transportation Type		Truck	n/a
Truck Distance (One-way)		10	MI
Safety Level		D	n/a

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Estimate Documentation Report

Comments: During the annual groundwater sampling events, 2 drums will be generated per event. Therefore a total of 60 drums will be generated over 30-years of annual groundwater monitoring.

Technology Name: **Well Abandonment (#1)**

User Name: **Well Abandonment**

Description	Default	Value	UOM
System Definition			
Required Parameters			
Safety Level		D	n/a
Abandon Wells			
Required Parameters			
Technology/Group Name		Groundwater Monitoring Well - Aquifer One	n/a
Number of Wells	4	4	n/a
Well Depth		18	FT
Well Diameter		2	IN
Well Abandonment Method		Overdrill / Removal	n/a
Formation Type		Unconsolidated	n/a
Karst Formation Type		False	n/a

Comments:

Phase Documentation:

Phase Type: Design

Phase Name: Remedial Design for Alt #3

Description: It is assumed that the remedial design costs will be approximately 12 percent of the total capital costs as per Exhibit 5-8: Examples Professional Services for Professional/Technical Services Capital Costs (USEPA, 2000).

USEPA, 2000. A Guide to Developing and Documenting Cost Estimates During the Feasibility Study (EPA 540-R-00-002; OSWER 9355.0-75).

Approach: Ex Situ

Start Date: January, 2016

Labor Rate Group: System Labor Rate

Analysis Rate Group: System Analysis Rate

Phase Markup Template: System Defaults

Technology Markups	Markup	% Prime	% Sub.
Remedial Design (Percent)	False	0	0

Total Marked-up Cost: $61,447.00

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Estimate Documentation Report

Technologies:

Technology Name: **Remedial Design (Percent) (#1)**

User Name: **Remedial Design (Percent)**

Description	Default	Value	UOM
System Definition			
Required Parameters			
Phase		Remedial Action for Alt #3	n/a
Approach		None	n/a
Phase Costs		222935.10	$
Calculate Design Cost			
Required Parameters			
Phase Date		2014	n/a
Design Approach		In Situ Containment	n/a
Design Percent	12.00	12.00	%
MCC		222935.10	$
Design $		61447.00	$
Year		2014	n/a

Comments:

Phase Documentation:

Phase Type: Site Closeout
Phase Name: Site Closeout for Alt #3
Description: Site closeout activities and documentation.

Approach: None
Start Date: July, 2047
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate

Phase Markup Template: System Defaults

Technology Markups	Markup	% Prime	% Sub.
Site Close-Out Documentation	True	100	0

Total Marked-up Cost: $65,677.52

Technologies:

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Estimate Documentation Report

Technology Name: **Site Close-Out Documentation (#1)**

User Name: **Site Close-Out Documentation**

Description	Default	Value	UOM
System Definition			
Required Parameters			
Meetings		True	n/a
Work Plans and Reports		False	n/a
Documents		True	n/a
Site Close-Out Complexity		High	n/a
Meetings			
Required Parameters			
Kick Off/Scoping Meetings		True	n/a
Kick Off/Scoping Meetings: Number of Meetings	1	1	EA
Kick Off/Scoping Meetings: Travel		True	n/a
Kick Off/Scoping Meetings: Travelers		2	EA
Kick Off/Scoping Meetings: Days		3	Days
Kick Off/Scoping Meetings: Air Fare		500.00	$
Review Meetings		True	n/a
Review Meetings: Number of Meetings	1	1	EA
Review Meetings: Travel		True	n/a
Review Meetings: Travelers		2	EA
Review Meetings: Days		3	Days
Review Meetings: Air Fare		500.00	$
Regulatory Review Meetings		True	n/a
Regulatory Review Meetings: Number of Meetings	1	1	EA
Regulatory Review Meetings: Travel		True	n/a
Regulatory Review Meetings: Travelers		2	EA
Regulatory Review Meetings: Days		3	Days
Regulatory Review Meetings: Air Fare		500.00	$
Documents			
Required Parameters			
Draft Decision Document		True	n/a
Draft Final Decision Document		True	n/a
Final Decision Document		True	n/a
Long Term Document Storage		False	n/a
Number of Boxes		0	EA
Duration of Storage		0	Yrs

Comments:

Phase Documentation:

Phase Type: Operations & Maintenance

Phase Name: O&M for Alt #3

Description: It is assumed that this alternative will not result in UU/UE. Post-Remedy O&M and Five-Year Reviews will be completed to ensure the continued effectiveness of any alternative that is not assumed to result in UU/UE.

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Estimate Documentation Report

Approach: None
Start Date: July, 2017
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Phase Markup Template: System Defaults

Technology Markups	Markup	% Prime	% Sub.
Five-Year Review	True	100	0
POST-REMEDY O&M	True	100	0

Total Marked-up Cost: $2,704,795.75

Technologies:

Technology Name: **Administrative Land Use Controls (#2)**
User Name: **POST-REMEDY O&M**

Description	Default	Value	UOM
System Definition			
Required Parameters			
Rename Model		POST-REMEDY O&M	n/a
Planning Documents		True	n/a
Planning Documents: Start Date		2016	n/a
Implementation		True	n/a
Implementation: Start Date		2017	n/a
Monitoring & Enforcement		True	n/a
Monitoring & Enforcement: Start Date		2017	n/a
Modification/Termination		False	n/a
Modification/Termination: Start Date		2014	n/a
Type of Site		Former Government Site	n/a
Planning Documents			
Required Parameters			
LUC Assurance Plan (LUCAP)		False	n/a
LUC Implementation Plan (LUCIP)		True	n/a
LUC Implementation Plan (LUCIP): Number		1	EA
LUC Implementation Plan (LUCIP): Plan Complexity		Medium	n/a
Long-term Stewardship (LTS) Plan		False	n/a
Long-term Stewardship (LTS) Plan: Number		0	EA
Memorandum of Agreements (MOA)		True	n/a
Memorandum of Agreements (MOA): Number		1	EA
Memorandum of Agreements (MOA): Plan Complexity		Medium	n/a
Installation (or City) Master Plan		True	n/a

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Estimate Documentation Report

Technology Name: **Administrative Land Use Controls (#2)**

User Name: **POST-REMEDY O&M**

Description	Default	Value	UOM
Planning Documents			
Secondary Parameters			
Installation (or City) Master Plan: Plan Complexity		Medium	n/a
Construction Permitting		False	n/a
Construction Permitting: Number		0	EA
Geographic Information Systems (GIS)/Overlay Maps		True	n/a
Geographic Information Systems (GIS)/Overlay Maps: Number		1	EA
Geographic Information Systems (GIS)/Overlay Maps: Plan Complexity		Medium	n/a
Planning Meetings			
Required Parameters			
LUCAP: Number of Meetings		0	EA
LUCAP: Number of People		0	EA
LUCAP: Number of Days		0	EA
LUCAP: Airfare Cost		0.00	$
LUCAP: Mileage to Meeting Site		0	MI
LUCIP: Number of Meetings		2	EA
LUCIP: Number of People		2	EA
LUCIP: Number of Days		2	EA
LUCIP: Airfare Cost		500.00	$
LUCIP: Mileage to Meeting Site		10	MI
LTS: Number of Meetings		0	EA
LTS: Number of People		0	EA
LTS: Number of Days		0	EA
LTS: Airfare Cost		0.00	$
LTS: Mileage to Meeting Site		0	MI
MOA: Number of Meetings		2	EA
MOA: Number of People		2	EA
MOA: Number of Days		2	EA
MOA: Airfare Cost		500.00	$
MOA: Mileage to Meeting Site		10	MI
Master Plan: Number of Meetings		2	EA
Master Plan: Number of People		2	EA
Master Plan: Number of Days		2	EA
Master Plan: Airfare Cost		500.00	$
Master Plan: Mileage to Meeting Site		10	MI
Construction Permitting: Number of Meetings		0	EA
Construction Permitting: Number of People		0	EA
Construction Permitting: Number of Days		0	EA
Construction Permitting: Airfare Cost		0.00	$
Construction Permitting: Mileage to Meeting Site		0	MI
GIS/Overlay Maps: Number of Meetings		2	EA

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Estimate Documentation Report

Technology Name: **Administrative Land Use Controls (#2)**

User Name: **POST-REMEDY O&M**

Description	Default	Value	UOM
Planning Meetings			
Secondary Parameters			
GIS/Overlay Maps: Number of People		2	EA
GIS/Overlay Maps: Number of Days		2	EA
GIS/Overlay Maps: Airfare Cost		500.00	$
GIS/Overlay Maps: Mileage to Meeting Site		10	MI
Implementation			
Required Parameters			
Modify Installation (or City) Master Plan		True	n/a
Modify Installation (or City) Master Plan: Task Complexity		Medium	n/a
Deed Notification		True	n/a
Deed Notification: Number		1	EA
Deed Notification: Task Complexity		Medium	n/a
Negotiating Easements		False	n/a
Negotiating Easements: Number		0	EA
Restrictive Covenants		True	n/a
Restrictive Covenants: Number		1	EA
Restrictive Covenants: Task Complexity		Medium	n/a
Equitable Servitudes		False	n/a
Equitable Servitudes: Number		0	EA
Access Control Signs		True	n/a
Access Control Signs: Number		24	EA
Access Control Signs: Task Complexity		Medium	n/a
Utility Notification Service		False	n/a
Access Control Signs: Number		0	EA
Geographic Information Systems (GIS)/Overlay Maps		True	n/a
Geographic Information Systems (GIS)/Overlay Maps: Number		1	EA
Geographic Information Systems (GIS)/Overlay Maps: Task Complexity		Medium	n/a
Develop Finding of Suitability to Transfer (FOST)		False	n/a
Monitoring & Enforcement			
Required Parameters			
Duration of Monitoring/Enforcement		30	Years
Notice Letters		True	n/a
Notice Letters: Number		24	EA
Notice Letters: Frequency		Annually	n/a
Guard Service/Security		False	n/a
Guard Service/Security: Number		0	EA
Reports & Certifications		True	n/a
Reports & Certifications: Frequency		Annually	n/a
Site Visits/Inspections		True	n/a
Site Visits/Inspections: Number		1	EA

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Estimate Documentation Report

Technology Name: **Administrative Land Use Controls (#2)**

User Name: **POST-REMEDY O&M**

Description	Default	Value	UOM
Monitoring & Enforcement			
Secondary Parameters			
Site Visits/Inspections: Safety Level		D	n/a
Site Visits/Inspections: Duration		2	Days
Site Visits/Inspections: Number of People		2	EA
Site Visits/Inspections: Frequency		Annually	n/a
Site Visits/Inspections: Airfare		500	$ Per Ticket
Site Visits/Inspections: Mileage		100	MI

Comments:

Technology Name: **Five-Year Review (#1)**

User Name: **Five-Year Review**

Description	Default	Value	UOM
System Definition			
Required Parameters			
Site Complexity		Moderate	n/a
Document Review		True	n/a
Interviews		True	n/a
Site Inspection		True	n/a
Report		True	n/a
Travel		True	n/a
Rebound Study		False	n/a
No. Reviews		6	EA
Safety Level		D	n/a
Document Review			
Required Parameters			
5-Year Review Check List		True	n/a
Record of Decision		True	n/a
Remedial Action Design & Construction		True	n/a
Close-Out Report		True	n/a
Operations & Maintenance Manuals & Reports		False	n/a
Consent Decree or Settlement Records		True	n/a
Groundwater Monitoring & Reports		True	n/a
Remedial Action Required		True	n/a
Previous 5-Year Review Reports		True	n/a
Interviews			
Required Parameters			
Current and Previous Staff Management		False	n/a
Community Groups		False	n/a
State Contacts		True	n/a
Local Government Contacts		True	n/a

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Estimate Documentation Report

Technology Name: **Five-Year Review (#1)**

User Name: **Five-Year Review**

Description	Default	Value	UOM
Interviews			
Secondary Parameters			
Operations & Maintenance Contractors		True	n/a
PRPs		True	n/a
Remedial Design Consultant		False	n/a
Site Inspection			
Required Parameters			
General Site Inspection		True	n/a
Containment System Inspection		True	n/a
Monitoring Systems Inspection		True	n/a
Treatment Systems Inspection		False	n/a
Regulatory Compliance		False	n/a
Site Visit Documentation (Photos, Diagrams, etc.)		True	n/a
Report			
Required Parameters			
Introduction		True	n/a
Remedial Objectives		True	n/a
ARARs Review		True	n/a
Summary of Site Visit		True	n/a
Areas of Non Compliance		True	n/a
Technology Recommendations		True	n/a
Statement of Protectiveness		True	n/a
Next Review		True	n/a
Implementation Requirements		True	n/a
Travel			
Required Parameters			
Number of Travelers		2	EA
Number of Days		3	EA
Air Fare Ticket Price		500.00	$
Need a rental car?		True	n/a

Comments:

Phase Documentation:

Phase Type: Design
Phase Name: USACE Project Plans
Description: New Phase

Approach: Ex Situ
Start Date: January, 2016
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate

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Estimate Documentation Report

Phase Markup Template: System Defaults

Technology Markups	Markup	% Prime	% Sub.
USACE Project Plans	True	100	0

Total Marked-up Cost: $224,775.00

Technologies:

Technology Name: **User Defined Estimate (#1)**

User Name: **USACE Project Plans**

Description	Default	Value	UOM
System Definition			
Required Parameters			
Model Name		USACE Project Plans	n/a
WBS Type		HTRW	n/a
Selected WBS		333.30.91	n/a
Safety Level		E	n/a

Comments:

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Site Cost Over Time Report
(with Markups)

System:

RACER Version: RACER™ Version 11.1.12.0
Database Location: N:\Projects_Ongoing\3108- LOOW\05_EU8-OCCP_FS (2012)\02_Draft\024_Appendices\Appendix F - RACER Cost Estimates\Post 2nd Backcheck Comments\LOOW_OCCP_FS_Draft_v05_11_1.mdb

Folder:

Folder Name: Lake Ontario Ordnance Works (LOOW)

Project:

ID: OCCP (EU8)
Name: OCCP (EU8)
Category: None

Location
State / Country: NEW YORK
City: NIAGARA BUFFALO DEFENSE AREA

Location Modifier	Default	User	Reason for changes
	1.100	1.113	

Options
Database: System Costs
Cost Database Date: 2011
Report Option: Fiscal

Description
The project is a Feasibility Study for Exposure Unit 8 (EU8) at the Occidental Chemical Corporation (OCCP). The OCCP is a portion of the former Lake Ontario Ordnance Works (LOOW) installation located in

Site Cost Over Time Report
(with Markups)

Lewiston, NY.

In accordance with the Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (USEPA, 1988), cost estimates for evaluating alternatives will be based on a variety of cost estimating data, include cost curves, generic unit costs, vendor information, conventional cost-estimating guides, and prior similar estimates as modified by site-specific information. Absolute accuracy of cost estimates during evaluating is not essential. Because uncertainties associated with the definition of alternatives often remain, it may not be practicable to define the costs of alternatives with the accuracy desired for the detailed analysis (i.e., +50 percent to -30 percent). The focus should be to make comparative estimates for alternatives with relative accuracy so that cost decisions among alternatives will be sustained as the accuracy of cost estimates improves beyond the evaluating process.

Because this cost estimate will serve as the basis for a Cost and Schedule Risk Analysis, escalation has not been applied.

Site:

ID: OCCP (EU8)
Name: Alternative #3 - Landfill Capping
Type: None

Media/Waste Type

Primary: Soil
Secondary: N/A

Contaminant

Primary: Ordnance (residual)
Secondary: Metals

Phase Names

SI ☐
RI/FS ☐
EE/CA ☐

Site Cost Over Time Report
(with Markups)

RD ☐
RmA-C ☐
IRA ☐
RA-C ☐
RA-O ☐
LTM ☐
PCO ☐

Documentation

Description: LOOW OCCP Feasibility Study - Alternative #3: Landfill Capping
Support Team: Documentation of personnel used to provide support for estimator and preparation of the estimate.
References: Documentation of reference sources used in the preparation of the estimate.

Estimator Information

Estimator Name: [redacted]
Estimator Title: Environmental Scientist
Agency/Org./Office: ERT, Inc.
Business Address: 14401 Sweitzer Lane, Suite 500
Laurel, MD 20707
Telephone Number: [redacted]
Email Address: [redacted]
Estimate Prepared Date: 04/29/2015

Estimator Signature: _____ **Date:** _____

Reviewer Information

Reviewer Name: [redacted]
Reviewer Title: PM
Agency/Org./Office: ERT, Inc.
Business Address: 14401 Sweitzer Lane, Suite 500
Laurel, MD 2070
Telephone Number: [redacted]

Site Cost Over Time Report
(with Markups)

Email Address: [redacted]
Date Reviewed: 04/29/2015

Reviewer Signature: _____ **Date:** _____

Site Cost Over Time Report
(with Markups)

Phase Type	Phase Name	2014	2015	2016	2017	2018	2019
Long Term Monitoring	LTM for Alt #3	$0	$0	$0	$149,320	$71,773	$71,773
Operations & Maintenance	O&M for Alt #3	$0	$0	$460,216	$257,538	$58,732	$58,732
Remedial Action	Remedial Action for Alt #3	$0	$0	$0	$222,935	$0	$0
Design	Remedial Design for Alt #3	$61,447	$0	$0	$0	$0	$0
Site Closeout	Site Closeout for Alt #3	$0	$0	$0	$0	$0	$0
Design	USACE Project Plans	$0	$0	$224,775	$0	$0	$0
Total Site Cost		$61,447	$0	$684,991	$629,793	$130,505	$130,505

Site Cost Over Time Report
(with Markups)

Phase Type	Phase Name	2020	2021	2022	2023	2024	2025
Long Term Monitoring	LTM for Alt #3	$71,773	$71,773	$71,773	$71,773	$71,773	$71,773
Operations & Maintenance	O&M for Alt #3	$58,732	$58,732	$106,034	$58,732	$58,732	$58,732
Remedial Action	Remedial Action for Alt #3	$0	$0	$0	$0	$0	$0
Design	Remedial Design for Alt #3	$0	$0	$0	$0	$0	$0
Site Closeout	Site Closeout for Alt #3	$0	$0	$0	$0	$0	$0
Design	USACE Project Plans	$0	$0	$0	$0	$0	$0
Total Site Cost		$130,505	$130,505	$177,807	$130,505	$130,505	$130,505

Site Cost Over Time Report
(with Markups)

Phase Type	Phase Name	2026	2027	2028	2029	2030	2031
Long Term Monitoring	LTM for Alt #3	$71,773	$71,773	$71,773	$71,773	$71,773	$71,773
Operations & Maintenance	O&M for Alt #3	$58,732	$106,034	$58,732	$58,732	$58,732	$58,732
Remedial Action	Remedial Action for Alt #3	$0	$0	$0	$0	$0	$0
Design	Remedial Design for Alt #3	$0	$0	$0	$0	$0	$0
Site Closeout	Site Closeout for Alt #3	$0	$0	$0	$0	$0	$0
Design	USACE Project Plans	$0	$0	$0	$0	$0	$0
Total Site Cost		$130,505	$177,807	$130,505	$130,505	$130,505	$130,505

Site Cost Over Time Report
(with Markups)

Phase Type	Phase Name	2032	2033	2034	2035	2036	2037
Long Term Monitoring	LTM for Alt #3	$71,773	$71,773	$71,773	$71,773	$71,773	$71,773
Operations & Maintenance	O&M for Alt #3	$106,034	$58,732	$58,732	$58,732	$58,732	$106,034
Remedial Action	Remedial Action for Alt #3	$0	$0	$0	$0	$0	$0
Design	Remedial Design for Alt #3	$0	$0	$0	$0	$0	$0
Site Closeout	Site Closeout for Alt #3	$0	$0	$0	$0	$0	$0
Design	USACE Project Plans	$0	$0	$0	$0	$0	$0
Total Site Cost		$177,807	$130,505	$130,505	$130,505	$130,505	$177,807

Site Cost Over Time Report
(with Markups)

Phase Type	Phase Name	2038	2039	2040	2041	2042	2043
Long Term Monitoring	LTM for Alt #3	$71,773	$71,773	$71,773	$71,773	$71,773	$71,773
Operations & Maintenance	O&M for Alt #3	$58,732	$58,732	$58,732	$58,732	$106,034	$58,732
Remedial Action	Remedial Action for Alt #3	$0	$0	$0	$0	$0	$0
Design	Remedial Design for Alt #3	$0	$0	$0	$0	$0	$0
Site Closeout	Site Closeout for Alt #3	$0	$0	$0	$0	$0	$0
Design	USACE Project Plans	$0	$0	$0	$0	$0	$0
Total Site Cost		$130,505	$130,505	$130,505	$130,505	$177,807	$130,505

Site Cost Over Time Report
(with Markups)

Phase Type	Phase Name	2044	2045	2046	2047	Total	
Long Term Monitoring	LTM for Alt #3	$71,773	$71,773	$71,773	$0	$2,230,732	
Operations & Maintenance	O&M for Alt #3	$58,732	$58,732	$58,732	$47,302	$2,704,796	
Remedial Action	Remedial Action for Alt #3	$0	$0	$0	$0	$222,935	
Design	Remedial Design for Alt #3	$0	$0	$0	$0	$61,447	
Site Closeout	Site Closeout for Alt #3	$0	$0	$0	$65,678	$65,678	
Design	USACE Project Plans	$0	$0	$0	$0	$224,775	
Total Site Cost		$130,505	$130,505	$130,505	$112,980	$5,510,363	$0

OCCP (EU 8) Alternative #3 - Landfill Capping Site Assembly Level Data Report

Phase Name	Tech. Key	Technology Name	Assembly No.	Assembly Description	Qty	UOM	Materials	Labor	Equipment	SubBid	Extended Cost
Remedial Action for Alt #3	1	Fencing	18040105	Boundary Fence, 5' Galvanized	350	LF	11.92	10.54	1.82	0.00	8,498.82
Remedial Action for Alt #3	1	Fencing	18040501	Hazardous Waste Signing	2	EA	43.42	31.96	0.00	0.00	150.75
	1 Total										8,649.57
Remedial Action for Alt #3	2	Cleanup and Landscaping	17040101	Cleaning Up, site debris clean up and removal	0.13	ACR	0.00	598.25	41.04	0.00	83.11
	2 Total										83.11
Remedial Action for Alt #3	3	Capping	17030423	Unclassified Fill, 6" Lifts, Off-Site, Includes Delivery, Spreading, and Compaction	799.03	CY	29.10	1.22	0.95	0.02	25,005.94
Remedial Action for Alt #3	3	Capping	18050301	Loam or topsoil, imported topsoil, 6" deep, furnish and place	133.17	LCY	28.05	6.55	1.89	0.00	4,858.36
Remedial Action for Alt #3	3	Capping	18050402	Seeding, Vegetative Cover	0.13	ACR	3,476.05	560.54	214.09	0.00	552.59
Remedial Action for Alt #3	3	Capping	33080513	Drainage Netting, Geotextile Fabric Heat-bonded 2 Sides	6328.3	SF	0.62	0.11	0.01	0.00	4,670.87
Remedial Action for Alt #3	3	Capping	33080520	Bentonite, rolls, with geotextile fabric both sides, 3/8" thick	6328.3	SF	0.91	0.43	0.03	0.00	8,681.78
Remedial Action for Alt #3	3	Capping	33080571	40 Mil Polymeric Liner, High-density Polyethylene	6328.3	SF	0.39	0.27	0.02	0.00	4,281.12
	3 Total										48,050.66
Remedial Action for Alt #3	4	Clear and Grub	17010102	Selective clearing, brush, medium clearing, with dozer and brush rake, excludes removal offsite	0.8	ACR	0.00	116.10	112.58	0.00	182.94
Remedial Action for Alt #3	4	Clear and Grub	17010111	Clear trees, wet conditions, medium growth, 200 H.P. dozer, excludes grubbing	0.2	ACR	0.00	1,273.78	1,193.88	0.00	493.53
Remedial Action for Alt #3	4	Clear and Grub	17010210	Site clearing trees, with 335 H.P. dozer, to 6" diameter	60	EA	0.00	2.58	3.67	0.00	374.83
Remedial Action for Alt #3	4	Clear and Grub	17010211	Site clearing trees, with 335 H.P. dozer, to 12" diameter	20	EA	0.00	4.81	6.85	0.00	233.23
Remedial Action for Alt #3	4	Clear and Grub	17010212	Site clearing trees, with 335 H.P. dozer, to 24" diameter	20	EA	0.00	7.22	10.27	0.00	349.84
Remedial Action for Alt #3	4	Clear and Grub	17010310	Remove stumbs, wet conditions, with dozer, to 6" diameter	12	EA	0.00	36.09	45.03	0.00	973.49
Remedial Action for Alt #3	4	Clear and Grub	17010311	Remove stumbs, wet conditions, with dozer, 6" to 12" diameter	4	EA	0.00	45.12	56.29	0.00	405.62
Remedial Action for Alt #3	4	Clear and Grub	17010312	Remove stumbs, wet conditions, with dozer, 12" to 24" diameter	4	EA	0.00	60.16	75.05	0.00	540.83
Remedial Action for Alt #3	4	Clear and Grub	17010314	Grub stumps, with 335 H.P. dozer, to 6" diameter	48	EA	0.00	1.80	2.57	0.00	209.91
Remedial Action for Alt #3	4	Clear and Grub	17010315	Grub stumps, with 335 H.P. dozer, to 12" diameter	16	EA	0.00	2.89	5.46	0.00	133.52
Remedial Action for Alt #3	4	Clear and Grub	17010316	Grub stumps, with 335 H.P. dozer, to 24" diameter	16	EA	0.00	28.88	54.57	0.00	1,335.16
Remedial Action for Alt #3	4	Clear and Grub	17020401	Dump Charges	4200	EA	15.00	0.00	0.00	0.00	63,000.00
Remedial Action for Alt #3	4	Clear and Grub	17030224	966, 4.0 CY, Wheel Loader	22	HR	0.00	75.25	75.89	0.00	3,324.97
Remedial Action for Alt #3	4	Clear and Grub	17030288	26 CY, Semi Dump	151	HR	0.00	70.22	65.10	0.00	20,433.62
	4 Total										91,991.48
LTM for Alt #3	5	Groundwater Monitoring Well	33010101	Mobilize/DeMobilize Drilling Rig & Crew	1	LS	0.00	1,353.63	792.17	0.00	2,145.79
LTM for Alt #3	5	Groundwater Monitoring Well	33020303	Organic Vapor Analyzer Rental, per Day	1	DAY	0.00	0.00	0.00	38.43	38.43
LTM for Alt #3	5	Groundwater Monitoring Well	33021710	Testing, soil & sediment analysis, metals (1 cp) (6010)	8	EA	0.00	0.00	0.00	15.89	127.15
LTM for Alt #3	5	Groundwater Monitoring Well	33022401	14 Nitroaromatic/Nitramine Compounds by EPA Method 8330	8	EA	0.00	0.00	0.00	231.26	1,850.07
LTM for Alt #3	5	Groundwater Monitoring Well	33170808	Decontaminate Rig, Augers, Screen (Rental Equipment)	1	DAY	23.08	541.36	0.00	0.00	564.45
LTM for Alt #3	5	Groundwater Monitoring Well	33220112	Field Technician	16	HR	0.00	42.44	0.00	0.00	678.96
LTM for Alt #3	5	Groundwater Monitoring Well	33230101	2" PVC, Schedule 40, Well Casing	32	LF	1.15	4.51	4.82	0.00	335.27
LTM for Alt #3	5	Groundwater Monitoring Well	33230201	2" PVC, Schedule 40, Well Screen	40	LF	3.81	4.51	4.82	0.00	525.49
LTM for Alt #3	5	Groundwater Monitoring Well	33230301	2" PVC, Well Plug	4	EA	12.35	13.54	14.46	0.00	161.39
LTM for Alt #3	5	Groundwater Monitoring Well	33231101	Hollow Stem Auger, 8" Dia Borehole, Depth <= 100 ft	76	LF	0.00	15.24	25.41	0.00	3,089.40
LTM for Alt #3	5	Groundwater Monitoring Well	33231173	Split Spoon Sampling	16	LF	0.00	11.98	5.98	0.00	287.31
LTM for Alt #3	5	Groundwater Monitoring Well	33231178	Move Rig/Equipment Around Site	3	EA	84.48	194.58	113.87	0.00	1,178.80
LTM for Alt #3	5	Groundwater Monitoring Well	33231182	DOT steel drums, 55 gal., open, 17C	4	EA	105.95	0.00	0.00	0.00	423.80
LTM for Alt #3	5	Groundwater Monitoring Well	33231401	2" Screen, Filter Pack	48	LF	8.42	3.48	3.72	0.00	749.94
LTM for Alt #3	5	Groundwater Monitoring Well	33231504	Surface Pad, Concrete, 2' x 2' x 4"	4	EA	52.59	15.13	0.18	0.00	271.60
LTM for Alt #3	5	Groundwater Monitoring Well	33231811	2" Well, Portland Cement Grout	20	LF	1.10	0.00	0.00	0.00	21.99
LTM for Alt #3	5	Groundwater Monitoring Well	33232101	2" Well, Bentonite Seal	4	EA	135.79	90.00	96.12	0.00	1,287.62
LTM for Alt #3	5	Groundwater Monitoring Well	33232301	5' Guard Posts, Cast Iron, Concrete Fill	16	EA	81.78	81.24	0.05	0.00	2,609.09
	5 Total										16,346.54
LTM for Alt #3	6	ANNUAL GROUNDWATER MONITORING	33010104	Sample collection, vehicle mileage charge, car or van	20	MI	0.00	0.00	0.00	0.58	11.60
LTM for Alt #3	6	ANNUAL GROUNDWATER MONITORING	33020401	Disposable Materials per Sample	8	EA	9.55	0.00	0.00	0.00	76.43
LTM for Alt #3	6	ANNUAL GROUNDWATER MONITORING	33020402	Decontamination Materials per Sample	8	EA	12.47	0.00	0.00	0.00	99.75
LTM for Alt #3	6	ANNUAL GROUNDWATER MONITORING	33020561	Lysimeter accessories, nylon tubing, 1/4" OD	85	LF	0.14	0.00	0.00	0.00	12.30
LTM for Alt #3	6	ANNUAL GROUNDWATER MONITORING	33021509	Monitor well sampling equipment, rental, water quality testing parameter device rental	1	WK	0.00	0.00	0.00	333.90	333.90

LTM for Alt #3	6	ANNUAL GROUNDWATER MONITORING	33021603	Testing, dissolved solids	8	EA	0.00	0.00	0.00	23.42	187.36
LTM for Alt #3	6	ANNUAL GROUNDWATER MONITORING	33021604	Testing, suspended solids	8	EA	0.00	0.00	0.00	18.33	146.63
LTM for Alt #3	6	ANNUAL GROUNDWATER MONITORING	33021620	Testing, TAL metals (6010/7000s)	8	EA	0.00	0.00	0.00	288.52	2,308.19
LTM for Alt #3	6	ANNUAL GROUNDWATER MONITORING	33022043	Overnight delivery service, 51 to 70 lb packages	180	LB	0.00	0.00	0.00	4.27	769.31
LTM for Alt #3	6	ANNUAL GROUNDWATER MONITORING	33022124	Testing, RCRA evaluations, EP toxicity analysis, metals (6010,7470)	1	EA	0.00	0.00	0.00	130.05	130.05
LTM for Alt #3	6	ANNUAL GROUNDWATER MONITORING	33022401	14 Nitroaromatic/Nitramine Compounds by EPA Method 8330	8	EA	0.00	0.00	0.00	279.82	2,238.59
LTM for Alt #3	6	ANNUAL GROUNDWATER MONITORING	33190403	DOT steel drums, 55 gal., closed only, 17H	2	EA	63.16	0.00	0.00	0.00	126.33
LTM for Alt #3	6	ANNUAL GROUNDWATER MONITORING	33220102	Project Manager	12	HR	0.00	70.74	0.00	0.00	848.83
LTM for Alt #3	6	ANNUAL GROUNDWATER MONITORING	33220102	Project Manager	2	HR	0.00	70.74	0.00	0.00	141.47
LTM for Alt #3	6	ANNUAL GROUNDWATER MONITORING	33220105	Project Engineer	70	HR	0.00	62.97	0.00	0.00	4,408.15
LTM for Alt #3	6	ANNUAL GROUNDWATER MONITORING	33220108	Project Scientist	134	HR	0.00	71.66	0.00	0.00	9,602.16
LTM for Alt #3	6	ANNUAL GROUNDWATER MONITORING	33220109	Staff Scientist	200	HR	0.00	40.95	0.00	0.00	8,189.48
LTM for Alt #3	6	ANNUAL GROUNDWATER MONITORING	33220110	QA/QC Officer	76	HR	0.00	70.98	0.00	0.00	5,394.38
LTM for Alt #3	6	ANNUAL GROUNDWATER MONITORING	33220112	Field Technician	32	HR	0.00	42.44	0.00	0.00	1,357.93
LTM for Alt #3	6	ANNUAL GROUNDWATER MONITORING	33220112	Field Technician	9	HR	0.00	42.44	0.00	0.00	381.92
LTM for Alt #3	6	ANNUAL GROUNDWATER MONITORING	33220114	Word Processing/Clerical	44	HR	0.00	36.48	0.00	0.00	1,605.29
LTM for Alt #3	6	ANNUAL GROUNDWATER MONITORING	33220115	Draftsman/CADD	24	HR	0.00	40.04	0.00	0.00	961.00
LTM for Alt #3	6	ANNUAL GROUNDWATER MONITORING	33230614	Peristaltic Pump, Weekly Rental	1	WK	0.00	0.00	0.00	79.77	79.77
LTM for Alt #3	6	ANNUAL GROUNDWATER MONITORING	33240101	Other Direct Costs	1	LS	775.23	0.00	0.00	0.00	775.23
	6 Total										40,186.06
LTM for Alt #3	7	Off-site Transportation and Waste Disposal	33190103	Load Drums on Disposal Vehicle	60	EA	0.00	5.13	1.58	0.00	402.74
LTM for Alt #3	7	Off-site Transportation and Waste Disposal	33190108	Tanker Pumping Equipment to Load Liquid	1	HR	0.00	0.00	0.00	37.47	37.47
LTM for Alt #3	7	Off-site Transportation and Waste Disposal	33190204	Transport 55 Gallon Drums of Hazardous Waste, Max 80 drums (per Mile)	10	MI	0.00	0.00	0.00	2.14	21.37
LTM for Alt #3	7	Off-site Transportation and Waste Disposal	33190317	Waste Stream Evaluation Fee, Not Including 50% Rebate on 1st Shipment	1	EA	0.00	0.00	0.00	533.81	533.81
LTM for Alt #3	7	Off-site Transportation and Waste Disposal	33190342	Drummed Site Waste Disposal, Non Haz	60	EA	0.00	0.00	0.00	116.87	7,011.90
	7 Total										8,007.29
LTM for Alt #3	36	Well Abandonment	33010101	Mobilize/DeMobilize Drilling Rig & Crew	1	LS	0.00	1,353.63	792.17	0.00	2,145.79
LTM for Alt #3	36	Well Abandonment	33190402	DOT steel drums, 55 gal., open only, 17H	3	EA	97.81	0.00	0.00	0.00	293.43
LTM for Alt #3	36	Well Abandonment	33220112	Field Technician	32	HR	0.00	42.44	0.00	0.00	1,357.93
LTM for Alt #3	36	Well Abandonment	33231101	Hollow Stem Auger, 8" Dia Borehole, Depth <= 100 ft	72	LF	0.00	15.24	25.41	0.00	2,926.80
LTM for Alt #3	36	Well Abandonment	33231178	Move Rig/Equipment Around Site	4	EA	84.48	194.58	113.87	0.00	1,571.74
LTM for Alt #3	36	Well Abandonment	33231820	Grout Continuous Borehole	12	CF	6.62	0.00	0.00	0.00	79.47
	36 Total										8,375.16
Remedial Design for Alt #3	37	Remedial Design (Percent)	32032001	Remedial Design Professional Labor	1	EA	0.00	61,447.00	0.00	0.00	61,447.00
	37 Total										61,447.00
Site Closeout for Alt #3	8	Site Close-Out Documentation	33010108	Sedan, Automobile, Rental	9	DAY	0.00	0.00	0.00	54.06	486.53
Site Closeout for Alt #3	8	Site Close-Out Documentation	33010202	Per Diem (per person)	18	DAY	0.00	0.00	0.00	154.00	2,772.00
Site Closeout for Alt #3	8	Site Close-Out Documentation	33041101	Airfare	1	LS	0.00	0.00	0.00	3,000.00	3,000.00
Site Closeout for Alt #3	8	Site Close-Out Documentation	33220101	Senior Project Manager	1	HR	0.00	93.55	0.00	0.00	93.55
Site Closeout for Alt #3	8	Site Close-Out Documentation	33220101	Senior Project Manager	3	HR	0.00	93.55	0.00	0.00	280.66
Site Closeout for Alt #3	8	Site Close-Out Documentation	33220102	Project Manager	48	HR	0.00	70.74	0.00	0.00	3,395.33
Site Closeout for Alt #3	8	Site Close-Out Documentation	33220102	Project Manager	33	HR	0.00	70.74	0.00	0.00	2,334.29
Site Closeout for Alt #3	8	Site Close-Out Documentation	33220104	Senior Staff Engineer	8	HR	0.00	93.62	0.00	0.00	748.96
Site Closeout for Alt #3	8	Site Close-Out Documentation	33220106	Staff Engineer	93	HR	0.00	83.45	0.00	0.00	7,760.60
Site Closeout for Alt #3	8	Site Close-Out Documentation	33220106	Staff Engineer	42	HR	0.00	83.45	0.00	0.00	3,504.79
Site Closeout for Alt #3	8	Site Close-Out Documentation	33220114	Word Processing/Clerical	38	HR	0.00	36.48	0.00	0.00	1,386.39
Site Closeout for Alt #3	8	Site Close-Out Documentation	33220114	Word Processing/Clerical	16	HR	0.00	36.48	0.00	0.00	583.74
Site Closeout for Alt #3	8	Site Close-Out Documentation	33220115	Draftsman/CADD	27	HR	0.00	40.04	0.00	0.00	1,081.13
Site Closeout for Alt #3	8	Site Close-Out Documentation	33220115	Draftsman/CADD	4	HR	0.00	40.04	0.00	0.00	160.17
	8 Total										27,588.14
O&M for Alt #3	10	Five-Year Review	33010108	Sedan, Automobile, Rental	3	DAY	0.00	0.00	0.00	59.32	177.97

O&M for Alt #3	10	Five-Year Review	33010202	Per Diem (per person)	6	DAY	0.00	0.00	0.00	156.00	936.00
O&M for Alt #3	10	Five-Year Review	33041101	Airfare	2	LS	0.00	0.00	0.00	500.00	1,000.00
O&M for Alt #3	10	Five-Year Review	33220102	Project Manager	9	HR	0.00	92.47	0.00	0.00	832.22
O&M for Alt #3	10	Five-Year Review	33220102	Project Manager	12	HR	0.00	92.47	0.00	0.00	1,109.63
O&M for Alt #3	10	Five-Year Review	33220102	Project Manager	12	HR	0.00	92.47	0.00	0.00	1,109.63
O&M for Alt #3	10	Five-Year Review	33220102	Project Manager	6	HR	0.00	92.47	0.00	0.00	554.81
O&M for Alt #3	10	Five-Year Review	33220105	Project Engineer	12	HR	0.00	77.23	0.00	0.00	926.71
O&M for Alt #3	10	Five-Year Review	33220105	Project Engineer	31	HR	0.00	77.23	0.00	0.00	2,394.00
O&M for Alt #3	10	Five-Year Review	33220105	Project Engineer	13	HR	0.00	77.23	0.00	0.00	1,003.94
O&M for Alt #3	10	Five-Year Review	33220108	Project Scientist	25	HR	0.00	85.43	0.00	0.00	2,135.78
O&M for Alt #3	10	Five-Year Review	33220108	Project Scientist	13	HR	0.00	85.43	0.00	0.00	1,110.60
O&M for Alt #3	10	Five-Year Review	33220108	Project Scientist	10	HR	0.00	85.43	0.00	0.00	854.31
O&M for Alt #3	10	Five-Year Review	33220109	Staff Scientist	21	HR	0.00	49.45	0.00	0.00	1,038.47
O&M for Alt #3	10	Five-Year Review	33220109	Staff Scientist	14	HR	0.00	49.45	0.00	0.00	692.31
O&M for Alt #3	10	Five-Year Review	33220109	Staff Scientist	50	HR	0.00	49.45	0.00	0.00	2,472.54
	10 Total										18,348.92
O&M for Alt #3	11	POST-REMEDY O&M	18010412	Construction Signs	576	SF	29.49	0.00	0.00	0.00	16,988.83
O&M for Alt #3	11	POST-REMEDY O&M	33010104	Sample collection, vehicle mileage charge, car or van	100	MI	0.00	0.00	0.00	0.51	51.00
O&M for Alt #3	11	POST-REMEDY O&M	33010104	Sample collection, vehicle mileage charge, car or van	120	MI	0.00	0.00	0.00	0.51	61.20
O&M for Alt #3	11	POST-REMEDY O&M	33010108	Sedan, Automobile, Rental	3	DAY	0.00	0.00	0.00	59.32	177.97
O&M for Alt #3	11	POST-REMEDY O&M	33010108	Sedan, Automobile, Rental	18	DAY	0.00	0.00	0.00	59.32	1,067.81
O&M for Alt #3	11	POST-REMEDY O&M	33010202	Per Diem (per person)	8	DAY	0.00	0.00	0.00	156.00	1,248.00
O&M for Alt #3	11	POST-REMEDY O&M	33010202	Per Diem (per person)	48	DAY	0.00	0.00	0.00	156.00	7,488.00
O&M for Alt #3	11	POST-REMEDY O&M	33022037	Overnight Delivery, 8 oz Letter	18	EA	0.00	0.00	0.00	20.19	363.42
O&M for Alt #3	11	POST-REMEDY O&M	33022038	Overnight delivery service, 1 lb package	6	LB	0.00	0.00	0.00	23.83	142.98
O&M for Alt #3	11	POST-REMEDY O&M	33022038	Overnight delivery service, 1 lb package	12	LB	0.00	0.00	0.00	23.83	285.95
O&M for Alt #3	11	POST-REMEDY O&M	33040671	Portable GPS Set with Mapping, 5 cm Accuracy	1	MO	2,660.07	0.00	0.00	0.00	2,660.07
O&M for Alt #3	11	POST-REMEDY O&M	33041101	Airfare	2	LS	0.00	0.00	0.00	500.00	1,000.00
O&M for Alt #3	11	POST-REMEDY O&M	33041101	Airfare	12	LS	0.00	0.00	0.00	500.00	6,000.00
O&M for Alt #3	11	POST-REMEDY O&M	33220102	Project Manager	62	HR	0.00	75.82	0.00	0.00	4,701.13
O&M for Alt #3	11	POST-REMEDY O&M	33220102	Project Manager	70	HR	0.00	75.82	0.00	0.00	5,307.73
O&M for Alt #3	11	POST-REMEDY O&M	33220102	Project Manager	267	HR	0.00	75.82	0.00	0.00	20,245.19
O&M for Alt #3	11	POST-REMEDY O&M	33220102	Project Manager	48	HR	0.00	92.47	0.00	0.00	4,438.52
O&M for Alt #3	11	POST-REMEDY O&M	33220105	Project Engineer	140	HR	0.00	63.33	0.00	0.00	8,865.52
O&M for Alt #3	11	POST-REMEDY O&M	33220105	Project Engineer	200	HR	0.00	63.33	0.00	0.00	12,665.03
O&M for Alt #3	11	POST-REMEDY O&M	33220105	Project Engineer	240	HR	0.00	63.33	0.00	0.00	15,198.03
O&M for Alt #3	11	POST-REMEDY O&M	33220106	Staff Engineer	110	HR	0.00	103.47	0.00	0.00	11,381.39
O&M for Alt #3	11	POST-REMEDY O&M	33220106	Staff Engineer	460	HR	0.00	84.84	0.00	0.00	39,027.83
O&M for Alt #3	11	POST-REMEDY O&M	33220106	Staff Engineer	160	HR	0.00	84.84	0.00	0.00	13,574.90
O&M for Alt #3	11	POST-REMEDY O&M	33220110	QA/QC Officer	40	HR	0.00	70.05	0.00	0.00	2,802.14
O&M for Alt #3	11	POST-REMEDY O&M	33220110	QA/QC Officer	74	HR	0.00	70.05	0.00	0.00	5,183.96
O&M for Alt #3	11	POST-REMEDY O&M	33220110	QA/QC Officer	7	HR	0.00	70.05	0.00	0.00	490.37
O&M for Alt #3	11	POST-REMEDY O&M	33220112	Field Technician	2	HR	0.00	42.60	0.00	0.00	85.21
O&M for Alt #3	11	POST-REMEDY O&M	33220114	Word Processing/Clerical	125	HR	0.00	37.81	0.00	0.00	4,726.76
O&M for Alt #3	11	POST-REMEDY O&M	33220114	Word Processing/Clerical	280	HR	0.00	37.81	0.00	0.00	10,587.94
O&M for Alt #3	11	POST-REMEDY O&M	33220114	Word Processing/Clerical	96	HR	0.00	37.81	0.00	0.00	3,630.15
O&M for Alt #3	11	POST-REMEDY O&M	33220114	Word Processing/Clerical	36	HR	0.00	46.11	0.00	0.00	1,660.13
O&M for Alt #3	11	POST-REMEDY O&M	33220115	Draftsman/CADD	320	HR	0.00	40.55	0.00	0.00	12,975.91
O&M for Alt #3	11	POST-REMEDY O&M	33220115	Draftsman/CADD	48	HR	0.00	40.55	0.00	0.00	1,946.39
O&M for Alt #3	11	POST-REMEDY O&M	33220115	Draftsman/CADD	16	HR	0.00	40.55	0.00	0.00	648.80
O&M for Alt #3	11	POST-REMEDY O&M	33220115	Draftsman/CADD	440	HR	0.00	40.55	0.00	0.00	17,841.87
O&M for Alt #3	11	POST-REMEDY O&M	33220119	Health and Safety Officer	17	HR	0.00	65.85	0.00	0.00	1,119.37
O&M for Alt #3	11	POST-REMEDY O&M	33220120	Computer Data Entry	200	HR	0.00	37.81	0.00	0.00	7,562.81
O&M for Alt #3	11	POST-REMEDY O&M	33220213	Surveying - 3-man Crew	4	DAY	0.00	1,523.86	15.76	0.00	6,158.49
O&M for Alt #3	11	POST-REMEDY O&M	33220503	Attorney, Partner, Real Estate	30	HR	0.00	269.36	0.00	0.00	8,080.79
O&M for Alt #3	11	POST-REMEDY O&M	33220504	Attorney, Partner, Contracts	40	HR	0.00	269.36	0.00	0.00	10,774.38
O&M for Alt #3	11	POST-REMEDY O&M	33220505	Attorney, Senior Associate, Real Estate	8	HR	0.00	233.84	0.00	0.00	1,870.69

O&M for Alt #3	11	POST-REMEDY O&M	33220507	Attorney, Associate, Real Estate	40	HR	0.00	190.05	0.00	0.00	7,602.11
O&M for Alt #3	11	POST-REMEDY O&M	33220508	Attorney, Associate, Contracts	80	HR	0.00	190.05	0.00	0.00	15,204.22
O&M for Alt #3	11	POST-REMEDY O&M	33220509	Paralegal, Real Estate	8	HR	0.00	55.29	0.00	0.00	442.30
O&M for Alt #3	11	POST-REMEDY O&M	33220509	Paralegal, Real Estate	40	HR	0.00	55.29	0.00	0.00	2,211.52
O&M for Alt #3	11	POST-REMEDY O&M	33220510	Paralegal, Contracts	80	HR	0.00	55.29	0.00	0.00	4,423.04
O&M for Alt #3	11	POST-REMEDY O&M	33240101	Other Direct Costs	1	LS	1,590.44	0.00	0.00	0.00	1,590.44
O&M for Alt #3	11	POST-REMEDY O&M	33240101	Other Direct Costs	1	LS	1,025.49	0.00	0.00	0.00	1,025.49
O&M for Alt #3	11	POST-REMEDY O&M	33240101	Other Direct Costs	1	LS	3,472.76	0.00	0.00	0.00	3,472.76
O&M for Alt #3	11	POST-REMEDY O&M	33240101	Other Direct Costs	1	LS	495.59	0.00	0.00	0.00	495.59
O&M for Alt #3	11	POST-REMEDY O&M	33990111	Local Fees	1	LS	200.00	0.00	0.00	0.00	200.00
	11 Total										307,754.10
USACE Project Plans	48	USACE Project Plans	32032001	Remedial Design Professional Labor	1	EA	0.00	150,000.00	0.00	0.00	150,000.00
	48 Total										150,000.00
	Grand Total										786,828.04

Alternative #4:
Excavation and Off-Site Disposal

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Estimate Documentation Report

System:

RACER Version: RACER™ Version 11.1.12.0
Database Location: N:\Projects_Ongoing\3108- LOOW\05_EU8-OCCP_FS (2012)\02_Draft\024_Appendices\Appendix F - RACER Cost Estimates\Post 2nd Backcheck Comments\LOOW_OCCP_FS_Draft_v05_11_1.mdb

Folder:

Folder Name: Lake Ontario Ordnance Works (LOOW)

Project:

ID: OCCP (EU8)
Name: OCCP (EU8)
Category: None

Location
State / Country: NEW YORK
City: NIAGARA BUFFALO DEFENSE AREA

Location Modifier	Default	User	Reason for changes
	1.100	1.113	

Options
Database: System Costs
Cost Database Date: 2011
Report Option: Fiscal

Description

The project is a Feasibility Study for Exposure Unit 8 (EU8) at the Occidental Chemical Corporation (OCCP). The OCCP is a portion of the former Lake Ontario Ordnance Works (LOOW) installation located in Lewiston, NY.

In accordance with the Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (USEPA, 1988), cost estimates for evaluating alternatives will be based on a variety of cost estimating data, include cost curves, generic unit costs, vendor information, conventional cost-estimating guides, and prior similar estimates as modified by site-specific information. Absolute accuracy of cost estimates during evaluating is not essential. Because uncertainties associated with the definition of alternatives often remain, it may not be practicable to define the costs of alternatives with the accuracy desired for the detailed analysis (i.e., +50 percent to -30 percent). The focus should be to make comparative estimates for alternatives with relative accuracy so that cost decisions among alternatives will be sustained as the accuracy of cost estimates improves beyond the evaluating process.

Because this cost estimate will serve as the basis for a Cost and Schedule Risk Analysis, escalation has not been applied.

This report for official U.S. Government use only.

Estimate Documentation Report

Site:

ID: OCCP (EU 8)
Name: Alternative #4 - Excavation and Offsite Disposal
Type: None

Media/Waste Type

Primary: Soil
Secondary: N/A

Contaminant

Primary: Ordnance (residual)
Secondary: Metals

Phase Names

- **SI** ☐
- **RI/FS** ☐
- **EE/CA** ☐
- **RD** ☐
- **RmA-C** ☐
- **IRA** ☐
- **RA-C** ☐
- **RA-O** ☐
- **LTM** ☐
- **PCO** ☐

Documentation

Description: LOOW OCCP Feasibility Study - Alternative #4: Excavation with Offsite Disposal
Support Team: Documentation of personnel used to provide support for estimator and preparation of the estimate.
References: Documentation of reference sources used in the preparation of the estimate.

Estimator Information

Estimator Name: [redacted]
Estimator Title: Environmental Scientist
Agency/Org./Office: ERT, Inc.
Business Address: 14401 Sweitzer Lane, Suite 300
Laurel, MD 20707
Telephone Number: [redacted]
Email Address: [redacted]
Estimate Prepared Date: 04/29/2015

Estimator Signature: _____ [redacted] _____

Reviewer Information

Reviewer Name: [redacted]
Reviewer Title: PM
Agency/Org./Office: ERT, Inc.
Business Address: 14401 Sweitzer Lane, Suite 300
Laurel, MD 20707

This report for official U.S. Government use only.

Estimate Documentation Report

Telephone Number: [redacted]
Email Address: [redacted]
Date Reviewed: 04/29/2015

Reviewer Signature: _____ **Date:** _____

Estimate Costs:

Phase Names	Direct Cost	Marked-Up
Remedial Action #4	$308,316.64	$423,119.78
Site Closeout for Alt #4	$27,588.14	$65,677.52
Remedial Design for Alt #4	$132,473.00	$132,473.00
USACE Project Plans	$150,000.00	$224,775.00
Total Cost:	$618,377.78	$846,045.29
Total Site Cost:	$618,377.78	$846,045.29

Phase Documentation:

Phase Type: Remedial Action
Phase Name: Remedial Action #4
Description: Mechanical excavation and offsite disposal of COC-contaminated soil and debris. It is assumed that this alternative will result in UU/UE. Post-Remedy O&M and Five-Year Reviews will not be necessary for any alternative that results in UU/UE.

Approach: Ex Situ
Start Date: January, 2017
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate

Phase Markup Template: System Defaults

Technology Markups	Markup	% Prime	% Sub.
Clear and Grub	True	100	0
Excavation	True	100	0
Off-site Transportation and Waste Disposal	True	100	0
Off-site Transportation and Waste Disposal	True	100	0
Cleanup and Landscaping	True	100	0
SEPARATION	True	100	0

Total Marked-up Cost: $423,119.78

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Estimate Documentation Report

Technologies:

Technology Name: **Cleanup and Landscaping (#1)**

User Name: **Cleanup and Landscaping**

Description	Default	Value	UOM
System Definition			
Required Parameters			
Type of Site Preparation		Cleanup	n/a
Preparation Area		0.13	AC
Safety Level		D	n/a
Landscaping			
Secondary Parameters			
Landscaping Type	Seeding	Seeding	n/a
Landscaping Area	0.00	0.00	%

Comments:

Technology Name: **Clear and Grub (#1)**

User Name: **Clear and Grub**

Description	Default	Value	UOM
System Definition			
Required Parameters			
Acres		1	AC
Dry Soil		80.00	%
Wet Soil		20.00	%
Include Load and Haul Costs		True	n/a
Safety Level		D	n/a
Clearing			
Secondary Parameters			
Brush Density	Medium	Medium	n/a
Debris Reduction	None	None	n/a
Trees Per Acre (<= 6")	0	60	EA/AC
Trees Per Acre (> 6" & <= 12")	100	20	EA/AC
Trees Per Acre (> 12" & <= 24")	0	20	EA/AC
Trees Per Acre (> 24" & <= 36")	0	0	EA/AC
Stumps Per Acre (<= 6")	0	60	EA/AC
Stumps Per Acre (> 6" & <= 12")	100	20	EA/AC
Stumps Per Acre (> 12" & <= 24")	0	20	EA/AC
Stumps Per Acre (> 24" & <= 36")	0	0	EA/AC
Grubbing			
Secondary Parameters			
Grubbing Depth	6	0	IN
Bulk Factor	1.2	1.2	n/a
Equipment	Dozer - 105hp	Dozer - 105hp	n/a

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Estimate Documentation Report

Technology Name: **Clear and Grub (#1)**

User Name: **Clear and Grub**

Description	Default	Value	UOM
Soil Stripping			
Secondary Parameters			
Soil Depth	0	0	IN
Stripping Area	0.00	0.00	%
Soil Equipment	Dozer - 200hp	Dozer - 200hp	n/a
Disposal	Stockpilling	Stockpilling	n/a
Bulk Factor	1.2	1.2	n/a
Load and Haul			
Secondary Parameters			
Truck Type		Highway	n/a
Volume		4200	CY
One-way Haul Distance		10	MI
Dump Charge		15	$/CY

Comments: Volume is assumed to be 30% of the area of EU8 by 1 yard.

Technology Name: **Excavation (#1)**

User Name: **Excavation**

Description	Default	Value	UOM
System Definition			
Required Parameters			
Estimating Method		Area / Depth	n/a
Area		0.13	AC
Depth		3	FT
Soil Type		Silt/Silty-Clay Mixture	n/a
Safety Level		D	n/a
Excavation			
Secondary Parameters			
Existing Cover	Soil/Gravel	Soil/Gravel	n/a
Replacement Cover	Soil/Seeding	Soil/Seeding	n/a
Sidewall Protection	None	None	n/a
% of Excavated Material To Be Used as Backfill	0.00	0.00	%
Source of Additional Fill	Off Site	Off Site	n/a
Backfill Hauling Distance (one way)	10	10	MI
Dewatering Required	False	False	n/a
Groundwater Depth		0	FT
Analytical			
Secondary Parameters			
Primary Analytical Template	System Soil - Ordnance Residual	System Soil - Ordnance Residual	n/a
Secondary Analytical Template	System Soil - Metals	System Soil - Metals	n/a
Number of Sampling Points/Locations	11	11	EA
Number of Composites Submitted to Lab	5	5	EA

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Estimate Documentation Report

Technology Name: **Excavation (#1)**

User Name: **Excavation**

Description	Default	Value	UOM
Analytical			
Secondary Parameters			
Turnaround Time	Standard (21 Days)	Standard (21 Days)	n/a
Submit Data Electronically	Yes	Yes	n/a
Data Package / QC	Stage 1	Stage 1	n/a
Lab Data Review	Stage 1	Stage 1	n/a
Sampling Reports	Abbreviated	Abbreviated	n/a

Comments:

Technology Name: **Off-site Transportation and Waste Disposal (#1)**

User Name: **Off-site Transportation and Waste Disposal**

Description	Default	Value	UOM
System Definition			
Required Parameters			
Waste Type		Non-Hazardous	n/a
Waste Form		Solid	n/a
Condition of Waste		Bulk to remain as bulk	n/a
Volume of Bulk Solid Waste		204	CY
Stabilization		Required	n/a
Transportation Type		Truck	n/a
Truck Distance (One-way)		10	MI
Safety Level		D	n/a

Comments: Soil - 611 CY of non-hazardous soil volume.

Technology Name: **Off-site Transportation and Waste Disposal (#2)**

User Name: **Off-site Transportation and Waste Disposal**

Description	Default	Value	UOM
System Definition			
Required Parameters			
Waste Type		Hazardous	n/a
Waste Form		Solid	n/a
Condition of Waste		Bulk to remain as bulk	n/a
Volume of Bulk Solid Waste		611	CY
Stabilization		Required	n/a
Transportation Type		Truck	n/a
Truck Distance (One-way)		30	MI
Safety Level		D	n/a

Comments: Debris - 204 CY of non-hazardous debris. Volume assumed to be equal to 30 percent of soil volume (611 CY).

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Estimate Documentation Report

Technology Name: **User Defined Estimate (#1)**

User Name: **SEPARATION**

Description	Default	Value	UOM
System Definition			
Required Parameters			
Model Name		SEPARATION	n/a
WBS Type		HTRW	n/a
Selected WBS		331.18.01	n/a
Safety Level		D	n/a

Comments:

Phase Documentation:

Phase Type: Site Closeout
Phase Name: Site Closeout for Alt #4
Description: Site closeout activities and reporting.

Approach: None
Start Date: July, 2017
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate

Phase Markup Template: System Defaults

Technology Markups	Markup	% Prime	% Sub.
Site Close-Out Documentation	True	100	0

Total Marked-up Cost: $65,677.52

Technologies:

Technology Name: **Site Close-Out Documentation (#1)**

User Name: **Site Close-Out Documentation**

Description	Default	Value	UOM
System Definition			
Required Parameters			
Meetings		True	n/a
Work Plans and Reports		False	n/a
Documents		True	n/a
Site Close-Out Complexity		High	n/a

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Estimate Documentation Report

Technology Name: **Site Close-Out Documentation (#1)**

User Name: **Site Close-Out Documentation**

Description	Default	Value	UOM
Meetings			
Required Parameters			
Kick Off/Scoping Meetings		True	n/a
Kick Off/Scoping Meetings: Number of Meetings	1	1	EA
Kick Off/Scoping Meetings: Travel		True	n/a
Kick Off/Scoping Meetings: Travelers		2	EA
Kick Off/Scoping Meetings: Days		3	Days
Kick Off/Scoping Meetings: Air Fare		500.00	$
Review Meetings		True	n/a
Review Meetings: Number of Meetings	1	1	EA
Review Meetings: Travel		True	n/a
Review Meetings: Travelers		2	EA
Review Meetings: Days		3	Days
Review Meetings: Air Fare		500.00	$
Regulatory Review Meetings		True	n/a
Regulatory Review Meetings: Number of Meetings	1	1	EA
Regulatory Review Meetings: Travel		True	n/a
Regulatory Review Meetings: Travelers		2	EA
Regulatory Review Meetings: Days		3	Days
Regulatory Review Meetings: Air Fare		500.00	$
Documents			
Required Parameters			
Draft Decision Document		True	n/a
Draft Final Decision Document		True	n/a
Final Decision Document		True	n/a
Long Term Document Storage		False	n/a
Number of Boxes		0	EA
Duration of Storage		0	Yrs

Comments:

Phase Documentation:

Phase Type: Design

Phase Name: Remedial Design for Alt #4

Description: It is assumed that the remedial design costs will be approximately 12 percent of the total capital costs as per Exhibit 5-8: Examples Professional Services for Professional/Technical Services Capital Costs (USEPA, 2000).

USEPA, 2000. A Guide to Developing and Documenting Cost Estimates During the Feasibility Study (EPA 540-R-00-002; OSWER 9355.0-75).

This report for official U.S. Government use only.

Estimate Documentation Report

Approach: Ex Situ
Start Date: January, 2016
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate

Phase Markup Template: System Defaults

Technology Markups	Markup	% Prime	% Sub.
Remedial Design (Percent)	False	0	0

Total Marked-up Cost: $132,473.00

Technologies:

Technology Name: **Remedial Design (Percent) (#1)**

User Name: **Remedial Design (Percent)**

Description	Default	Value	UOM
System Definition			
Required Parameters			
Phase		Remedial Action #4	n/a
Approach		Ex Situ	n/a
Phase Costs		423119.78	$
Calculate Design Cost			
Required Parameters			
Phase Date		2013	n/a
Design Approach		Ex Situ Removal - Off-site Treatment or Disposal	n/a
Design Percent	12.00	12.00	%
MCC		423119.78	$
Design $		132473.00	$
Year		2014	n/a

Comments:

Phase Documentation:

Phase Type: Design
Phase Name: USACE Project Plans
Description: New Phase

Approach: Ex Situ
Start Date: January, 2016
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate

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Estimate Documentation Report

Phase Markup Template: System Defaults

Technology Markups	Markup	% Prime	% Sub.
USACE Project Plans	True	100	0

Total Marked-up Cost: $224,775.00

Technologies:

Technology Name: **User Defined Estimate (#2)**

User Name: **USACE Project Plans**

Description	Default	Value	UOM
System Definition			
Required Parameters			
Model Name		USACE Project Plans	n/a
WBS Type		HTRW	n/a
Selected WBS		333.30.91	n/a
Safety Level		E	n/a

Comments:

This report for official U.S. Government use only.

Site Cost Over Time Report
(with Markups)

System:

RACER Version: RACER™ Version 11.1.12.0
Database Location: N:\Projects_Ongoing\3108- LOOW\05_EU8-OCCP_FS (2012)\02_Draft\024_Appendices\Appendix F - RACER Cost Estimates\Post 2nd Backcheck Comments\LOOW_OCCP_FS_Draft_v05_11_1.mdb

Folder:

Folder Name: Lake Ontario Ordnance Works (LOOW)

Project:

ID: OCCP (EU8)
Name: OCCP (EU8)
Category: None

Location
State / Country: NEW YORK
City: NIAGARA BUFFALO DEFENSE AREA

Location Modifier	Default	User	Reason for changes
	1.100	1.113	

Options
Database: System Costs
Cost Database Date: 2011
Report Option: Fiscal

Description
The project is a Feasibility Study for Exposure Unit 8 (EU8) at the Occidental Chemical Corporation (OCCP). The OCCP is a portion of the former Lake Ontario Ordnance Works (LOOW) installation located in

Site Cost Over Time Report
(with Markups)

Lewiston, NY.

In accordance with the Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (USEPA, 1988), cost estimates for evaluating alternatives will be based on a variety of cost estimating data, include cost curves, generic unit costs, vendor information, conventional cost-estimating guides, and prior similar estimates as modified by site-specific information. Absolute accuracy of cost estimates during evaluating is not essential. Because uncertainties associated with the definition of alternatives often remain, it may not be practicable to define the costs of alternatives with the accuracy desired for the detailed analysis (i.e., +50 percent to -30 percent). The focus should be to make comparative estimates for alternatives with relative accuracy so that cost decisions among alternatives will be sustained as the accuracy of cost estimates improves beyond the evaluating process.

Because this cost estimate will serve as the basis for a Cost and Schedule Risk Analysis, escalation has not been applied.

Site:

ID: OCCP (EU 8)
Name: Alternative #4 - Excavation and Offsite Disposal
Type: None

Media/Waste Type

Primary: Soil
Secondary: N/A

Contaminant

Primary: Ordnance (residual)
Secondary: Metals

Phase Names

SI ☐
RI/FS ☐
EE/CA ☐

Site Cost Over Time Report
(with Markups)

RD ☐
RmA-C ☐
IRA ☐
RA-C ☐
RA-O ☐
LTM ☐
PCO ☐

Documentation

Description: LOOW OCCP Feasibility Study - Alternative #4: Excavation with Offsite Disposal
Support Team: Documentation of personnel used to provide support for estimator and preparation of the estimate.
References: Documentation of reference sources used in the preparation of the estimate.

Estimator Information

Estimator Name: [redacted]
Estimator Title: Environmental Scientist
Agency/Org./Office: ERT, Inc.
Business Address: 14401 Sweitzer Lane, Suite 300
Laurel, MD 20707
Telephone Number: [redacted]
Email Address: [redacted]
Estimate Prepared Date: 04/29/2015

Estimator Signature: _____ **Date:** _____

Reviewer Information

Reviewer Name: [redacted]
Reviewer Title: PM
Agency/Org./Office: ERT, Inc.
Business Address: 14401 Sweitzer Lane, Suite 300
Laurel, MD 20707
Telephone Number: [redacted]

Site Cost Over Time Report
(with Markups)

Email Address: [redacted]
Date Reviewed: 04/29/2015

Reviewer Signature: _____ **Date:** _____

Site Cost Over Time Report
(with Markups)

Phase Type	Phase Name	2016	2017	Total			
Remedial Action	Remedial Action #4	$0	$423,120	$423,120			
Design	Remedial Design for Alt #4	$132,473	$0	$132,473			
Site Closeout	Site Closeout for Alt #4	$0	$65,678	$65,678			
Design	USACE Project Plans	$224,775	$0	$224,775			
Total Site Cost		$357,248	$488,797	$846,045	$0	$0	$0

OCCP (EU8) Alternative #4 - Excavation and Off-site Disposal Assembly Level Data Report											
Phase Name	**Tech. Key**	**Technology Name**	**Assembly No.**	**Assembly Description**	**Qty**	**UOM**	**Materials**	**Labor**	**Equipment**	**SubBid**	**Extended Cost**
Remedial Action #4	12	Clear and Grub	17010102	Selective clearing, brush, medium clearing, with dozer and brush rake, excludes removal offsite	0.8	ACR	0.00	116.10	112.58	0.00	182.94
Remedial Action #4	12	Clear and Grub	17010111	Clear trees, wet conditions, medium growth, 200 H.P. dozer, excludes grubbing	0.2	ACR	0.00	1,273.78	1,193.88	0.00	493.53
Remedial Action #4	12	Clear and Grub	17010210	Site clearing trees, with 335 H.P. dozer, to 6" diameter	60	EA	0.00	2.58	3.67	0.00	374.83
Remedial Action #4	12	Clear and Grub	17010211	Site clearing trees, with 335 H.P. dozer, to 12" diameter	20	EA	0.00	4.81	6.85	0.00	233.23
Remedial Action #4	12	Clear and Grub	17010212	Site clearing trees, with 335 H.P. dozer, to 24" diameter	20	EA	0.00	7.22	10.27	0.00	349.84
Remedial Action #4	12	Clear and Grub	17010310	Remove stumbs, wet conditions, with dozer, to 6" diameter	12	EA	0.00	36.09	45.03	0.00	973.49
Remedial Action #4	12	Clear and Grub	17010311	Remove stumbs, wet conditions, with dozer, 6" to 12" diameter	4	EA	0.00	45.12	56.29	0.00	405.62
Remedial Action #4	12	Clear and Grub	17010312	Remove stumbs, wet conditions, with dozer, 12" to 24" diameter	4	EA	0.00	60.16	75.05	0.00	540.83
Remedial Action #4	12	Clear and Grub	17010314	Grub stumps, with 335 H.P. dozer, to 6" diameter	48	EA	0.00	1.80	2.57	0.00	209.91
Remedial Action #4	12	Clear and Grub	17010315	Grub stumps, with 335 H.P. dozer, to 12" diameter	16	EA	0.00	2.89	5.46	0.00	133.52
Remedial Action #4	12	Clear and Grub	17010316	Grub stumps, with 335 H.P. dozer, to 24" diameter	16	EA	0.00	28.88	54.57	0.00	1,335.16
Remedial Action #4	12	Clear and Grub	17020401	Dump Charges	4200	EA	15.00	0.00	0.00	0.00	63,000.00
Remedial Action #4	12	Clear and Grub	17030224	966, 4.0 CY, Wheel Loader	22	HR	0.00	75.25	75.89	0.00	3,324.97
Remedial Action #4	12	Clear and Grub	17030288	26 CY, Semi Dump	151	HR	0.00	70.22	65.10	0.00	20,433.62
	12 Total										91,991.48
Remedial Action #4	13	Excavation	17020416	12 CY Dump Truck Haul/Hour	40	HR	0.00	73.82	44.26	0.00	4,723.45
Remedial Action #4	13	Excavation	17030277	Excavate and load, bank measure, medium material, 2 C.Y. bucket, hydraulic excavator	630	BCY	0.00	1.12	0.73	0.00	1,163.10
Remedial Action #4	13	Excavation	17030423	Unclassified Fill, 6" Lifts, Off-Site, Includes Delivery, Spreading, and Compaction	818	CY	29.10	1.22	0.95	0.02	25,598.36
Remedial Action #4	13	Excavation	18050402	Seeding, Vegetative Cover	0.16	ACR	3,476.05	560.54	214.09	0.00	680.11
Remedial Action #4	13	Excavation	33020401	Disposable Materials per Sample	11	EA	10.95	0.00	0.00	0.00	120.50
Remedial Action #4	13	Excavation	33021709	Testing, TAL metals (6010/7000s)	5	EA	0.00	0.00	0.00	130.39	651.94
Remedial Action #4	13	Excavation	33021710	Testing, soil & sediment analysis, metals (1 cp) (6010)	5	EA	0.00	0.00	0.00	12.24	61.22
Remedial Action #4	13	Excavation	33022401	14 Nitroaromatic/Nitramine Compounds by EPA Method 8330	5	EA	0.00	0.00	0.00	306.08	1,530.38
Remedial Action #4	13	Excavation	33220102	Project Manager	5	HR	0.00	92.47	0.00	0.00	462.35
Remedial Action #4	13	Excavation	33220108	Project Scientist	5	HR	0.00	85.43	0.00	0.00	427.16
Remedial Action #4	13	Excavation	33220110	QA/QC Officer	1	HR	0.00	85.43	0.00	0.00	85.43
Remedial Action #4	13	Excavation	33220112	Field Technician	1	HR	0.00	42.60	0.00	0.00	42.60
Remedial Action #4	13	Excavation	33220114	Word Processing/Clerical	1	HR	0.00	46.11	0.00	0.00	46.11
Remedial Action #4	13	Excavation	33220115	Draftsman/CADD	1	HR	0.00	49.45	0.00	0.00	49.45
	13 Total										35,642.16
Remedial Action #4	14	Off-site Transportation and Waste Disposal	33190102	Bulk Solid Waste Loading Into Disposal Vehicle or Bulk Disposal Container	204	BCY	1.00	1.39	0.40	0.00	570.46
Remedial Action #4	14	Off-site Transportation and Waste Disposal	33190205	Transport Bulk Solid Hazardous Waste, Maximum 20 CY (per Mile)	110	MI	0.00	0.00	0.00	2.89	318.32
Remedial Action #4	14	Off-site Transportation and Waste Disposal	33190317	Waste Stream Evaluation Fee, Not Including 50% Rebate on 1st Shipment	1	EA	0.00	0.00	0.00	69.56	69.56
Remedial Action #4	14	Off-site Transportation and Waste Disposal	33190807	32 Ft. Dump Truck, 6 Mil Liner, disposable	11	EA	25.80	0.00	0.00	0.00	283.79
Remedial Action #4	14	Off-site Transportation and Waste Disposal	33197270	Landfill Nonhazardous Solid Bulk Waste by CY	204	CY	0.00	0.00	0.00	25.19	5,138.19
	14 Total										6,380.32
Remedial Action #4	15	Off-site Transportation and Waste Disposal	33190102	Bulk Solid Waste Loading Into Disposal Vehicle or Bulk Disposal Container	611	BCY	1.00	1.39	0.40	0.00	1,708.57
Remedial Action #4	15	Off-site Transportation and Waste Disposal	33190205	Transport Bulk Solid Hazardous Waste, Maximum 20 CY (per Mile)	930	MI	0.00	0.00	0.00	2.89	2,691.23
Remedial Action #4	15	Off-site Transportation and Waste Disposal	33190317	Waste Stream Evaluation Fee, Not Including 50% Rebate on 1st Shipment	1	EA	0.00	0.00	0.00	69.56	69.56
Remedial Action #4	15	Off-site Transportation and Waste Disposal	33190807	32 Ft. Dump Truck, 6 Mil Liner, disposable	31	EA	25.80	0.00	0.00	0.00	799.78
Remedial Action #4	15	Off-site Transportation and Waste Disposal	33197265	Landfill Hazardous Solid Bulk Waste Requiring Stabilization	611	CY	0.00	0.00	0.00	202.93	123,992.24
	15 Total										129,261.39
Remedial Action #4	16	Cleanup and Landscaping	17040101	Cleaning Up, site debris clean up and removal	0.13	ACR	0.00	598.25	41.04	0.00	83.11
	16 Total										83.11
Remedial Action #4	17	SEPARATION	17030234	Crawler-mounted, 4.0 CY, Koehring 1166 Hydraulic Excavator	30	HR	0.00	76.04	144.92	0.00	6,628.80
Remedial Action #4	17	SEPARATION	17030285	12 CY, Dump Truck	30	HR	0.00	70.22	44.16	0.00	3,431.32
Remedial Action #4	17	SEPARATION	17030436	0.75 CY Wheel Loader	90	HR	0.00	105.60	32.29	0.00	12,409.98
Remedial Action #4	17	SEPARATION	17040101	Cleaning Up, site debris clean up and removal	0.13	ACR	1.00	484.70	40.82	0.00	68.45
Remedial Action #4	17	SEPARATION	33040662	Trommel Screener	1	MO	0.00	0.00	6,047.85	0.00	6,047.85
Remedial Action #4	17	SEPARATION	33040663	Grizzly Shaker Unit	1	MO	0.00	0.00	4,437.59	0.00	4,437.59
Remedial Action #4	17	SEPARATION	33188402	Conveyors, Material Handling, horizontal belt, center drive & takeup, 60 fpm, 24" belt, 61.5' length	1	EA	6,872.78	3,239.46	0.00	0.00	10,112.24
Remedial Action #4	17	SEPARATION	33240101	Other Direct Costs	1	LS	1,821.95	0.00	0.00	0.00	1,821.95
	17 Total										44,958.18
Site Closeout for Alt #4	18	Site Close-Out Documentation	33010108	Sedan, Automobile, Rental	9	DAY	0.00	0.00	0.00	54.06	486.53
Site Closeout for Alt #4	18	Site Close-Out Documentation	33010202	Per Diem (per person)	18	DAY	0.00	0.00	0.00	154.00	2,772.00
Site Closeout for Alt #4	18	Site Close-Out Documentation	33041101	Airfare	1	LS	0.00	0.00	0.00	3,000.00	3,000.00
Site Closeout for Alt #4	18	Site Close-Out Documentation	33220101	Senior Project Manager	1	HR	0.00	93.55	0.00	0.00	93.55
Site Closeout for Alt #4	18	Site Close-Out Documentation	33220101	Senior Project Manager	3	HR	0.00	93.55	0.00	0.00	280.66

Site Closeout for Alt #4	18	Site Close-Out Documentation	33220102	Project Manager	33	HR	0.00	70.74	0.00	0.00	2,334.29
Site Closeout for Alt #4	18	Site Close-Out Documentation	33220102	Project Manager	48	HR	0.00	70.74	0.00	0.00	3,395.33
Site Closeout for Alt #4	18	Site Close-Out Documentation	33220104	Senior Staff Engineer	8	HR	0.00	93.62	0.00	0.00	748.96
Site Closeout for Alt #4	18	Site Close-Out Documentation	33220106	Staff Engineer	93	HR	0.00	83.45	0.00	0.00	7,760.60
Site Closeout for Alt #4	18	Site Close-Out Documentation	33220106	Staff Engineer	42	HR	0.00	83.45	0.00	0.00	3,504.79
Site Closeout for Alt #4	18	Site Close-Out Documentation	33220114	Word Processing/Clerical	38	HR	0.00	36.48	0.00	0.00	1,386.39
Site Closeout for Alt #4	18	Site Close-Out Documentation	33220114	Word Processing/Clerical	16	HR	0.00	36.48	0.00	0.00	583.74
Site Closeout for Alt #4	18	Site Close-Out Documentation	33220115	Draftsman/CADD	4	HR	0.00	40.04	0.00	0.00	160.17
Site Closeout for Alt #4	18	Site Close-Out Documentation	33220115	Draftsman/CADD	27	HR	0.00	40.04	0.00	0.00	1,081.13
	18 Total										27,588.14
Remedial Design for Alt #4	38	Remedial Design (Percent)	32032001	Remedial Design Professional Labor	1	EA	0.00	132,473.00	0.00	0.00	132,473.00
	38 Total										132,473.00
USACE Project Plans	49	USACE Project Plans	32032001	Remedial Design Professional Labor	1	EA	0.00	150,000.00	0.00	0.00	150,000.00
	49 Total										150,000.00
	Grand Total										**618,377.78**

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Alternative #5:
In Situ Chemical Reduction/Oxidation and Stabilization

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Estimate Documentation Report

System:

RACER Version: RACER™ Version 11.1.12.0
Database Location: N:\Projects_Ongoing\3108- LOOW\05_EU8-OCCP_FS (2012)\02_Draft\024_Appendices\Appendix F - RACER Cost Estimates\Post 2nd Backcheck Comments\LOOW_OCCP_FS_Draft_v05_11_1.mdb

Folder:

Folder Name: Lake Ontario Ordnance Works (LOOW)

Project:

ID: OCCP (EU8)
Name: OCCP (EU8)
Category: None

Location

State / Country: NEW YORK
City: NIAGARA BUFFALO DEFENSE AREA

Location Modifier	Default	User	Reason for changes
	1.100	1.113	

Options

Database: System Costs
Cost Database Date: 2011
Report Option: Fiscal

Description

The project is a Feasibility Study for Exposure Unit 8 (EU8) at the Occidental Chemical Corporation (OCCP). The OCCP is a portion of the former Lake Ontario Ordnance Works (LOOW) installation located in Lewiston, NY.

In accordance with the Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (USEPA, 1988), cost estimates for evaluating alternatives will be based on a variety of cost estimating data, include cost curves, generic unit costs, vendor information, conventional cost-estimating guides, and prior similar estimates as modified by site-specific information. Absolute accuracy of cost estimates during evaluating is not essential. Because uncertainties associated with the definition of alternatives often remain, it may not be practicable to define the costs of alternatives with the accuracy desired for the detailed analysis (i.e., +50 percent to -30 percent). The focus should be to make comparative estimates for alternatives with relative accuracy so that cost decisions among alternatives will be sustained as the accuracy of cost estimates improves beyond the evaluating process.

Because this cost estimate will serve as the basis for a Cost and Schedule Risk Analysis, escalation has not been applied.

This report for official U.S. Government use only.

Estimate Documentation Report

Site:

ID: OCCP (EU8)
Name: Alternative #5 - Ex Situ Chemical Reduct/Oxidation
Type: None

Media/Waste Type

Primary: Soil
Secondary: N/A

Contaminant

Primary: Ordnance (residual)
Secondary: Metals

Phase Names

- **SI** ☐
- **RI/FS** ☐
- **EE/CA** ☐
- **RD** ☐
- **RmA-C** ☐
- **IRA** ☐
- **RA-C** ☐
- **RA-O** ☐
- **LTM** ☐
- **PCO** ☐

Documentation

Description: LOOW OCCP Feasibility Study - Alternative #5: Ex-Situ Chemical Reduction/Oxidation
Support Team: Documentation of personnel used to provide support for estimator and preparation of the estimate.
References: Documentation of reference sources used in the preparation of the estimate.

Estimator Information

Estimator Name: [redacted]
Estimator Title: Environmental Scientist
Agency/Org./Office: ERT, Inc.
Business Address: 14401 Sweitzer Lane, Suite 300
Laurel, MD 20707
Telephone Number: [redacted]
Email Address: [redacted]
Estimate Prepared Date: 04/29/2015

Estimator Signature: _____ **Date:** _____

Reviewer Information

Reviewer Name: [redacted]
Reviewer Title: PM
Agency/Org./Office: ERT, Inc.
Business Address: 14401 Sweitzer Lane, Suite 300
Laurel, MD 20707

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Estimate Documentation Report

Telephone Number: [redacted]
Email [redacted]
Date Reviewed: 04/29/2015

Reviewer Signature: _____ **Date:** _____

Estimate Costs:

Phase Names	Direct Cost	Marked-Up
Remedial Action for Alt #5	$673,207.19	$986,061.04
Remedial Design for Alt #5	$158,840.00	$158,840.00
Site Closeout for Alt #5	$27,588.14	$65,677.52
LTM for Alt #5	$934,876.23	$2,230,732.34
O&M for Alt #5	$1,087,234.33	$2,704,795.75
USACE Project Plans	$150,000.00	$224,775.00
Total Cost:	$3,031,745.89	$6,370,881.64
Total Site Cost:	$3,031,745.89	$6,370,881.64

Phase Documentation:

Phase Type: Remedial Action
Phase Name: Remedial Action for Alt #5
Description: Ex-situ chemical reduction / oxidation (assuming excavation). Onsite reuse of remediated soil and offsite disposal of debris.

Approach: Ex Situ
Start Date: January, 2017
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate

Phase Markup Template: System Defaults

Technology Markups	Markup	% Prime	% Sub.
Fencing	True	100	0
Excavation	True	100	0
Cleanup and Landscaping	True	100	0
Off-site Transportation and Waste Disposal	True	100	0
Clear and Grub	True	100	0
SEPARATION	True	100	0
MUNIREM (C) - BENCH SCALE TEST	True	100	0
MUNIREM (C) - PILOT SCALE TEST	True	100	0
MUNIREM (C) - FULL SCALE TEST	True	100	0

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Estimate Documentation Report

Total Marked-up Cost: $986,061.04

Technologies:

Technology Name: **Cleanup and Landscaping (#1)**

User Name: **Cleanup and Landscaping**

Description	Default	Value	UOM
System Definition			
Required Parameters			
Type of Site Preparation		Cleanup	n/a
Preparation Area		1	AC
Safety Level		D	n/a
Landscaping			
Secondary Parameters			
Landscaping Type	Seeding	Seeding	n/a
Landscaping Area	100.00	100.00	%

Comments:

Technology Name: **Clear and Grub (#1)**

User Name: **Clear and Grub**

Description	Default	Value	UOM
System Definition			
Required Parameters			
Acres		1	AC
Dry Soil		80.00	%
Wet Soil		20.00	%
Include Load and Haul Costs		True	n/a
Safety Level		D	n/a
Clearing			
Secondary Parameters			
Brush Density	Medium	Medium	n/a
Debris Reduction	None	None	n/a
Trees Per Acre (<= 6")	0	60	EA/AC
Trees Per Acre (> 6" & <= 12")	100	20	EA/AC
Trees Per Acre (> 12" & <= 24")	0	20	EA/AC
Trees Per Acre (> 24" & <= 36")	0	0	EA/AC
Stumps Per Acre (<= 6")	0	60	EA/AC
Stumps Per Acre (> 6" & <= 12")	100	20	EA/AC
Stumps Per Acre (> 12" & <= 24")	0	20	EA/AC
Stumps Per Acre (> 24" & <= 36")	0	0	EA/AC

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Estimate Documentation Report

Technology Name: **Clear and Grub (#1)**

User Name: **Clear and Grub**

Description	Default	Value	UOM
Grubbing			
Secondary Parameters			
Grubbing Depth	6	0	IN
Bulk Factor	1.2	1.2	n/a
Equipment	Dozer - 105hp	Dozer - 105hp	n/a
Soil Stripping			
Secondary Parameters			
Soil Depth	0	0	IN
Stripping Area	0.00	0.00	%
Soil Equipment	Dozer - 200hp	Dozer - 200hp	n/a
Disposal	Stockpilling	Stockpilling	n/a
Bulk Factor	1.2	1.2	n/a
Load and Haul			
Secondary Parameters			
Truck Type		Highway	n/a
Volume		4200	CY
One-way Haul Distance		10	MI
Dump Charge		15	$/CY

Comments: Volume is assumed to be 30% of the area of EU8 by 1 yard.

Technology Name: **Excavation (#1)**

User Name: **Excavation**

Description	Default	Value	UOM
System Definition			
Required Parameters			
Estimating Method		Area / Depth	n/a
Area		0.13	AC
Depth		3	FT
Soil Type		Sand-Silt/Sand-Clay Mixture	n/a
Safety Level		D	n/a
Excavation			
Secondary Parameters			
Existing Cover	Soil/Gravel	Soil/Gravel	n/a
Replacement Cover	Soil/Seeding	Soil/Seeding	n/a
Sidewall Protection	None	None	n/a
% of Excavated Material To Be Used as Backfill	0.00	0.00	%
Source of Additional Fill	Off Site	Off Site	n/a
Backfill Hauling Distance (one way)	10	10	MI
Dewatering Required	False	False	n/a
Groundwater Depth		0	FT

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Estimate Documentation Report

Technology Name: **Excavation (#1)**

User Name: **Excavation**

Description	Default	Value	UOM
Analytical			
Secondary Parameters			
Primary Analytical Template	System Soil - Ordnance Residual	System Soil - Ordnance Residual	n/a
Secondary Analytical Template	System Soil - Metals	System Soil - Metals	n/a
Number of Sampling Points/Locations	11	11	EA
Number of Composites Submitted to Lab	5	5	EA
Turnaround Time	Standard (21 Days)	Standard (21 Days)	n/a
Submit Data Electronically	Yes	Yes	n/a
Data Package / QC	Stage 1	Stage 1	n/a
Lab Data Review	Stage 1	Stage 1	n/a
Sampling Reports	Abbreviated	Abbreviated	n/a

Comments:

Technology Name: **Fencing (#1)**

User Name: **Fencing**

Description	Default	Value	UOM
System Definition			
Required Parameters			
Type of Fence		Boundary	n/a
Fence Length		350	LF
Safety Level		D	n/a

Comments: Perimeter Fencing.

Technology Name: **Off-site Transportation and Waste Disposal (#1)**

User Name: **Off-site Transportation and Waste Disposal**

Description	Default	Value	UOM
System Definition			
Required Parameters			
Waste Type		Non-Hazardous	n/a
Waste Form		Solid	n/a
Condition of Waste		Bulk to remain as bulk	n/a
Volume of Bulk Solid Waste		204	CY
Stabilization		Not Required	n/a
Transportation Type		Truck	n/a
Truck Distance (One-way)		10	MI
Safety Level		D	n/a

Comments: Debris - 204 CY of non-hazardous debris. Volume assumed to be equal to 30 percent of soil volume (611 CY).

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Estimate Documentation Report

Technology Name: **User Defined Estimate (#1)**

User Name: **SEPARATION**

Description	Default	Value	UOM
System Definition			
Required Parameters			
Model Name		SEPARATION	n/a
WBS Type		HTRW	n/a
Selected WBS		331.18.01	n/a
Safety Level		D	n/a

Comments:

Technology Name: **User Defined Estimate (#2)**

User Name: **MUNIREM (C) - BENCH SCALE TEST**

Description	Default	Value	UOM
System Definition			
Required Parameters			
Model Name		MUNIREM (C) - BENCH SCALE TEST	n/a
WBS Type		HTRW	n/a
Selected WBS		331.12.01	n/a
Safety Level		D	n/a

Comments: It's assumed that 15.75 tons of MuniRem (c) (at a price of $17,000 per tone) will be required to remediate the 4,200 CY of COC-contaminated soil.

It's assumed that the Bench Scale Test will equal 10 percent ($37,000) of the total Full Scale Test cost ($370,000) for excavation, separation, MuniRem (c), and off-site transportation and waste disposal.

It's assumed that the Pilot Scale Test will equal 20 percent ($74,000) of the total Full Scale Test cost ($370,000) cost for excavation, separation, MuniRem (c), and off-site transportation and waste disposal.

Technology Name: **User Defined Estimate (#3)**

User Name: **MUNIREM (C) - PILOT SCALE TEST**

Description	Default	Value	UOM
System Definition			
Required Parameters			
Model Name		MUNIREM (C) - PILOT SCALE TEST	n/a
WBS Type		HTRW	n/a
Selected WBS		331.12.01	n/a
Safety Level		D	n/a

Comments: It's assumed that 15.75 tons of MuniRem (c) (at a price of $17,000 per tone) will be required to remediate the 4,200 CY of COC-contaminated soil.

It's assumed that the Bench Scale Test will equal 10 percent ($37,000) of the total Full Scale

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Estimate Documentation Report

Test cost ($370,000) for excavation, separation, MuniRem (c), and off-site transportation and waste disposal.

It's assumed that the Pilot Scale Test will equal 20 percent ($74,000) of the total Full Scale Test cost ($370,000) cost for excavation, separation, MuniRem (c), and off-site transportation and waste disposal.

Technology Name: **User Defined Estimate (#4)**

User Name: **MUNIREM (C) - FULL SCALE TEST**

Description	Default	Value	UOM
System Definition			
Required Parameters			
Model Name		MUNIREM (C) - FULL SCALE TEST	n/a
WBS Type		HTRW	n/a
Selected WBS		331.12.01	n/a
Safety Level		D	n/a

Comments: It's assumed that 15.75 tons of MuniRem (c) (at a price of $17,000 per tone) will be required to remediate the 4,200 CY of COC-contaminated soil.

It's assumed that the bench scale testing will equal 10 percent ($62,000) of the total cost for excavation, separation, MuniRem (c), and off-site transportation and waste disposal ($620,000).

It's assumed that the pilot scale testing will equal 20 percent ($124,000) of the total cost for excavation, separation, MuniRem (c), and off-site transportation and waste disposal ($620,000).

Phase Documentation:

Phase Type: Design

Phase Name: Remedial Design for Alt #5

Description: It is assumed that the remedial design costs will be approximately 12 percent of the total capital costs as per Exhibit 5-8: Examples Professional Services for Professional/Technical Services Capital Costs (USEPA, 2000).

USEPA, 2000. A Guide to Developing and Documenting Cost Estimates During the Feasibility Study (EPA 540-R-00-002; OSWER 9355.0-75).

Approach: Ex Situ

Start Date: January, 2017

Labor Rate Group: System Labor Rate

Analysis Rate Group: System Analysis Rate

Phase Markup Template: System Defaults

Technology Markups	Markup	% Prime	% Sub.
Remedial Design (Percent)	False	0	0

Total Marked-up Cost: $158,840.00

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Estimate Documentation Report

Technologies:

Technology Name: **Remedial Design (Percent) (#1)**

User Name: **Remedial Design (Percent)**

Description	Default	Value	UOM
System Definition			
Required Parameters			
Phase		Remedial Action for Alt #5	n/a
Approach		Ex Situ	n/a
Phase Costs		986061.04	$
Calculate Design Cost			
Required Parameters			
Phase Date		2016	n/a
Design Approach		Ex Situ Removal - Detailed Design On-site Treatment or Disposal	n/a
Design Percent	12.00	12.00	%
MCC		986061.04	$
Design $		158840.00	$
Year		2014	n/a

Comments:

Phase Documentation:

Phase Type: Site Closeout
Phase Name: Site Closeout for Alt #5
Description: Site closeout activities and reporting.
Approach: None
Start Date: July, 2047
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Phase Markup Template: System Defaults

Technology Markups	Markup	% Prime	% Sub.
Site Close-Out Documentation	True	100	0

Total Marked-up Cost: $65,677.52

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Estimate Documentation Report

Technologies:

Technology Name: **Site Close-Out Documentation (#1)**

User Name: **Site Close-Out Documentation**

Description	Default	Value	UOM
System Definition			
Required Parameters			
Meetings		True	n/a
Work Plans and Reports		False	n/a
Documents		True	n/a
Site Close-Out Complexity		High	n/a
Meetings			
Required Parameters			
Kick Off/Scoping Meetings		True	n/a
Kick Off/Scoping Meetings: Number of Meetings	1	1	EA
Kick Off/Scoping Meetings: Travel		True	n/a
Kick Off/Scoping Meetings: Travelers		2	EA
Kick Off/Scoping Meetings: Days		3	Days
Kick Off/Scoping Meetings: Air Fare		500.00	$
Review Meetings		True	n/a
Review Meetings: Number of Meetings	1	1	EA
Review Meetings: Travel		True	n/a
Review Meetings: Travelers		2	EA
Review Meetings: Days		3	Days
Review Meetings: Air Fare		500.00	$
Regulatory Review Meetings		True	n/a
Regulatory Review Meetings: Number of Meetings	1	1	EA
Regulatory Review Meetings: Travel		True	n/a
Regulatory Review Meetings: Travelers		2	EA
Regulatory Review Meetings: Days		3	Days
Regulatory Review Meetings: Air Fare		500.00	$
Documents			
Required Parameters			
Draft Decision Document		True	n/a
Draft Final Decision Document		True	n/a
Final Decision Document		True	n/a
Long Term Document Storage		False	n/a
Number of Boxes		0	EA
Duration of Storage		0	Yrs

Comments:

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Estimate Documentation Report

Phase Documentation:

Phase Type: Long Term Monitoring
Phase Name: LTM for Alt #5
Description: Long term monitoring of groundwater and reporting will be completed annually to verify the long-term effectiveness of ex situ chemical reduction / oxidation. Four groundwater monitoring wells will be installed and sampled annually. Annual reports presenting the groundwater analyticla data will be generated.
Approach: None
Start Date: July, 2017
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Phase Markup Template: System Defaults

Technology Markups	Markup	% Prime	% Sub.
Groundwater Monitoring Well	True	100	0
ANNUAL GROUNDWATER MONITORING	True	100	0
Off-site Transportation and Waste Disposal	True	100	0
Well Abandonment	True	100	0

Total Marked-up Cost: $2,230,732.34

Technologies:

Technology Name: **Groundwater Monitoring Well (#1)**
User Name: **Groundwater Monitoring Well**

Description	Default	Value	UOM
System Definition			
Required Parameters			
Number of Aquifers		One	n/a
Include Guard Posts		Yes	n/a
Depth to Groundwater to Aquifer One		8	FT
Number of Wells to Aquifer One		4	EA
Safety Level		D	n/a
Aquifer One			
Required Parameters			
Aquifer One: Average Well Depth		18	LF
Aquifer One: Formation Type		Unconsolidated	n/a
Aquifer One: Drilling Method		Hollow Stem	n/a
Aquifer One: Well Diameter		2 Inch	n/a
Aquifer One: Well Construction Material		PVC Schedule 40	n/a

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Estimate Documentation Report

Technology Name: **Groundwater Monitoring Well (#1)**

User Name: **Groundwater Monitoring Well**

Description	Default	Value	UOM
Aquifer One			
Secondary Parameters			
Aquifer One: Split Spoon Sample Collection		True	n/a
Aquifer One: Average Number of Soil Samples per Well		2	EA
Aquifer One: Soil Analytical Template		System Soil - Ordnance Residual	n/a
Aquifer One: Safety Level		D	n/a

Comments:

Technology Name: **Monitoring (#1)**

User Name: **ANNUAL GROUNDWATER MONITORING**

Description	Default	Value	UOM
System Definition			
Required Parameters			
Model Name		ANNUAL GROUNDWATER MONITORING	n/a
Groundwater		True	n/a
Surface Soil		False	n/a
Surface Water		False	n/a
Subsurface Soil		False	n/a
Sediment		False	n/a
Soil Gas		False	n/a
Air		False	n/a
Site Distance (One-way)		10	MI
Safety Level		D	n/a
Groundwater			
Required Parameters			
Average Sample Depth		15	FT
Samples per Event (First Year)		4	n/a
Samples per Event (Out Years)		4	n/a
Number of Events (First Year)		1	n/a
Number of Events (Out Years)		1	n/a
Number of Years (Out Years)		29	n/a
Secondary Parameters			
Primary Analytical Template	System Water - Ordnance Residual	System Water - Ordnance Residual	n/a
Secondary Analytical Template	System Water - Metals	System Water - Metals	n/a
Turnaround Time	Standard (21 Days)	Standard (21 Days)	n/a
Data Package/QC	Stage 1	Stage 4	n/a
Sampling Method	Existing Wells - Low Flow Pump	Existing Wells - Low Flow Pump	n/a

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Estimate Documentation Report

Technology Name: **Monitoring (#1)**

User Name: **ANNUAL GROUNDWATER MONITORING**

Description	Default	Value	UOM
Groundwater			
Secondary Parameters			
Number of Wells/Day	8	4	EA
Contain Purge Water	Yes	Yes	n/a
QA/QC			
Secondary Parameters			
Split Samples	10	10	EA
Field Duplicate Samples	10	10	EA
Rinse Blanks (per Round)	1	1	EA
Trip Blanks (per Day)	0	0	EA
Matrix Spikes/Matrix Spike Duplicates	20	20	EA
Data Management			
Secondary Parameters			
Monitoring Plan	Standard	Standard	n/a
Lab Data Review	Stage 4	Stage 4	n/a
Submit Data Electronically	Yes	Yes	n/a
Monitoring Reports	Comprehensive	Comprehensive	n/a

Comments:

Technology Name: **Off-site Transportation and Waste Disposal (#1)**

User Name: **Off-site Transportation and Waste Disposal**

Description	Default	Value	UOM
System Definition			
Required Parameters			
Waste Type		Non-Hazardous	n/a
Waste Form		Liquid/Sludge	n/a
Condition of Waste		Non-leaking Drums	n/a
Quantity of Non-Leaking Drums		60	Drums
Transportation Type		Truck	n/a
Truck Distance (One-way)		10	MI
Safety Level		D	n/a

Comments: During the annual groundwater sampling events, 2 drums will be generated per event.
Therefore a total of 60 drums will be generated over 30-years of annual groundwater monitoring.

Technology Name: **Well Abandonment (#1)**

User Name: **Well Abandonment**

Description	Default	Value	UOM
System Definition			
Required Parameters			
Safety Level		D	n/a

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Estimate Documentation Report

Technology Name: **Well Abandonment (#1)**

User Name: **Well Abandonment**

Description	Default	Value	UOM
Abandon Wells			
Required Parameters			
Technology/Group Name		Groundwater Monitoring Well - Aquifer One	n/a
Number of Wells	4	4	n/a
Well Depth		18	FT
Well Diameter		2	IN
Well Abandonment Method		Overdrill / Removal	n/a
Formation Type		Unconsolidated	n/a
Karst Formation Type		False	n/a

Comments:

Phase Documentation:

Phase Type: Operations & Maintenance

Phase Name: O&M for Alt #5

Description: It is assumed that this alternative will not result in UU/UE. Post-Remedy O&M and Five-Year Reviews will be completed to ensure the continued effectiveness of any alternative that is not assumed to result in UU/UE.

Approach: None

Start Date: July, 2017

Labor Rate Group: System Labor Rate

Analysis Rate Group: System Analysis Rate

Phase Markup Template: System Defaults

Technology Markups	Markup	% Prime	% Sub.
Five-Year Review	True	100	0
POST-REMEDY O&M	True	100	0

Total Marked-up Cost: $2,704,795.75

Technologies:

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Estimate Documentation Report

Technology Name: **Administrative Land Use Controls (#2)**

User Name: **POST-REMEDY O&M**

Description	Default	Value	UOM
System Definition			
Required Parameters			
Rename Model		POST-REMEDY O&M	n/a
Planning Documents		True	n/a
Planning Documents: Start Date		2016	n/a
Implementation		True	n/a
Implementation: Start Date		2017	n/a
Monitoring & Enforcement		True	n/a
Monitoring & Enforcement: Start Date		2017	n/a
Modification/Termination		False	n/a
Modification/Termination: Start Date		2014	n/a
Type of Site		Former Government Site	n/a
Planning Documents			
Required Parameters			
LUC Assurance Plan (LUCAP)		False	n/a
LUC Implementation Plan (LUCIP)		True	n/a
LUC Implementation Plan (LUCIP): Number		1	EA
LUC Implementation Plan (LUCIP): Plan Complexity		Medium	n/a
Long-term Stewardship (LTS) Plan		False	n/a
Long-term Stewardship (LTS) Plan: Number		0	EA
Memorandum of Agreements (MOA)		True	n/a
Memorandum of Agreements (MOA): Number		1	EA
Memorandum of Agreements (MOA): Plan Complexity		Medium	n/a
Installation (or City) Master Plan		True	n/a
Installation (or City) Master Plan: Plan Complexity		Medium	n/a
Construction Permitting		False	n/a
Construction Permitting: Number		0	EA
Geographic Information Systems (GIS)/Overlay Maps		True	n/a
Geographic Information Systems (GIS)/Overlay Maps: Number		1	EA
Geographic Information Systems (GIS)/Overlay Maps: Plan Complexity		Medium	n/a
Planning Meetings			
Required Parameters			
LUCAP: Number of Meetings		0	EA
LUCAP: Number of People		0	EA
LUCAP: Number of Days		0	EA
LUCAP: Airfare Cost		0.00	$
LUCAP: Mileage to Meeting Site		0	MI
LUCIP: Number of Meetings		2	EA
LUCIP: Number of People		2	EA
LUCIP: Number of Days		2	EA
LUCIP: Airfare Cost		500.00	$

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Estimate Documentation Report

Technology Name: **Administrative Land Use Controls (#2)**

User Name: **POST-REMEDY O&M**

Description	Default	Value	UOM
Planning Meetings			
Secondary Parameters			
LUCIP: Mileage to Meeting Site		10	MI
LTS: Number of Meetings		0	EA
LTS: Number of People		0	EA
LTS: Number of Days		0	EA
LTS: Airfare Cost		0.00	$
LTS: Mileage to Meeting Site		0	MI
MOA: Number of Meetings		2	EA
MOA: Number of People		2	EA
MOA: Number of Days		2	EA
MOA: Airfare Cost		500.00	$
MOA: Mileage to Meeting Site		10	MI
Master Plan: Number of Meetings		2	EA
Master Plan: Number of People		2	EA
Master Plan: Number of Days		2	EA
Master Plan: Airfare Cost		500.00	$
Master Plan: Mileage to Meeting Site		10	MI
Construction Permitting: Number of Meetings		0	EA
Construction Permitting: Number of People		0	EA
Construction Permitting: Number of Days		0	EA
Construction Permitting: Airfare Cost		0.00	$
Construction Permitting: Mileage to Meeting Site		0	MI
GIS/Overlay Maps: Number of Meetings		2	EA
GIS/Overlay Maps: Number of People		2	EA
GIS/Overlay Maps: Number of Days		2	EA
GIS/Overlay Maps: Airfare Cost		500.00	$
GIS/Overlay Maps: Mileage to Meeting Site		10	MI
Implementation			
Required Parameters			
Modify Installation (or City) Master Plan		True	n/a
Modify Installation (or City) Master Plan: Task Complexity		Medium	n/a
Deed Notification		True	n/a
Deed Notification: Number		1	EA
Deed Notification: Task Complexity		Medium	n/a
Negotiating Easements		False	n/a
Negotiating Easements: Number		0	EA
Restrictive Covenants		True	n/a
Restrictive Covenants: Number		1	EA
Restrictive Covenants: Task Complexity		Medium	n/a
Equitable Servitudes		False	n/a
Equitable Servitudes: Number		0	EA

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Estimate Documentation Report

Technology Name: **Administrative Land Use Controls (#2)**

User Name: **POST-REMEDY O&M**

Description	Default	Value	UOM
Implementation			
Secondary Parameters			
Access Control Signs		True	n/a
Access Control Signs: Number		24	EA
Access Control Signs: Task Complexity		Medium	n/a
Utility Notification Service		False	n/a
Access Control Signs: Number		0	EA
Geographic Information Systems (GIS)/Overlay Maps		True	n/a
Geographic Information Systems (GIS)/Overlay Maps: Number		1	EA
Geographic Information Systems (GIS)/Overlay Maps: Task Complexity		Medium	n/a
Develop Finding of Suitability to Transfer (FOST)		False	n/a
Monitoring & Enforcement			
Required Parameters			
Duration of Monitoring/Enforcement		30	Years
Notice Letters		True	n/a
Notice Letters: Number		24	EA
Notice Letters: Frequency		Annually	n/a
Guard Service/Security		False	n/a
Guard Service/Security: Number		0	EA
Reports & Certifications		True	n/a
Reports & Certifications: Frequency		Annually	n/a
Site Visits/Inspections		True	n/a
Site Visits/Inspections: Number		1	EA
Site Visits/Inspections: Safety Level		D	n/a
Site Visits/Inspections: Duration		2	Days
Site Visits/Inspections: Number of People		2	EA
Site Visits/Inspections: Frequency		Annually	n/a
Site Visits/Inspections: Airfare		500	$ Per Ticket
Site Visits/Inspections: Mileage		100	MI

Comments:

Technology Name: **Five-Year Review (#2)**

User Name: **Five-Year Review**

Description	Default	Value	UOM
System Definition			
Required Parameters			
Site Complexity		Moderate	n/a
Document Review		True	n/a
Interviews		True	n/a

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Technology Name: **Five-Year Review (#2)**

User Name: **Five-Year Review**

Description	Default	Value	UOM
System Definition			
Secondary Parameters			
Site Inspection		True	n/a
Report		True	n/a
Travel		True	n/a
Rebound Study		False	n/a
No. Reviews		6	EA
Safety Level		D	n/a
Document Review			
Required Parameters			
5-Year Review Check List		True	n/a
Record of Decision		True	n/a
Remedial Action Design & Construction		True	n/a
Close-Out Report		True	n/a
Operations & Maintenance Manuals & Reports		False	n/a
Consent Decree or Settlement Records		True	n/a
Groundwater Monitoring & Reports		True	n/a
Remedial Action Required		True	n/a
Previous 5-Year Review Reports		True	n/a
Interviews			
Required Parameters			
Current and Previous Staff Management		False	n/a
Community Groups		False	n/a
State Contacts		True	n/a
Local Government Contacts		True	n/a
Operations & Maintenance Contractors		True	n/a
PRPs		True	n/a
Remedial Design Consultant		False	n/a
Site Inspection			
Required Parameters			
General Site Inspection		True	n/a
Containment System Inspection		True	n/a
Monitoring Systems Inspection		True	n/a
Treatment Systems Inspection		False	n/a
Regulatory Compliance		False	n/a
Site Visit Documentation (Photos, Diagrams, etc.)		True	n/a
Report			
Required Parameters			
Introduction		True	n/a
Remedial Objectives		True	n/a
ARARs Review		True	n/a
Summary of Site Visit		True	n/a
Areas of Non Compliance		True	n/a

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Estimate Documentation Report

Technology Name: **Five-Year Review (#2)**

User Name: **Five-Year Review**

Description	Default	Value	UOM
Report			
Secondary Parameters			
Technology Recommendations		True	n/a
Statement of Protectiveness		True	n/a
Next Review		True	n/a
Implementation Requirements		True	n/a
Travel			
Required Parameters			
Number of Travelers		2	EA
Number of Days		3	EA
Air Fare Ticket Price		500.00	$
Need a rental car?		True	n/a

Comments:

Phase Documentation:

Phase Type: Design
Phase Name: USACE Project Plans
Description: New Phase

Approach: Ex Situ
Start Date: March, 2015
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate

Phase Markup Template: System Defaults

Technology Markups	Markup	% Prime	% Sub.
USACE Project Plans	True	100	0

Total Marked-up Cost: $224,775.00

Technologies:

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Estimate Documentation Report

Technology Name: **User Defined Estimate (#2)**

User Name: **USACE Project Plans**

Description	Default	Value	UOM
System Definition			
Required Parameters			
Model Name		USACE Project Plans	n/a
WBS Type		HTRW	n/a
Selected WBS		333.30.91	n/a
Safety Level		E	n/a

Comments:

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Site Cost Over Time Report
(with Markups)

System:

RACER Version: RACER™ Version 11.1.12.0
Database Location: N:\Projects_Ongoing\3108- LOOW\05_EU8-OCCP_FS (2012)\02_Draft\024_Appendices\Appendix F - RACER Cost Estimates\Post 2nd Backcheck Comments\LOOW_OCCP_FS_Draft_v05_11_1.mdb

Folder:

Folder Name: Lake Ontario Ordnance Works (LOOW)

Project:

ID: OCCP (EU8)
Name: OCCP (EU8)
Category: None

Location
State / Country: NEW YORK
City: NIAGARA BUFFALO DEFENSE AREA

Location Modifier	Default	User	Reason for changes
	1.100	1.113	

Options
Database: System Costs
Cost Database Date: 2011
Report Option: Fiscal

Description
The project is a Feasibility Study for Exposure Unit 8 (EU8) at the Occidental Chemical Corporation (OCCP). The OCCP is a portion of the former Lake Ontario Ordnance Works (LOOW) installation located in

Site Cost Over Time Report
(with Markups)

Lewiston, NY.

In accordance with the Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (USEPA, 1988), cost estimates for evaluating alternatives will be based on a variety of cost estimating data, include cost curves, generic unit costs, vendor information, conventional cost-estimating guides, and prior similar estimates as modified by site-specific information. Absolute accuracy of cost estimates during evaluating is not essential. Because uncertainties associated with the definition of alternatives often remain, it may not be practicable to define the costs of alternatives with the accuracy desired for the detailed analysis (i.e., +50 percent to -30 percent). The focus should be to make comparative estimates for alternatives with relative accuracy so that cost decisions among alternatives will be sustained as the accuracy of cost estimates improves beyond the evaluating process.

Because this cost estimate will serve as the basis for a Cost and Schedule Risk Analysis, escalation has not been applied.

Site:

ID: OCCP (EU8)
Name: Alternative #5 - Ex Situ Chemical Reduct/Oxidation
Type: None

Media/Waste Type

Primary: Soil
Secondary: N/A

Contaminant

Primary: Ordnance (residual)
Secondary: Metals

Phase Names

SI ☐
RI/FS ☐
EE/CA ☐

Site Cost Over Time Report
(with Markups)

RD ☐
RmA-C ☐
IRA ☐
RA-C ☐
RA-O ☐
LTM ☐
PCO ☐

Documentation

Description: LOOW OCCP Feasibility Study - Alternative #5: Ex-Situ Chemical Reduction/Oxidation

Support Team: Documentation of personnel used to provide support for estimator and preparation of the estimate.

References: Documentation of reference sources used in the preparation of the estimate.

Estimator Information

Estimator Name: [redacted]
Estimator Title: Environmental Scientist
Agency/Org./Office: ERT, Inc.
Business Address: 14401 Sweitzer Lane, Suite 300
Laurel, MD 20707
Telephone Number: [redacted]
Email Address: [redacted]rtcorp.com
Estimate Prepared Date: 04/29/2015

Estimator Signature: _____ **Date:** _____

Reviewer Information

Reviewer Name: [redacted]
Reviewer Title: PM
Agency/Org./Office: ERT, Inc.
Business Address: 14401 Sweitzer Lane, Suite 300
Laurel, MD 20707
Telephone Number: [redacted]

Site Cost Over Time Report
(with Markups)

Email Address: [redacted].com
Date Reviewed: 04/29/2015

Reviewer Signature: _____ **Date:** _____

Site Cost Over Time Report
(with Markups)

Phase Type	Phase Name	2014	2015	2016	2017	2018	2019
Long Term Monitoring	LTM for Alt #5	$0	$0	$0	$149,320	$71,773	$71,773
Operations & Maintenance	O&M for Alt #5	$0	$0	$460,216	$257,538	$58,732	$58,732
Remedial Action	Remedial Action for Alt #5	$0	$0	$0	$986,061	$0	$0
Design	Remedial Design for Alt #5	$158,840	$0	$0	$0	$0	$0
Site Closeout	Site Closeout for Alt #5	$0	$0	$0	$0	$0	$0
Design	USACE Project Plans	$0	$224,775	$0	$0	$0	$0
Total Site Cost		$158,840	$224,775	$460,216	$1,392,919	$130,505	$130,505

Site Cost Over Time Report
(with Markups)

Phase Type	Phase Name	2020	2021	2022	2023	2024	2025
Long Term Monitoring	LTM for Alt #5	$71,773	$71,773	$71,773	$71,773	$71,773	$71,773
Operations & Maintenance	O&M for Alt #5	$58,732	$58,732	$106,034	$58,732	$58,732	$58,732
Remedial Action	Remedial Action for Alt #5	$0	$0	$0	$0	$0	$0
Design	Remedial Design for Alt #5	$0	$0	$0	$0	$0	$0
Site Closeout	Site Closeout for Alt #5	$0	$0	$0	$0	$0	$0
Design	USACE Project Plans	$0	$0	$0	$0	$0	$0
Total Site Cost		$130,505	$130,505	$177,807	$130,505	$130,505	$130,505

Site Cost Over Time Report
(with Markups)

Phase Type	Phase Name	2026	2027	2028	2029	2030	2031
Long Term Monitoring	LTM for Alt #5	$71,773	$71,773	$71,773	$71,773	$71,773	$71,773
Operations & Maintenance	O&M for Alt #5	$58,732	$106,034	$58,732	$58,732	$58,732	$58,732
Remedial Action	Remedial Action for Alt #5	$0	$0	$0	$0	$0	$0
Design	Remedial Design for Alt #5	$0	$0	$0	$0	$0	$0
Site Closeout	Site Closeout for Alt #5	$0	$0	$0	$0	$0	$0
Design	USACE Project Plans	$0	$0	$0	$0	$0	$0
Total Site Cost		$130,505	$177,807	$130,505	$130,505	$130,505	$130,505

Site Cost Over Time Report
(with Markups)

Phase Type	Phase Name	2032	2033	2034	2035	2036	2037
Long Term Monitoring	LTM for Alt #5	$71,773	$71,773	$71,773	$71,773	$71,773	$71,773
Operations & Maintenance	O&M for Alt #5	$106,034	$58,732	$58,732	$58,732	$58,732	$106,034
Remedial Action	Remedial Action for Alt #5	$0	$0	$0	$0	$0	$0
Design	Remedial Design for Alt #5	$0	$0	$0	$0	$0	$0
Site Closeout	Site Closeout for Alt #5	$0	$0	$0	$0	$0	$0
Design	USACE Project Plans	$0	$0	$0	$0	$0	$0
Total Site Cost		$177,807	$130,505	$130,505	$130,505	$130,505	$177,807

Site Cost Over Time Report
(with Markups)

Phase Type	Phase Name	2038	2039	2040	2041	2042	2043
Long Term Monitoring	LTM for Alt #5	$71,773	$71,773	$71,773	$71,773	$71,773	$71,773
Operations & Maintenance	O&M for Alt #5	$58,732	$58,732	$58,732	$58,732	$106,034	$58,732
Remedial Action	Remedial Action for Alt #5	$0	$0	$0	$0	$0	$0
Design	Remedial Design for Alt #5	$0	$0	$0	$0	$0	$0
Site Closeout	Site Closeout for Alt #5	$0	$0	$0	$0	$0	$0
Design	USACE Project Plans	$0	$0	$0	$0	$0	$0
Total Site Cost		$130,505	$130,505	$130,505	$130,505	$177,807	$130,505

Site Cost Over Time Report
(with Markups)

Phase Type	Phase Name	2044	2045	2046	2047	Total	
Long Term Monitoring	LTM for Alt #5	$71,773	$71,773	$71,773	$0	$2,230,732	
Operations & Maintenance	O&M for Alt #5	$58,732	$58,732	$58,732	$47,302	$2,704,796	
Remedial Action	Remedial Action for Alt #5	$0	$0	$0	$0	$986,061	
Design	Remedial Design for Alt #5	$0	$0	$0	$0	$158,840	
Site Closeout	Site Closeout for Alt #5	$0	$0	$0	$65,678	$65,678	
Design	USACE Project Plans	$0	$0	$0	$0	$224,775	
Total Site Cost		$130,505	$130,505	$130,505	$112,980	$6,370,882	$0

OCCP (EU8) Alternative #5 - Ex-Situ Chemical Reduction/Oxidation Site Assembly Level Data Report

Phase Name	Tech. Key	Technology Name	Assembly No.	Assembly Description	Qty	UOM	Materials	Labor	Equipment	SubBid	Extended Cost
Remedial Action for Alt #5	20	Fencing	18040105	Boundary Fence, 5' Galvanized	350	LF	11.92	10.54	1.82	0.00	8,498.82
Remedial Action for Alt #5	20	Fencing	18040501	Hazardous Waste Signing	2	EA	43.42	31.96	0.00	0.00	150.75
Remedial Action for Alt #5	21	Excavation	17020416	12 CY Dump Truck Haul/Hour	40	HR	0.00	73.82	44.26	0.00	4,723.45
Remedial Action for Alt #5	21	Excavation	17030277	Excavate and load, bank measure, medium material, 2 C.Y. bucket, hydraulic excavator	630	BCY	0.00	1.12	0.73	0.00	1,163.10
Remedial Action for Alt #5	21	Excavation	17030423	Unclassified Fill, 6" Lifts, Off-Site, Includes Delivery, Spreading, and Compaction	817.96	CY	29.10	1.22	0.95	0.02	25,598.36
Remedial Action for Alt #5	21	Excavation	18050402	Seeding, Vegetative Cover	0.16	ACR	3,476.05	560.54	214.09	0.00	680.11
Remedial Action for Alt #5	21	Excavation	33020401	Disposable Materials per Sample	11	EA	10.95	0.00	0.00	0.00	120.50
Remedial Action for Alt #5	21	Excavation	33021709	Testing, TAL metals (6010/7000s)	5	EA	0.00	0.00	0.00	130.39	651.94
Remedial Action for Alt #5	21	Excavation	33021710	Testing, soil & sediment analysis, metals (1 cp) (6010)	5	EA	0.00	0.00	0.00	12.24	61.22
Remedial Action for Alt #5	21	Excavation	33022401	14 Nitroaromatic/Nitramine Compounds by EPA Method 8330	5	EA	0.00	0.00	0.00	306.08	1,530.38
Remedial Action for Alt #5	21	Excavation	33220102	Project Manager	5	HR	0.00	92.47	0.00	0.00	462.35
Remedial Action for Alt #5	21	Excavation	33220108	Project Scientist	5	HR	0.00	85.43	0.00	0.00	427.16
Remedial Action for Alt #5	21	Excavation	33220110	QA/QC Officer	1	HR	0.00	85.43	0.00	0.00	85.43
Remedial Action for Alt #5	21	Excavation	33220112	Field Technician	1	HR	0.00	42.60	0.00	0.00	42.60
Remedial Action for Alt #5	21	Excavation	33220114	Word Processing/Clerical	1	HR	0.00	46.11	0.00	0.00	46.11
Remedial Action for Alt #5	21	Excavation	33220115	Draftsman/CADD	1	HR	0.00	49.45	0.00	0.00	49.45
Remedial Action for Alt #5	22	Cleanup and Landscaping	17040101	Cleaning Up, site debris clean up and removal	1	ACR	0.00	484.70	40.82	0.00	525.52
Remedial Action for Alt #5	22	Cleanup and Landscaping	18050101	Area Preparation, 67% Level & 33% Slope	1	ACR	0.00	18.05	22.52	0.00	40.56
Remedial Action for Alt #5	22	Cleanup and Landscaping	18050401	Seeding, 67% Level & 33% Slope, Hydroseeding	1	ACR	2,254.43	767.38	596.01	0.00	3,617.81
Remedial Action for Alt #5	22	Cleanup and Landscaping	18050408	Fertilizer, Hydro Spread	2	ACR	116.36	74.10	27.32	0.00	435.57
Remedial Action for Alt #5	22	Cleanup and Landscaping	18050413	Watering with 3,000-Gallon Tank Truck, per Pass	8	ACR	204.92	41.86	43.34	0.00	2,320.95
Remedial Action for Alt #5	22	Cleanup and Landscaping	18050415	Mowing	2	ACR	0.00	277.40	0.00	0.00	554.79
Remedial Action for Alt #5	23	Off-site Transportation and Waste Disposal	33190102	Bulk Solid Waste Loading Into Disposal Vehicle or Bulk Disposal Container	204	BCY	1.00	1.39	0.40	0.00	570.46
Remedial Action for Alt #5	23	Off-site Transportation and Waste Disposal	33190205	Transport Bulk Solid Hazardous Waste, Maximum 20 CY (per Mile)	110	MI	0.00	0.00	0.00	2.89	318.32
Remedial Action for Alt #5	23	Off-site Transportation and Waste Disposal	33190317	Waste Stream Evaluation Fee, Not Including 50% Rebate on 1st Shipment	1	EA	0.00	0.00	0.00	69.56	69.56
Remedial Action for Alt #5	23	Off-site Transportation and Waste Disposal	33190807	32 Ft. Dump Truck, 6 Mil Liner, disposable	11	EA	25.80	0.00	0.00	0.00	283.79
Remedial Action for Alt #5	23	Off-site Transportation and Waste Disposal	33197270	Landfill Nonhazardous Solid Bulk Waste by CY	204	CY	0.00	0.00	0.00	25.19	5,138.19
Remedial Action for Alt #5	24	Clear and Grub	17010102	Selective clearing, brush, medium clearing, with dozer and brush rake, excludes removal offsite	0.8	ACR	0.00	116.10	112.58	0.00	182.94
Remedial Action for Alt #5	24	Clear and Grub	17010111	Clear trees, wet conditions, medium growth, 200 H.P. dozer, excludes grubbing	0.2	ACR	0.00	1,273.78	1,193.88	0.00	493.53
Remedial Action for Alt #5	24	Clear and Grub	17010210	Site clearing trees, with 335 H.P. dozer, to 6" diameter	60	EA	0.00	2.58	3.67	0.00	374.83
Remedial Action for Alt #5	24	Clear and Grub	17010211	Site clearing trees, with 335 H.P. dozer, to 12" diameter	20	EA	0.00	4.81	6.85	0.00	233.23
Remedial Action for Alt #5	24	Clear and Grub	17010212	Site clearing trees, with 335 H.P. dozer, to 24" diameter	20	EA	0.00	7.22	10.27	0.00	349.84
Remedial Action for Alt #5	24	Clear and Grub	17010310	Remove stumbs, wet conditions, with dozer, to 6" diameter	12	EA	0.00	36.09	45.03	0.00	973.49
Remedial Action for Alt #5	24	Clear and Grub	17010311	Remove stumbs, wet conditions, with dozer, 6" to 12" diameter	4	EA	0.00	45.12	56.29	0.00	405.62
Remedial Action for Alt #5	24	Clear and Grub	17010312	Remove stumbs, wet conditions, with dozer, 12" to 24" diameter	4	EA	0.00	60.16	75.05	0.00	540.83
Remedial Action for Alt #5	24	Clear and Grub	17010314	Grub stumps, with 335 H.P. dozer, to 6" diameter	48	EA	0.00	1.80	2.57	0.00	209.91
Remedial Action for Alt #5	24	Clear and Grub	17010315	Grub stumps, with 335 H.P. dozer, to 12" diameter	16	EA	0.00	2.89	5.46	0.00	133.52
Remedial Action for Alt #5	24	Clear and Grub	17010316	Grub stumps, with 335 H.P. dozer, to 24" diameter	16	EA	0.00	28.88	54.57	0.00	1,335.16
Remedial Action for Alt #5	24	Clear and Grub	17020401	Dump Charges	4200	EA	15.00	0.00	0.00	0.00	63,000.00
Remedial Action for Alt #5	24	Clear and Grub	17030224	966, 4.0 CY, Wheel Loader	22	HR	0.00	75.25	75.89	0.00	3,324.97
Remedial Action for Alt #5	24	Clear and Grub	17030288	26 CY, Semi Dump	151	HR	0.00	70.22	65.10	0.00	20,433.62
Remedial Action for Alt #5	25	SEPARATION	17030234	Crawler-mounted, 4.0 CY, Koehring 1166 Hydraulic Excavator	30	HR	0.00	76.04	144.92	0.00	6,628.80
Remedial Action for Alt #5	25	SEPARATION	17030285	12 CY, Dump Truck	30	HR	0.00	70.22	44.16	0.00	3,431.32
Remedial Action for Alt #5	25	SEPARATION	17030436	0.75 CY Wheel Loader	90	HR	0.00	105.60	32.29	0.00	12,409.98
Remedial Action for Alt #5	25	SEPARATION	17040101	Cleaning Up, site debris clean up and removal	0.13	ACR	1.00	484.70	40.82	0.00	68.45
Remedial Action for Alt #5	25	SEPARATION	33040662	Trommel Screener	1	MO	0.00	0.00	6,047.85	0.00	6,047.85
Remedial Action for Alt #5	25	SEPARATION	33040663	Grizzly Shaker Unit	1	MO	0.00	0.00	4,437.59	0.00	4,437.59
Remedial Action for Alt #5	25	SEPARATION	33188402	Conveyors, Material Handling, horizontal belt, center drive & takeup, 60 fpm, 24" belt, 61.5' length	1	EA	6,872.78	3,239.46	0.00	0.00	10,112.24
Remedial Action for Alt #5	25	SEPARATION	33240101	Other Direct Costs	1	LS	1,821.95	0.00	0.00	0.00	1,821.95
Remedial Action for Alt #5	26	MUNIREM (C) - BENCH SCALE TEST	33240102	Bench Scale Test	1	LS	37,000.00	0.00	0.00	0.00	37,000.00
Remedial Action for Alt #5	27	MUNIREM (C) - PILOT SCALE TEST	33240103	Pilot Scale Test	1	LS	74,000.00	0.00	0.00	0.00	74,000.00
Remedial Action for Alt #5	28	MUNIREM (C) - FULL SCALE TEST	17030220	910, 1.25 CY, Wheel Loader	41	HR	0.00	75.25	32.29	0.00	4,408.91
Remedial Action for Alt #5	28	MUNIREM (C) - FULL SCALE TEST	17030285	12 CY, Dump Truck	41	HR	0.00	70.22	44.16	0.00	4,689.47
Remedial Action for Alt #5	28	MUNIREM (C) - FULL SCALE TEST	19040401	Wastewater holding tanks, above ground, ss, DOT approved, monthly rental, 550 gal	1	MO	0.00	0.00	0.00	463.25	463.25

Remedial Action for Alt #5	28	MUNIREM (C) - FULL SCALE TEST	19040408	Wastewater holding tanks, above ground, steel, open, stationary, monthly rental, 21,000 gal	1	MO	0.00	0.00	0.00	1,587.23	1,587.23
Remedial Action for Alt #5	28	MUNIREM (C) - FULL SCALE TEST	33150418	1 CY Plywood Boxes	6	EA	34.06	40.72	0.00	0.00	448.68
Remedial Action for Alt #5	28	MUNIREM (C) - FULL SCALE TEST	33150420	Operational Labor for Process Equipment	82	HR	0.00	47.02	0.00	0.00	3,855.43
Remedial Action for Alt #5	28	MUNIREM (C) - FULL SCALE TEST	33150421	Bulk Chemical Transport (40,000 Lb Truckload)	23	EA	0.00	0.00	0.00	2,640.01	60,720.32
Remedial Action for Alt #5	28	MUNIREM (C) - FULL SCALE TEST	33150433	Chemical Fixation & Stabilization, on-site mobile waste mixing equip., 3 month rental,10 CY waste mixer, diesel powered, trailer mounted	1	MO	0.00	0.00	0.00	10,085.78	10,085.78
Remedial Action for Alt #5	28	MUNIREM (C) - FULL SCALE TEST	33150435	Solidification/Stabilization Ancillary Equipment	1	EA	12,068.64	0.00	0.00	0.00	12,068.64
Remedial Action for Alt #5	28	MUNIREM (C) - FULL SCALE TEST	33150437	Maintenance of Solidification/Stabilization Unit	0.02	YR	0.00	7,334.72	0.00	0.00	146.69
Remedial Action for Alt #5	28	MUNIREM (C) - FULL SCALE TEST	33199921	DOT steel drums, 55 gal., open, 17C	3	EA	105.95	0.00	0.00	0.00	317.85
Remedial Action for Alt #5	28	MUNIREM (C) - FULL SCALE TEST	33240101	Other Direct Costs	15.75	LS	17,000.00	0.00	0.00	0.00	267,750.00
Remedial Action for Alt #5	28	MUNIREM (C) - FULL SCALE TEST	33420201	Diesel Fuel	123	GAL	3.22	0.00	0.00	0.00	395.64
Remedial Action for Alt #5	28	MUNIREM (C) - FULL SCALE TEST	33420301	Process Water, Supplied by Tanker Truck	12	KGA	12.70	0.00	0.00	0.00	152.39
Remedial Design for Alt #5	39	Remedial Design (Percent)	32032001	Remedial Design Professional Labor	1	EA	0.00	158,840.00	0.00	0.00	158,840.00
Site Closeout for Alt #5	29	Site Close-Out Documentation	33010108	Sedan, Automobile, Rental	9	DAY	0.00	0.00	0.00	54.06	486.53
Site Closeout for Alt #5	29	Site Close-Out Documentation	33010202	Per Diem (per person)	18	DAY	0.00	0.00	0.00	154.00	2,772.00
Site Closeout for Alt #5	29	Site Close-Out Documentation	33041101	Airfare	1	LS	0.00	0.00	0.00	3,000.00	3,000.00
Site Closeout for Alt #5	29	Site Close-Out Documentation	33220101	Senior Project Manager	3	HR	0.00	93.55	0.00	0.00	280.66
Site Closeout for Alt #5	29	Site Close-Out Documentation	33220101	Senior Project Manager	1	HR	0.00	93.55	0.00	0.00	93.55
Site Closeout for Alt #5	29	Site Close-Out Documentation	33220102	Project Manager	33	HR	0.00	70.74	0.00	0.00	2,334.29
Site Closeout for Alt #5	29	Site Close-Out Documentation	33220102	Project Manager	48	HR	0.00	70.74	0.00	0.00	3,395.33
Site Closeout for Alt #5	29	Site Close-Out Documentation	33220104	Senior Staff Engineer	8	HR	0.00	93.62	0.00	0.00	748.96
Site Closeout for Alt #5	29	Site Close-Out Documentation	33220106	Staff Engineer	42	HR	0.00	83.45	0.00	0.00	3,504.79
Site Closeout for Alt #5	29	Site Close-Out Documentation	33220106	Staff Engineer	93	HR	0.00	83.45	0.00	0.00	7,760.60
Site Closeout for Alt #5	29	Site Close-Out Documentation	33220114	Word Processing/Clerical	16	HR	0.00	36.48	0.00	0.00	583.74
Site Closeout for Alt #5	29	Site Close-Out Documentation	33220114	Word Processing/Clerical	38	HR	0.00	36.48	0.00	0.00	1,386.39
Site Closeout for Alt #5	29	Site Close-Out Documentation	33220115	Draftsman/CADD	4	HR	0.00	40.04	0.00	0.00	160.17
Site Closeout for Alt #5	29	Site Close-Out Documentation	33220115	Draftsman/CADD	27	HR	0.00	40.04	0.00	0.00	1,081.13
LTM for Alt #5	30	Groundwater Monitoring Well	33010101	Mobilize/DeMobilize Drilling Rig & Crew	1	LS	0.00	1,353.63	792.17	0.00	2,145.79
LTM for Alt #5	30	Groundwater Monitoring Well	33020303	Organic Vapor Analyzer Rental, per Day	1	DAY	0.00	0.00	0.00	38.43	38.43
LTM for Alt #5	30	Groundwater Monitoring Well	33021710	Testing, soil & sediment analysis, metals (1 cp) (6010)	8	EA	0.00	0.00	0.00	15.89	127.15
LTM for Alt #5	30	Groundwater Monitoring Well	33022401	14 Nitroaromatic/Nitramine Compounds by EPA Method 8330	8	EA	0.00	0.00	0.00	231.26	1,850.07
LTM for Alt #5	30	Groundwater Monitoring Well	33170808	Decontaminate Rig, Augers, Screen (Rental Equipment)	1	DAY	23.08	541.36	0.00	0.00	564.45
LTM for Alt #5	30	Groundwater Monitoring Well	33220112	Field Technician	16	HR	0.00	42.44	0.00	0.00	678.96
LTM for Alt #5	30	Groundwater Monitoring Well	33230101	2" PVC, Schedule 40, Well Casing	32	LF	1.15	4.51	4.82	0.00	335.27
LTM for Alt #5	30	Groundwater Monitoring Well	33230201	2" PVC, Schedule 40, Well Screen	40	LF	3.81	4.51	4.82	0.00	525.49
LTM for Alt #5	30	Groundwater Monitoring Well	33230301	2" PVC, Well Plug	4	EA	12.35	13.54	14.46	0.00	161.39
LTM for Alt #5	30	Groundwater Monitoring Well	33231101	Hollow Stem Auger, 8" Dia Borehole, Depth <= 100 ft	76	LF	0.00	15.24	25.41	0.00	3,089.40
LTM for Alt #5	30	Groundwater Monitoring Well	33231173	Split Spoon Sampling	16	LF	0.00	11.98	5.98	0.00	287.31
LTM for Alt #5	30	Groundwater Monitoring Well	33231178	Move Rig/Equipment Around Site	3	EA	84.48	194.58	113.87	0.00	1,178.80
LTM for Alt #5	30	Groundwater Monitoring Well	33231182	DOT steel drums, 55 gal., open, 17C	4	EA	105.95	0.00	0.00	0.00	423.80
LTM for Alt #5	30	Groundwater Monitoring Well	33231401	2" Screen, Filter Pack	48	LF	8.42	3.48	3.72	0.00	749.94
LTM for Alt #5	30	Groundwater Monitoring Well	33231504	Surface Pad, Concrete, 2' x 2' x 4"	4	EA	52.59	15.13	0.18	0.00	271.60
LTM for Alt #5	30	Groundwater Monitoring Well	33231811	2" Well, Portland Cement Grout	20	LF	1.10	0.00	0.00	0.00	21.99
LTM for Alt #5	30	Groundwater Monitoring Well	33232101	2" Well, Bentonite Seal	4	EA	135.79	90.00	96.12	0.00	1,287.62
LTM for Alt #5	30	Groundwater Monitoring Well	33232301	5' Guard Posts, Cast Iron, Concrete Fill	16	EA	81.78	81.24	0.05	0.00	2,609.09
LTM for Alt #5	31	ANNUAL GROUNDWATER MONITORING	33010104	Sample collection, vehicle mileage charge, car or van	20	MI	0.00	0.00	0.00	0.58	11.60
LTM for Alt #5	31	ANNUAL GROUNDWATER MONITORING	33020401	Disposable Materials per Sample	8	EA	9.55	0.00	0.00	0.00	76.43
LTM for Alt #5	31	ANNUAL GROUNDWATER MONITORING	33020402	Decontamination Materials per Sample	8	EA	12.47	0.00	0.00	0.00	99.75
LTM for Alt #5	31	ANNUAL GROUNDWATER MONITORING	33020561	Lysimeter accessories, nylon tubing, 1/4" OD	85	LF	0.14	0.00	0.00	0.00	12.30
LTM for Alt #5	31	ANNUAL GROUNDWATER MONITORING	33021509	Monitor well sampling equipment, rental, water quality testing parameter device rental	1	WK	0.00	0.00	0.00	333.90	333.90
LTM for Alt #5	31	ANNUAL GROUNDWATER MONITORING	33021603	Testing, dissolved solids	8	EA	0.00	0.00	0.00	23.42	187.36
LTM for Alt #5	31	ANNUAL GROUNDWATER MONITORING	33021604	Testing, suspended solids	8	EA	0.00	0.00	0.00	18.33	146.63
LTM for Alt #5	31	ANNUAL GROUNDWATER MONITORING	33021620	Testing, TAL metals (6010/7000s)	8	EA	0.00	0.00	0.00	288.52	2,308.19
LTM for Alt #5	31	ANNUAL GROUNDWATER MONITORING	33022043	Overnight delivery service, 51 to 70 lb packages	180	LB	0.00	0.00	0.00	4.27	769.31
LTM for Alt #5	31	ANNUAL GROUNDWATER MONITORING	33022124	Testing, RCRA evaluations, EP toxicity analysis, metals (6010,7470)	1	EA	0.00	0.00	0.00	130.05	130.05
LTM for Alt #5	31	ANNUAL GROUNDWATER MONITORING	33022401	14 Nitroaromatic/Nitramine Compounds by EPA Method 8330	8	EA	0.00	0.00	0.00	279.82	2,238.59
LTM for Alt #5	31	ANNUAL GROUNDWATER MONITORING	33190403	DOT steel drums, 55 gal., closed only, 17H	2	EA	63.16	0.00	0.00	0.00	126.33
LTM for Alt #5	31	ANNUAL GROUNDWATER MONITORING	33220102	Project Manager	12	HR	0.00	70.74	0.00	0.00	848.83
LTM for Alt #5	31	ANNUAL GROUNDWATER MONITORING	33220102	Project Manager	2	HR	0.00	70.74	0.00	0.00	141.47
LTM for Alt #5	31	ANNUAL GROUNDWATER MONITORING	33220105	Project Engineer	70	HR	0.00	62.97	0.00	0.00	4,408.15
LTM for Alt #5	31	ANNUAL GROUNDWATER MONITORING	33220108	Project Scientist	134	HR	0.00	71.66	0.00	0.00	9,602.16
LTM for Alt #5	31	ANNUAL GROUNDWATER MONITORING	33220109	Staff Scientist	200	HR	0.00	40.95	0.00	0.00	8,189.48

LTM for Alt #5	31	ANNUAL GROUNDWATER MONITORING	33220110	QA/QC Officer	76	HR	0.00	70.98	0.00	0.00	5,394.38
LTM for Alt #5	31	ANNUAL GROUNDWATER MONITORING	33220112	Field Technician	32	HR	0.00	42.44	0.00	0.00	1,357.93
LTM for Alt #5	31	ANNUAL GROUNDWATER MONITORING	33220112	Field Technician	9	HR	0.00	42.44	0.00	0.00	381.92
LTM for Alt #5	31	ANNUAL GROUNDWATER MONITORING	33220114	Word Processing/Clerical	44	HR	0.00	36.48	0.00	0.00	1,605.29
LTM for Alt #5	31	ANNUAL GROUNDWATER MONITORING	33220115	Draftsman/CADD	24	HR	0.00	40.04	0.00	0.00	961.00
LTM for Alt #5	31	ANNUAL GROUNDWATER MONITORING	33230614	Peristaltic Pump, Weekly Rental	1	WK	0.00	0.00	0.00	79.77	79.77
LTM for Alt #5	31	ANNUAL GROUNDWATER MONITORING	33240101	Other Direct Costs	1	LS	775.23	0.00	0.00	0.00	775.23
LTM for Alt #5	32	Off-site Transportation and Waste Disposal	33190103	Load Drums on Disposal Vehicle	60	EA	0.00	5.13	1.58	0.00	402.74
LTM for Alt #5	32	Off-site Transportation and Waste Disposal	33190108	Tanker Pumping Equipment to Load Liquid	1	HR	0.00	0.00	0.00	37.47	37.47
LTM for Alt #5	32	Off-site Transportation and Waste Disposal	33190204	Transport 55 Gallon Drums of Hazardous Waste, Max 80 drums (per Mile)	10	MI	0.00	0.00	0.00	2.14	21.37
LTM for Alt #5	32	Off-site Transportation and Waste Disposal	33190317	Waste Stream Evaluation Fee, Not Including 50% Rebate on 1st Shipment	1	EA	0.00	0.00	0.00	533.81	533.81
LTM for Alt #5	32	Off-site Transportation and Waste Disposal	33190342	Drummed Site Waste Disposal, Non Haz	60	EA	0.00	0.00	0.00	116.87	7,011.90
LTM for Alt #5	40	Well Abandonment	33010101	Mobilize/DeMobilize Drilling Rig & Crew	1	LS	0.00	1,353.63	792.17	0.00	2,145.79
LTM for Alt #5	40	Well Abandonment	33190402	DOT steel drums, 55 gal., open only, 17H	3	EA	97.81	0.00	0.00	0.00	293.43
LTM for Alt #5	40	Well Abandonment	33220112	Field Technician	32	HR	0.00	42.44	0.00	0.00	1,357.93
LTM for Alt #5	40	Well Abandonment	33231101	Hollow Stem Auger, 8" Dia Borehole, Depth <= 100 ft	72	LF	0.00	15.24	25.41	0.00	2,926.80