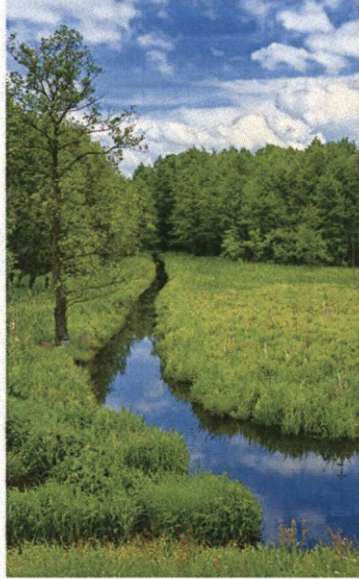


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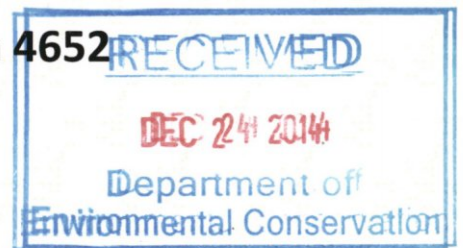


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Report

**Conceptual Site Model
Former Unocal Service Station 4652
Chevron Site 306448
1441 C Street
Anchorage AK**



Prepared for: Alaska Department of Environmental Conservation

Conestoga-Rovers & Associates

14998 West 6th Avenue, Suite 800
Golden, Colorado 80401

December 2014 • 621049 (306448) • Report No. 42





**CONESTOGA-ROVERS
& ASSOCIATES**

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Conceptual Site Model

Former Unocal Service Station 4652
Chevron Site 306448
1441 C Street
Anchorage, Alaska
ADEC File ID: 2100.26.117

Prepared for:
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Alaska Department of Environmental Conservation



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List of Acronyms and Abbreviations

AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
COPC	contaminant of potential concern
CRA	Conestoga-Rovers & Associates
CSM	conceptual site model
DRO	diesel range organics
fbg	feet below grade
GRO	gasoline range organics
LNAPL	light non-aqueous phase liquids
mg/kg	milligrams per kilogram
mg/L	milligrams per Liter
P.G.	Professional Geologist
UST	underground storage tank

Section 1.0 Introduction

Conestoga-Rovers & Associates (CRA) is submitting this *Conceptual Site Model (CSM)* to the Alaska Department of Environmental Conservation (ADEC) on behalf of Chevron Environmental Management Company (Chevron) for Chevron Site 306448 in Anchorage, Alaska. This report was written in accordance with ADEC's October 2010 *Policy Guidance on Developing Conceptual Site Models* with the purpose of describing and evaluating current and possible future migration of petroleum hydrocarbons in the environment. The ADEC Human Health Conceptual Site Model Scoping Form and Human Health Conceptual Site Model Graphic are presented as Appendix A. The site background, general information, exposure pathways, and additional exposure pathways are described below.

Section 2.0 Site Description and Background

The site is a fenced, vacant lot on the northeast intersection of West 15th Avenue and C Street in Anchorage, Alaska (Figure 1). The property's legal description is THIRD ADDITION BLK 31D LT 7A. The site latitude and longitude are 61.208085° North and 149.887301° West. A Unocal service station operated at the site until 1987 and consisted of three underground storage tanks (USTs). Eight groundwater monitoring wells are monitored with the site and six are sampled semiannually (Figure 2). Site photographs are presented as Appendix B. Site environmental history is presented as Appendix C.

2.1 Hydrogeology

The site is located in south central Alaska, between the northern Knik Arm and the southern Turnagain Arm of the Cook Inlet. Groundwater flows southeast. Historical static groundwater depths have ranged between 3.33 to 14.11 feet below grade (fbg) according to groundwater data from 1986 to present. Groundwater flows to the south-southeast with a general gradient of 0.01.

2.2 Regional and Site Geology

Anchorage area bedrock consists of Mesozoic metamorphic and igneous rocks overlain by densely consolidated sediments of the Kenai Group. A series of marine transgressive sequences combined with fluvial sediments, deposited in a lacustrine environment and created by ice fronts surrounding the Anchorage area, are overlain by the most recent glacial sediments.

Site subsurface sediments primarily consist of sand with gravel to approximately 5 fbg, underlain by silty sand to approximately 10 fbg, and clay from 10 fbg to the total explored depth of 15 fbg.

2.3 Contaminants of Potential Concern – Cleanup Levels

Site contaminants of potential concern (COPCs) are diesel range organics (DRO), gasoline range organics (GRO), and benzene. The ADEC Table C Groundwater Cleanup Levels (*Title 18 Alaska Administrative Code (AAC) 75.345*), and ADEC Method Two Soil Cleanup Levels, migration to groundwater (*Title 18 AAC 75.341*) are the established cleanup levels for a site Cleanup Complete designation.

Section 3.0 Release Information

3.1 Sources

Petroleum hydrocarbons at the site originated from USTs, product dispensers, and associated piping. Source details are described below.

Underground Storage Tanks

Two 12,000-gallon USTs were removed in 1987. Soil samples were collected from the bottom of the excavation. Soil samples contained petroleum hydrocarbons above ADEC Method Two Soil Cleanup Levels. An UST leak due to a defective in-line leak detector is presumed to be the source of impact.

3.2 Release Mechanisms

The release mechanism describes how petroleum hydrocarbons were released from the source into the environment. No direct evidence of a release was noted during the removal of USTs and associated product lines and dispenser islands.

Leaks

Impacted soil and groundwater were discovered at the site during a 1987 UST removal. A presumed leak occurred in one UST on July 25, 1986 due to a defective in-line leak detector. This UST leak is presumed to be the origin of petroleum hydrocarbons at the site. There were reported leaks in 1989 and 1990 from a six inch jet fuel pipeline along the east property boundary.

Spills

No site spills have been recorded.

Section 4.0 Impacted and Exposure Media

The impacted media primarily includes soil, sediment, groundwater, surface water, and/or air. Site media impacted by petroleum hydrocarbons are described below.

4.1 Soil

Impacted subsurface soil was encountered in 1986. The USTs were subsequently removed in 1987. COPCs in soil are DRO, GRO and benzene. Confirmation soil borings were advanced in 2008 to assess areas of previous exceedances. Petroleum hydrocarbons have been delineated upgradient (north of the former USTs) by borings SS-1 and SS-3. DRO has been delineated downgradient south by borings SS-8 (20 milligrams per kilogram (mg/kg)), SS-9 (140 mg/kg) and SS-10 (39 mg/kg). The highest DRO detected in 2008 was 580 mg/kg (SS-4). There is a de minimus quantity of GRO downgradient southwest of the former dispenser islands (SS-7 480 mg/kg). Benzene was detected offsite at 0.0298 mg/kg (MW-21) and is not defined southwest of the site. No benzene was detected above cleanup levels in wells MW-22 and MW-23. The highest benzene detected in 2008 was 3.2 mg/kg (SS-8 at 12 fbg). Historical soil analytical results are presented as Appendix D.

4.2 Groundwater

COPCs in groundwater are DRO, GRO and benzene. A site specific benzene cleanup level of 6.24 milligrams per liter (mg/L) and 10^{-5} risk level was approved per compliance order for consent #88-2-1-1-138-2 in 1991. During the November 2014 sampling event well MW-20 contained the highest DRO (9.5 mg/L), GRO (62.9 mg/L) and benzene (0.31 mg/L). No petroleum hydrocarbons were detected above cleanup levels in offsite wells during 2014. Groundwater analytical results are presented in Table 1.

Light non-aqueous phase liquids (LNAPL) was measured in onsite wells B-2 and B-11 in 1986 and 1987. No LNAPL has been measured since 1987.

4.3 Surface Water

Surface water transport mechanisms may include water flow, sorption to and deposition of sediments, and biota uptake. The Westchester Lagoon is located approximately ½-mile southwest of the site and Cook Inlet is approximately 1-mile to the west of the site. Based on distance, local topography, and groundwater gradient, the Westchester Lagoon and Cook Inlet are not likely to be impacted from site activities.

4.4 Air

Benzene in soil and groundwater has the potential to volatilize to air. Air is a potential exposure media.

4.5 Biota

Release of petroleum hydrocarbons in site soil was not in the root zone for plants or burrowing depth for animals. Biota impact or exposure is not likely.

Section 5.0 Exposure Pathways

The main exposure routes for humans are eating/drinking (ingestion), breathing (inhalation), and skin (dermal) contact.

5.1 Direct Contact

Direct contact with soil is comprised of two exposure pathways, ingestion of soil and dermal absorption of contaminants from soil.

Incidental Soil Ingestion

The soil ingestion pathway is complete since impacted soil is present above 15 ft bgs.

Dermal Absorption of Contaminants from Soil

Dermal absorption is not a complete exposure pathway since constituents detected in soil above 15 fbg are skin permeating constituents listed on *Appendix B* of the ADEC's October 2010 *Policy Guidance on Developing Conceptual Site Models*.

5.2 Ingestion

Ingestion of Groundwater

Petroleum hydrocarbons have been detected in site groundwater above ADEC Table C Groundwater Cleanup Levels. The Municipality of Anchorage has developed water well standards, defined in GAAB 15.55, that include a minimum distance of no less than 100 feet from existing sewer lines. The State of Alaska Drinking Water Regulations (*Title 18 AAC 80*) also requires a minimum distance of 100 feet from sewer lines. A drinking water well cannot be installed onsite within these regulations except for the northwest upgradient corner where groundwater is not impacted. Ingestion of groundwater is a potentially complete pathway if regulations in the future change.

Ingestion of Surface Water

The Westchester Lagoon is located approximately ½-mile to the southwest from the site and Cook Inlet is located approximately 1-mile west of the site. Ingestion of surface water is an incomplete exposure pathway due to distance of Westchester Lagoon and Cook Inlet from the site.

Ingestion of Wild and Farmed Foods

Petroleum hydrocarbons detected on site are not included in Appendix C of the ADEC's October 2010 *Guidance on Developing Conceptual Site Models* and do not have the potential to bioaccumulate. The site is located within the city limits and is not currently used or reasonably could be used in the future for hunting, fishing, or harvesting of wild food. Ingestion of wild foods is not a complete exposure pathway.

5.3 Inhalation

Inhalation of Outdoor Air

Shallow onsite soils and groundwater currently contain volatile contaminants above ADEC Method Two Soil Cleanup Levels. Inhalation of outdoor air is a complete pathway since impacted soil was present within 15 ft bgs and the site may be used in the future.

Inhalation of Indoor Air

Inhalation of indoor air is an incomplete exposure pathway since no buildings are within 30 ft of subsurface benzene impacts.

5.4 Additional Exposure Pathways

No additional exposure pathways were identified.

Section 6.0 Human Receptors

Potential human receptors are people who may be exposed to potential site impact. These groups are selected based on present and future locations and activities of the site.

Residential (Adult or Child)

The area surrounding the site is in an area of mixed residential and commercial buildings. Residents are current and future receptors.

Commercial or Industrial Workers

Commercial or industrial workers are future receptors since the site is currently vacant; however hydrocarbon-bearing soil is present above 15 fbg.

Construction Workers

No construction activities are currently being conducted at the site. Any future construction or earthwork will potentially expose construction workers to impacted soil. Construction workers are future receptors.

Site visitors and Trespassers

Site visitors and trespassers are current and future receptors.

Recreational Users

Recreational users are potential future receptors only if future lands use changes.

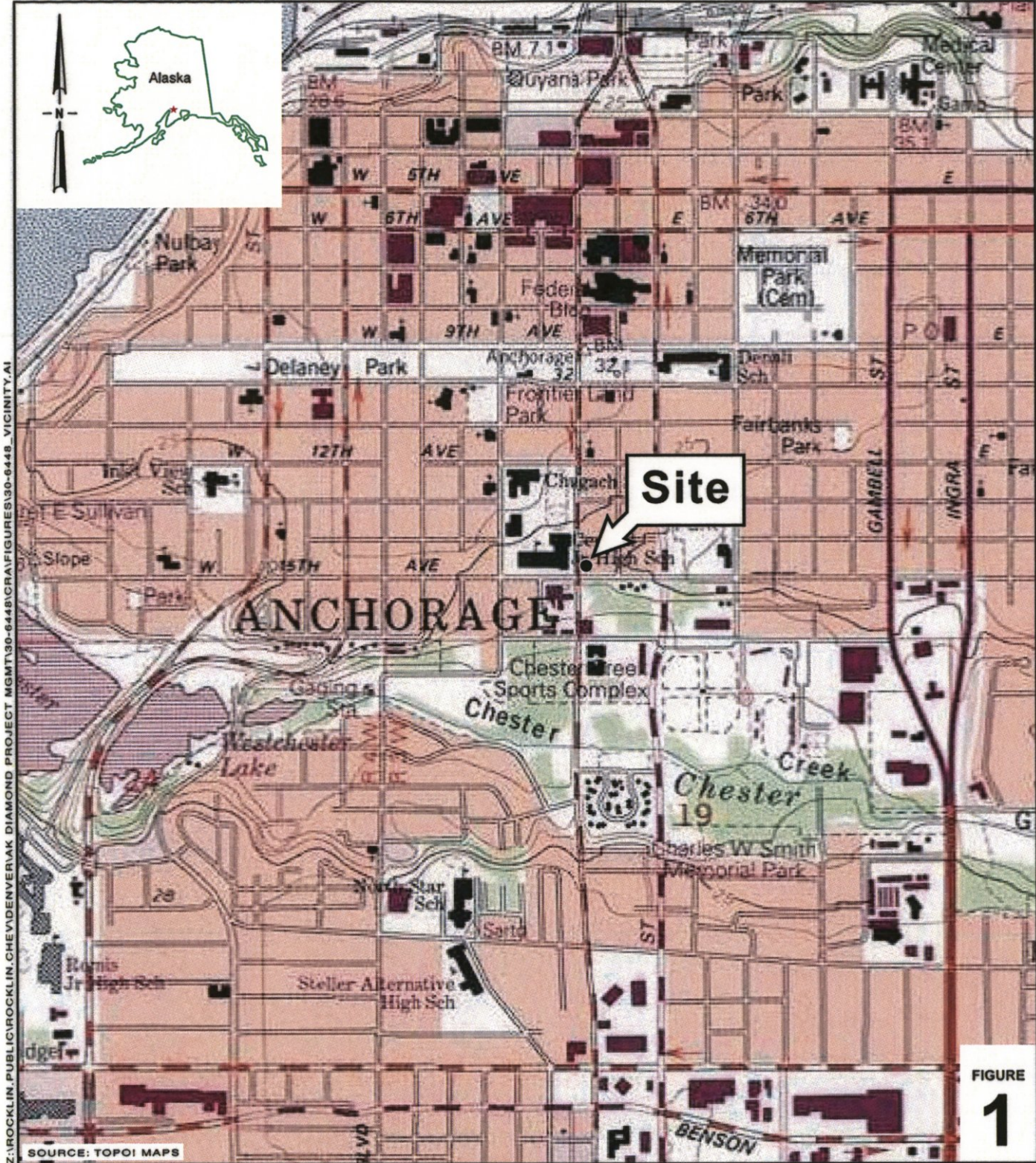
Section 7.0 Conclusions

An evaluation of exposure pathways has identified incidental soil ingestion, ingestion of groundwater and inhalation of indoor and outdoor air as complete pathways. Exposure risk may be mitigated by implementing proper institutional controls limiting site land and groundwater use. Proper air monitoring during future earthwork would minimize exposure risk to outdoor air.

Figures

F1: Vicinity Map

F2: Site Plan



Z:\ROCKLIN.PUBLIC\ROCKLIN.CHEVIDENVERAK DIAMOND PROJECT MGMT\30-6448\CRA\FIGURES\30-6448_VICINITY.AI

SOURCE: TOPOI MAPS

FIGURE 1

0 1/8 1/4 1/2 1
SCALE : 1" = 1/4 MILE

Former Unocal Station 4652
1441 C Street
Anchorage, Alaska



CONESTOGA-ROVERS & ASSOCIATES

Vicinity Map

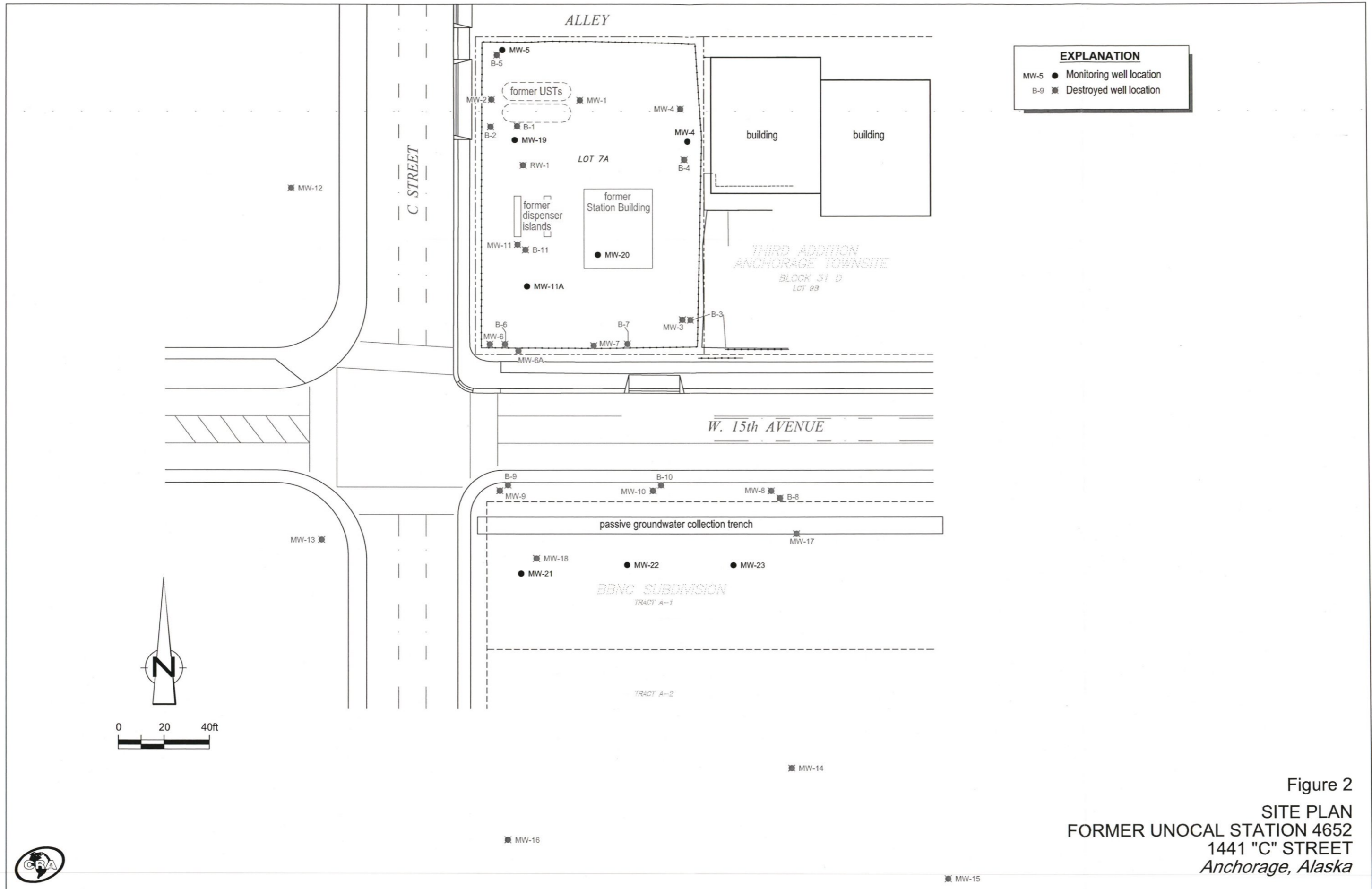


Figure 2
 SITE PLAN
 FORMER UNOCAL STATION 4652
 1441 "C" STREET
 Anchorage, Alaska



Tables

T1: Groundwater Analytical Data

TABLE 1

GROUNDWATER EFFLUENT MONITORING
FORMER UNOCAL STATION 4652
CHEVRON SITE 306448
1441 C STREET
ANCHORAGE, ALASKA

Location	Date	FLOW RATE		MMULATIVE FL-HYDROCARBON ¹			PRIMARY VOCs			TAH
		Units	g/m	gallons	GRO mg/L	Benzene mg/L	Toluene mg/L	Ethylbenzene mg/L	Total Xylenes mg/L	
ADEC Groundwater Cleanup Levels ^a					2.2	0.005	1.0	0.7	10.0	5.0
Effluent-1	11/7/2003	--	104,130	-	--	--	--	--	--	0.0157
Effluent-1	12/15/2003	--	49,400	-	--	--	--	--	--	0.03556
Effluent-1	3/29/2004	--	151,200	-	--	--	--	--	--	0.0192
Effluent-1	6/30/2004	--	100,440	-	--	--	--	--	--	0.013
Effluent-1	9/30/2004	--	390,960	-	--	--	--	--	--	<0.001
Effluent-1	12/15/2004	--	54,720	-	--	--	--	--	--	0.0024
Effluent-1	9/18/2006	1.2	53,000	-	0.0053	<0.0005	0.0007	0.0047		0.0107
Effluent-1	12/31/2006	0.6	26,000	-	0.0022	<0.001	<0.001	<0.002		0.0022
Effluent-1	6/29/2007	0.7	91,980	-	<0.001	<0.001	<0.001	<0.002		<0.001
Effluent-1	3/31/2008	0.8	104,832	-	0.000868	0.00413	<0.0005	<0.0015		0.0050
Effluent-1	6/19/2008	0.58	76,003	-	0.003	<0.001	<0.001	<0.002		0.0070
Effluent-1	8/29/2008	0.45	59,616	-	0.006	<0.001	0.002	0.003		0.0120
Effluent-1	10/9/2008	0.99	131,155	-	0.004	<0.001	0.002	0.003		0.0100
Effluent-1	02/21/2009	2.62	339,818	-	<0.001 / <0.001	<0.001 / <0.001	<0.001 / <0.001	<0.002 / <0.002		<0.005
Effluent-1	05/14/2009	1.27	165,147	0.015 J / <0.010 J	0.0011 J / 0.0014 J	<0.0005 UJ / <0.0005 UJ	<0.0005 UJ / <0.0005 UJ	<0.0015 UJ / <0.0015 UJ		0.0189
Effluent-1	8/27/2009	1.37	177,696	0.12 / 0.12	0.0066 / 0.0066	0.022 / 0.023	0.0042 / 0.0043	0.023 / 0.024		0.1779
Effluent-1	10/07/2009	2.33	301,863	-	0.0006 J / 0.0006 J	<0.0005 / <0.0005	<0.0005 / <0.0005	<0.0015 / <0.0015		0.0006
Effluent-1	02/26/2010	1.06	137,367	-	<0.0005	<0.0005	<0.0005	<0.0015		<0.0005
Effluent-1	06/08/2010	1.32	172,973	-	0.0023	<0.0005	<0.0005	<0.0015		0.0023
Effluent-1	08/06/2010	1.22	158,112	-	0.0029	<0.0005	<0.0005	<0.0015		0.0029
Effluent-1	11/11/2010	1.13	149,702	-	0.0019 J	<0.0005	<0.0005	<0.0015		0.0019
Effluent-1	03/09/2011	0.95	122,634	-	0.0018 J	<0.0005	<0.0005	<0.0015		0.0018
Effluent-1	05/19/2011	2.26	296,150	-	0.0016 J	<0.0005	<0.0005	<0.0015		0.0016
Effluent-1	08/01/2011	0.25	33,120	0.015 J	0.0018 J	<0.0005	<0.0005	<0.0015		0.0018
Effluent-1	11/01/2011	1.22	108,922	-	0.0019 J / 0.0019 J	<0.0005 / <0.0005	<0.0005 / <0.0005	<0.0015 / <0.0015		0.0019 / 0.0019
Effluent-1	03/22/2012	0.73	95,660	-	0.0007 J / 0.0007 J	<0.0005 / <0.0005	<0.0005 / <0.0005	<0.0015 / <0.0015		0.0007 / 0.0007
Effluent-1	05/31/2012	0.63	83,027	-	0.002 J	<0.0008	<0.0008	<0.0009		0.002
Effluent-1	7/31/2012	0.63	83,462	-	0.003	<0.0008	<0.0008	<0.0009		0.003
Effluent-1	11/6/2012	0.87	115,257	-	0.002 J / 0.002	<0.0005 / <0.0005	<0.0005 / <0.0005	<0.0015 / <0.0015		0.002 / 0.002
Effluent-1	3/25/2013	0.5	64,800	-	0.00091 J / 0.00088 J	<0.000076 / <0.000076	<0.000071 / <0.000071	<0.00017 / <0.00017		0.00091 / 0.00088
Effluent-1	5/9/2013	4	524,160	-	0.00062 J / 0.00057 J	0.00015 J / 0.00013 J	<0.000076 / <0.000076	0.00047 J / 0.00046 J		0.00124 J / 0.00116 J
Effluent-1	9/18/2013	0.71	94,060	-	0.0040 / 0.0039	<0.00023 / <0.00023	0.0016 / 0.0016	0.0017 J / 0.0018 J		0.0073 J / 0.0073 J
Effluent-1	11/5/2013	0.79	104,659	-	0.0030 / 0.0029	<0.00023 / 0.0023 J	<0.00024 / 0.00024	<0.00072 / <0.00072		0.0030 / 0.0052 J
Effluent-1	3/25/2014	0.26	33,696	-	0.0018	<0.00024	0.00032J	<0.00072		0.00212J
Effluent-1	6/7/2014	7.93	1,038,513	-	0.0013 / 0.0012	<0.00011 / <0.00011	0.00022 J / 0.00018J	0.0013 J / 0.0012 J		0.00282 J / 0.00268 J
Effluent-1	7/29/2014	2.64	349,747	-	0.00054 J / <0.00015	0.00033 J / <0.00011	<0.00016 / <0.00016	<0.00040 / <0.00040		0.00087 J / <0.00011

Appendix A

ADEC Human Health Conceptual Site Model Graphic and Scoping Form

HUMAN HEALTH CONCEPTUAL SITE MODEL GRAPHIC FORM

Site: Chevron 306448
ADEC File ID: 2100.26.117

Completed By: Siobhan Pritchard
 Date Completed: 12/2/2014

Instructions: Follow the numbered directions below. Do not consider contaminant concentrations or engineering/land use controls when describing pathways.

(1) Check the media that could be directly affected by the release.	(2) For each medium identified in (1), follow the top arrow and check possible transport mechanisms. Check additional media under (1) if the media acts as a secondary source.
Media	Transport Mechanisms
<input type="checkbox"/> Surface Soil (0-2 ft bgs)	<input checked="" type="checkbox"/> Direct release to surface soil <i>check soil</i> <input type="checkbox"/> Migration to subsurface <i>check soil</i> <input type="checkbox"/> Migration to groundwater <i>check groundwater</i> <input type="checkbox"/> Volatilization <i>check air</i> <input type="checkbox"/> Runoff or erosion <i>check surface water</i> <input type="checkbox"/> Uptake by plants or animals <i>check biota</i> <input type="checkbox"/> Other (list): _____
<input checked="" type="checkbox"/> Subsurface Soil (2-15 ft bgs)	<input checked="" type="checkbox"/> Direct release to subsurface soil <i>check soil</i> <input type="checkbox"/> Migration to groundwater <i>check groundwater</i> <input type="checkbox"/> Volatilization <i>check air</i> <input type="checkbox"/> Uptake by plants or animals <i>check biota</i> <input type="checkbox"/> Other (list): _____
<input type="checkbox"/> Ground-water	<input type="checkbox"/> Direct release to groundwater <i>check groundwater</i> <input type="checkbox"/> Volatilization <i>check air</i> <input type="checkbox"/> Flow to surface water body <i>check surface water</i> <input type="checkbox"/> Flow to sediment <i>check sediment</i> <input type="checkbox"/> Uptake by plants or animals <i>check biota</i> <input type="checkbox"/> Other (list): _____
<input type="checkbox"/> Surface Water	<input type="checkbox"/> Direct release to surface water <i>check surface water</i> <input type="checkbox"/> Volatilization <i>check air</i> <input type="checkbox"/> Sedimentation <i>check sediment</i> <input type="checkbox"/> Uptake by plants or animals <i>check biota</i> <input type="checkbox"/> Other (list): _____
<input type="checkbox"/> Sediment	<input type="checkbox"/> Direct release to sediment <i>check sediment</i> <input type="checkbox"/> Resuspension, runoff, or erosion <i>check surface water</i> <input type="checkbox"/> Uptake by plants or animals <i>check biota</i> <input type="checkbox"/> Other (list): _____

(3) Check all exposure media identified in (2).	(4) Check all pathways that could be complete. The pathways identified in this column must agree with Sections 2 and 3 of the Human Health CSM Scoping Form.	(5) Identify the receptors potentially affected by each exposure pathway: Enter "C" for current receptors, "F" for future receptors, "C/F" for both current and future receptors, or "I" for insignificant exposure.								
Exposure Media	Exposure Pathway/Route	Current & Future Receptors								
		Residents (adults or children) Commercial or industrial workers Site visitors, trespassers, or recreational users Construction workers Farmers or subsistence harvesters Subsistence consumers Other								
<input checked="" type="checkbox"/> soil	<input checked="" type="checkbox"/> Incidental Soil Ingestion <input type="checkbox"/> Dermal Absorption of Contaminants from Soil <input type="checkbox"/> Inhalation of Fugitive Dust	<table border="1"> <tr> <td>C/F</td> <td>F</td> <td>C/F</td> <td>F</td> <td></td> <td></td> <td></td> <td></td> </tr> </table>	C/F	F	C/F	F				
C/F	F	C/F	F							
<input checked="" type="checkbox"/> groundwater	<input checked="" type="checkbox"/> Ingestion of Groundwater <input type="checkbox"/> Dermal Absorption of Contaminants in Groundwater <input type="checkbox"/> Inhalation of Volatile Compounds in Tap Water	<table border="1"> <tr> <td>C/F</td> <td>F</td> <td>C/F</td> <td>F</td> <td></td> <td></td> <td></td> <td></td> </tr> </table>	C/F	F	C/F	F				
C/F	F	C/F	F							
<input checked="" type="checkbox"/> air	<input checked="" type="checkbox"/> Inhalation of Outdoor Air <input type="checkbox"/> Inhalation of Indoor Air <input type="checkbox"/> Inhalation of Fugitive Dust	<table border="1"> <tr> <td>C/F</td> <td>F</td> <td>C/F</td> <td>F</td> <td></td> <td></td> <td></td> <td></td> </tr> </table>	C/F	F	C/F	F				
C/F	F	C/F	F							
<input type="checkbox"/> surface water	<input type="checkbox"/> Ingestion of Surface Water <input type="checkbox"/> Dermal Absorption of Contaminants in Surface Water <input type="checkbox"/> Inhalation of Volatile Compounds in Tap Water	<table border="1"> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>								
<input type="checkbox"/> sediment	<input type="checkbox"/> Direct Contact with Sediment	<table border="1"> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>								
<input type="checkbox"/> biota	<input type="checkbox"/> Ingestion of Wild or Farmed Foods	<table border="1"> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>								

Human Health Conceptual Site Model Scoping Form

Site Name:

File Number:

Completed by:

Introduction

The form should be used to reach agreement with the Alaska Department of Environmental Conservation (DEC) about which exposure pathways should be further investigated during site characterization. From this information, summary text about the CSM and a graphic depicting exposure pathways should be submitted with the site characterization work plan and updated as needed in later reports.

General Instructions: Follow the italicized instructions in each section below.

1. General Information:

Sources (check potential sources at the site)

- | | |
|---|--|
| <input checked="" type="checkbox"/> USTs | <input type="checkbox"/> Vehicles |
| <input type="checkbox"/> ASTs | <input type="checkbox"/> Landfills |
| <input checked="" type="checkbox"/> Dispensers/fuel loading racks | <input type="checkbox"/> Transformers |
| <input type="checkbox"/> Drums | <input type="checkbox"/> Other: <input type="text"/> |

Release Mechanisms (check potential release mechanisms at the site)

- | | |
|---|--|
| <input type="checkbox"/> Spills | <input type="checkbox"/> Direct discharge |
| <input checked="" type="checkbox"/> Leaks | <input type="checkbox"/> Burning |
| | <input type="checkbox"/> Other: <input type="text"/> |

Impacted Media (check potentially-impacted media at the site)

- | | |
|---|--|
| <input type="checkbox"/> Surface soil (0-2 feet bgs*) | <input checked="" type="checkbox"/> Groundwater |
| <input checked="" type="checkbox"/> Subsurface soil (>2 feet bgs) | <input type="checkbox"/> Surface water |
| <input checked="" type="checkbox"/> Air | <input type="checkbox"/> Biota |
| <input type="checkbox"/> Sediment | <input type="checkbox"/> Other: <input type="text"/> |

Receptors (check receptors that could be affected by contamination at the site)

- | | |
|--|---|
| <input checked="" type="checkbox"/> Residents (adult or child) | <input checked="" type="checkbox"/> Site visitor |
| <input checked="" type="checkbox"/> Commercial or industrial worker | <input checked="" type="checkbox"/> Trespasser |
| <input checked="" type="checkbox"/> Construction worker | <input checked="" type="checkbox"/> Recreational user |
| <input type="checkbox"/> Subsistence harvester (i.e. gathers wild foods) | <input type="checkbox"/> Farmer |
| <input type="checkbox"/> Subsistence consumer (i.e. eats wild foods) | <input type="checkbox"/> Other: <input type="text"/> |

* bgs - below ground surface

2. Exposure Pathways: *(The answers to the following questions will identify complete exposure pathways at the site. Check each box where the answer to the question is "yes".)*

a) Direct Contact -

1. Incidental Soil Ingestion

Are contaminants present or potentially present in surface soil between 0 and 15 feet below the ground surface?
(Contamination at deeper depths may require evaluation on a site-specific basis.)

If the box is checked, label this pathway complete:

Complete

Comments:

2. Dermal Absorption of Contaminants from Soil

Are contaminants present or potentially present in surface soil between 0 and 15 feet below the ground surface?
(Contamination at deeper depths may require evaluation on a site specific basis.)

Can the soil contaminants permeate the skin (see Appendix B in the guidance document)?

If both boxes are checked, label this pathway complete:

Incomplete

Comments:

b) Ingestion -

1. Ingestion of Groundwater

Have contaminants been detected or are they expected to be detected in the groundwater,
or are contaminants expected to migrate to groundwater in the future?

Could the potentially affected groundwater be used as a current or future drinking water
source? Please note, only leave the box unchecked if DEC has determined the ground-
water is not a currently or reasonably expected future source of drinking water according
to 18 AAC 75.350.

If both boxes are checked, label this pathway complete:

Complete

Comments:

2. Ingestion of Surface Water

Have contaminants been detected or are they expected to be detected in surface water, or are contaminants expected to migrate to surface water in the future?

Could potentially affected surface water bodies be used, currently or in the future, as a drinking water source? Consider both public water systems and private use (i.e., during residential, recreational or subsistence activities).

If both boxes are checked, label this pathway complete:

Incomplete

Comments:

3. Ingestion of Wild and Farmed Foods

Is the site in an area that is used or reasonably could be used for hunting, fishing, or harvesting of wild or farmed foods?

Do the site contaminants have the potential to bioaccumulate (see Appendix C in the guidance document)?

Are site contaminants located where they would have the potential to be taken up into biota? (i.e. soil within the root zone for plants or burrowing depth for animals, in groundwater that could be connected to surface water, etc.)

If all of the boxes are checked, label this pathway complete:

Incomplete

Comments:

c) Inhalation-

1. Inhalation of Outdoor Air

Are contaminants present or potentially present in surface soil between 0 and 15 feet below the ground surface? (Contamination at deeper depths may require evaluation on a site specific basis.)

Are the contaminants in soil volatile (see Appendix D in the guidance document)?

If both boxes are checked, label this pathway complete:

Complete

Comments:

2. Inhalation of Indoor Air

Are occupied buildings on the site or reasonably expected to be occupied or placed on the site in an area that could be affected by contaminant vapors? (within 30 horizontal or vertical feet of petroleum contaminated soil or groundwater; within 100 feet of non-petroleum contaminated soil or groundwater; or subject to "preferential pathways," which promote easy airflow like utility conduits or rock fractures)

Are volatile compounds present in soil or groundwater (see Appendix D in the guidance document)?

If both boxes are checked, label this pathway complete:

Comments:

3. Additional Exposure Pathways: *(Although there are no definitive questions provided in this section, these exposure pathways should also be considered at each site. Use the guidelines provided below to determine if further evaluation of each pathway is warranted.)*

Dermal Exposure to Contaminants in Groundwater and Surface Water

Dermal exposure to contaminants in groundwater and surface water may be a complete pathway if:

- Climate permits recreational use of waters for swimming.
- Climate permits exposure to groundwater during activities, such as construction.
- Groundwater or surface water is used for household purposes, such as bathing or cleaning.

Generally, DEC groundwater cleanup levels in 18 AAC 75, Table C, are assumed to be protective of this pathway.

Check the box if further evaluation of this pathway is needed:

Comments:

Inhalation of Volatile Compounds in Tap Water

Inhalation of volatile compounds in tap water may be a complete pathway if:

- The contaminated water is used for indoor household purposes such as showering, laundering, and dish washing.
- The contaminants of concern are volatile (common volatile contaminants are listed in Appendix D in the guidance document.)

Generally, DEC groundwater cleanup levels in 18 AAC 75, Table C, are assumed to be protective of this pathway.

Check the box if further evaluation of this pathway is needed:

Comments:

Inhalation of Fugitive Dust

Inhalation of fugitive dust may be a complete pathway if:

- Nonvolatile compounds are found in the top 2 centimeters of soil. The top 2 centimeters of soil are likely to be dispersed in the wind as dust particles.
- Dust particles are less than 10 micrometers (Particulate Matter - PM₁₀). Particles of this size are called respirable particles and can reach the pulmonary parts of the lungs when inhaled.
- Chromium is present in soil that can be dispersed as dust particles of any size.

Generally, DEC direct contact soil cleanup levels in Table B1 of 18 AAC 75 are protective of this pathway because it is assumed most dust particles are incidentally ingested instead of inhaled to the lower lungs. The inhalation pathway only needs to be evaluated when very small dust particles are present (e.g., along a dirt roadway or where dusts are a nuisance). This is not true in the case of chromium. Site specific cleanup levels will need to be calculated in the event that inhalation of dust containing chromium is a complete pathway at a site.

Check the box if further evaluation of this pathway is needed:

Comments:

Direct Contact with Sediment

This pathway involves people's hands being exposed to sediment, such as during some recreational, subsistence, or industrial activity. People then incidentally ingest sediment from normal hand-to-mouth activities. In addition, dermal absorption of contaminants may be of concern if the the contaminants are able to permeate the skin (see Appendix B in the guidance document). This type of exposure should be investigated if:

- Climate permits recreational activities around sediment.
- The community has identified subsistence or recreational activities that would result in exposure to the sediment, such as clam digging.

Generally, DEC direct contact soil cleanup levels in 18 AAC 75, Table B1, are assumed to be protective of direct contact with sediment.

Check the box if further evaluation of this pathway is needed:

Comments:

4. Other Comments *(Provide other comments as necessary to support the information provided in this form.)*

[Empty rectangular box for providing other comments]

Appendix B

Site Photographs



1. Site layout looking Northeast



2. Site layout looking Northwest



3. Site layout looking Southeast



4. Site layout looking Southwest



SITE PHOTOGRAPHS
FORMER UNOCAL STATION 4652
1441 C STREET
Anchorage, Alaska

Appendix C

Environmental History

1986 Subsurface Investigation and Well Installation

Twelve soil borings were advanced and ten completed as monitoring wells B-3 through B-11 and RW-1. Recovery well RW-1 was installed south of the USTs in August to recover LNAPL and assess impact south of the site. Details are presented in Rittenhouse-Zeman and Associates' (RZA) September 9, 1986 *Subsurface Product Loss Evaluation*.

1987 Site Demolition, UST Removal and Excavation

Three USTs were removed and the service station was demolished in October 1987. Details are presented in RZA's January 1989 *Contamination Assessment*.

1988 Soil Vapor Survey, Test Pits, and Well Installation

Monitoring wells B-12 and B-13 were installed. Petrex soil vapor samplers were installed on properties adjacent to the site. Test pits TP-1 through TP-5 were excavated to assess the vertical and horizontal extent of petroleum hydrocarbons in the subsurface. Details are presented in RZA's January 1989 *Contamination Assessment*.

1988 Subsurface Investigation

Six test pits TP-6 through TP-12 were excavated to assess the downgradient extent of petroleum hydrocarbons in soil. Approximately 300 cubic yards (yd³) of soil was excavated near the former used oil tank and septic system. Details are presented in RZA's January 1989 *Contamination Assessment*.

1989 Well Installation

Groundwater monitoring wells MW-14 through MW-16 were installed. Details are presented as RZA's May 1992 *Summary Report*.

1989 Groundwater Extraction System Installation

A groundwater extraction and treatment system was installed and operated from December 1989 until March 1994. Details are presented as GeoEngineers' January 5, 1998 *Results of Ground Water Monitoring and Sampling*.

1990 Soil Vapor Extraction System Installation

A soil vapor extraction (SVE) system was installed and operated from January 1990 until October 1993. Details are presented as GeoEngineers' January 5, 1998 *Results of Ground Water Monitoring and Sampling*.

1990 Well Installation

Groundwater monitoring wells MW-6A, MW-11A, MW-17, and MW-18 were installed. RZA's May 1992 *Summary Report*.

1997 Phase II Environmental Site Assessment

Test pits TP-A through TP-L were excavated south of the site to assess downgradient migration. Details are presented as GeoEngineers' September 22, 2003 *Report of Remedial Activities*.

2003 Excavation and Well Decommissioning

Monitoring wells MW-14 through MW-18 were decommissioned. Approximately 2,005 yd³ of soil were excavated along the northern and western extent of the property south of the site. Details are presented as GeoEngineers' September 22, 2003 *Report of Remedial Activities*.

2004 Well Installation

Groundwater monitoring wells MW-21 through MW-23 were installed. Details are presented in Oil Risk Consultants' March 2005 *Monitoring Well Installation Report*.

2008 Subsurface Investigation

CRA advanced soil borings SS-1 through SS-10 to assess the residual horizontal and vertical extent of petroleum hydrocarbons in soil. Details are presented in CRA's March 3, 2009 *Subsurface Investigation Report*.

Appendix D

Historical Soil Analytical Data

CONESTOGA-ROVERS & ASSOCIATES

Table 1. Soil Analytical Results - Former Unocal Service Station 30-6448, 1441 C Street, Anchorage, Alaska

Sample ID	Date Sampled (mm/dd/yy)	GRO	DRO	Benzene	Toluene	Ethyl- benzene	Total Xylenes	1,2-DCA	EDB	TOC
SS-1-4.0	10/09/08	<0.6	34	<0.007	<0.007	<0.007	<0.02	--	--	--
SS-1-7.0	10/09/08	<1	53	<0.01	<0.01	<0.01	<0.03	--	--	--
SS-1-9.0	10/09/08	<0.7	<4.9	<0.007	<0.007	<0.007	<0.02	--	--	--
SS-2-4.0	10/09/08	<0.6	<4.2	<0.005	0.02	<0.005	0.03	<0.053	<0.053	3,530
SS-2-8.0	10/09/08	<0.6	<4.4	<0.007	0.04	<0.007	0.08	--	--	--
SS-2-12.0	10/09/08	110	35	0.1	0.1	5.4	28	--	--	--
SS-3-2.0	10/09/08	<6.2	<420	<0.06	<0.06	<0.06	<0.02	--	--	--
SS-3-6.0	10/09/08	<0.7	16	0.02	0.02	<0.007	<0.02	--	--	--
SS-3-9.0	10/09/08	<0.7	<4.7	<0.007	<0.007	<0.007	<0.02	--	--	--
SS-4-3.0	10/09/08	<11	580	<0.1	<0.1	<0.1	<0.3	--	--	--
SS-4-6.0	10/09/08	<0.7	8.7	<0.007	0.008	<0.007	0.02	--	--	--
SS-4-9.0	10/09/08	<1	84	<0.01	0.01	<0.01	<0.03	--	--	--
SS-5-3.0	10/09/08	<0.6	33	0.01	0.03	0.01	0.06	--	--	--
SS-5-9.0	10/09/08	1.6	25	0.06	0.01	0.008	0.6	--	--	--
SS-5-12.0	10/09/08	1.8	<4.9	0.05	0.02	0.03	0.7	--	--	--
ADEC Cleanup Levels**		300	250	0.025	6.5	6.9	63	--	--	--

CONESTOGA-ROVERS & ASSOCIATES

Table 1. Soil Analytical Results - Former Unocal Service Station 30-6448, 1441 C Street, Anchorage, Alaska

Sample ID	Date Sampled (mm/dd/yy)	GRO	DRO	Benzene	Toluene	Ethyl- benzene	Total Xylenes	1,2-DCA	EDB	TOC
SS-6-3.0	10/09/08	1.4	<4.1	<0.005	0.03	0.02	0.2	--	--	--
SS-6-8.0	10/09/08	260	89	0.3	5.0	6.4	65	<0.065	<0.065	--
SS-6-8.0 (DUP-1)	10/09/08	630	71	0.8	9.1	15	130	<0.079	<0.079	--
SS-6-11.0	10/09/08	5.5	7.8	0.03	0.05	0.07	0.4	--	--	1,210
SS-7-4.0	10/09/08	1.6	20	0.02	0.05	0.03	0.2	--	--	--
SS-7-7.0	10/09/08	3.0	12	0.02	0.05	0.03	0.3	--	--	--
SS-7-9.0	10/09/08	480	520	<0.007	0.9	2.9	22	<0.070	<0.070	--
SS-8-3.0	10/09/08	1.0	20	0.01	0.04	0.02	0.1	--	--	--
SS-8-10.0	10/09/08	6.7	5.9	0.4	0.02	0.3	2.2	--	--	--
SS-8-10.0 (DUP-2)	10/09/08	7.7	7.2	0.5	0.03	0.3	2.3	--	--	--
SS-8-12.0	10/09/08	6.9	<4.8	3.2	0.01	0.05	0.3	--	--	--
SS-9-4.0	10/09/08	1.4	140	0.01	0.04	0.02	0.1	--	--	--
SS-9-8.0	10/09/08	15	17	0.06	0.1	0.2	2.9	--	--	--
SS-9-8.0 (DUP-3)	10/09/08	10	32	0.2	0.05	0.6	2.5	--	--	--
SS-9-10.0	10/09/08	8.2	<4.5	0.2	0.02	0.8	0.6	--	--	--
SS-10-3.0	10/09/08	0.6	28	0.007	0.02	0.01	0.08	--	--	--
SS-10-7.0	10/09/08	<9.3	39	<0.09	<0.09	0.1	0.5	--	--	--
SS-10-10.0	10/09/08	5.8	<4.4	2.7	0.04	0.01	0.06	--	--	5,220
ADEC Cleanup Levels**		300	250	0.025	6.5	6.9	63	0.016	0.00016	--

Notes and Abbreviations:

mg/kg = Milligrams per kilogram

<x = Not detected above x milligrams per kilogram

ND = Not Detected

ADEC = Alaska Department of Environmental Conservation

EPA = Environmental Protection Agency

DRO = Diesel Range Organics by Alaska Series Method AK101

GRO = Gasoline Range Organics by Alaska Series Method AK102

BTEX = Benzene, Toluene, Ethylbenzene, and Total Xylenes by EPA Method 8260B

1,2-DCA = 1,2-Dichloroethane by EPA Method 8260B

EDB = Dibromoethane by EPA Method 8260B

TOC = Total Organic Carbon by SM20 5310B modified

-- = Not Measured/Not Analyzed

** = Levels established in ADEC Method II - Soil Cleanup Levels, Table B1 and B2, Under 40 Inch Zone, Migration to Groundwater (ADEC, 18 AAC 75.345)

Table 4-1. Soil Analysis Results

	Sample	Benzene, mg/Kg	Toluene, mg/Kg	Ethyl- benzene	Xylenes, mg/Kg	GRO, mg/Kg	DRO, mg/Kg
	MW-21/5'	0.0227/ 0.0298	ND(0.019)/ ND(0.024)	ND(0.019)/ ND(0.024)	ND(0.029)/ ND(0.036)	ND(1.9)/ ND(2.4)	ND(28)/ ND(29)
	MW-22/5'	ND(0.007)	ND(0.014)	ND(0.014)	ND(0.021)	ND(1.4)	ND(25)
	MW-23/10'	ND(0.008)	ND(0.016)	ND(0.016)	ND(0.024)	ND(1.6)	ND(29)
Method 2 cleanup levels	Ingestion	290	20,300	10,000	203,000	1,000	10,250
	Inhalation	9	180	89	81	1,000	12,500
	Migration to GW	0.02	5	5.5	78	150	250