Report of Barbara D. Beck, Ph.D., DABT, Fellow ATS Concerning the East White Lake Site, Vermilion Louisiana

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Table of Contents

List of Tables

List of Figures

Abbreviations

Coastal	Coastal Environments, Inc.
COC	Constituent of Concern
CSF	Cancer Slope Factor
DA_{event}	Absorbed Dose Per Event
DRO	Diesel-Range Organics
ELCR	Excess Lifetime Cancer Risk
EPC	Exposure Point Concentration
EPD	Effective Predictive Domain
ERM	Environmental Resources Management, Inc.
EWL	East White Lake
ft bgs	Feet Below Ground Surface
GI ABS	Gastrointestinal Absorption
HI	Hazard Index
HQ	Hazard Quotient
IUR	Inhalation Unit Risk
ICON	ICON Environmental Services
IRIS	Integrated Risk Information System
K	Andelman Volatilization Factor
Kp	Dermal Permeability Coefficient of a Compound in Water
LDEQ	Louisiana Department of Environmental Quality
LDHH	Louisiana Department of Health and Hospitals
LDNR	Louisiana Department of Natural Resources
LOAEC	Lowest Observed Adverse Effect Concentration
LOAEL	Lowest Observed Adverse Effect Level
MADEP	Massachusetts Department of Environmental Protection
MCL	Maximum Contaminant Level
MO	Management Option
MOE	Margin of Exposure
MPA	Michael Pisani & Associates, Inc.
NHANES	National Health and Nutrition Examination Survey
NOAEL	No Observed Adverse Effect Level
OES	Omega EnviroSolutions, Inc.
ORO	Oil-Range Organics
ORNL	Oak Ridge National Laboratory
PAH	Polycyclic Aromatic Hydrocarbon
POD	Point of Departure
PPRTV	Provisional Peer-Reviewed Toxicity Value
RAIS	Risk Assessment Information System
RECAP	Risk Evaluation/Corrective Action Program
RfC	Reference Concentration
RfD	Reference Dose
RME	Reasonable Maximum Exposure
RSL	Regional Screening Level

SS	Screening Standard
TDS	Total Dissolved Solids
TOSHI	Target Organ-Specific Hazard Index
TPH	Total Petroleum Hydrocarbon
TPHCWG	Total Petroleum Hydrocarbon Criteria Working Group
TSL	Tissue Screening Level
TT	True Total
UCLM	Upper Confidence Limit on the Mean
US DOE	United States Department of Energy
US EPA	United States Environmental Protection Agency
USDA	United States Department of Agriculture

Executive Summary

The property, which consists of approximately 1,197 acres, is located in Vermilion Parish, Louisiana, and consists of Section 16 of Township 15 South Range 01 East within the East White Lake (EWL) Oil and Gas Field (the Site). The Site has historically been used for oil and gas development (MPA, 2010a). Oil and gas have been produced on the Site since 1940, and current operations include a large central facility with processing equipment and storage vessels, 2 saltwater injection wells, 1 gas well, and 12 producing oil wells (MPA, 2010b). The Site, most of which is classified as intermediate marsh, is only accessible by boat.

For this assessment, I have conducted a scientifically appropriate analysis of Site risks to human health. This analysis is based on information developed from Site data, regulatory agency methodology, and the general scientific literature. I considered the circumstances under which people may plausibly come into contact with environmental media at the Site. Specifically, I identified a person who fishes as the person most likely to be exposed to constituents of concern (COCs) at the Site through soil/sediment (ingestion and dermal exposures), surface water (dermal exposure), groundwater (ingestion, dermal, and inhalation exposures), and fish/shellfish (ingestion exposure). Adolescent recreators (11-16 years old) may also be present at the Site, with exposures similar to the adult recreator but for a shorter duration than the adult (5 years for an adolescent *versus* 26 years for an adult). Workers at the Peak Facility, located on the northern portion of the Site, may also be exposed to soil/sediment (ingestion and dermal), surface water (dermal), and groundwater (dermal and inhalation) at the Site. Because both receptors are likely to have lower exposures than the adult recreator, I focused on the adult recreator for the main risk analysis and considered an adolescent recreator and a worker at the Peak Facility as part of my sensitivity analysis.

I first assessed the Site risk to human health by conducting an initial screening analysis using United States Environmental Protection Agency's (US EPA's) residential Regional Screening Levels (RSLs) for soil and tap water criteria to select COCs for a further in-depth analysis. RSLs are media-specific concentrations of chemicals associated with specific target risk levels (10^{-6} for cancer risk and a hazard index [HI] of 0.1 for non-cancer risk) that are based on very conservative exposure assumptions that are likely to overestimate risk. Although this Site is not appropriate for residential development (it is, essentially, a marsh), in the absence of RSLs specific to a recreational scenario, I used the most conservative RSLs – the residential RSLs – for screening, because these levels are more protective than industrial RSLs. RSLs are meant to be used as comparison values for screening Site concentrations to determine areas and contaminants that require further evaluation. (It should be emphasized that exceedance of an RSL is not, by itself, evidence of excess risk.) After selecting COCs, I conducted a more in-depth assessment of Site risks using US EPA risk assessment guidelines and methodology.

Details on the COC selection process are as follows. For soil/sediment, I screened the maximum detected concentrations from 0-3 feet below ground surface (ft bgs) against US EPA RSLs that are protective of soil ingestion, dermal contact, and inhalation of particles and volatiles. For groundwater and surface water, I compared the maximum detected concentrations to US EPA RSLs for tap water and Maximum Contaminant Levels (MCLs)[1] for drinking water. To conduct a conservative screening analysis for groundwater and surface water, I used benchmarks that are protective of human consumption of drinking water. For sampled crabs, I compared maximum detected edible crab tissue concentrations to RSLs that

[1] MCLs are the highest concentration allowed in drinking water taking into account the best available treatment technology and cost; they are enforceable standards and are protective of human health.

are protective of fish ingestion.[2] For those chemicals that exceeded screening concentrations, I conducted a complete risk assessment using reasonable maximum exposure (RME) assumptions intended to overestimate likely human health risks.

The results of the risk assessment I conducted using the most current US EPA methodology and site-specific assumptions show that neither cancer nor non-cancer risks exceed the permissible limits defined by the Louisiana Department of Environmental Quality (LDEQ) and US EPA.

Arsenic and benzene were the only carcinogenic COCs detected at the Site. I calculated a cancer risk of 7×10^{-6}, which is within US EPA's target cancer risk range and LDEQ's acceptable cancer range for Management Option-3 of 1×10^{-6} to 1×10^{-4}. Moreover, 47% of this risk is contributed by arsenic in crabs, which is not Site-related, given that Site, Site-reference, and market samples of crab all had comparable arsenic concentrations, based on a statistical analysis. The remaining 53% of cancer risk is from benzene in groundwater[3] (22% total risk, 14% of which is from inhalation and 8% of which is from dermal contact) and arsenic in all other media (31%).

I calculated non-cancer risks (*i.e.*, HIs) using total petroleum hydrocarbon (TPH) fractions. Although TPH in soil/sediment and groundwater were analyzed for both TPH fractions and TPH ranges, I focused on the TPH fractionated data, because they are more scientifically accurate and better characterize TPH. I combined the TPH risks with non-cancer risks for other COCs. Using the most current US EPA guidance, when summing all the non-cancer risks for the different COCs with various target organs, I calculated a total HI of 2. Consistent with US EPA guidance, I further refined my non-cancer risk assessment by calculating target organ-specific hazard indices (TOSHIs). The TOSHIs I calculated are all less than 1. The highest TOSHI, *i.e.*, the one associated with the greatest risk, was 0.8, for the liver, below LDEQ and US EPA's target HI of 1. Although fractions are more appropriate for a risk assessment, to be complete, I separately calculated non-cancer risks using TPH range data. The highest TOSHI using TPH range data was 1, for the liver, which meets US EPA and LDEQ's target HI. The TOSHIs for all other endpoints were less than 1.

Using the TPH fraction data, the ingestion of soil/sediment and dermal contact with soil/sediment pathways contribute 5% of the liver HI. Ingestion of fish/shellfish using measured blue crab TPH (evaluated as TPH fractions C8-C16 and C16-C28) concentrations contributes 95% of the liver HI. As with inorganic arsenic, the presence of TPH in crabs at the Site is not Site-related, given that Site, Site-reference, and market samples of crab all had comparable TPH concentrations, based on a statistical analysis.

This analysis is conservative and generally employs high-end plausible assumptions intended to overestimate likely human health risks. For example, I used maximum concentrations for screening and 95% upper confidence limit on the mean (UCLM) concentrations (instead of mean concentrations) for the constituents in soil/sediment, surface water, and crab included in the risk assessment. For groundwater, I used maximum concentrations to evaluate exposures *via* ingestion, dermal, and inhalation exposures. For dermal contact exposures, I applied 95th percentile skin surface area values for dermal exposures. To evaluate ingestion of Site contaminants *via* locally caught seafood, I based my analysis on measured crab data and used a higher-than-average ingestion rate for either recreationally caught fish or shellfish that is likely to overestimate intake for many individuals. In addition, the risk assessment assumes that all fish/shellfish consumed over a 26-year exposure period was recreationally caught from the Site.

[2] There are no RSL values specific for crab or other shellfish. It should be noted that, in general, fish consumption is estimated to be greater than shellfish consumption (US EPA, 2014b). Therefore, the use of an RSL based on fish ingestion to evaluate measured crab data is conservative.

[3] These are hypothetical risks from dermal contact. Arsenic and benzene were not detected in the groundwater used for drinking water.

Furthermore, arsenic cancer risks in the assessment were conservatively estimated, in that they were quantified using US EPA's default cancer slope factor (CSF), which assumes a linear, no-threshold dose-response relationship, the most conservative dose-response model used by US EPA. In summary, even using conservative assumptions, Site exposures do not exceed permissible risk-based criteria. In addition, Site exposures are also well below exposures at which adverse health effects from the COCs have been identified in humans or in animals.

Thus, based on my assessment of both cancer and non-cancer endpoints, Site risks are within US EPA guidelines and pose no harm to human health. I note that my conclusion regarding permissible risks from crab ingestion is consistent with an analysis conducted by the Louisiana Department of Health and Hospitals (LDHH), which also concluded that crab ingestion from the Site did not present a public health hazard. In fact, LDHH concluded that "data do not support the need for a consumption advisory due to barium and arsenic concentrations in crab tissue" (LDHH, 2015).

1 Introduction

1.1 Professional Qualifications

My name is Barbara D. Beck, Ph.D., and I am a board-certified toxicologist (*i.e.*, a diplomate of the American Board of Toxicology), specializing in human health risk assessment. I am also a Fellow and President of the Academy of Toxicological Sciences. I am an appointed Instructor in the Molecular and Integrative Physiological Sciences Program in the Department of Environmental Health at the Harvard School of Public Health and a Principal at Gradient, an environmental consulting company that specializes in the fate and transport of chemicals in the environment and human health risk assessment.

I received an A.B. degree (*cum laude*) in biology from Bryn Mawr College in 1968 and a Ph.D. in molecular biology and microbiology from Tufts University in 1975. Thereafter, I received postdoctoral training under a Cystic Fibrosis Fellowship and an American Cancer Society Fellowship at the University of Massachusetts Medical School and Harvard University, where I conducted research in molecular biology and in biochemistry. I was an instructor in protein chemistry at Tufts University School of Medicine between 1978 and 1979, where I researched mechanisms of susceptibility to bacterial infection.

From 1979-1985, I was a research associate in respiratory biology in the Department of Environmental Health at the Harvard School of Public Health, where I developed a short-term bioassay to predict the toxicity of particulate matter and gases for the lungs. I was also an editor and author of a monograph on variations in susceptibility to inhaled pollutants.

From 1985-1987, I was Regional Expert in Toxicology and Chief of the Air Toxics Staff at Region I of the United States Environmental Protection Agency (US EPA), which includes the New England states. In this capacity, I provided expert advice on matters of toxicology, particularly as related to air toxics.

In 1987, I joined Gradient. My consulting practice consists of health risk assessments for cancer and non-cancer endpoints, reviews of animal toxicology and human epidemiology studies, multi-media assessments of exposure to environmental chemicals, and evaluations of the historical development of toxicology, with a special emphasis on inhaled chemicals, complex organic compounds, and metals.

My *curriculum vitae* is attached as Appendix D.

1.2 Approach and Information Sources Used

My analysis is based on my review of 1) the scientific literature, specifically as related to toxicology, chemistry, risk assessment, and epidemiology; 2) Site documents; and 3) publicly available environmental and regulatory documents, *e.g.*, documents from the Louisiana Department of Environmental Quality (LDEQ), the Louisiana Department of Health and Hospitals (LDHH), and US EPA. In addition, I visited the Site on May 25, 2010.

1.3 Historical Use and Site Investigations

The Property is located in Vermilion Parish, Louisiana and consists of Section 16 of Township 15 South Range 01 East within the East White Lake (EWL) Oil and Gas Field (the Site). The approximately 1,197-acre Site is located 0.5 miles east of White Lake and the White Lake Wetlands Conservation Area. The Site has historically been used for oil and gas development (MPA, 2010a). Unocal and Louisiana Land Exploration produced oil and gas on the Site from 1940-1995. A total of 85 wells have been drilled on the Site since Unocal first conducted exploration and production activities. In 1995, Unocal's interest in the EWL Oil and Gas Field was divested to Resource Acquisitions Corporation (MPA, 2010a). In 2003, Peak Operating Company took over operations and is the current operator. There are currently 15 active wells located on the Site (2 of which are now salt water injection wells) (MPA, 2010a). Current operations include the Peak Central Facility, with processing equipment and storage vessels, 2 saltwater injection wells, 1 gas well, and 12 producing oil wells (MPA, 2010b). The Site, most of which is classified as intermediate marsh that is subject to storm surges, is only accessible by boat (MPA, 2010a).

Coastal Environments, Inc. (Coastal) conducted an environmental investigation of the Site in 2010 (Coastal, 2010). The goals of the investigation were to assess and document any impacts to the environment caused by activities associated with exploration and production of oil and gas reserves at the Site. Their report presents a general overview of the geology and biology of the area, including types of vegetation and wildlife, habitats, and fish species. ICON Environmental Services (ICON) prepared a Feasibility Study and Remediation Estimate for EWL Oil and Gas Field in April 2010 (ICON, 2010a). Michael Pisani & Associates, Inc. (MPA) prepared a Site Evaluation Plan in April 2010 (MPA, 2010b). Since those two reports were prepared, additional sampling has been performed and numerous reports have been generated. In addition, fish and/or crabs were sampled by MPA in 2010 and 2011 (MPA, 2014a; ERM, 2014), Dr. William J. (Jim) Rogers of Omega EnviroSolutions, Inc. (OES) on October 16-17, 2010 (Rogers, 2014), and LDHH in November 2010 (LDHH, 2015).

2 Risk Assessment

2.1 Receptor and Exposure Pathways Evaluated

2.1.1 Receptors

The 2010 MPA Site Plan describes the Site as an "intermittently flooded marsh environment" and notes that the Site lies in an area that is "frequently inundated with salty water from Vermilion Bay" (MPA, 2010b). Ground surface elevations range from below sea level to 2 feet above mean sea level in undisturbed areas, and "elevated land exists only from dredge spoils originating from canal dredging and maintenance" (MPA, 2010b). The report notes that access to the Site is by boat, and there is "no land based vehicle access to the property" (MPA, 2010b). The surrounding land surface is used for "recreational hunting, fishing, and in support of oil and gas activities" (MPA, 2010b).

Because the Site is largely a marsh and frequently completely submerged under water, the construction of residential housing is not feasible (MPA, 2010a). According to the United States Department of Agriculture (USDA) Natural Resources Conservation Service, "farming, grazing, wildlife habitat development, and/or residential development of the property are precluded because the area is periodically inundated and the soil types are unsuitable for propagation of crops and support of animals" (MPA, 2010b). Therefore, I did not evaluate a residential scenario.

Although the surrounding area is primarily used for recreational fishing and hunting, I limited my evaluation to adults who may fish solely at the Site, thereby potentially contacting surface water and sediment and subsequently ingesting any fish/shellfish they catch from the Site. I evaluated risks to adults potentially exposed to soil/sediment *via* incidental ingestion and dermal contact; surface water *via* dermal contact; groundwater *via* dermal contact, inhalation of volatiles, and ingestion; and fish/shellfish *via* ingestion. Adolescent recreators may also be present at the Site, but are likely present for a shorter duration than an adult (5 years for an adolescent recreator 11-16 years old[4] *versus* 26 years for an adult). Workers at the Peak Facility, located on the northern portion of the Site, may also be exposed to Site media; however, their exposures are likely to be less than those of the adult recreator, because workers are not expected to ingest groundwater and fish/shellfish[5] from the Site. Because both receptors are likely to have lower exposures than the adult recreator, I focused on the adult recreator in my main risk analysis and evaluated the worker and adolescent recreator as part of my sensitivity analysis.

Although hunters are known to hunt at the Site, I did not quantify risks from recreational hunting and consumption of game, because such risks are likely to be lower than the risks from consumption of fish/shellfish. There are several reasons for this, including the likely lower exposure frequency for recreational hunting and the lower consumption rate of game compared with fish/shellfish. For example, US EPA's Exposure Factors Handbook (US EPA, 2011a) reported lower game meat ingestion rates in comparison with fish/shellfish rates among adults. The 99th percentile for ingestion of game in the US population is 0.098 g game meat/kg body weight/day, or approximately 7 g of game per day, well below

[4] Children younger than 11 years old were not evaluated because, based on professional judgment, it is not reasonable to assume that they would be at the Site 2 days/week year-round.

[5] To the extent that workers at the Peak Facility are also consuming locally caught fish/shellfish, that scenario is addressed through my evaluation of the adult recreator and discussed in my sensitivity analysis (Section 3.5.6).

the 30 g/day (adjusted to 34 g/day, based on body weight) I chose for fish/shellfish. In addition, the fish/shellfish species I chose to base my analysis on (blue crabs) live in close contact with sediment and would be expected to have greater exposure to constituents in the sediment than would a hunted organism (*e.g.*, nutria), providing further evidence of the potentially greater risk presented by the fishing/crabbing pathway than the hunting pathway. Because no risks to an adult who ingests fish/shellfish exceed acceptable limits, it is expected that risks to the hunter would also be acceptable.

I did not quantitatively evaluate exposure to foraged blackberries and poke weed (a possible exposure route raised by Coastal, 2010), because exposure *via* this route would be much less than exposure *via* fishing. The limited exposure from this source is due to the need to access the Site by boat, the limited season for blackberries, and the potential toxicity of poke weed, which necessitates careful preparation to prevent toxicity.

2.1.2 Fish/Shellfish Ingestion

The area surrounding the Site is primarily used for recreational fishing and hunting. As reported by Coastal, the fresh marshes adjacent to White Lake support freshwater fish, including largemouth bass; bluegill; warmouth; crappie; gars; bowfin; blue, channel, and flathead catfish; and freshwater drum. The marshes and associated shallow waters at the Site also provide habitats for Gulf menhaden, Atlantic croaker, striped mullet, white shrimp, and blue crab (Coastal, 2010). In the Vermilion area of Louisiana, people eat fish and blue crabs during a large part of the year. Therefore, I evaluated an adult recreator consuming fish/shellfish caught from the Site.

I conservatively based my analysis on measured concentrations of the constituents of concern (COCs) in blue crab and fish ingestion rates. Blue crabs live in close contact with sediment, at times burying in the sediment (Van Haeukelem, Undated). Unlike fish, they can be exposed to soil/sediment outside the water and can feed on organisms that live in the sediment and soil (*e.g.*, benthic macroinvertebrates, plants, and mollusks). Recent US EPA data suggest that adults consume more fish than shellfish (US EPA, 2014b). Therefore, I conservatively applied measured COC concentrations in Site blue crab[6] to fish ingestion rates to evaluate recreator risks from consuming fish or shellfish collected solely from the Site.

2.1.3 Groundwater, Surface Water, and Sediment

According to the published literature, the Site is underlain by multiple layers of unconsolidated sediments (MPA, 2010a). The upper 800 ft of these sediments have been differentiated into the following units: peat, clay, surficial confining unit and shallow sand, clay with sand lenses, upper sand of the Chicot Aquifer system, and lower sand of the Chicot Aquifer system. Site information was further refined by MPA when they conducted a Site-specific investigation. The pore water in the peat zone at a depth of less than 13 ft is not usable groundwater and is classified as Class 3 groundwater under the LDEQ Risk Evaluation/Corrective Action Program (RECAP) by both ICON and MPA. This pore water can contain more than 10,000 mg/L total dissolved solids (TDS), due to storm surges (MPA, 2010a). The remaining units have productivity adequate for wells (MPA, 2010a). Wells and their associated aquifer are presented in Appendix Table A.1.

[6] I also considered mercury data from higher trophic level fish caught in the East White Lake (EWL) area by the Louisiana Department of Environmental Quality (LDEQ) in 1998, 2003, 2004, and 2008, as discussed in Section 3.5.3.

On the Site, fishing and crabbing take place in boats. Fishing lines and/or crab traps are pulled into the boat along with some surface water and sediment, such that hands, forearms, and feet could be exposed to surface water and sediment. I also evaluated dermal contact with sediment and surface water as well as incidental ingestion of soil/sediment while fishing and crabbing.

There is a Peak Facility water well (AWW1) at a depth of 400 ft below ground surface (ft bgs) in the upper sand of the Chicot Aquifer (MPA, 2010a). This well has water that meets Primary and Secondary Drinking Water Standards, with the exception of naturally occurring iron and TDS (MPA, 2010a). Water from this well is used for showering but not drinking (bottled water is provided to the Peak Facility workers to use as drinking water) (Collier, 2010). In addition, there are shallow water wells (*e.g.*, 65 ft deep) that may be associated with camps in the area and may be used for washing. This use is consistent with water quality indicators, which show that water in the shallow zones beneath the Site has objectionable aesthetic characteristics (*e.g.*, taste) (MPA, 2010a). Due to its lack of palatability, the water from these wells is unlikely to be used for drinking, but it is reportedly used for washing.

I also evaluated the person fishing, whose hands, forearms, and feet could potentially come in contact with Site well water when using it to wash the catch, wash their hands, wash the boat, *etc*. In addition, fishers at the Site could potentially inhale volatile chemicals from the water while washing – for example, at a camp. (As mentioned earlier, it would be unreasonable to assume that there would be potential residential development on this Site. For example, the area is periodically inundated and access to the Site is only possible *via* boat. Therefore, as per US EPA exposure guidelines, I have not included that scenario.)

I evaluated dermal contact with surface water and groundwater using surface water samples and groundwater samples that are not from the peat zone. Individuals are potentially exposed to groundwater at the Site only *via* well water. Of all the wells installed at the Site, only six are permanent (the Peak Facility well [AWW1], SB-1-MW-S, SB-2-MW-S and SB-3-MW-S, the J. Guidry well, and the P. Hebert well) and only three (the Peak Facility well [AWW1], the J. Guidry well, and the P. Hebert well) potentially allow access to groundwater *via* a pump/spigot.[7] Although only three Site wells (the Peak Facility well [AWW1], the J. Guidry well, and the P. Hebert well) currently provide access to groundwater, I used all the wells on the Site (both temporary and permanent) that are not associated with the peat layer in my risk screening evaluation to address the possibility that future wells may provide exposure to groundwater.

For ingestion of groundwater from Site wells, I considered the Peak Facility well (AWW1), the J. Guidry well, and the P. Hebert well, because they are the only permanent wells on the Site with a pump/spigot. Bottled water is provided for drinking at the Peak Facility, because, although there is one well, it is not used for drinking water (Collier, 2010).[8] Therefore, I did not assess exposure from drinking water from the Peak Facility well (AWW1). However, the groundwater at the Peak Facility is used for washing, so I included these data when evaluating inhalation of volatile compounds. I evaluated risk from drinking water from the J. Guidry well, although it is not known definitively whether anyone drinks water from this well. Water from the P. Hebert well has excess iron, manganese, and natural TDS above Secondary Maximum Contaminant Levels (MCLs) for aesthetic effects (*e.g.*, taste, odor, color), and, therefore, the water from this well would not be potable. The well is reportedly used for sanitary purposes, but not for drinking water (MPA, 2014b).

[7] The remaining three wells are monitoring wells and do not provide access to groundwater. I have been informed that the A. Crouch well is also a permanent well but was abandoned, eliminating potential exposure to humans (Levert, 2014).

[8] In addition, all sampling results from the Peak Facility well (AWW1) are below corresponding United States Environmental Protection Agency (US EPA) Primary Maximum Contaminant Levels (MCLs), which are health-based.

2.2 Summary of Data Used

For my analysis, I relied on a database compiled by Ms. Angela Levert. Appendix A presents the raw data considered in my analyses. For my analyses, I used surface soil/sediment, crab, groundwater, and surface water data, as described below.

Several field duplicate samples were collected as part of the Sampling Quality Control and Quality Assurance Plan to measure the precision of the sampling and laboratory analysis. Because these samples are useable data, for cases in which field duplicate samples were collected, I averaged the parent and duplicate samples. I also averaged field duplicates and delineation samples with the parent sample using the full detection limit for samples that were not detected, which is a very conservative approach. US EPA guidance (US EPA, 1989) recommends using half the detection limit as a proxy concentration, while LDEQ RECAP (LDEQ, 2003) applies the full detection limit as a proxy. Using the full detection limit would bias the averaged concentrations high (Smith, 1991). Several samples were split and analyzed by two different laboratories, for ICON and MPA. Because both results represent the same sample, the two results were averaged using the full detection limit for samples that were not detected. This averaging was conducted to weight all samples equally when generating an average for the entire study area.

2.2.1 Soil/Sediment Data

Field observations indicated that the Site is within an inundated marsh environment (MPA, 2010a), and the soils at the Site are "very poorly drained, ponded most of the time, and… frequently flooded" (Coastal, 2010). For this reason, I did not differentiate between sediment and soil samples and considered them all as one (soil/sediment) dataset.

Although direct contact with soil/sediment is highly unlikely to occur at depths greater than 1-2 ft, I averaged the results from samples with maximum depths of 0-3 ft, to include more of the available data in my analysis. Starting in 2006, ICON collected samples at the Site, but, starting in 2010, multiple samples were split and analyzed by both ICON and MPA. Some sediment and soil samples were collected at multiple depth intervals per boring, within the 0- to 3-ft interval (*e.g.*, 0-0.5 and 0.5-2 ft bgs). In cases in which soil and sediment samples were collected at multiple depths from a single location, I averaged the concentrations to generate one result for each sampling station. This averaging was conducted to weight all samples equally when generating an average for the entire study area.

I also included samples that were collected for further delineation (SED-15, SED-6, SS8, and AB5) (MPA, 2010c). Ten samples (including a field duplicate) were collected to delineate mercury contamination near SED-6 and SS8 (Hg-MPA-01 to Hg-MPA-09 and Hg-MPA-09Dup) (MPA, 2010c). A historical pit was identified in the area of SED-15, based on aerial photographs, and, therefore, additional samples were collected to delineate this area (MPA, 2010c). Because multiple samples were collected, I averaged these delineation samples to represent that location. In addition, a portion of the SED-15 area was excavated in 2014, and the following surface soil/sediment samples were from the area excavated (MPA, 2015) and were, therefore, not included in my analysis:

- MPA-SED-15 (6/8/2010)
- SED-15 and SED-115 (5/6/2010)
- SED15 (2/26/2010)
- SP-MPA-05 (10/5/2010)

All MPA soil/sediment data were reported on a wet weight basis (Gulf Coast, 2010a,b). However, US EPA requires the use of dry weight data for evaluating risks (US EPA, 2004).[9] Because US EPA requires data on a dry weight basis for risk evaluation, I converted the MPA results to dry weight, using the following equation:

$$Dry\ wt = \frac{Wet\ wt}{1 - (fraction\ moisture)}$$

where:

Dry wt	=	Dry weight concentration (mg/kg)
Wet wt	=	Wet weight concentration (mg/kg wwt)
Fraction moisture	=	Fraction moisture of the sample

All of the ICON data I used (sediment and soil data for metals) were reported using a dry weight preparation method.[10] Several samples were reported as both dry weight and dry weight preparation samples. Dry weight preparation samples have an additional preparation step in which samples are pulverized before analysis (LDEQ, 2005). In cases in which both results were presented, the dry weight samples were used, because the additional pulverizing step used for the dry weight preparation samples is not representative of Site exposures. In cases in which only the dry weight preparation results were presented, I included them in my analysis and treated them as dry weight samples. None of the dry weight and dry weight preparation samples required any conversion.

Based on my review of the data, I screened out polycyclic aromatic hydrocarbon (PAH) data from my quantitative analysis for soil/sediment, due to the low frequency of detection, the absence of detected PAHs in other media, and the low concentrations detected (the data are presented in Appendix A). This approach is consistent with US EPA guidance (US EPA, 1989), which notes that a chemical can be excluded from a quantitative risk assessment if the chemical is detected infrequently and is not detected in other media or at high concentrations.

2.2.2 Crab Data

I used the blue crab data collected by MPA from the Site and reference locations (White Lake and Schooner Bayou Canal) in 2010 and 2011 (MPA, 2014a; ERM, 2014) (Appendix Table A.4). In addition, crabs were purchased (in Baton Rouge, Lake Charles, New Orleans, and Des Allemands, Louisiana; Biloxi, Mississippi; and Houston, Texas) for analysis as representative concentrations of regional crabs. Arsenic, inorganic arsenic, barium, mercury, methyl mercury, and total petroleum hydrocarbon (TPH, reported as total fractions, *i.e.*, not separated into aliphatics and aromatics) were measured in crabs (ERM, 2014). These crab samples were divided into hepatopancreas, exoskeleton, meat, and other soft tissue before being analyzed by the laboratory (Appendix Table A.4). Edible portions of the crab typically include only the meat; however, due to the eating habits of local populations or subpopulations, I included the chemical concentrations in the hepatopancreas in my evaluation (LDHH *et al*., 2012; LDHH, 2015).

[10] Laboratory sheets for samples analyzed for ICON Environmental Services (ICON) indicate that samples were analyzed using the 29B preparation method (*i.e.*, Sherry Laboratories, 2010).

I weighted the meat and hepatopancreas chemical concentrations to calculate the chemical concentrations in the edible tissue using the following equation:

$$Conc_{edible} = \left(Conc_{hepa} \times \frac{wgt_{hepa}}{wgt_{total}} \right) + \left(Conc_{meat} \times \frac{wgt_{meat}}{wgt_{total}} \right)$$

where:

$Conc_{edible}$	=	Chemical concentration in the edible tissue (mg/kg)
$Conc_{hepa}$	=	Chemical concentration in the hepatopancreas (mg/kg)
wgt_{hepa}	=	Weight of the hepatopancreas (g)
wgt_{total}	=	Weight of total crab (g)
$Conc_{meat}$	=	Chemical concentration in meat (mg/kg)
wgt_{meat}	=	Weight of meat (g)

Although the forage fish were collected by MPA and analyzed for TPH, I relied on the crab data to represent human health exposure, because adult recreators generally target larger fish for consumption, and the forage fish (bait, bluegill, and shad), which are relatively small, were collected to support the ecological risk assessment. Appendix Table A.4 presents the chemical concentrations by crab body part and edible tissue (hepatopancreas and meat) chemical concentrations that I used in my risk calculations.

Additional crab samples were collected from the Site by Dr. William J. (Jim) Rogers of OES and by LDHH. I did not include these data in my quantitative analysis, as explained below. On October 16-17, 2010, 22 blue crabs from nine locations throughout the Site were collected by Dr. Rogers. Dr. Barbee (also of OES) and Dr. Rogers both reported that the entire crab was homogenized prior to extraction and analysis for metals and TPH (Barbee, 2010; Rogers, 2014). I excluded the results from these samples because they were analyzed for whole crab, including parts that are not consumed (*e.g.*, the crab exoskeleton). US EPA (1989) notes that exposure from fish or shellfish is calculated using the concentration of a chemical in the edible tissues. Similarly, LDHH (2015) states that "it is not appropriate to compare TSLs [tissue screening levels] to data based on whole body analysis which includes non-edible tissues (*i.e.*, crab shells). This is particularly true of inorganic constituents such as arsenic and barium that are likely to be concentrated in the non-edible shell of the blue crab." LDHH (2015) also notes that the literature supports the likelihood that barium replaces calcium in the shells of shellfish, which is composed largely of calcium carbonate. Consequently, the homogenized whole body sampling methodology utilized in the OES crab dataset does not provide an accurate characterization of barium tissue concentrations measured at these Site sampling locations (LDHH, 2015).

On November 23 and 29, 2010, LDHH collected composite samples of at least eight blue crabs from nine locations on the Site. LDHH segregated the composite samples into two sets for processing and analysis, to evaluate the release of crab shell contaminants during boiling and cooking (LDHH, 2015). In set one, composited samples of four to nine crabs were boiled together using clean tap water; the tap water used for the boil was sampled both before and after boiling. After boiling, the tissue and hepatopancreases of the crabs were removed from the shell, separated, and then homogenized. The second set of samples consisted of four to nine uncooked crabs; in this sample set, the tissue and hepatopancreases of the crabs were also removed from the shell, separated, and homogenized. All samples were analyzed for arsenic and barium.

Arsenic and barium concentrations were not detected in pre-boiled water samples, while, in post-boiled water samples, both barium and arsenic concentrations were detected below health screening values (LDHH, 2015). Arsenic concentrations detected in the LDHH boiled and unboiled meat tissue concentrations were below the laboratory detection limit (0.5 mg/kg), while mean boiled and unboiled hepatopancreas arsenic concentrations ranged slightly above the detection limit (0.447-0.545 mg/kg). LDHH calculated a draft tissue screening level (TSL) of 467 mg/kg for barium; mean barium concentrations were well below the TSL value. Overall, LDHH (2015) concluded that the barium concentrations from both LDHH datasets were significantly lower than the values for the whole body samples sampled by Dr. Rogers of OES, including non-edible shell portions. Although the uncooked crab dataset provides results separately for crab meat and hepatopancreas (fat), tissue wet weights or the underlying laboratory documentation were not available to me. Consequently, weighted concentrations of the edible crab tissue could not be calculated, and, therefore, I did not include these data in my quantitative analysis.

2.2.3 Groundwater and Well Water Samples

For groundwater, I evaluated all of the data collected between 2006 and 2014 from four different depths: the shallow sand confining unit (37-55 ft bgs), the intermediate sand confining unit (72-77 ft bgs and 80-83 ft bgs), the deep sand confining unit (97-100 ft bgs), and the Chicot Aquifer (>400 ft bgs).[11] Appendix A lists all the groundwater data and their associated aquifers. Multiple samples (HP-MPA temporary wells) were collected in the fall of 2010 (MPA, 2010c); the J. Guidry well was also sampled during that time (MPA, 2010c). In April 2014, samples were collected from station SB-1 and the P. Hebert well (Appendix Table A.1) (Gulf Coast, 2014a,b).

I did not use the groundwater data collected from Site wells in the peat layer (AB-2, AB-3, AB5-AB7, AB15, AB19, and WL-6). Water from this peat zone would not be used by people for drinking or washing based on high TDS (*e.g.*, high TDS content, which can exceed 10,000 mg/L)[12] and low productivity (MPA, 2010a). For dermal contact and inhalation of volatiles in groundwater (*e.g.*, as might occur through the use of an indoor shower), I used data from all of the wells on the Site (temporary and permanent) that are not associated with the peat layer. For ingestion of groundwater from Site wells, I evaluated risk from drinking water from the J. Guidry well, although it is not known definitively whether anyone drinks water from this well. Metals data were reported in both total and dissolved concentrations. As per US EPA (2014a), I evaluated metals using total metals for all exposure pathways.[13]

2.2.4 Surface Water Samples

In 2010, surface water samples were collected from 10 locations across the Site. Samples were split and analyzed separately by ICON and MPA. MPA analyzed metals data as both total and dissolved concentrations. Similar to groundwater, I evaluated metals using total metals for surface water dermal exposures. I used all the surface water samples collected from the Site in my analysis.

[11] US EPA (2014a) recommends using data collected from the latest two rounds of sampling. Therefore, I did not use data from a sample collected from well AWW1 by ICON in 1995, because more recent data were available (ICON, 2010b).

[12] Noticeable effects from total dissolved solid (TDS) concentrations above the Secondary MCL of 500 mg/L include hardness, deposits, colored water, staining, and salty taste (US EPA, 2013a).

[13] Several samples collected for ICON with a hydropunch exhibited high turbidity (*e.g.*, collected samples that begin with HP-MPA, MW-1C MW-4D, MW-5D, MW-6S, MW-6D, and SB-1-MW-D; presented in Appendix Table A.1). Due to the high turbidity, these samples were filtered in the field, as indicated in their chain of custody forms (MPA, 2010c) but were reported as unfiltered results.

2.3 Screening

I conducted a screening-level analysis to identify COCs to be evaluated in the quantitative risk assessment. It should be emphasized that some of the scenarios and assumptions used in the screening-level analysis are overly conservative and are not representative of Site-specific conditions. As discussed in more detail below, the screening-level analysis helps focus the quantitative risk assessment on the most relevant COCs.

2.3.1 Screening Protocols

US EPA has published a set of risk-based media concentrations known as Regional Screening Levels (RSLs) (US EPA, 2015a). Prior to 2008, US EPA Regions III, VI, and IX each published their own set of risk-based screening levels. In 2008, these three US EPA Regions combined their screening levels into one table, now called "Regional Screening Levels (RSL) for Chemical Contaminants at Superfund Sites" (US EPA, 2015a). RSLs present risk-based screening values for individual compounds in residential and industrial soil, air, and drinking water. US EPA derives RSLs by combining generic conservative exposure assumptions with US EPA toxicity criteria. They are considered to be protective for humans (including sensitive groups) over a lifetime (US EPA, 2015a). RSLs are based on a cancer risk of 1×10^{-6} and a non-cancer hazard quotient (HQ) of 1 or 0.1. A target HQ of 0.1 is used to account for potential exposure to multiple chemicals affecting the same target organ (US EPA, 2015a). I used RSLs based on an HQ of 0.1, which is more conservative and more likely to result in the inclusion of chemicals as COCs, as compared with using a target HQ of 1.

These RSLs are values protective of hypothetical high-end chronic exposure scenarios that are not indicative of Site exposures. RSLs are intentionally conservative to help identify sites that do not warrant further investigation (when all maximum detected concentrations are less than corresponding RSLs). As described under both RECAP and US EPA guidelines, screening values are used to identify chemicals of interest at a site, for the purposes of further investigation and decision making (US EPA, 2015b; LDEQ, 2003). RSLs are meant to be used as comparison values for screening site concentrations, not as final cleanup standards; the goal of screening is to determine areas and contaminants that require further evaluation at a particular site. Exceedance of a screening level does not mean that a site presents an unacceptable health risk, only that further evaluation of potential site risks is warranted (US EPA, 2015b).

US EPA RSLs are based on assumptions of frequency and duration of exposure, as well as on the age of the receptor, and are likely to overestimate any plausible exposures on the Site. For example, the RSL residential soil standards assume an exposure frequency of 350 days/year, an exposure assumption that is not likely to occur at the Site. The RSL criteria and RECAP screening standard (SS) are both based on a 10^{-6} (1 in 1 million) risk for carcinogens. The RECAP SSs are based on a target HQ of 0.1, whereas US EPA RSLs can be based on a target HQ of either 1 or 0.1.

2.3.2 Screening Protocol, by Medium

In the screening assessment for soil/sediment, I used the raw data (field duplicates, splits, delineated samples, samples collected from multiple depths within the same location) without averaging to identify the minimum and maximum detected concentration of each measured analyte. The maximum detected soil/sediment concentrations were screened against health-protective US EPA RSLs for residential soil from exposure *via* ingestion, dermal contact, and inhalation of particulates and volatiles (US EPA, 2015a). For diesel-range organic compounds (total petroleum hydrocarbon–diesel-range organics [TPH-

DRO]) and oil-range organic compounds (total petroleum hydrocarbon–oil-range organics [TPH-ORO]), I used the most conservative screening benchmark within the appropriate carbon range.

Groundwater results were compared to US EPA RSLs for tap water (protective from exposures *via* ingestion, dermal contact, and inhalation of volatiles) and Maximum Contaminant Levels (MCLs. MCLs, which are set by US EPA, represent concentrations of contaminants in drinking water that are safe for consumption (US EPA, 2009a). In the absence of health-protective surface water benchmarks, I compared surface water concentrations to US EPA RSLs for tap water and MCLs. I also compared surface water concentrations to National Recommended Water Quality Criteria for the consumption of water and organisms (US EPA, 2015c). Although the majority of the groundwater wells that were sampled and all of the surface water[14] at the Site are not potable, I used benchmarks that are protective of human receptors drinking Site water, in order to conduct a conservative screening analysis and to be more inclusive with respect to selected COCs.

For crab, I screened maximum tissue-weighted concentrations in crabs against calculated fish tissue RSLs.[15] Although US EPA has withdrawn their fish tissue RSLs, I calculated new RSLs for fish (Table 2.1), using US EPA's most recent RSL guidelines (US EPA, 2015b) and the withdrawn ingestion rate of 54 g/day used by US EPA in 2013 for calculating fish tissue RSLs (US EPA, 2013b). That ingestion rate was based on fish ingestion when 70 kg was used for an adult body weight (US EPA, 1991a). Taking into account US EPA's current, higher recommended adult body weight, 80 kg (Stalcup, 2014), I adjusted the fish ingestion rate to 62 g/day (54 g/day × 80 kg ÷ 70 kg), assuming that ingestion rates are correlated to body weight. Similar to the screening for other media, RSLs were calculated based on a cancer risk of 10^{-6} and a non-cancer HQ of 0.1. Arsenic in crabs was analyzed as both inorganic and total arsenic. Because the toxicity values used to calculate the RSLs are based on inorganic arsenic and not total arsenic, an RSL was only calculated for inorganic arsenic.

Chemicals with maximum concentrations that exceeded the RSLs were carried forward into the risk assessment.

2.3.3 Screening Results

Tables 2.2-2.5 present the screening results. In soil/sediment (Table 2.2 and Appendix Table A.2), there were screening exceedances for arsenic,[16] barium, mercury, TPH-DRO, TPH-ORO, and six TPH hydrocarbon fractions. Both RECAP (LDEQ, 2003) and US EPA (2009b) note that fractionated data (*e.g.*, aliphatics and aromatics) are a better means of characterizing TPH than range data (*e.g.*, DRO, ORO). Therefore, TPH was evaluated using fractionated data. To be complete, I separately evaluated risks using the TPH range data as well. A screening criterion was not available for true total barium (TT barium), so it was not included as a COC but was evaluated as a part of barium.

For groundwater (Table 2.3), the maximum concentrations of arsenic, barium, chromium, iron, lead, selenium, strontium, benzene, TPH-DRO, and TPH-ORO exceeded either an MCL or a risk-based concentration (tap water RSL) in at least one of the sampled aquifers. As previously stated, fractionated data are a better means of characterizing TPH. Because TPH fractions were not detected, TPH using fractions in groundwater was not included in risk calculations. However to be complete, similar to

[14] LDEQ designated uses for the surface water at the Site are primary and secondary contact recreation, fish and wildlife propagation and agriculture and not as a drinking water supply source (LDEQ, 2015a).
[15] As discussed earlier, because ingestion in fish is generally greater than ingestion of shellfish (Section 2.1.2), use of a regional screening level (RSL) based on fish ingestion to evaluate ingestion of crab or other shellfish is conservative.
[16] It should be noted that soil/sediment wet weight concentrations collected 0-3 feet below ground surface (ft bgs) are below the state-wide background arsenic concentration (LDEQ, 2003).

soil/sediment, I separately evaluated risks using TPH range data in my analysis (Table 2.3 and Appendix Table A.1).

For surface water (Table 2.4), arsenic, barium, iron, lead, selenium, strontium, TPH-DRO, and TPH-ORO exceeded the screening levels and were carried forward into the risk assessment. Because there are no TPH fraction data for surface water, to be complete, I present the surface water risk results based on TPH range data in my analysis (Table 2.4 and Appendix Table A.3).

In crab, inorganic arsenic, methyl mercury, mercury, and TPH concentrations exceeded screening concentrations and were carried forward into the risk assessment (Table 2.5). TPH-DRO (C8-C28), TPH C8-C16, TPH C16-C28, and TPH C8-C40 were all detected in crabs above screening levels. Although the TPH C8-C40 maximum concentration exceeds the screening level, it was not carried forward in the risk calculations, because the higher carbons (>C28) are likely associated with lipids (see Section 2.4.4.2). TPH-DRO (C8-C28) was evaluated in the risk assessment as TPH C8-C16 and TPH C16-C28, which encompasses the entire carbon range (C8-C28) and is also consistent with the TPH ranges in the analytical data provided (Table 2.5 and Appendix Table A.4).

See Table 2.6 for a list, by medium, of chemicals I considered to be COCs after completing my screening-level assessment.

2.4 Risk Assessment Methodology

2.4.1 Summary of Receptors, Exposure Pathways, and Exposure Point Concentrations

As discussed previously, I evaluated risks to adult recreators who may fish on Site and may, thereby, be exposed to soil/sediment *via* incidental ingestion and dermal contact; groundwater *via* dermal contact, inhalation, and ingestion; surface water *via* dermal contact and inhalation; and fish/shellfish *via* ingestion. I used the following exposure assumptions when estimating exposure to adults who fish at the Site. Adults fishing at the Site were assumed to be on the Site for 2 days per week for a minimum of 6 hours a day,[17] all year long (104 days/year), for 26 years. These values are highly conservative, because, for example, it is unlikely that adults who fish at the Site would visit the Site every weekend, due to inclement weather, among other factors. In addition, US EPA's Supplemental Guidance for Inhalation Risk Assessment notes that, "an example trespasser/recreational scenario could consist of an exposure…for 100 days per year or less" (US EPA, 2009c). The Risk Assessment Information System (RAIS) Risk Calculator developed under the United States Department of Energy (US DOE) Oak Ridge National Laboratory (ORNL) recommends an exposure frequency of 74 days/year for a Recreator (RAIS, 2013). Although the Site is situated in a larger recreational area frequently used for fishing, I assumed that all soil/sediment, surface water, and groundwater exposures occurred on Site and that all fish/shellfish consumed by the adult recreator were solely from the Site.

My risk assessment is based on using a reasonable maximum exposure (RME), which US EPA (1989) defines as "the highest exposure that is reasonably expected to occur at a site." An RME is used to estimate a conservative exposure case (*i.e.*, well above the average case) that is still within the range of reasonably possible exposures. An RME is calculated using a combination of high-end and central tendency values for exposure parameters. RMEs are estimated for individual pathways, and, if a population is exposed *via* more than one pathway, the combination of exposures across pathways also must represent an RME (US EPA, 1989, 2004).

[17] Recreators were assumed to be exposed to surface water for 4 hours while crabbing and groundwater for 2 hours while cleaning equipment/catch, discussed in Section 2.4.2.

I used exposure assumptions and equations as described in Section 2.4.2. With regard to the exposure point concentration (EPC), I applied the 95% upper confidence limit on the mean (UCLM), when available, or defaulted to the maximum concentration, in the absence of a UCLM. For the sampled crabs, although LDEQ *et al*. (2012) recommends using an average concentration to represent the concentration of a contaminant in fish/shellfish tissue for a specific water body, I used the UCLM, to provide reasonable confidence that the true average would not be underestimated (LDEQ, 2003; US EPA, 1989). This approach is consistent with US EPA methodology.

US EPA (2014a) recommends using data from the latest two rounds of sampling for each well to calculate the EPC that represents current conditions. Because all the wells on the Site were sampled only one or two times, I used all the data from the Site wells to calculate the EPCs. For dermal contact and inhalation of volatiles in groundwater from household water uses (*e.g.*, as might occur if a well was developed at a camp site anywhere on the Site), I used all the wells on the Site (both temporary and permanent) that are not associated with the peat layer. I conservatively calculated risks using the maximum detected concentration, regardless of the aquifer affected (excluding the peat zone wells). Although the water from the various aquifers is from different sources, I combined the maximum concentrations, as a conservative approach.

For ingestion of groundwater, I considered only the permanent wells that have a pump/spigot: the Peak Facility well (AWW1), the J. Guidry well, and the P. Hebert well. Water from the P. Hebert well is not potable (Section 2.1.3), and the well at the Peak Facility well is not used for drinking water (Collier, 2010). Due to the lack of sufficient samples to calculate an UCLM, I used the maximum concentration from the J. Guidry well as the EPC for drinking water, although it is not known definitively whether anyone drinks water from this well.

I did not assess risk for the following elements, because they are essential nutrients and/or lack toxicity factors: calcium, magnesium, potassium, sodium, bromide, and sulfate. I did considered chloride in terms of the usability of the aquifer as drinking water.

2.4.2 Exposure Equations and Calculations

Using the EPCs, exposure to chemicals in soil and sediment, surface water, groundwater, and crab were calculated using the following equations (US EPA, 1989). Table 2.7 presents the exposure assumptions I used.

2.4.2.1 Ingestion of Chemicals in Soil/Sediment

$$Intake = \frac{EPC_{soil} \cdot IR_{soil} \cdot FR \cdot B \cdot EF \cdot ED \cdot CF}{BW \cdot AT}$$

where:

EPC_{soil}	=	Exposure point concentration of chemical in soil/sediment (mg/kg)
IR_{soil}	=	Soil ingestion rate (mg/day)
FR	=	Fraction from Site (unitless)
B	=	Relative oral bioavailability (unitless)
EF	=	Exposure frequency (days/year)

ED = Exposure duration (years)
CF = Conversion factor (kg/mg)
BW = Body weight (kg)
AT = Averaging time (days)

A mean soil ingestion rate of 50 mg/day for the adult recommended by US EPA (1997) was used (Table 2.7). This is a conservative estimate of soil ingestion, in that it assumes that all of the soil ingested by an individual over an entire day comes from the Site, which is very unlikely. In addition, using the US EPA-recommended soil ingestion rate of 50 mg for an adult (US EPA, 1997, 2009d) is conservative, in light of the findings of studies of adult soil ingestion rates. For example, Stanek *et al*. (1997) reported an average estimate of soil ingestion of 10 mg/day (based on results from 10 adults), while Calabrese *et al*. (1990) reported an average ingestion rate of approximately 40 mg/day (based on results from 6 adults). Although the Site is located in a larger recreational area, I conservatively assumed all soil/sediment incidentally ingested occurred within the Site (fraction from the Site = 1).

The bioavailability of chemicals in soil is dependent on a number of factors, including chemical form, solubility, particle size of the ingested soil, and soil type (Richardson *et al*., 2006). A relative oral bioavailability estimate for a specific compound represents the oral absorption fraction from the exposure route of concern (soil, in this analysis) relative to the oral absorption fraction from food or water (in most toxicity studies, chemicals are administered in food or water). I used a relative oral bioavailability of 60% for arsenic in soil (US EPA, 2012a). As demonstrated in numerous animal studies, arsenic that is adsorbed to ingested soil is less bioavailable than ingested arsenic that is dissolved in water (Cohen *et al*., 2013; Yager *et al.*, 2015; US EPA, 2012b). The toxicity factors commonly used to quantify arsenic carcinogenicity, however, are derived from studies of populations exposed to arsenic in drinking water, a medium from which arsenic bioavailability is considered to be 100% (*e.g.*, Petito Boyce *et al*., 2008). When estimating exposure and risk associated with arsenic in soil, a bioavailability adjustment factor that reflects the absorption of arsenic from soil relative to that from water needs to be incorporated. For all other compounds, relative oral bioavailability information was not readily available. Therefore, I conservatively assumed a relative bioavailability of 100%. The bioavailability values for all COCs are summarized in Table 2.8.

Although the recreator is not a resident of the Site, I assumed an exposure duration of 26 years for the recreator, the 90th percentile residential occupancy period in the US, which is used to calculate US EPA's RSLs (US EPA, 2011a, 2015a). I used an exposure frequency of 104 days/year and US EPA's recommended adult body weight of 80 kg (Stalcup, 2014). An averaging time of 25,550 days (365 days/year × 70 years) was used to assess cancer risks, and an averaging time of 9,490 days (365 days/year × the exposure duration of 26 years) was used to characterize non-cancer risks.

2.4.2.2 Dermal Contact with Chemicals in Soil/Sediment

$$Intake = \frac{EPC_{soil} \cdot SA \cdot AF \cdot DA \cdot EF \cdot ED \cdot CF}{BW \cdot AT}$$

where:

EPC_{soil} = Exposure point concentration of COC in soil/sediment (mg/kg)
SA = Skin surface area exposed to soil (cm^2/day)
AF = Soil-skin adherence factor (mg/cm^2)
DA = Dermal absorption fraction (unitless)
EF = Exposure frequency (days/year)

ED = Exposure duration (years)
CF = Conversion factor (kg/mg)
BW = Body weight (kg)
AT = Averaging time (days)

Dermal contact with soil/sediment and surface water was assumed to occur over a 6,910 cm^2 area of skin for the adult (Table 2.7). For the adult (male), the surface area is the sum of the 95th percentile for hands, forearms, and feet (US EPA, 2011a). An adherence factor for recreational fishing was not available for adults. A soil/skin adherence factor of 0.2 mg/cm^2 was used, based on the geometric mean for children playing in wet soil, an activity for which exposure was deemed similar to exposure during recreational fishing (US EPA, 2004). This is a conservative estimate, because most commercial and industrial activities performed by adults have adherence factors of 0.2 mg/cm^2 or less (US EPA, 2004).

Absorption of chemicals through skin is frequently less than 100%. Therefore, a dermal absorption fraction represents the amount of a chemical in contact with skin that is absorbed through the skin and into the bloodstream. Chemical-specific dermal absorption fractions for all COCs are summarized in Table 2.8. I used the values recommended by US EPA (2004). For petroleum hydrocarbons, I used a dermal absorption value of 0.1 for the high aromatic fractions, based on the values used in the US EPA RSLs (US EPA, 2015a).

The values used for other parameters are the same as discussed in Section 2.4.2.1.

2.4.2.3 Dermal Contact with Chemicals in Surface Water and Groundwater

$$Intake = \frac{DA_{event} \cdot SA \cdot EV \cdot EF \cdot ED}{BW \cdot AT}$$

where:

DA_{event} = Absorbed dose per event (mg/cm^2-event); includes the surface water/groundwater EPC
SA = Skin surface area exposed to water (cm^2)
EV = Event frequency (event/day)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
BW = Body weight (kg)
AT = Averaging time (days)

Adults who fish at the Site were also assumed to be exposed to surface water for 4 hours/day, as a conservative estimate, given the nature of contacting surface water. Recreators were assumed to spend 2 hours/day using groundwater from permanent or temporary wells at the Site to clean (*e.g.*, their catch, equipment, and/or themselves). The absorbed dose per event (DA_{event}) from surface water and groundwater dermal contact was calculated using the equations detailed in US EPA's "Supplemental Guidance for Dermal Risk Assessment" (US EPA, 2004). For inorganics in water, the DA_{event} was calculated using the dermal permeability coefficient of a compound in water (Kp), accounting for the event duration. For organics in water, US EPA uses a mathematical model to predict absorption from exposures to water. Compounds for which there are sufficient data to predict dermal absorption with acceptable confidence are said to be within the model's "effective predictive domain" (EPD). There is significant uncertainty associated with evaluation of dermal absorption for highly lipophilic chemicals that fall outside the EPD. There is low confidence in the predicted permeability coefficient (Kp) for these

chemicals, and, therefore, US EPA (2004) recommends not including an evaluation of dermal risk for these chemicals in the baseline risk assessment. TPHs fall outside the EPD; therefore, I did not evaluate dermal risks quantitatively for these compounds. Table 2.7 presents the exposure assumptions I used. The DA_{event} for each COC for surface water and groundwater is presented in Appendix Table B.4.

The values used for other parameters are the same as discussed in Section 2.4.2.1.

2.4.2.4 Ingestion of Chemicals in Groundwater

Recreators could potentially ingest groundwater from the J. Guidry well. Intake of chemicals in groundwater *via* ingestion were calculated using the following equation (US EPA, 1989).

$$Intake = \frac{EPC_{gw} \cdot IR_{gw} \cdot EF \cdot ED}{BW \cdot AT}$$

where:

EPC_{gw}	=	Exposure point concentration of COC in groundwater (mg/L)
IR_{gw}	=	Groundwater ingestion rate (L/day)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)
BW	=	Body weight (kg)
AT	=	Averaging time (days)

I assumed the adult recreator is consuming groundwater solely from the Site for the 104 days they are assumed to fish on Site. I conservatively used US EPA's recommended residential groundwater ingestion rate of 2.5 L/day for the adult recreator (US EPA, 2015b). This ingestion rate is based on the 90th percentile of drinking water ingestion for adults (US EPA, 2011a).

The values used for other parameters are the same as discussed in Section 2.4.2.1.

2.4.2.5 Inhalation of Chemicals in Groundwater

Organic compounds can volatilize from groundwater into indoor air from household uses of water (*e.g.*, showering, laundering, washing dishes). For inhalation of volatiles in groundwater, exposure was calculated as:

$$Exposure = \frac{EPC_{air} \cdot EF \cdot ED \cdot ET \cdot CF}{AT}$$

The air concentration is calculated as:

$$EPC_{air} = EPC_{gw} \cdot K$$

where:

EPC_{GW}	=	Exposure point concentration of COC in water (mg/L)
EPC_{air}	=	Exposure point concentration of COC in air (mg/m^3)

K	=	Andelman Volatilization Factor (L/m^3)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)
ET	=	Exposure time (hours/day)
CF	=	Conversion factor (day/hour)
AT	=	Averaging time (days)

The air concentration from COCs volatizing from groundwater was calculated using an Andelman Volatilization Factor (K). Andelman applied a default volatilization factor (K) of 0.5 L/m^3 (0.0005 × 1,000 L/m^3) when defining the relationship between concentrations of volatile organics in household water and the average concentration of volatilized chemical in air (US EPA, 1991b). He accounted for all uses of household water (*e.g.*, showering, laundering, washing dishes). He also made additional assumptions regarding the volume of water used in a day and the air exchange rate in a home (US EPA, 1991b). US EPA (2015b) uses this factor when calculating RSLs, to evaluate inhalation exposures to chemicals that volatilize from tap water.

Adult recreators were assumed to be exposed to groundwater *via* inhalation during the time they were exposed to groundwater *via* dermal contact (2 hours) for 104 days/year, for 26 years.

The values used for other parameters are the same as discussed in Section 2.4.2.1.

2.4.2.6 Ingestion of Chemicals in Fish/Shellfish

$$Intake = \frac{EPC_{crab} \cdot IR \cdot EF \cdot ED \cdot CF}{BW \cdot AT}$$

where:

EPC_{crab}	=	Exposure point concentration of COC in crabs (mg/kg)
IR	=	Fish/Shellfish ingestion rate (mg/day)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)
CF	=	Conversion factor (kg/mg)
BW	=	Body weight (kg)
AT	=	Averaging time (days)

I conservatively assumed that an adult recreator is consuming fish or shellfish solely caught from the Site. To select an ingestion rate applicable to either fish or shellfish from the Site, I considered sources from Louisiana state organizations and US EPA, as discussed below. It should be noted that the implications of consuming all seafood (fish and shellfish combined) is discussed in my interpretation of findings in Section 3.5.1.

LDHH, LDEQ, the Louisiana Department of Agriculture and Forestry, and the Louisiana Department of Wildlife and Fisheries recommend a Louisiana-specific ingestion rate for adults of 30 g/day when issuing public health advisories for chemical contaminants in recreationally caught fish and shellfish (LDHH *et al*., 2012). This value is a species- and area-specific consumption rate and equal to four 8-ounce meals a month year round of a single fish/shellfish species from a site. The advisory-supported consumption rate is based on the protection of the general population, which consumes 30 g/day (of a single species obtained from the same water body) for a period of 30 years (LDHH, 2015). In addition, LDEQ uses the 30 g/day in their "Tissue Screening Level Guidelines" (LDEQ *et al*., 2012).

US EPA recommends a 95th percentile fish ingestion rate of 26 g/day of recreationally caught marine fish for the Gulf coast, which is based on a National Marine Fisheries Service survey of marine recreational fishing (US EPA, 2011a). US EPA does not have a current recommended value for freshwater anglers; however, US EPA recommended a 95th percentile fish ingestion rate of 25 g/day for adult recreational freshwater anglers in 1997 (the mean ingestion rate recommended by US EPA was 8 g/day) (US EPA, 1997). Both of US EPA's recommended fish consumption rates are based on total fish consumption. Louisiana's fish/shellfish ingestion rate is species-specific and more conservative than the US EPA ingestion rates, which are for total fish. In addition, US EPA does not have any recommended consumption values for recreationally caught shellfish. However, recent US EPA data suggest that adults consume more fish than shellfish (US EPA, 2014b). Therefore, these US EPA fish ingestion rates would be a conservative estimate of shellfish ingestion.

Based on Louisiana Guidance (LDHH, 2015; LDEQ *et al*., 2012) and the 95th percentile values reported by US EPA, I used the higher Louisiana-specific ingestion rate of 30 g/day as a reasonable representation for individuals who consume self-caught fish/shellfish. Louisiana's fish/shellfish ingestion rate of 30 g/day is for an adult (body weight = 70 kg). Assuming that ingestion rate is correlated with body weight, I modified the fish/shellfish ingestion rate of 30 g/day to 34 g/day, based on the body weight of the adult recreator (80 kg).

2.4.3 Toxicity Factors

Toxicity factors, which are used to quantify the cancer and/or non-cancer health effects of a constituent, include the oral cancer slope factor (CSF), the inhalation unit risk (IUR), the chronic oral reference dose (RfD), the reference concentration (RfC), the dermal cancer slope factor (CSF_{dermal}), and the dermal reference dose (RfD_{dermal}). The primary source of toxicity values is US EPA's Integrated Risk Information System (IRIS). Toxicity values in IRIS undergo a rigorous peer-review process and are generally considered to be of high quality. Additional toxicity values were obtained from the US EPA RSL Table (US EPA, 2015a), which includes values from US EPA's Provisional Peer-Reviewed Toxicity Values (PPRTVs), the Agency for Toxic Substances and Disease Registry, the California Environmental Protection Agency, and US EPA's Health Effects Assessment Summary Tables.

US EPA's National Center for Environmental Assessment recommended TPH toxicity values (PPRTVs) (US EPA, 2009b) that are based on guidance developed by the Massachusetts Department of Environmental Protection (MADEP, 2003) and the Total Petroleum Hydrocarbon Criteria Working Group (TPHCWG) (Weisman, 1998; Potter and Simons, 1998; Gustafson *et al*., 1997; TPHCWG, 1997; Vorhees *et al*., 1999). Because there are no PAH COCs, I assumed that TPH C10-C16 aliphatics were primarily high-flash, non-aromatic naphtha and not naphthalene and 2-methylnapthalene (US EPA, 2009b).

For TPH-DRO and TPH-ORO, the lowest RfD and RfC within the carbon ranges (C10-C28 representing TPH DRO and C28-C > 35 representing TPH-ORO) were conservatively used, assuming the entire range is made up of the fraction with the most stringent RfD and RfC.

There are no US EPA-derived toxicity criteria based specifically on toxicity studies involving dermal exposures. In the absence of dermal-specific RfDs and CSFs, oral toxicity factors are used, assuming that, once a chemical is absorbed into the bloodstream, the health effects are similar regardless of whether the route of exposure is oral or dermal. However, because oral toxicity criteria are applicable to administered doses (intakes), they need to be adjusted using oral absorption rates in order to be applicable to absorbed doses. According to US EPA guidance (2004), it is only necessary to adjust oral toxicity

criteria for dermal exposures if the gastrointestinal absorption (GI ABS) is less than 50%. Barium, chromium, manganese, and mercury had GI ABS factors of less than 50%, and, therefore, the toxicity values were adjusted accordingly (Oral RfD × GI ABS). Toxicity factors used in this risk evaluation are summarized in Table 2.8.

2.4.4 Crab Data

2.4.4.1 Comparison to Site-Reference and Market Samples

In addition to the crabs collected from the Site for the analysis, crabs were also collected from reference locations not expected to be affected by the Site as well as multiple markets in Louisiana (Baton Rouge, Lake Charles, New Orleans, and Des Allemands), Mississippi (Biloxi), and Texas (Houston) (ERM, 2014). These reference and market samples were also divided into the various crab body parts and analyzed for the same constituents. I compared the edible tissue concentrations (tissue-weighted meat and hepatopancreas) of the crab COCs (inorganic arsenic, methyl mercury, mercury, and TPH), between the three locations (Site, Site-reference, and market) using the Wilcoxon-Mann-Whitney test, which compares the mean, median, and spread of the datasets. Overall, the COC concentrations in crabs at the Site were comparable from all three sources with the exception of mercury and methyl mercury (Table 2.9). Mercury and methyl mercury Site concentrations were higher than the concentrations found in the market samples, but were comparable to Site RfCs. This comparison indicates that there was no impact of Site exposures on inorganic arsenic, methyl mercury, mercury, and TPH concentrations in crab.

2.4.4.2 TPH Data in Crabs

Although TPH in crabs were analyzed for various carbon fraction ranges between C8-C40, I focused on TPH concentrations between C8-C28. This is because compounds with less than 8 carbons (<C8) are likely to volatilize readily, and compounds with more than 28 carbons are likely attributable to lipids and not to Site-related sources (ERM, 2014; QAA, 2014).[18] There is no toxicity criterion specifically assigned to C8-C28, so I used the criteria from two ranges: TPH C8-C16 and TPH C16-C28. However, the toxicity criteria in these ranges differ depending on whether the TPHs are aliphatic or aromatic. In the absence of aliphatic/aromatic data for the crabs, I reviewed the composition of TPHs in the sediment in which crabs are potentially exposed to TPH from the Site. In sediment locations where both TPH fractionated data and TPH range data are presented, the average distribution is 90% aliphatics and 10% aromatics, based on detected values and 60% aliphatics and 40% aromatics, when considering the non-detected concentrations. Because aromatics are typically more toxic than aliphatic TPHs, I conservatively assumed that the detected C8-C16 and C16-C28 TPH concentrations in crab were 50% aliphatic and 50% aromatic.

2.4.4.3 Form of Arsenic

Fish and shellfish can naturally contain elevated concentrations of arsenic, mostly in the organic form – arsenobetaine (ATSDR, 2007a; EFSA, 2009). The relative toxicity of arsenic is dependent on its form (inorganic *versus* organic arsenic). In general, inorganic arsenic is more toxic than the forms of organic arsenic typically found in the environment (see, for example, Cohen *et al*., 2013). The crab samples collected by MPA were analyzed for both total and inorganic arsenic. Due to the higher toxicity of

[18] Moreover, lipids could also contribute to some of the total petroleum hydrocarbon (TPH) detected in the C8-C28 range (ERM, 2014).

inorganic arsenic, I relied on the measured inorganic arsenic concentrations to appropriately represent arsenic exposure *via* ingestion of crabs.

In the absence of a comprehensive assessment of inorganic arsenic in fish (by species, region, or other factors), agencies have used generic factors (ranging from 3-30% or higher) to account for inorganic arsenic fractions in seafood (NRC, 1999; ATSDR, 2007a). As noted above, the crabs collected by MPA were analyzed for both total and inorganic arsenic. The percentage of inorganic arsenic in the edible tissue ranged from 1-7%, comparable to the 0.1-3.5% inorganic arsenic found in fresh and frozen fish (Sirot *et al*., 2009) and the 10% inorganic arsenic found in freshwater fish (Schoof and Yager, 2007; ATSDR, 2007a).

3 Results of Risk Analysis

3.1 Risk Calculation Equations

Carcinogenic risk represents the upper bound incremental probability that an individual will develop cancer during his or her lifetime due to chemical exposure. The term "incremental" implies that this risk corresponds to the added probability of cancer above the background cancer risk experienced by all individuals in the course of daily life. Cancer risks are expressed as a unitless probability (*e.g.*, 1 in 1 million, or 1×10^{-6}) of an individual developing cancer over a lifetime, above the background risk, as a result of the exposure.[19]

For ingestion and dermal exposure pathways, cancer risk is calculated by multiplying the lifetime average daily dose by the oral CSF, as follows (US EPA, 1989):

$$CancerRisk = Intake\left(\frac{mg}{kg-day}\right) \cdot CSF\left(\frac{mg}{kg-day}\right)^{-1}$$

For the inhalation pathway, the cancer risk was calculated as the inhalation exposure concentration (in $\mu g/m^3$) multiplied by the IUR:

$$CancerRisk = Exposure\left(\frac{\mu g}{m^3}\right) \cdot IUR\left(\frac{\mu g}{m^3}\right)^{-1}$$

I used the above equations to calculate cancer risk for the adult recreator by pathway and COC. I then summed the COC-specific risks associated with the pathway for the adult recreator and, in turn, summed these pathway-specific risks to estimate the excess lifetime cancer risk (ELCR) for the receptor. Pursuant to US EPA guidance (US EPA, 1989), the total cancer risks were rounded to one significant digit for presentation.[20]

Risks from non-carcinogenic effects are expressed as HQs rather than probabilities. An HQ compares the calculated intakes and exposures (average daily doses or exposures) to RfDs or RfCs derived by US EPA. For soil/sediment ingestion, oral intake estimates (expressed as applied or administered doses) were divided by the oral RfD (applicable to applied or administered doses). For dermal exposures to soil/sediment, dermal intake estimates (expressed as an absorbed dose) were divided by an adjusted oral RfD (adjusted to apply to absorbed doses) (US EPA, 2004). For ingestion pathways and dermal exposure, I calculated HQs using the following equation, as shown in US EPA (1989):

[19] It should be emphasized that these risk calculations are hypothetical and are typically based on a number of assumptions, such as low dose linearity and that animal carcinogens are likely to be human carcinogens. The use of such assumptions means that the resulting calculations should be considered upper bound hypothetical values and not precise estimates of risk.

[20] The use of one significant digit in reporting risk results was presented in US EPA (1989), page 8-8, for non-cancer hazard, and page 8-12, for cancer risk.

$$HQ = \frac{Intake\left(\frac{mg}{kg-day}\right)}{RfD\left(\frac{mg}{kg-day}\right)}$$

For the inhalation pathway, the HQ was calculated as the inhalation exposure concentration (in mg/m^3) divided by the inhalation RfC:

$$HQ = \frac{Exposure\left(\frac{mg}{m^3}\right)}{RfC\left(\frac{mg}{m^3}\right)}$$

The equations described above were used to calculate the HQ for each chemical by exposure pathway. The sum of these HQs for each pathway derived the pathway-specific hazard index (HI) for the adult recreator. A total HI for a receptor was determined by summing the HIs for the complete exposure pathways evaluated for each receptor. Summing HQs or HIs for different COCs represents a conservative approach that may overestimate actual Site risks, because the RfD or RfC for a COC is calculated based on a specific toxicological endpoint (*e.g.*, liver or kidney effects). As per US EPA guidance, HIs were rounded to one significant digit, and HIs for the individual exposure pathways were rounded to two significant digits (US EPA, 1989).

A total HI $\leq$ 1 suggests that exposures are likely to be without an appreciable risk of non-cancer effects during a lifetime. An HI greater than 1 indicates only that a potential may exist for adverse health effects (US EPA, 1989, 2011b, 2015b). Thus target organ specific hazard indices (TOSHIs) for each exposure pathway provide a more accurate, but still conservative, estimate of potential non-cancer health risks. Like an HI, a TOSHI $\leq$ 1 indicates that exposures are likely to be without appreciable risk of non-cancer adverse effects during a lifetime. Although a total HI might indicate that exposures exceed the risk threshold, a TOSHI of 1 or less indicates no concern for adverse risks to the target organ (US EPA, 2011b). Therefore, I calculated and presented TOSHIs for each exposure pathway and across exposure pathways.

3.2 Risk Results

Table 3.1 presents estimated cancer and non-cancer risks, and Appendix B presents detailed risk calculations. The total risk for the adult recreator is the sum of the risks over all COCs and pathways at the Site (incidental ingestion of soil/sediment, dermal contact with soil/sediment, dermal contact with surface water, dermal contact with groundwater, ingestion and inhalation of groundwater, and ingestion of fish/shellfish).

The total hypothetical ELCR for the adult exposed to soil/sediment, surface water, groundwater, and fish/shellfish from the Site is 7×10^{-6}, which is well within US EPA's cumulative target cancer risk of 10^{-4} to 10^{-6}. Arsenic and benzene were the only carcinogenic COCs identified at the Site. Inhalation of volatiles in groundwater contributed 14% of the total cancer risks, with benzene contributing all of that risk. Benzene and arsenic contributed 59% and 41%, respectively, of the cancer risk from dermal contact with groundwater. Arsenic was the sole cancer risk contributor for all of the other exposure pathways. Moreover, 47% of the total cancer risk was from inorganic arsenic in crabs, which is not Site-related,

given that the Site, Site reference, and market samples of crab had comparable arsenic concentrations (Table 2.9).

When I summed the HIs for all COCs with different target organs and all pathways, which is a conservative approach that may overestimate Site risks, I calculated a total HI of 2. Therefore, pursuant to US EPA Guidance (US EPA, 1989, 2000), I refined non-cancer risks by calculating target organ-specific risks. TOSHIs are the most scientifically appropriate way for characterizing non-cancer risk eliminating some of the uncertainties associated with summing all COCs with different target organs. Based on target organ-specific risks and using the TPH fraction data, the highest total potential non-cancer TOSHI is 0.8 (for the liver), below US EPA's target HI of 1. All other TOSHIs for the adult recreator are less than 0.8. Ingestion of fish/shellfish using measured crab data contributes 95% of the liver HI and 73% of the total HI, 45% of which is from TPH (C8-C16). TPH (C8-C16) is not Site-related, given that TPH (C8-C16) concentrations in Site crab are comparable to concentrations found in reference and market crab samples (see Table 2.9). Excluding the non-Site-related TPH in crab at the Site would reduce the total HI to 1 and all TOSHIs would still be less than 1.

I separately calculated cancer risk and a non-cancer HI using the TPH range data (TPH-DRO) instead of the TPH fraction data (when available), to include more data in my analysis. The cancer risk was exactly the same – 7×10^{-6} – which is well within US EPA's cumulative target cancer risk of 10^{-4} to 10^{-6}, and the TOSHIs for non-cancer effects were at or below 1, which meets US EPA's target HI. These hypothetical risks are overestimates, because I assumed that the TPH ranges in soil/sediment consisted entirely of the most potent fraction, which was not the case when my calculations are based on the measured fractionated data.

Because risks to the adult recreator who ingests fish/shellfish do not exceed permissible limits, it is expected that risks to the hunter would also be acceptable. I did not quantify risks from recreational hunting and game consumption, because such risks are likely to be lower than the risks from fish/shellfish consumption. There are several reasons for this, including the likely lower exposure frequency for recreational hunting and the lower game consumption rate as compared to fish/shellfish consumption. In addition, because the chosen fish/shellfish species (blue crab) live in close contact with sediment, these organisms would have greater exposure to constituents in the Site sediment than would hunted organisms (*e.g.*, nutria), providing further evidence of potentially greater risk from the fishing pathway than the hunting pathway.

3.3 Comparison with Analysis Under RECAP

LDEQ has its own screening values under RECAP. RECAP consists of a tiered framework composed of a Screening Option and three Management Options (MOs). As the MO tier increases, the approach becomes more site-specific, and, hence, the level of effort required to meet the objectives of the MO increases. Although the level of effort required for each MO varies, each achieves a common goal: the protection of human health and the environment. The tiers are equally protective, and allow for the development of site-specific numerical standards, when appropriate (LDEQ, 2003).

In accordance with Louisiana's Environmental Quality Act, risk to human health and the environment must be evaluated in the remedial decision-making process. Risk evaluation is therefore used to 1) determine whether corrective action is necessary for the protection of human health and the environment, and 2) identify constituent levels in environmental media that do not pose unacceptable risks to human health or the environment.

Two objectives of both the US EPA and LDEQ risk assessment methods are to ensure that health-protective concentration levels and remediation standards are developed consistently and to ensure that risk to human health and the environment is the primary consideration when remedial decisions are made.

My results and conclusions are consistent with those of Ms. Angela Levert, who performed a human health evaluation in accordance with RECAP. Ms. Levert concluded that the concentrations reported in Site sediment, surface water, ground water, and crab do not pose a health risk based on RME factors.

3.4 Additional Discussion of Arsenic and Barium

3.4.1 Arsenic

Arsenic cancer risks in the assessment were conservatively estimated, in that they were quantified using US EPA's default CSF, which assumes a linear, no-threshold dose-response relationship, the most conservative dose-response model used by US EPA. For arsenic, US EPA's linear slope factor predicts risks from US background arsenic exposures that, in some cases, exceed regulatory levels of concern. Substantial evidence of a sublinear or threshold dose-response relationship for the carcinogenicity of ingested arsenic has been provided by epidemiological and mechanistic studies (Petito Boyce *et al*., 2008; Schoen *et al*., 2004; Suzuki *et al*., 2010; Cohen *et al*., 2013). The implication of this finding is that more arsenic would be required before potential health effects are seen and that arsenic is less toxic than currently quantified using US EPA's CSF.

The total cancer risk for arsenic in the assessment is 5×10^{-6}, which is about 78% of estimated total Site cancer risk. Nonetheless, this cancer risk is well below the risk that would be expected from background exposures to arsenic, which occurs naturally in food, water, and soil. More specifically, Petito Boyce *et al*. (2008) estimated that a typical person in the US is exposed to inorganic arsenic at a dose of 7.1×10^{-5} mg/kg-d. This exposure results in a background cancer risk of 1×10^{-4}, a value over 20 times higher than the arsenic risks calculated for people fishing at the Site.

3.4.2 Barium

Different barium compounds are known to exhibit very different toxicities related to the presence of the free barium ion (US EPA, 2005a; ATSDR, 2007b). Soluble barium compounds dissociate in water, releasing barium ions and corresponding anions. Barite (barium sulfate) is used as a major component of oilfield drilling muds (Alberta Environment, 2009), and, therefore, if barium is present at the Site due to seepage from oil and gas operations, it is reasonable to assume that barium sulfate is the form of barium present at the Site. Barium sulfate is extremely insoluble and very little, if any, ingested barium sulfate is absorbed. It is, therefore, an inefficient source of the barium ion (ATSDR, 2007b). As a result, the soluble barium compounds are recognized to have a much higher toxicity than barium sulfate (US EPA, 2005a). The insoluble, non-toxic nature of barium sulfate has made it practical and safe to use in medical applications, such as its use a contrast medium for X-ray examination of the gastrointestinal tract (ATSDR, 2007b). As noted by LDEQ, the soil SS for barium is based on the assumption that barium is present at the Site in a mobile, ionic form. But "if barium is present at a site in a less mobile, inert, form such as barium sulfate, the SS would not be appropriate for screening the site" (LDEQ, 2003). According to LDHH (2015), barium is usually present in water systems as barium sulfate, an insoluble, relatively non-toxic form. It should be emphasized that my analysis assumes that the form of barium was the more soluble form and, hence, my analysis of any potential risks presented by barium at the Site is conservative.

3.5 Discussion

3.5.1 Interpretation of Findings

The results of this analysis indicate that cancer and non-cancer risks at the Site do not exceed permissible limits. This analysis also demonstrates that neither the presence of TPH nor arsenic in crabs at the Site is Site-related, given that the concentrations of these constituents are not statistically different in Site, Site-reference, and market crab samples.

When interpreting these results, it must be recognized that the findings are based on assumptions that overestimate exposure and risk and are, thus, conservative. As an example, I used a mean soil ingestion rate of 50 mg/day for an adult recreator, as recommended by US EPA (1997). This ingestion rate assumes that all of the soil ingested by an adult for the entire day comes from the Site, which is very unlikely. In addition, two pilot studies reported average adult soil ingestion rates of 10 or 40 mg/day (Stanek *et al*., 1997; Calabrese *et al*., 1990). A recent publication by Wilson *et al*. (2013), who calculated soil transfer rates based on hand-to-mouth transfer, indicated even lower ingestion rates of soil for adults of 1.6 ± 2.9 mg/day, with a 95th percentile estimate of 5.9 mg/day. Applying a soil ingestion rate for sediment ingestion is also conservative. Most of the sediment samples are subaqueous, limiting exposure, because the sediment would likely wash off in the surface water.

In addition, I used conservative toxicity reference values. US EPA's PPRTV (2009b) recommends a screening level RfD of 1×10^{-2} mg/kg-day for medium carbon range aliphatics (C10-C16), based on Anonymous (1990, 1991a,b, as cited in US EPA, 2009b). This RfD is based on a no observed adverse effect level (NOAEL) of 100 mg/kg-day, with the application of a composite uncertainty factor of 10,000 (10 for sensitive individuals, 10 for animal-to-human extrapolation, 10 for database inadequacies, and 10 for subchronic-to-chronic adjustment) (US EPA, 2009e). The PPRTV uncertainty factor of 10,000 is inconsistent with US EPA's guidance, which recommends a maximum uncertainty factor of 3,000 for four factors (US EPA, 2002a). In contrast, MADEP (2003) uses the same study as the basis of their RfD, but applies an uncertainty factor of 1,000, excluding the uncertainty factor of 10 for database inadequacies to yield a less stringent, but still health-protective RfD. Medium aliphatics are a major risk contributor for the soil/sediment and crab ingestion pathways. Use of the very conservative US EPA PPRTV RfD overestimates the overall risk. The maximum TOSHI would be reduced from 0.8 to 0.4 for liver if the MADEP RfD of 0.1 mg/kg-d (MADEP, 2003) was applied to the medium carbon range aliphatics.

I also researched other ingestion rates reported for seafood in the Louisiana Gulf Coast area. Lincoln *et al*. (2011) surveyed recreational anglers in coastal Louisiana to determine whether they had high mercury exposure. They surveyed 534 anglers by interviewing them at boat launches and fishing tournaments, combined with an Internet-based survey method. Lincoln *et al*. (2011) found that approximately 64% of participants' fish-based meals came from recreationally caught seafood. In addition, they identified a combined fish and shellfish ingestion rate of 55 g/day as the high-end value. I calculated the 55 g/day as a 98th percentile value.[21] It was not possible to calculate the more typical 95th percentile using the available data. Applying the 64% of fish and shellfish eaten to the 98th percentile amount of fish and

[21] 55 g/day was the 98th percentile developed by Gradient from data in Table 1 and associated text of Lincoln *et al.* (2011). Ingesting fish three times/week was equivalent to eating 55 g/day: 129 g/meal × 3 meals/week / 7 days/week =55 g/day. The 98th percentile was derived as follows: Sum of 3 times/week (n = 158 surveyed participants that provided a hair sample) + 1 time/week (n = 211) + less than or equal 1 time/month (n = 23) = 392. 392/398 (total number of people in the survey) = 0.98. 64% of all finfish and shellfish ingested was from recreational sources, in Lincoln *et al.* (2011, p 248). 64% × 55 g/day = 35 g/day.

shellfish eaten of 55 g/day results in a daily ingestion rate of 35 g of finfish and shellfish. This ingestion rate is very close to the one I used, 34 g/day.

US EPA estimated fish ingestion based on 2003-2010 data collected by the National Health and Nutrition Examination Survey (NHANES) and reported that the 95th percentile amount of finfish and shellfish ingested in the coastal/inland region near the Gulf of Mexico was 70.6 g/day (US EPA, 2014b). Assuming that 64% of all finfish and shellfish ingested was from recreational sources, as reported by Lincoln *et al*. (2011), results in an ingestion rate of 45 g/day. I adjusted this ingestion rate to 52 g/day assuming the fish/shellfish ingestion rate is correlated with body weight (45 g/day x 80 kg ÷ 70 kg). Using the higher ingestion rate of 52 g/day would not change my overall conclusions for the Site. The higher ingestion rate would result in a cancer risk of 8×10^{-6} and a maximum TOSHI of 1 for the liver, thus meeting US EPA's target cancer risk and HI (see Appendix C for calculations).

3.5.2 Comparison of Risk Assessment Results with Louisiana Department of Health and Hospitals' East White Lake Report

The results of my risk assessment and the conclusions I have drawn are consistent with those reached by the LDHH in their report titled "East White Lake Oil and Gas Field Seafood Sampling Evaluation Vermilion Parish, Louisiana," finalized on March 13, 2015 (LDHH, 2015).

In December 2014, the Louisiana Department of Natural Resources (LDNR) requested that LDHH conduct a review of the Environmental Resources Management, Inc. (ERM) crab data collected from the EWL areas of interest (the data I used in my analysis). In addition to reviewing the December 2010/January 2011 ERM data, LDHH also reviewed the October 2010 OES (these crab data were collected by Dr. Rogers, as discussed in Section 2.2.2) and the November 2010 LDHH crab datasets, to provide a comprehensive review of all available Site crab sample results.

LDHH's findings and conclusions are summarized below.

- OES sampling methodology, laboratory analysis, and data evaluation approaches were "not consistent with the advisory development process as detailed in the *Protocol for Issuing Public Health Advisories for Chemical Contaminants in Recreationally Caught Fish and Shellfish*. October 2010 OES data are inadequate to support a consumption advisory for the East White Lake sampling areas" (LDHH, 2015).
- LDHH collected crab tissue data in November 2010 to further characterize edible crab portions from the OES-sampled areas of interest. Sampling, which was conducted in accordance with the Louisiana advisory protocol, found that mean arsenic and barium tissue concentrations were below their respective TSLs. LDHH noted that speciation methodology was not available at the time of laboratory analyses to quantify organic arsenic content. LDHH concluded that "data do not support the need for a consumption advisory due to barium and arsenic concentrations in crab tissue" (LDHH, 2015).
- In December 2010/January 2011, ERM collected crab tissue samples, which were analyzed in accordance with the Louisiana advisory protocol. Mean inorganic arsenic, methyl mercury, barium, and TPH concentrations detected in Site, reference, and commercial market crab tissue and hepatopancreas samples were either non-detect or below default and consultant-derived TSLs. LDHH concluded that the "Reported constituent concentrations detected in crabs from the East White Lake areas of interest are below levels of health concern; no potential human health hazards were identified" (LDHH, 2015).

3.5.3 Comparison of Mercury Data for the Study Area with Mercury Data for East White Lake Fish Collected by LDEQ

As part of its mercury initiative, LDEQ conducted studies of mercury concentrations in Louisiana fish from various waterbodies in the State, including fish from nine locations near the EWL study area, in 1998, 2003, 2004, and 2008 (LDEQ, 2015b). During this period, total mercury concentrations in the fish sampled near the EWL study area ranged from 0.0001 mg/kg to a maximum concentration of 0.73 mg/kg, with an average (mean) concentration of 0.23 mg/kg. LDHH makes health advisory decisions based on a review of the full dataset from the specific area (*e.g.*, fish tissue concentrations and size of fish) and the average (mean) concentrations in fish or shellfish (LDHH *et al*., 2012). Under the mercury initiative in Louisiana, the LDHH/LDEQ action levels are 0.5 mg/kg (LDEQ, 2007) and the calculated TSL of 0.7 mg/kg using LDEQ TSL guidance (LDEQ *et al*., 2012; ERM, 2014). The mean concentration of mercury in the LDEQ sampling near the EWL study area is below the LDHH/LDEQ action level. Louisiana has not issued a fish advisory for this area for any compound, including mercury.

3.5.4 Margin of Exposure Evaluation

Table 3.2 lists the margins of exposure (MOEs) for the Site, which are based on comparisons of the estimated daily intake of COCs to the point of departure (POD) identified by US EPA. The POD is the dose used by US EPA as the basis of their toxicity criterion for each COC. As shown in Table 3.2 the basis for a POD can be a NOAEL, a benchmark dose (identified by modeling dose-response data), or a lowest observed adverse effect level or concentration (LOAEL or LOAEC). The MOE is calculated by creating a ratio in which the POD is in the numerator and the daily intake is in the denominator. I calculated MOEs to demonstrate the health protectiveness of the toxicity criteria and the overall conservative nature of my analysis. The MOEs for the Site ranged from 81 for methyl mercury in crab to 1,700,000 for total mercury in soil. The MOEs for TPH in Site crab, calculated using both TPH aliphatic C8-C16 and aromatic C8-C16, range from 25,000-130,000. For arsenic at the Site, the MOE is 480 for non-cancer effects and 13,000 for cancer; and for benzene at the Site, the MOE is 15,000. Thus, Site exposures are well below exposures at which health effects have been observed in humans or in animals.

3.5.5 TPH-Ranges *versus* TPH Fractionated Data

Soil/sediment and groundwater samples were analyzed for both TPH fractions and ranges. For groundwater, several ICON split samples were analyzed for TPH range data, and MPA splits were analyzed for TPH fractionated data. In cases in which both ICON and MPA samples were analyzed for TPH ranges (MW1, MW2 and MW3), the results were consistent (Appendix Table A.1). In addition, TPH fraction data were analyzed from samples collected from all locations where TPH range data were detected, with the exception of the 2006 samples collected from the peat zone. MPA split samples were not collected during the 2006 sampling of the peat zone groundwater. Since risks were not quantitatively evaluated for the peat zone, the fractionated data adequately represent the Site.

For soil/sediment, fractionated data were collected at 28 Site locations, and range data were collected at 80 Site locations (Table 2.2 and Appendix Table A.2). Although more range data were collected at the Site, the fractionated data and range data were highly correlated. For example, in comparison to TPH-DRO (C8-C28), the aliphatic fraction data for C10-C12, C12-C16, and C16-C35 were highly correlated (R^2 = 0.9473-0.9858) (see Figure 3.1). For the same TPH-DRO fraction as compared with the aromatic fraction data (the same carbon ranges as for the aliphatic fraction data plus one additional range of C21-C35), the data are once again highly correlated (all $R^2 \geq 0.9157$) (see Figure 3.2). Similarly, the

concentrations for the range data for TPH-ORO (>C28) were highly correlated with both aliphatic (>C16-C35) and aromatic (>C21-C35) fraction data (R^2 = 0.9341 and 0.989, respectively) (see Figure 3.3). Thus, even though there are TPH fraction data from fewer sites than TPH range data, this analysis indicates that the available TPH fraction data at the selected Site sampling locations would be an appropriate and even conservative representation of TPH fraction data at all of the Site sampling locations.

3.5.6 Additional Receptors Considered

Additional receptors could potentially be present at the Site. Adolescent recreators could also be exposed to soil/sediment, surface water, groundwater, and fish/shellfish at the Site. In addition, workers could be exposed to soil/sediment, surface water, and groundwater at and near the Peak Facility. Although these additional receptors are not anticipated to be present on-Site as frequently as the adult recreator, I evaluated risks to these receptors as part of a sensitivity analysis.

Similar to an adult recreator, an adolescent recreator (11-16 years old) was assumed to be on the Site with the adult recreator (104 days/year, for 5 years). I assumed that the adolescent recreator was exposed to the same media and exposure pathways as the adult recreator (incidental ingestion and dermal contact of soil/sediment, dermal contact of surface water and groundwater, ingestion of groundwater from the J. Guidry well, inhalation of groundwater, and ingestion of fish/shellfish). I applied the same soil/sediment ingestion rate and soil adherence factor as the adult recreator (50 mg/day and 0.2 mg/cm^2, respectively), the 95th percentile surface area for 11- to 16-year-olds (5,240 cm^2 for arms, hands, and feet), the 95th consumer-only drinking water rate for 11- to 16-year-olds, and an age-weighted mean adolescent body weight of 57 kg. The basis of the fish/shellfish ingestion rate of 30 g/day is for an adult (body weight = 70 kg). Assuming that the fish/shellfish ingestion rate is correlated with body weight, I modified the fish ingestion rate from 30 g/day to 24 g/day for the adolescent, based on body weight. I calculated a cancer risk of 1×10^{-6} and a maximum TOSHI of 0.8 for liver for the adolescent recreator exposed to soil/sediment, surface water, groundwater, and crabs at the Site, which is within US EPA's target cancer risk and below the target HI (see Appendix C).

Workers at the Site could be exposed to media at the Peak Facility (soil/sediment *via* ingestion and dermal contact, surface water *via* dermal contact, and groundwater *via* dermal contact and inhalation). I used US EPA default assumptions (Stalcup, 2014), assuming exposure to all media 250 days/year, for 25 years. I calculated a cancer risk of 5×10^{-6} and maximum TOSHIs of 0.1 for the liver and 0.1 for the central nervous system, within US EPA's target cancer risk and below the target HI (see Appendix C). Even if the worker were to consume fish/shellfish at the recreational rate, the risks would still be within or below acceptable limits (the maximum TOSHI for the liver would be 0.9 and the cancer risk would be 8×10^{-6}).

3.6 Conclusion

I calculated risks for an adult recreator who fishes on the Site and is exposed to soil/sediment, surface water, groundwater, and fish/shellfish *via* ingestion, dermal contact, and/or inhalation. The results of the risk assessment I conducted using US EPA methodology, coupled with Site-specific fish/shellfish ingestion rates, show that both cancer and non-cancer risks at the Site do not exceed permissible limits, as defined by LDEQ and US EPA, for an adult recreator.

For the adult recreator, the cancer risk was within US EPA and LDEQ's target cancer risk range and the non-cancer TOSHIs were all below the target HI of 1. Ingestion of fish/shellfish using concentrations measured in crab contributed the majority of the risk and hazards. Excluding COCs in measured crab that are not Site-related would further lower the cancer risk and non-cancer hazards.

I also evaluated risks to additional receptors (adolescent recreator and Site worker) as part of my sensitivity analysis. Risks for both receptors were within US EPA and LDEQ's target cancer risk and below the target HI. As part of my analysis, I also considered the conservativeness of my risk assessment. I evaluated risks using alternate assumptions (*e.g.*, TPH range data, fish/shellfish ingestion rate, toxicity reference value) and conducted an MOE analysis to evaluate the conservativeness of my risk assessment. Based on all my analyses, Site risks are within US EPA acceptable risk limits and pose no harm to human health.

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Tables

Table 2.1 Fish RSLs

Chemical Group	Chemical	Reference Dose (RfD) (mg/kg-d)	Cancer Slope Factor (CSF) $(mg/kg\text{-}d)^{-1}$	Screening Level: Non-cancer (SL_{nc}) (mg/kg)	Screening Level: Cancer (SL_c) (mg/kg)	Screening Level (mg/kg)
Metals	Inorganic Arsenic	0.0003	1.5	0.041	0.0024	0.0024
Metals	Methyl Mercury	0.0001	NA	0.014	NA	0.014
Metals	Arsenic	0.0003	1.5	0.041	0.0024	0.0024
Metals	Barium	0.2	NA	27	NA	27
Metals	Mercury	0.0003	NA	0.041	NA	0.041
TPH	TPH-DRO (C8-C28)	0.004	NA	0.54	NA	0.54
TPH	TPH (C08-C16)	0.004	NA	0.54	NA	0.54
TPH	TPH (C16-C28)	0.04	NA	5.4	NA	5.4
TPH	TPH (C08-C40)	0.004	NA	0.54	NA	0.54

Notes:
DRO = Diesel-Range Organic; NA = Not Applicable; RSL = Regional Screening Level; TPH = Total Petroleum Hydrocarbon.
Screening Level (SL) is the more stringent of the screening levels calculated for cancer and non-cancer endpoints.

Target Hazard Quotient	THQ	0.1
Target Cancer Risk	TR	1E-06
Averaging Time - Non-cancer (d/y)	AT_{nc}	9,490
Averaging Time - Cancer (d/y)	AT_c	25,550
Exposure Duration (y)	ED	26
Body Weight (kg)	BW	80
Exposure Frequency (d/y)	EF	350
Fish Ingestion Rate (mg/d)	IRF_a	61,714
Conversion Factor (kg/mg)	CF	1E-06

$$SL_{nc} = \frac{THQ \cdot AT_{nc} \cdot BW}{EF \cdot ED \cdot \frac{1}{RfD} \cdot IRF_a \cdot CF}$$

$$SL_c = \frac{TR \cdot AT_c \cdot BW}{EF \cdot ED \cdot CSF \cdot IRF_a \cdot CF}$$

Table 2.2 Screening Assessment Under US EPA's Methodology – Soil/Sediment (0-3 ft bgs)

Chemical Group	Parameter	Number Detected	Number Sampled	Minimum Detected[1]	Mean[2]	95% UCLM[3]	Maximum Detected[1]	Unit	US EPA Regional Screening Levels[4]	# Samples > US EPA RSL[5]	COC?[6]
									Residential	Residential	
Metals	Arsenic	70	70	0.9	6.0	6.5	40	mg/kg	0.68	70	**Yes**
Metals	Barium	66	66	76	1316	2423	15700	mg/kg	1500	11	**Yes**
Metals	Cadmium	23	39	0.026	0.57	0.67	3.5	mg/kg	7.1	0	No
Metals	Chromium	42	42	2.1	14	15	36	mg/kg	12000	0	No
Metals	Lead	45	45	4.7	29	47	150	mg/kg	400	0	No
Metals	Mercury	56	60	0.021	0.53	1.02	27	mg/kg	2.3	4	**Yes**
Metals	Selenium	20	58	0.59	2.8	2.0	4.7	mg/kg	39	0	No
Metals	Strontium	36	36	15	119	199	461	mg/kg	4700	0	No
Metals	TT Barium	24	24	106	1093	1310	9351	mg/kg	NC	0	No-7
Metals	Zinc	27	27	17	148	490	2185	mg/kg	2300	0	No
TPH	Aliphatic >C10-C12	7	28	15	77	123	699	mg/kg	9.6	7	**Yes**
TPH	Aliphatic >C12-C16	18	28	24	365	1024	3950	mg/kg	9.6	18	**Yes**
TPH	Aliphatic >C16-C35	18	28	82	1640	4309	12570	mg/kg	23000	0	No
TPH	Aromatic >C10-C12	3	28	15	30	26	480	mg/kg	11	3	**Yes**
TPH	Aromatic >C12-C16	7	28	20	97	165	2659	mg/kg	11	7	**Yes**
TPH	Aromatic >C16-C21	9	28	46	196	367	3227	mg/kg	250	5	**Yes**
TPH	Aromatic >C21-C35	9	28	27	299	574	3091	mg/kg	250	6	**Yes**
TPH	TPH-DRO	66	80	25	1937	6263	41111	mg/kg	9.6	66	**Yes-8**
TPH	TPH-ORO	49	80	13	1055	2449	22116	mg/kg	250	36	**Yes-8**

Notes:

DRO = Diesel-Range Organic; ft bgs = Feet Below Ground Surface; NC = No Criterion Available; RSL = Regional Screening Level; TPH = Total Petroleum Hydrocarbon; ORO = Oil-Range Organic.
Blank = Not Analyzed.

All post-remediation soil and sediment samples collected from 0-3 ft bgs are evaluated.

Concentrations expressed in wet weight were converted to dry weight using the moisture content of the sample.
Evaluated parameters were detected in at least one sample.

Split samples analyzed by two different laboratories were averaged, and samples collected at multiple depths were averaged, resulting in one result per station to avoid biasing the data.
See text.

(1) When determining the maximum and minimum detected concentration, all samples (did not average splits, duplicates, or depths) were included to reflect minimum and maximum detected concentrations.

(2) The full detection limit was used to calculate the mean. This is a very conservative approach. See text.

(3) 95% UCLM = 95% Upper Confidence Limit of the Mean, calculated using the average of splits and samples collected at multiple depths (each station had one result) to eliminate biasing.

(4) US EPA RSLs (US EPA, 2015a) based on a Target Hazard Index (HI) of 0.1 and a Target Cancer Risk of 1×10^{-6}.

(5) Number of samples that exceed respective criterion.

(6) Maximum detected concentrations from background samples presented (AB1-AB4; SED-BK-01 to SED-BK-11).

(6) COC = Constituent of Concern, based on maximum concentration.

(7) Evaluated under barium in the absence of health based screening number for true total barium (TT barium).

(8) Evaluated in my primary analysis as fractionated data (aliphatics and aromatics). Range data are evaluated in my risk assessment as a separate analysis.

Table 2.3 Screening Assessment Under US EPA's Methodology – Groundwater

Aquifer	Chemical Group	Parameter	Number Detected	Number Sampled	Minimum Detected[1]	Mean[2]	Maximum Detected[1]	Unit	US EPA Regional Screening Levels[4]		# Samples > US EPA Benchmarks[4]		COC?[5]
									MCL	Tap Water	MCL	Tap Water	
Chicot	Metals	Arsenic	1	3	0.011	0.010	0.011	mg/L	0.01	0.000052	1	1	**Yes**
Chicot	Metals	Barium	4	4	0.26	0.30	0.78	mg/L	2	0.38	0	2	**Yes**
Chicot	Metals	Calcium	3	3	50	40	73	mg/L	NC	NC	0	0	No-6
Chicot	Metals	Iron	3	3	0.75	0.62	1.1	mg/L	NC	1.4	0	0	No
Chicot	Metals	Magnesium	3	3	18	14	24	mg/L	NC	NC	0	0	No-6
Chicot	Metals	Manganese	3	3	0.068	0.055	0.082	mg/L	NC	0.043	0	0	No
Chicot	Metals	Potassium	3	3	2.5	1.8	2.7	mg/L	NC	NC	0	0	No-6
Chicot	Metals	Strontium	4	4	0.46	0.38	0.57	mg/L	NC	1.2	0	0	No
Chicot	Metals	Zinc	3	3	0.022	0.10	0.32	mg/L	NC	0.6	0	0	No
Chicot	TPH	TPH-DRO	1	3	0.84	0.37	0.84	mg/L	NC	0.00055	0	1	**Yes-7**
Chicot	TPH	TPH-ORO	1	3	0.45	0.23	0.45	mg/L	NC	0.08	0	1	**Yes-7**
Shallow sand - confining unit	VOC	Benzene	7	25	0.0014	0.0056	0.030	mg/L	0.005	0.00045	2	3	**Yes**
Shallow sand - confining unit	VOC	Toluene	4	24	0.0058	0.0073	0.0076	mg/L	1	0.11	0	0	No
Shallow sand - confining unit	Metals	Arsenic	11	24	0.0023	0.011	0.032	mg/L	0.01	0.000052	6	9	**Yes**
Shallow sand - confining unit	Metals	Barium	24	24	0.22	1.4	15	mg/L	2	0.38	2	6	**Yes**
Shallow sand - confining unit	Metals	Calcium	20	20	62	168	880	mg/L	NC	NC	0	0	No-6
Shallow sand - confining unit	Metals	Chromium	10	21	0.010	0.033	0.33	mg/L	NC	2.2	1	0	**Yes**
Shallow sand - confining unit	Metals	Iron	19	19	2.6	16	69	mg/L	NC	1.4	0	18	**Yes**
Shallow sand - confining unit	Metals	Lead	7	21	0.0035	0.013	0.032	mg/L	0.015	0.015	3	3	**Yes**
Shallow sand - confining unit	Metals	Magnesium	19	19	33	71	357	mg/L	NC	NC	0	0	No-6
Shallow sand - confining unit	Metals	Manganese	18	18	0.36	0.96	3.3	mg/L	NC	0.043	0	0	No
Shallow sand - confining unit	Metals	Potassium	19	19	5.1	6.2	46	mg/L	NC	NC	0	0	No-6
Shallow sand - confining unit	Metals	Selenium	14	22	0.030	0.040	0.077	mg/L	0.05	0.01	3	13	**Yes**
Shallow sand - confining unit	Metals	Sodium	18	18	309	634	2250	mg/L	NC	NC	0	0	No-6
Shallow sand - confining unit	Metals	Strontium	21	21	0.47	2.0	14	mg/L	NC	1.2	0	3	**Yes**
Shallow sand - confining unit	Metals	Zinc	20	21	0.014	0.052	0.16	mg/L	NC	0.6	0	0	No
Shallow sand - confining unit	TPH	TPH-DRO	2	20	0.15	0.14	0.17	mg/L	NC	0.00055	0	0	**Yes-7**
Shallow sand - confining unit	TPH	TPH-ORO	2	20	0.12	0.13	0.15	mg/L	NC	0.080	0	0	**Yes-7**
Intermediate sand - confining unit	VOC	Benzene	1	22	0.0019	0.0049	0.0019	mg/L	0.005	0.00045	0	1	**Yes**
Intermediate sand - confining unit	VOC	Toluene	10	22	0.0057	0.0085	0.011	mg/L	1	0.11	0	0	No
Intermediate sand - confining unit	Metals	Arsenic	9	22	0.0041	0.012	0.028	mg/L	0.01	0.000052	6	9	**Yes**
Intermediate sand - confining unit	Metals	Barium	15	15	0.54	1.4	2.1	mg/L	2	0.38	1	8	**Yes**
Intermediate sand - confining unit	Metals	Calcium	15	15	72	141	204	mg/L	NC	NC	0	0	No-6
Intermediate sand - confining unit	Metals	Chromium	10	11	0.010	0.044	0.34	mg/L	NC	2.2	1	0	**Yes**
Intermediate sand - confining unit	Metals	Iron	13	13	12	33	83	mg/L	NC	1.4	0	13	**Yes**
Intermediate sand - confining unit	Metals	Lead	4	11	0.027	0.016	0.057	mg/L	0.015	0.015	4	4	**Yes**
Intermediate sand - confining unit	Metals	Magnesium	15	15	25	51	76	mg/L	NC	NC	0	0	No-6
Intermediate sand - confining unit	Metals	Manganese	13	13	0.33	0.73	1.7	mg/L	NC	0.043	0	0	No
Intermediate sand - confining unit	Metals	Potassium	14	15	5.1	6.4	13	mg/L	NC	NC	0	0	No-6
Intermediate sand - confining unit	Metals	Selenium	9	15	0.037	0.051	0.098	mg/L	0.05	0.01	6	9	**Yes**
Intermediate sand - confining unit	Metals	Sodium	15	15	200	407	628	mg/L	NC	NC	0	0	No-6
Intermediate sand - confining unit	Metals	Strontium	11	11	0.69	1.2	1.5	mg/L	NC	1.2	0	2	**Yes**

Aquifer	Chemical Group	Parameter	Number Detected	Number Sampled	Minimum Detected[1]	Mean[2]	Maximum Detected[1]	Unit	US EPA Regional Screening Levels[4]		# Samples > US EPA Benchmarks[4]		COC?[5]
									MCL	Tap Water	MCL	Tap Water	
Intermediate sand - confining unit	Metals	Zinc	11	11	0.013	0.090	0.35	mg/L	NC	0.6	0	0	No
Deep sand - confining unit	Metals	Barium	1	1	1.2	1.2	1.2	mg/L	2	0.38	0	1	**Yes**
Deep sand - confining unit	Metals	Calcium	1	1	124	124	124	mg/L	NC	NC	0	0	No-6
Deep sand - confining unit	Metals	Iron	1	1	7.5	7.5	7.5	mg/L	NC	1.4	0	1	**Yes**
Deep sand - confining unit	Metals	Magnesium	1	1	44	44	44	mg/L	NC	NC	0	0	No-6
Deep sand - confining unit	Metals	Manganese	1	1	0.24	0.24	0.24	mg/L	NC	0.043	0	0	No
Deep sand - confining unit	Metals	Potassium	1	1	6.0	6.0	6.0	mg/L	NC	NC	0	0	No-6
Deep sand - confining unit	Metals	Sodium	1	1	494	494	494	mg/L	NC	NC	0	0	No-6

Notes:

DRO = Diesel-Range Organic; NC = No Criterion Available; ORO = Oil-Range Organic; TPH = Total Petroleum Hydrocarbon; VOC = Volatile Organic Compound.

Blank = Not Analyzed.

Only included groundwater collected outside the Peat Zone.

Split samples analyzed by two different laboratories were average. See text.

Evaluated parameters were detected in at least one sample.

(1) When determining the maximum and minimum detected concentration, all samples (did not average splits or duplicates) were included to reflect minimum and maximum detected concentrations.

(2) The full detection limit was used to calculate the mean.

(3) US EPA Regional Screening Levels.

MCL = Maximum Contaminant Level; Tap Water = Tap water screening level (US EPA, 2015a).

MCL for iron, manganese, and zinc are secondary drinking water regulations based on cosmetic (skin or tooth discoloration) or aesthetic (taste, odor, or color) effects (http://water.epa.gov/drink/contaminants/index.cfm).

(4) Number of samples that exceed respective criteria.

(5) COC = Constituent of Concern, based on maximum concentration.

(6) Calcium, magnesium, potassium, and sodium were not evaluated, because they are considered essential nutrients (US EPA, 1989).

(7) Evaluated in my primary analysis as fractionated data (aliphatics and aromatics). All fractionated data were not detected. Range data are evaluated in my risk assessment as a separate analysis.

Table 2.4 Screening Assessment Under US EPA's Methodology – Surface Water

Chemical Group	Parameter	Number Detected	Number Sampled	Minimum Detected[1]	Mean[2]	95% UCLM[3]	Maximum Detected[1]	Unit	NRWQC[4]	US EPA Regional Screening Levels[5]		# Samples > Benchmarks[6]			COC?[7]
									Water and Org.	MCL	Tap Water	NRWQC	MCL	Tap Water	
Metals	Arsenic	2	10	0.0019	0.0062	0.0081	0.013	mg/L	0.000018	0.010	0.000052	0	1	2	**Yes**
Metals	Barium	10	10	0.25	0.13	0.59	1.2	mg/L	1	2.0	0.38	0	0	1	**Yes**
Metals	Calcium	10	10	38	45	57	74	mg/L	NC	NC	NC	0	0	0	No-8
Metals	Chromium	10	10	0.0022	0.0067	0.0066	0.0075	mg/L	NC	NC	2.2	0	0	0	No
Metals	Iron	10	10	0.49	1.9	6.5	11	mg/L	NC	NC	1.4	0	0	1	**Yes**
Metals	Lead	1	10	0.021	0.0073	--	0.021	mg/L	NC	0.015	0.015	0	1	1	**Yes**
Metals	Magnesium	10	10	88	101	127	149	mg/L	NC	NC	NC	0	0	0	No-8
Metals	Manganese	10	10	0.16	0.37	0.53	0.83	mg/L	0.05	NC	0.043	0	0	0	No
Metals	Potassium	10	10	29	34	43	60	mg/L	NC	NC	NC	0	0	0	No-8
Metals	Selenium	9	10	0.032	0.019	0.022	0.048	mg/L	0.17	0.050	0.010	9	0	9	**Yes**
Metals	Strontium	10	10	0.55	0.22	1.1	1.7	mg/L	NC	NC	1.2	0	0	1	**Yes**
Metals	Zinc	8	10	0.0045	0.014	0.027	0.067	mg/L	7.4	NC	0.60	0	0	0	No
TPH	TPH-DRO	1	10	1.3	0.26	--	1.3	mg/L	NC	NC	0.00055	0	0	1	**Yes**
TPH	TPH-ORO	2	10	0.17	0.23	--	1.1	mg/L	NC	NC	0.080	0	0	1	**Yes**

Notes:

DRO = Diesel-Range Organic; NRWQC = National Recommended Water Quality Criteria; NC = No Criterion Available; ND = Not Detected; ORO = Oil-Range Organic; TPH = Total Petroleum Hydrocarbon.

-- = Not calculated due to insufficient number of unique concentrations, according to ProUCL.

All samples are evaluated.

Split samples analyzed by two different laboratories were average. See text.

Evaluated parameters were detected in at least one sample.

(1) When determining the maximum and minimum detected concentration, all samples (did not average splits or duplicates) were included to reflect minimum and maximum detected concentrations.

(2) The full detection limit was used to calculate the mean.

(3) 95% UCLM = 95% Upper Confidence Limit of the Mean, calculated using the average of splits and duplicates (each station had one result) to eliminate biasing. See text.

(4) US EPA National Recommended Water Quality Human Health Criteria, for the consumption of water and organisms (US EPA, 2015c).

(5) US EPA Regional Screening Levels: MCL = Maximum Contaminant Level; Tap Water = Tap water screening level (US EPA, 2015a).

(6) Number of samples that exceed respective criteria.

(7) COC = Constituent of Concern, based on maximum concentration.

(8) Calcium, magnesium, and potassium were not evaluated because they are considered essential nutrients (US EPA, 1989).

Table 2.5 Screening Assessment Under US EPA's Methodology – Crab

Chemical Group	Parameter	Number Detected	Number Sampled	Minimum Detected	Mean[1]	95% UCLM[2]	Maximum Detected	Unit	US EPA Regional Screening Levels[3]	COC?[4]
Metals	Inorganic Arsenic	13	13	0.0045	0.011	0.013	0.018	mg/kg wwt	0.0024	**Yes**
Metals	Methyl Mercury	13	13	0.015	0.035	0.042	0.061	mg/kg wwt	0.014	**Yes**
Metals	Arsenic	13	13	0.10	0.28	0.32	0.43	mg/kg wwt	NC	No
Metals	Barium	13	13	3.2	8.1	9.3	12	mg/kg wwt	27	No
Metals	Mercury	13	13	0.036	0.060	0.067	0.081	mg/kg wwt	0.041	**Yes**
TPH	TPH-DRO (C8-C28)	13	13	6.4	53	74	165	mg/kg wwt	0.54	**Yes-5**
TPH	TPH (C08-C16)	7	13	3.6	16	18	30	mg/kg wwt	0.54	**Yes**
TPH	TPH (C16-C28)	13	13	6.2	44	63	151	mg/kg wwt	5.4	**Yes**
TPH	TPH (C08-C40)	13	13	42	225	335	663	mg/kg wwt	0.54	No-6

Notes:

COC = Constituent of Concern; DRO = Diesel-Range Organic; NC = No Criterion Available; RSL = Regional Screening Level; TPH = Total Petroleum Hydrocarbon; US EPA = United States Environmental Protection Agency.

Crabs were collected and measured for samples are evaluated for five metals and TPH.

Muscle and hepatopancreas weighted concentrations were averaged for each crab before averaged across the Site.

(1) The full detection limit was used to calculate the mean.

(2) 95% UCLM = 95% Upper Confidence Limit of the Mean, calculated using the average of splits and duplicates (each station had one result) to eliminate biasing. See text.

(3) US EPA Fish Tissue Concentration RSLs, calculated using equations from EPA RSL User Guide (US EPA, 2015b) and presented in Table 2.1.

(4) Parameters were considered COCs if the maximum concentration exceeded at least one of the screening levels.

(5) Evaluated as TPH C8-C16 and C16-C28.

(6) Although the C8-C40 concentration exceeds the benchmark, it will not be carried forward in the risk calculations because the higher carbons (>C28) are likely associated with lipids.

Table 2.6 Constituents of Concern by Medium

Chemical Group	Parameter	Soil/Sediment (0-3 ft bgs)	Groundwater	Surface Water	Crab
Metals	Arsenic	**Yes**	**Yes**	**Yes**	No
Metals	Inorganic Arsenic				**Yes**
Metals	Barium	**Yes**	**Yes**	**Yes**	No
Metals	Cadmium	No			
Metals	Chromium	No	**Yes**	No	
Metals	Iron		**Yes**	**Yes**	
Metals	Lead	No	**Yes**	**Yes**	
Metals	Manganese		No	No	
Metals	Mercury	**Yes**			**Yes**
Metals	Methyl Mercury				**Yes**
Metals	Selenium	No	**Yes**	**Yes**	
Metals	Strontium	No	**Yes**	**Yes**	
Metals	Zinc	No	No	No	
VOCs	Benzene		**Yes**		
VOCs	Toluene		No		
TPH	Aliphatic >C10-C12	**Yes**			
TPH	Aliphatic >C12-C16	**Yes**			
TPH	Aliphatic >C16-C35	No			
TPH	Aromatic >C10-C12	**Yes**			
TPH	Aromatic >C12-C16	**Yes**			
TPH	Aromatic >C16-C21	**Yes**			
TPH	Aromatic >C21-C35	**Yes**			
TPH	TPH-DRO (C8-C28)				**Yes-3**
TPH	TPH (C08-C16)				**Yes**
TPH	TPH (C16-C28)				**Yes**
TPH	TPH (C08-C40)				No
TPH	TPH-DRO	**Yes - 1**	**Yes-2**	**Yes**	
TPH	TPH-ORO	**Yes - 1**	**Yes-2**	**Yes**	

Notes:

DRO = Diesel-Range Organic; ft bgs = Feet Below Ground Surface; ORO = Oil-Range Organic; TPH = Total Petroleum Hydrocarbon; VOC = Volatile Organic Compound.

Blank = Not analyzed or not detected.

(1) Evaluated in my primary analysis as fractionated data (aliphatics and aromatics). Range data are evaluated in my risk assessment as a separate analysis.

(2) Evaluated in my primary analysis as fractionated data (aliphatics and aromatics). All fractionated data were not detected. Range data are evaluated in my risk assessment as a separate analysis.

(3) Evaluated as TPH C8-C16 and C16-C28.

Table 2.7 Exposure Factors Input Values

Exposure Pathway/Exposure Factor	Acronym	Adult Recreator	
		Value	Comment (Reference)
General			
Body Weight (kg)	BW	80	Recommended Default Value (Stalcup, 2014)
Exposure Duration (years)	ED	26	Recommended Default Value (Stalcup, 2014)
Exposure Frequency (days/years)	EF	104	Professional judgment. Assumes 2 days/week, year round.
Averaging Period - Cancer (days)	AT-C	25,550	70 years x 365 days/year
Averaging Period - Non-cancer (days)	AT-NC	9,490	Exposure duration x 365 days/year
Incidental Ingestion of Soil/Sediment			
Soil/Sediment Ingestion Rate (mg/day)	IR_{soil}	50	Reasonable central estimate and US EPA-recommended value for adult soil ingestion rate (US EPA, 2011a).
Fraction Soil/Sediment from Contaminated Source	FR	1	100% of soil/sediment ingestion occurs on Site.
Dermal Contact with Soil/Sediment			
Surface Area Exposed to Soil/Sediment (cm^2/day)	SA	6,910	95^{th} percentile for surface area of adult males, assuming exposure to hands, arms, and feet (US EPA, 2011a).
Soil-Sediment/Skin Adherence Factor (mg/cm^2)	AF	0.2	Adherence factor for children 8-12 years old, playing in wet soil, used as proxy for contact with wet sediment for adults (US EPA, 2004, Exhibit 3-3).
Dermal Contact with Surface Water			
Surface Area Exposed to Water (cm^2)	SA	6,910	95^{th} percentile for surface area of adult males, assuming exposure to hands, arms, and feet (US EPA, 2011a).
Exposure Event (event/day)	EV	1	Assumed 1 event per day
Exposure Time (hours/day)	ET	4	Professional judgment. Assumed 4 hours while crabbing.
Dermal Contact with Groundwater			
Surface Area Exposed to Water (cm^2)	SA	6,910	95^{th} percentile for surface area of adult males, assuming exposure to hands, arms, and feet (US EPA, 2011a).
Exposure Event (event/day)	EV	1	Assumed 1 event per day
Exposure Time (hours/day)	ET	2	Professional judgment. Assumed 2 hours while cleaning crabs and equipment.
Ingestion of Groundwater			
Groundwater Ingestion Rate	IR_{gw}	2.5	Recommended Default Value (Stalcup, 2014)
Inhalation of Volatiles in Groundwater			
Andelman Volatilization Factor (L/m^3)	K	0.5	(US EPA, 1991b)
Exposure Time (hours/day)	ET	2	Professional judgment. Assumed 2 hours while cleaning crabs and equipment.
Ingestion of Fish			
Fish/Shellfish Ingestion Rate (mg/day)	IR	34,286	Based on 30 g/day for 365 days/year, adjusted for body weight - for a single species collected solely from the Site (LDHH *et al* ., 2012).
Fish/Shellfish Ingestion Exposure Frequency (days/year)	EF	365	Assumed ingestion year round.

Note:

Sources – LDHH et al. (2012), US EPA (1991b, 2004, 2011a), and Stalcup (2014).

Table 2.8 Toxicity Factors for Constituents of Concern

Constituents of Concern (COCs)	Oral			Dermal		Inhalation			Other			RFD Target Organ	RFC Target Organ
	Cancer Slope Factor (CSFo) $(mg/kg\text{-}d)^{-1}$		Reference Dose (RfD) (mg/kg-day)	Dermal CSF (CSFd) $(mg/kg\text{-}d)^{-1}$	Dermal RfD (mg/kg-day)	Inhalation Unit Risk $(\mu g/m^3)^{-1}$		Reference Concentration (RfC) (mg/m^3)	GI Absorption (GI ABS)	Bioavailability (B)	Dermal Absorption (ABS)		
Metals													
Arsenic	1.5E+00	IRIS	3.0E-04 IRIS	1.5E+00	3.0E-04	4.3E-03	IRIS	1.5E-05 CalEPA	1	0.6	0.03	Skin	Lung
Inorganic Arsenic	1.5E+00	IRIS	3.0E-04 IRIS	1.5E+00	3.0E-04	4.3E-03	IRIS	1.5E-05 CalEPA	1	0.6	0.03	Skin	Lung
Barium	NA		2.0E-01 IRIS	NA	1.4E-02	NA		5.0E-04 HEAST	0.07	1	NA	Kidney	Fetus
Chromium	NA		1.5E+00 IRIS	NA	2.0E-02	NA		NA	0.013	1	NA	None Reported	NA
Iron	NA		7.0E-01 PPRTV	NA	7.0E-01	NA		NA	1	1	NA	Gastrointestinal	NA
Lead	NA		NA	NA	NA	NA		NA	1	1	NA	NA	NA
Mercury	NA		3.0E-04 IRIS	NA	2.1E-05	NA		3.0E-04 S	0.07	1	NA	Immunological	Central Nervous System
Methyl Mercury	NA		1.0E-04 IRIS	NA	1.0E-04	NA		NA	1	1	NA	Central Nervous System	NA
Selenium	NA		5.0E-03 IRIS	NA	5.0E-03	NA		2.0E-02 CalEPA	1	1	NA	Skin	Skin
Strontium	NA		6.0E-01 IRIS	NA	6.0E-01	NA		NA	1	1	NA	Bone	NA
Volatile Organic Compounds													
Benzene	5.5E-02	IRIS	4.0E-03 IRIS	5.5E-02	4.0E-03	7.8E-06	IRIS	3.0E-02 IRIS	1	1	NA	Blood	Blood
Total Petroleum Hydrocarbons													
Aliphatic >C10-C12	NA		1.0E-02 PPRTV: Ali-med (C9-C18)	NA	1.0E-02	NA		1.0E-01 PPRTV: Ali-med (C9-C18)	1	1	NA	Liver	
Aliphatic >C12-C16	NA		1.0E-02 PPRTV: Ali-med (C9-C18)	NA	1.0E-02	NA		1.0E-01 PPRTV: Ali-med (C9-C18)	1	1	NA	Liver	
Aromatic >C10-C12	NA		3.0E-02 PPRTV: See text.	NA	3.0E-02	NA		1.0E-01 PPRTV: See text.	1	1	NA	Blood	
Aromatic >C12-C16	NA		3.0E-02 PPRTV: See text.	NA	3.0E-02	NA		1.0E-01 PPRTV: See text.	1	1	NA	Blood	
Aromatic >C16-C21	NA		4.0E-02 PPRTV: Aro-high (C17-C32)	NA	4.0E-02	NA		NA	1	1	0.1	Liver	
Aromatic >C21-C35	NA		4.0E-02 PPRTV: Aro-high (C17-C32)	NA	4.0E-02	NA		NA	1	1	0.1	Liver	
TPH-DRO	NA		1.0E-02 min RfD	NA	1.0E-02	NA		1.0E-01 min RfC	1	1	0.1	Liver	
TPH-ORO	NA		4.0E-02 min RfD	NA	4.0E-02	NA		NA	1	1	0.1	Liver	

Notes:

DRO = Diesel-Range Organic; NA = Not Available/Not Applicable; ORO = Oil-Range Organic; RSL = Regional Screening Level; TPH = Total Petroleum Hydrocarbon; US EPA = United States Environmental Protection Agency.

Toxicity Values from US EPA RSLs.

US EPA (2015a) cites the following sources for toxicity values (Cancer Slope Factor, Reference Dose, Unit Risk and Reference Concentration):

IRIS = US EPA Integrated Risk Information System (http://www.epa.gov/iris).

PPRTV = US EPA Provisional Peer-Reviewed Toxicity Value.

CalEPA = California Environmental Protection Agency.

HEAST = Health Effects Assessment Summary Tables.

S = IRIS RfD was adjusted to exclude manganese from diet.

The gastrointestinal absorption efficiency (GIABS) and dermal absorption factors (ABS) were obtained from US EPA (2004, Exhibit 4-1) or US EPA RSLs (US EPA, 2015a).

Table 2.9 Comparison of Crab COC Data by Exposure Area (MPA Data)

Species	Parameter	Site					Market					Site Reference					Comparable to Market/Site Reference?
		Detected	Sampled	Min.	Mean	Max.	Detected	Sampled	Min.	Mean	Max.	Detected	Sampled	Min.	Mean	Max.	
Crab	Inorganic Arsenic	13	13	0.0045	0.011	0.018	6	6	0.0070	0.013	0.023	10	10	0.013	0.015	0.018	Yes
Crab	Methyl Mercury	13	13	0.015	0.035	0.061	6	6	0.0086	0.016	0.027	10	10	0.017	0.028	0.052	Site and Site reference significantly > market
Crab	Mercury	13	13	0.036	0.060	0.081	6	6	0.017	0.032	0.048	10	10	0.044	0.062	0.092	Site and Site reference significantly > market
Crab	TPH - Diesel (C10-C28)	13	13	6.4	52	162	6	6	18	46	82	9	10	7.2	54	110	Yes
Crab	TPH (C08-C16)	7	13	3.6	16	30	2	6	6.5	20	45	6	10	7.2	19	42	Yes
Crab	TPH (C16-C28)	13	13	6.2	44	151	6	6	15	38	62	9	10	7.2	42	87	Yes

Notes:

COC = Constituent of Concern; TPH = Total Petroleum Hydrocarbon.

Measured crab concentration (meat + hepatopancreas - weighted by tissue weight).

All concentrations reported in mg/kg wet weight.

Table 3.1 Estimated Cancer and Non-cancer Risks

With TPH Fraction Data for Soil/Sediment and Groundwater

Exposure Pathway	Cancer Risk	Percent Contribution	COC Contributing Majority of Risk by Pathway (% Contribution)	Non-cancer Hazard	Percentage Contribution	COC Contributing Majority of Hazard by Pathway (% Contribution)
Adult Recreator						
Incidental Ingestion of Soil/Sediment	3.9E-07	5.7%	Arsenic (100%)	3.1E-02	2.0%	Aliphatic >C12-C16 (59%)
Dermal Contact with Soil/Sediment	5.4E-07	7.9%	Arsenic (100%)	1.5E-02	<1%	Aromatic >C21-C35 (48%)
Dermal Contact with Surface Water	4.4E-07	6.5%	Arsenic (100%)	6.3E-02	4.0%	Manganese (87%)
Dermal Contact with Groundwater	1.3E-06	19%	Arsenic (59%)	2.2E-01	14%	Manganese (69%)
Ingestion of Groundwater	0.0E+00			8.4E-02	5%	Barium (41%)
Inhalation of Volatiles in Groundwater	9.6E-07	14%	Benzene (100%)	1.1E-02	<1%	Benzene (100%)
Ingestion of Fish/Shellfish	3.2E-06	47%	Inorganic Arsenic (100%)	1.2E+00	73%	TPH (C08-C16) (45%)
Total Cancer Risk (ELCR):	7E-06		**Total Hazard Index:**	2E+00		

Target Organ Specific Hazard Index (TPH-Fraction Data for Soil/Sediment and Groundwater)

Endpoint	Incidental Ingestion of Soil/SD	Dermal Contact with Soil/SD	Dermal Contact with SW	Dermal Contact with GW	Ingestion of GW	Inhalation of GW	Ingestion of Fish/Shellfish	Total
Blood	1.1E-03	0.0E+00		6.5E-03		1.1E-02	1.3E-01	**1E-01**
Bone			1.8E-04	1.0E-03	8.5E-03			**1E-02**
Central Nervous System			5.5E-02	1.5E-01	2.7E-02		1.8E-01	**4E-01**
Gastrointestinal			9.2E-04	5.8E-03	1.4E-02			**2E-02**
Immunological	6.1E-04	0.0E+00					9.5E-02	**1E-01**
Kidney	2.2E-03	0.0E+00	4.1E-03	5.0E-02	3.5E-02			**9E-02**
Liver	2.5E-02	1.2E-02	0.0E+00				7.3E-01	**8E-01**
None Reported				8.3E-04				**8E-04**
Skin	2.3E-03	3.2E-03	3.1E-03	5.5E-03			1.9E-02	**3E-02**
Total:	**3E-02**	**1E-02**	**6E-02**	**2E-01**	**8E-02**	**1E-02**	**1E+00**	

Notes:

COC = Constituent of Concern; DRO = Diesel-Range Organic; ELCR = Exccess Lifetime Cancer Risk; GW = Groundwater; Soil/SD = Soil/Sediment; SW = Surface Water; TPH = Total Petroleum Hydrocarbon.

With TPH Range Data for Soil/Sediment and Groundwater

Exposure Pathway	Cancer Risk	Percent Contribution	COC Contributing Majority of Risk by Pathway (% Contribution)	Non-cancer Hazard	Percentage Contribution	COC Contributing Majority of Hazard by Pathway (% Contribution)
Adult Recreator						
Incidental Ingestion of Soil/Sediment	3.9E-07	5.7%	Arsenic (100%)	1.3E-01	6.3%	TPH-DRO (87%)
Dermal Contact with Soil/Sediment	5.4E-07	7.9%	Arsenic (100%)	3.4E-01	17%	TPH-DRO (90%)
Dermal Contact with Surface Water	4.4E-07	6.5%	Arsenic (100%)	6.3E-02	3.1%	Manganese (87%)
Dermal Contact with Groundwater	1.3E-06	19%	Arsenic (59%)	2.2E-01	11%	Manganese (69%)
Ingestion of Groundwater	0.0E+00			8.4E-02	4.2%	Barium (41%)
Inhalation of Volatiles in Groundwater	9.6E-07	14%	Benzene (100%)	1.1E-02	<1%	Benzene (100%)
Ingestion of Fish/Shellfish	3.2E-06	47%	Inorganic Arsenic (100%)	1.2E+00	58%	TPH (C08-C16) (45%)
Total Cancer Risk (ELCR):	7E-06		**Total Hazard Index:**	2E+00		

Target Organ Specific Hazard Index (TPH Range Data for Soil/Sediment and Groundwater)

Endpoint	Incidental Ingestion of Soil/SD	Dermal Contact with Soil/SD	Dermal Contact with SW	Dermal Contact with GW	Ingestion of GW	Inhalation of GW	Ingestion of Fish/Shellfish	Total
Blood				6.5E-03		1.1E-02	1.3E-01	**1E-01**
Bone			1.8E-04	1.0E-03	8.5E-03			**1E-02**
Central Nervous System			5.5E-02	1.5E-01	2.7E-02		1.8E-01	**4E-01**
Gastrointestinal			9.2E-04	5.8E-03	1.4E-02			**2E-02**
Immunological	6.1E-04	0.0E+00					9.5E-02	**1E-01**
Kidney	2.2E-03	0.0E+00	4.1E-03	5.0E-02	3.5E-02			**9E-02**
Liver	1.2E-01	3.4E-01	0.0E+00	0.0E+00			7.3E-01	**1E+00**
None Reported				8.3E-04				**8E-04**
Skin	2.3E-03	3.2E-03	3.1E-03	5.5E-03			1.9E-02	**3E-02**
Total:	**1E-01**	**3E-01**	**6E-02**	**2E-01**	**8E-02**	**1E-02**	**1E+00**	

Notes:

COC = Constituent of Concern; DRO = Diesel-Range Organic; ELCR = Exccess Lifetime Cancer Risk; GW = Groundwater; Soil/SD = Soil/Sediment; SW = Surface Water; TPH = Total Petroleum Hydrocarbon.

Table 3.2 Margin of Exposure (MOE) Analysis

Analyte	Exposure Pathway	Total Daily Intake (DI) (mg/kg-day)	Point of Departure (POD) (mg/kg-day)	Basis for POD	Margin of Exposure (MOE) = POD/DI	Source
Non-Cancer Endpoints						
Arsenic Non-cancer	Crab Ingestion (34 g/day)	5.7E-06	0.0008	NOAEL based on Human Chronic oral exposures by Tseng (1977); Tseng *et al* . (1968). NOAEL of 0.009 mg/L was converted to an intake assuming 4.5 L/day + 0.002 mg/day (arsenic from missing data) divided by a body weight of 55 kg.	140	US EPA IRIS (2003)
Barium	Groundwater dermal (2 hours/day)	7.0E-04	63	$BMDL_{05}$ for nephropathy based on a 2-year drinking water study in mice (NTP, 1994).	90,000	US EPA IRIS (2005b)
Manganese	Groundwater dermal (2 hours/day)	1.5E-04	0.07	The NOAEL for non-diet was calculated by subtracting the dietary contribution (an upper limit of 5 mg/day) from the NOAEL reported in IRIS (0.14 mg/kg-day) based on human chronic ingestion studies (NRC, 1989; Freeland-Graves *et al.* , 1987, WHO, 1973), which includes all sources.	470	US EPA IRIS, RSL[1] (2015b)
Mercury	Soil/Sediment ingestion	1.8E-07	0.317	LOAEL for autoimmune effects observed in rat subchronic feeding and subcutaneous studies (US EPA, 1987).	1,700,000	US EPA IRIS (2002b)
Methyl Mercury	Crab Ingestion (34 g/day)	1.8E-05	0.00147	$BMDL_{05}$ range of 46-79 ppb in maternal blood for different neuropsychological effects in the offspring at 7 years of age, corresponding to a range of maternal daily intakes of 0.857-1.472 µg/kg-day.	81	US EPA IRIS (2011c)
TPH Aliphatic C8-C16	Crab Ingestion (34 g/day)	3.9E-03	100	NOAEL based on two s/c gavage studies in rats (Anonymous, 1990, 1991a, as cited in US EPA, 2009d)	25,000	Appendix A, US EPA (2009e)
	Crab Ingestion (34 g/day)	3.9E-03	500	LOAEL based on two s/c gavage studies in rats (Anonymous, 1990, 1991a, as cited in US EPA, 2009d)	130,000	US EPA (2009b,e)
TPH Aromatic C8-C16	Crab Ingestion (34 g/day)	3.9E-03	125	NOAEL based on dogs	32,000	Bio/Dynamics Inc. (1990b, as cited in US EPA, 2009f); US EPA (2009b)
	Crab Ingestion (34 g/day)	3.9E-03	250	LOAEL based on dogs; mild anemia	64,000	Bio/Dynamics Inc. (1990b, as cited in US EPA, 2009f); US EPA (2009b)

Analyte	Exposure Pathway	Total Daily Intake (DI) (mg/kg-day)	Point of Departure (POD) (mg/kg-day)	Basis for POD	Margin of Exposure (MOE) = POD/DI	Source
Cancer Endpoints						
Arsenic	Crab Ingestion (34 g/day)	6.0E-07	0.008	LOAEL (8 µg/kg-day) from Appendix B (Table B-3 and supporting text) in US EPA (1988) for skin cancer.	13,000	Appendix B, US EPA (1988)
Benzene	Groundwater dermal (2 hours/day)	9.6E-06	0.15	Lowest concentration at which a statistically significant increase in leukemia based on Paxton *et al.* (1994a,b) analysis of Rinsky (1981, 1987), Crump and Allen (1984), Paustenbach *et al* . (1993) is 50 ppm-years for a lifetime exposure. LOAEC of 1,200 µg/m^3 for a 24 hour/day, 7 days/week, 30-year exposure adjusted to a 70-year lifetime exposure assuming an inhalation rate of 20 m^3/day and a body weight of 70 kg.	15,000	US EPA (2008)

Notes:

IRIS = Integrated Risk Information System; LOAEC = Lowest Observed Adverse Effect Concentration; LOAEL = Lowest Observed Adverse Effect Level; NOAEL = No Observed Adverse Effect Level; ppb = Parts Per Billion; ppm = Parts Per Million; RSL = Regional Screening Level; Soil/SD = Soil/Sediment; s/c = Subcutaneous; BMDL05 = Benchmark Dose 95% Lower Confidence Limit; TPH = Total Petroleum Hydrocarbon; US EPA = United States Environmental Protection Agency.

(1) From RSL table, Region III, 3/4/2015 User Guide, Section 5: "The IRIS RfD (0.14 mg/kg-day) includes manganese from all sources, including diet. The author of the IRIS assessment for manganese recommended that the dietary contribution from the normal U.S. diet (an upper limit of 5 mg/day) be subtracted when evaluating non-food (e.g., drinking water or soil) exposures to manganese, leading to a RfD of 0.071 mg/kg-day for non-food items. The explanatory text in IRIS further recommends using a modifying factor of 3 when calculating risks associated with non-food sources due to a number of uncertainties that are discussed in the IRIS file for manganese, leading to a RfD of 0.024 mg/kg-day. This modified RfD has been used in the derivation of some manganese screening levels for soil and water. For more information regarding the Manganese RfD, users are advised to contact the author of the IRIS assessment on Manganese" (US EPA, 2015b).

Figures

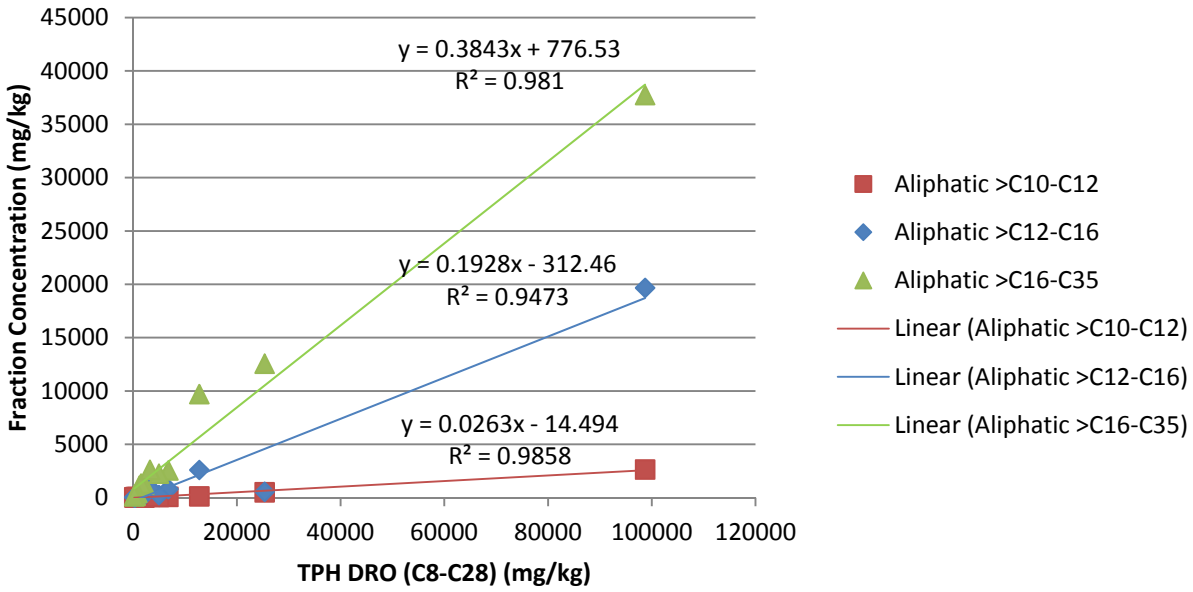

Figure 3.1 Aliphatic Fraction Data *vs.* Range Data – TPH-DRO (C8-C28)

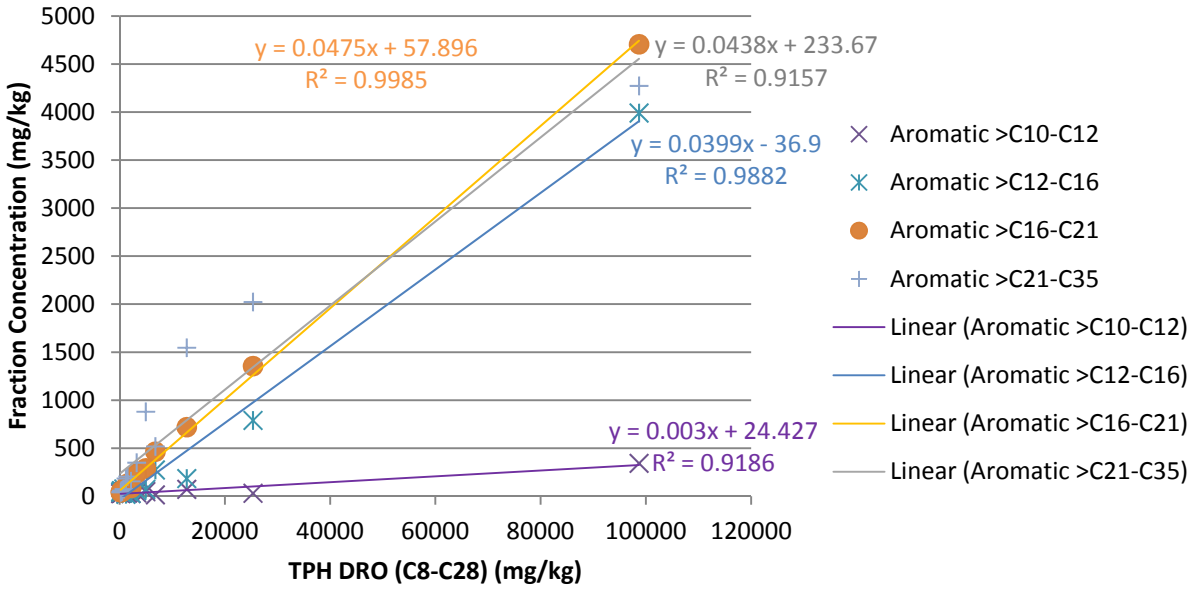

Figure 3.2 Aromatic Fraction Data *vs.* Range Data – TPH-DRO (C8-C28)

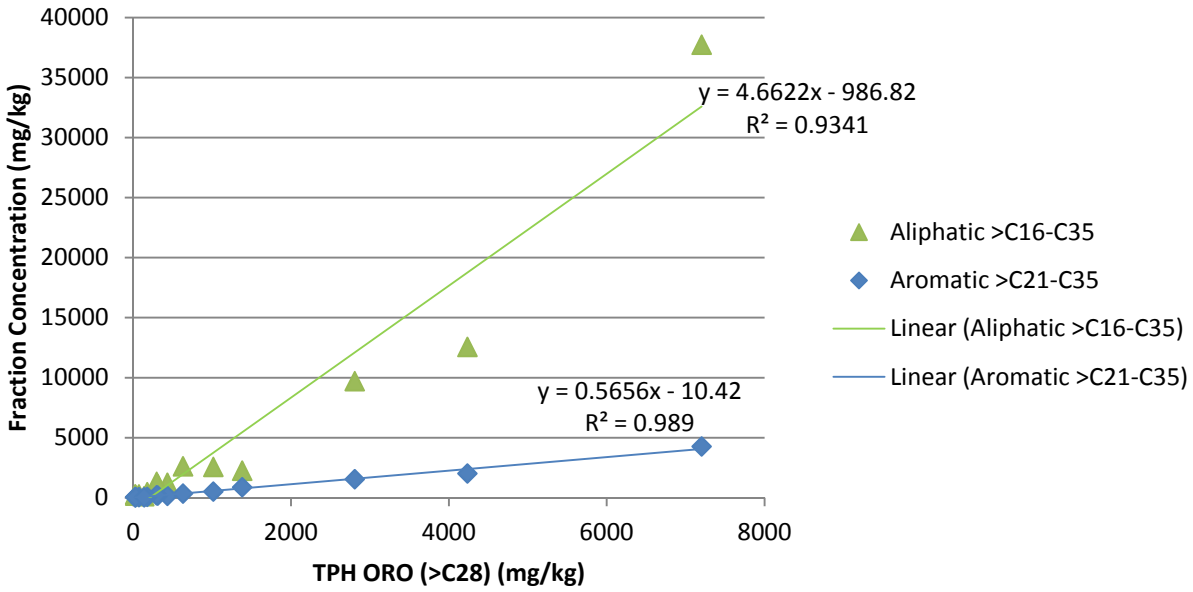

Figure 3.3 Fraction Data vs. Range Data – TPH-ORO (>C28)

Appendix A

Data Considered in Risk Assessment

List of Tables

Table A.1 All Groundwater Samples

Sampler	Chemical Group	Parameter	Aquifer:	Chicot - Facility Well			Chicot					Peat		
			Sample Location:	AWW1	AWW1	AWW1	A_ CROUCH WELL SW	J GUIDRY WELL AT 400 GAL	J GUIDRY WELL AT 525 GAL	J GUIDRY WELL	J GUIDRY WELL-Pump	AB15	AB19	AB2
			Sample Date:	4/3/1995	11/14/2006	5/25/2010	9/1/2010	9/1/2010	9/1/2010	9/1/2010	9/1/2010	11/13/2006	11/10/2006	11/10/2006
			Screening Interval (ft bgs):									8 - 18	8 - 18	11-21
			Unit											
ICON	VOC	Benzene	mg/L		0.005 U	0.005 U				0.005 U		0.005 U	0.005 U	0.005 U
ICON	VOC	Ethylbenzene	mg/L		0.005 U	0.005 U				0.005 U		0.005 U	0.005 U	0.005 U
ICON	VOC	Toluene	mg/L		0.005 U	0.01 U				0.01 U		0.005 U	0.005 U	0.005 U
ICON	VOC	Xylenes	mg/L		0.015 U	0.05 U				0.05 U		0.015 U	0.015 U	0.015 U
ICON	Dissolved Metals	Arsenic	mg/L											
ICON	Dissolved Metals	Barium	mg/L											
ICON	Dissolved Metals	Cadmium	mg/L											
ICON	Dissolved Metals	Chromium	mg/L											
ICON	Dissolved Metals	Lead	mg/L											
ICON	Dissolved Metals	Mercury	mg/L											
ICON	Dissolved Metals	Selenium	mg/L											
ICON	Dissolved Metals	Strontium	mg/L											
ICON	Dissolved Metals	Zinc	mg/L											
ICON	Metals	Arsenic	mg/L		0.011	0.01 U				0.01 U		0.017	0.01 U	0.015
ICON	Metals	Barium	mg/L		0.431	0.432				0.258		3.69	1.06	0.67
ICON	Metals	Cadmium	mg/L		0.001 U	0.005 U				0.005 U		0.002	0.001	0.001
ICON	Metals	Calcium	mg/L											
ICON	Metals	Chromium	mg/L			0.01 U				0.01 U				
ICON	Metals	Lead	mg/L		0.005 U	0.01 U				0.01 U		0.005 U	0.005 U	0.01
ICON	Metals	Magnesium	mg/L											
ICON	Metals	Mercury	mg/L			0.0002 U								
ICON	Metals	Potassium	mg/L											
ICON	Metals	Selenium	mg/L			0.02 U				0.02 U				
ICON	Metals	Sodium	mg/L											
ICON	Metals	Strontium	mg/L		0.46	0.461				0.568		11.4	1.47	1.06
ICON	Metals	Zinc	mg/L			0.022				0.042				
ICON	TPH	TPH-DRO	mg/L		0.839	0.135 U				0.135 U		0.214	0.121 U	0.12 U
ICON	TPH	TPH-GRO	mg/L		0.15 U	0.15 U				0.15 U		0.15 U	0.15 U	0.15 U
ICON	TPH	TPH-ORO	mg/L		0.447	0.125 U				0.125 U		0.206	0.156	0.1 U
ICON	Other	Bicarbonate Alkalinity	mg/L CaCO3			368								
ICON	Other	Bromide	mg/L			0.42								
ICON	Other	Carbonate Alkalinity	mg/L CaCO3			10 U								
ICON	Other	Chlorides	mg/L		170	192				852		7630	3020	2310
ICON	Other	Field EC	uS		1306							17990	6080	6680
ICON	Other	Field pH	std units		7.62							6.19	6.45	7.15
ICON	Other	Field Turbidity	NTU		8							32	15.5	
ICON	Other	Sulfate	mg/L			0.2 U								
ICON	Other	TDS	mg/L	564	553	663				1720		10300	3700	3780
MPA	VOC	Benzene	mg/L			0.005 U				0.005 U	0.005 U			
MPA	VOC	Ethylbenzene	mg/L			0.005 U				0.005 U	0.005 U			
MPA	VOC	Toluene	mg/L			0.005 U				0.005 U	0.005 U			
MPA	VOC	Xylenes	mg/L			0.01 U				0.01 U	0.01 U			
MPA	Dissolved Metals	Arsenic	mg/L											
MPA	Dissolved Metals	Barium	mg/L											
MPA	Dissolved Metals	Cadmium	mg/L											
MPA	Dissolved Metals	Calcium	mg/L											
MPA	Dissolved Metals	Chromium	mg/L											
MPA	Dissolved Metals	Iron	mg/L											
MPA	Dissolved Metals	Lead	mg/L											
MPA	Dissolved Metals	Magnesium	mg/L											
MPA	Dissolved Metals	Manganese	mg/L											
MPA	Dissolved Metals	Mercury	mg/L											
MPA	Dissolved Metals	Potassium	mg/L											
MPA	Dissolved Metals	Selenium	mg/L											
MPA	Dissolved Metals	Sodium	mg/L											

Table A.1 All Groundwater Samples

Sampler	Chemical Group	Parameter	Aquifer:	Chicot - Facility Well			Chicot					Peat		
			Sample Location:	AWW1	AWW1	AWW1	A_ CROUCH WELL SW	J GUIDRY WELL AT 400 GAL	J GUIDRY WELL AT 525 GAL	J GUIDRY WELL	J GUIDRY WELL-Pump	AB15	AB19	AB2
			Sample Date:	4/3/1995	11/14/2006	5/25/2010	9/1/2010	9/1/2010	9/1/2010	9/1/2010	9/1/2010	11/13/2006	11/10/2006	11/10/2006
			Screening Interval (ft bgs):									8 - 18	8 - 18	11-21
			Unit											
MPA	Dissolved Metals	Strontium	mg/L											
MPA	Dissolved Metals	Zinc	mg/L											
MPA	Metals	Arsenic	mg/L			0.01 U				0.01 U				
MPA	Metals	Barium	mg/L			0.47				0.73	0.74			
MPA	Metals	Cadmium	mg/L							0.005 U	0.005 U			
MPA	Metals	Calcium	mg/L			49.9				68.3	70.5			
MPA	Metals	Chromium	mg/L							0.01 U	0.01 U			
MPA	Metals	Iron	mg/L			0.75				1.02	1.01			
MPA	Metals	Lead	mg/L							0.015 U	0.015 U			
MPA	Metals	Magnesium	mg/L			17.7				22	22.8			
MPA	Metals	Manganese	mg/L			0.082				0.068	0.068			
MPA	Metals	Mercury	mg/L							0.0002 U	0.0002 U			
MPA	Metals	Potassium	mg/L			2.47				2.47	2.46			
MPA	Metals	Selenium	mg/L			0.04 U				0.04 U	0.04 U			
MPA	Metals	Sodium	mg/L											
MPA	Metals	Strontium	mg/L							0.54	0.54			
MPA	Metals	Zinc	mg/L							0.31	0.26			
MPA	TPH	Aliphatic >C10-C12	mg/L			0.15 U				0.15 U	0.15 U			
MPA	TPH	Aliphatic >C12-C16	mg/L			0.15 U				0.15 U	0.15 U			
MPA	TPH	Aliphatic >C16-C35	mg/L			0.15 U				0.15 U	0.15 U			
MPA	TPH	Aliphatic >C8-C10	mg/L			0.15 U				0.15 U	0.15 U			
MPA	TPH	Aliphatic C6-C8	mg/L			0.15 U				0.15 U	0.15 U			
MPA	TPH	Aromatic >C10-C12	mg/L			0.15 U				0.15 U	0.15 U			
MPA	TPH	Aromatic >C12-C16	mg/L			0.15 U				0.15 U	0.15 U			
MPA	TPH	Aromatic >C16-C21	mg/L			0.15 U				0.15 U	0.15 U			
MPA	TPH	Aromatic >C21-C35	mg/L			0.15 U				0.15 U	0.15 U			
MPA	TPH	Aromatic >C8-C10	mg/L			0.15 U				0.15 U	0.15 U			
MPA	TPH	TPH-DRO	mg/L											
MPA	TPH	TPH-GRO	mg/L											
MPA	TPH	TPH-ORO	mg/L											
MPA	Other	Bicarbonate Alkalinity	mg/L CaCO3			356				340	345			
MPA	Other	Bromide	mg/L											
MPA	Other	Carbonate Alkalinity	mg/L CaCO3			1 U				1 U	1 U			
MPA	Other	Chlorides	mg/L			195	523	146	149	139	139			
MPA	Other	Field Turbidity	NTU											
MPA	Other	Sodium	mg/L			161				109	109			
MPA	Other	Specific Conductance	umhos/cm				1880	1116	1073	1094	1097			
MPA	Other	Sulfate	mg/L			5 U				5 U	5 U			
MPA	Other	TDS	mg/L			616	970	640	620	582	632			

Notes:

VOC = Volatile Organic Compound; TPH = Total Petroleum Hydrocarbon; GRO = Gasoline-range Organic; DRO = Diesel-range Organic, ORO = Oil-range Organic; TDS = Total Dissolved Solids.

All samples evaluated are included. Parent and field duplicate samples presented separately.

Detection limits present for non-detected samples.

U = Not detected.

J = Estimated.

Table A.1 All Groundwater Samples

Sampler	Chemical Group	Parameter	Aquifer:	Peat				Shallow Sand - Confining Unit							
			Sample Location:	AB3	AB5	AB6	AB7	WL-6	A CROUCH WELL AT 1	A_ CROUCH WELL	AB1	HP-MPA-01-T	HP-MPA-02-T	HP-MPA-03-T	HP-MPA-03-T
			Sample Date:	11/10/2006	11/13/2006	11/10/2006	11/13/2006	1/7/2015	9/1/2010	9/1/2010	11/10/2006	9/29/2010	9/29/2010	10/4/2010	9/30/2010
			Screening Interval (ft bgs):	10-20	10 - 22	8 - 18	10 - 20				40 - 50	42 - 45	42 - 45	42 - 45	42 - 45
			Unit												
ICON	VOC	Benzene	mg/L	0.005 U	0.005	0.005 U	0.005 U	0.005 U		0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	
ICON	VOC	Ethylbenzene	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U		0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	
ICON	VOC	Toluene	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.01 U		0.01 U	0.005 U	0.01 U	0.01 U	0.01 U	
ICON	VOC	Xylenes	mg/L	0.015 U	0.015 U	0.015 U	0.015 U	0.05 U		0.05 U	0.015 U	0.05 U	0.05 U	0.05 U	
ICON	Dissolved Metals	Arsenic	mg/L												
ICON	Dissolved Metals	Barium	mg/L												
ICON	Dissolved Metals	Cadmium	mg/L												
ICON	Dissolved Metals	Chromium	mg/L												
ICON	Dissolved Metals	Lead	mg/L												
ICON	Dissolved Metals	Mercury	mg/L												
ICON	Dissolved Metals	Selenium	mg/L												
ICON	Dissolved Metals	Strontium	mg/L												
ICON	Dissolved Metals	Zinc	mg/L												
ICON	Metals	Arsenic	mg/L	0.01 U	0.01 U	0.012	0.025	0.01 U		0.01 U	0.021	0.014	0.01 U	0.014	
ICON	Metals	Barium	mg/L	1.52	1.12	2.13	2.36	11.8		0.517	0.509	1.4	0.46	0.59	
ICON	Metals	Cadmium	mg/L	0.001	0.002	0.001 U	0.002	0.001 U		0.005 U	0.001	0.005 U	0.005 U	0.005 U	
ICON	Metals	Calcium	mg/L									200	66	110	
ICON	Metals	Chromium	mg/L					0.01 U		0.01 U		0.01 U	0.014	0.01 U	
ICON	Metals	Lead	mg/L	0.011	0.006	0.005 U	0.005 U	0.01 U		0.01	0.007	0.01 U	0.01 U	0.01 U	
ICON	Metals	Magnesium	mg/L									70	140	45	
ICON	Metals	Mercury	mg/L					0.002 U			0.0002 U	0.0002 U	0.0002 U	0.0002 U	
ICON	Metals	Potassium	mg/L									5 U	35	5.2	
ICON	Metals	Selenium	mg/L					0.058		0.02 U		0.043	0.051	0.045	
ICON	Metals	Sodium	mg/L									410	1100	400	
ICON	Metals	Strontium	mg/L	1.68	11.9	5.68	2.43	18.7		1.2	0.691	2	0.98	0.82	
ICON	Metals	Zinc	mg/L					0.017		0.116		0.16	0.13	0.11	
ICON	TPH	TPH-DRO	mg/L	0.122 U	0.477	0.171	0.122 U	0.85		0.14 U	0.121 U	0.15	0.13 U	0.17	
ICON	TPH	TPH-GRO	mg/L	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U		0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	
ICON	TPH	TPH-ORO	mg/L	0.102 U	0.405	0.163	0.188	0.33		0.13 U	0.101 U	0.12	0.12 U	0.15	
ICON	Other	Bicarbonate Alkalinity	mg/L CaCO3									570	200	380	
ICON	Other	Bromide	mg/L					22.4							
ICON	Other	Carbonate Alkalinity	mg/L CaCO3									10 U	10 U	10 U	
ICON	Other	Chlorides	mg/L	2660	14400	3900	6210	16600		1630	888	990	2600	850	
ICON	Other	Field EC	uS	6050	27510	8630	13150				2510				
ICON	Other	Field pH	std units	7.01	6.65	6.04	7.2				7.29				
ICON	Other	Field Turbidity	NTU	260	77	24	13.4				45	191	32.4	170	
ICON	Other	Sulfate	mg/L												
ICON	Other	TDS	mg/L	3740	17200	4840	7470			3400	1680	2500	4800	1900	
MPA	VOC	Benzene	mg/L					0.005 U		0.005 U		0.005 U	0.005 U		0.005 U
MPA	VOC	Ethylbenzene	mg/L					0.005 U		0.005 U		0.005 U	0.005 U		0.005 U
MPA	VOC	Toluene	mg/L					0.005 U		0.005 U		0.00609	0.00764		0.005 U
MPA	VOC	Xylenes	mg/L					0.015 U		0.01 U		0.01 U	0.01 U		0.01 U
MPA	Dissolved Metals	Arsenic	mg/L					0.1 U				0.01 U	0.01 U		0.01 U
MPA	Dissolved Metals	Barium	mg/L					10.8				1.45	0.31		0.69
MPA	Dissolved Metals	Cadmium	mg/L					0.1 U				0.005 U	0.005 U		0.005 U
MPA	Dissolved Metals	Calcium	mg/L									233	65.8		131
MPA	Dissolved Metals	Chromium	mg/L					0.1 U				0.01 U	0.01 U		0.01 U
MPA	Dissolved Metals	Iron	mg/L					16.7				9.69	0.57		3.27
MPA	Dissolved Metals	Lead	mg/L					0.1 U				0.015 U	0.015 U		0.015 U
MPA	Dissolved Metals	Magnesium	mg/L					5.12				79.4	152		54.7
MPA	Dissolved Metals	Manganese	mg/L									0.53	0.67		0.37
MPA	Dissolved Metals	Mercury	mg/L					0.0002 U				0.0002 U	0.0002 U		0.0002 U
MPA	Dissolved Metals	Potassium	mg/L									5.43	44.4		5.54
MPA	Dissolved Metals	Selenium	mg/L									0.04 U	0.04 U		0.04 U
MPA	Dissolved Metals	Sodium	mg/L									477	1330		472

Table A.1 All Groundwater Samples

Sampler	Chemical Group	Parameter	Aquifer:	Peat				Shallow Sand - Confining Unit							
			Sample Location:	AB3	AB5	AB6	AB7	WL-6	A CROUCH WELL AT 1	A_ CROUCH WELL	AB1	HP-MPA-01-T	HP-MPA-02-T	HP-MPA-03-T	HP-MPA-03-T
			Sample Date:	11/10/2006	11/13/2006	11/10/2006	11/13/2006	1/7/2015	9/1/2010	9/1/2010	11/10/2006	9/29/2010	9/29/2010	10/4/2010	9/30/2010
			Screening Interval (ft bgs):	10-20	10 - 22	8 - 18	10 - 20				40 - 50	42 - 45	42 - 45	42 - 45	42 - 45
			Unit												
MPA	Dissolved Metals	Strontium	mg/L					18.4				1.87	1		0.92
MPA	Dissolved Metals	Zinc	mg/L					2 U				0.02 U	0.039		0.02 U
MPA	Metals	Arsenic	mg/L					0.1 U		0.01 U		0.01 U	0.01 U		0.01 U
MPA	Metals	Barium	mg/L					12.1		0.61		2.04	0.43		1.13
MPA	Metals	Cadmium	mg/L					0.1 U		0.01 U		0.005 U	0.005 U		0.005 U
MPA	Metals	Calcium	mg/L					764		160		228	70.1		145
MPA	Metals	Chromium	mg/L					0.1 U		0.02 U		0.071	0.01 U		0.059
MPA	Metals	Iron	mg/L					18.8		68.9		29.1	7.75		16.7
MPA	Metals	Lead	mg/L					0.1 U		0.03 U		0.016	0.015 U		0.015 U
MPA	Metals	Magnesium	mg/L					770				80.1	158		59
MPA	Metals	Manganese	mg/L					5.84				0.78	0.85		0.53
MPA	Metals	Mercury	mg/L					0.0002 U		0.0002 U		0.0002 U	0.0002 U		0.0002 U
MPA	Metals	Potassium	mg/L					61.1				7.17	46.4		6.48
MPA	Metals	Selenium	mg/L									0.04 U	0.04 U		0.04 U
MPA	Metals	Sodium	mg/L					9540				495	1360		525
MPA	Metals	Strontium	mg/L					17				1.87	1.06		1.02
MPA	Metals	Zinc	mg/L					2 U				0.087	0.02 U		0.14
MPA	TPH	Aliphatic >C10-C12	mg/L					0.15 U		0.15 U		0.15 U	0.15 U		0.15 U
MPA	TPH	Aliphatic >C12-C16	mg/L					0.15 U		0.15 U		0.15 U	0.15 U		0.15 U
MPA	TPH	Aliphatic >C16-C35	mg/L					0.15 U		0.15 U		0.15 U	0.15 U		0.15 U
MPA	TPH	Aliphatic >C8-C10	mg/L					0.15 U		0.15 U		0.15 U	0.15 U		0.15 U
MPA	TPH	Aliphatic C6-C8	mg/L					0.15 U		0.15 U		0.15 U	0.15 U		0.15 U
MPA	TPH	Aromatic >C10-C12	mg/L					0.15 U		0.15 U		0.15 U	0.15 U		0.15 U
MPA	TPH	Aromatic >C12-C16	mg/L					0.15 U		0.15 U		0.15 U	0.15 U		0.15 U
MPA	TPH	Aromatic >C16-C21	mg/L					0.15 U		0.15 U		0.15 U	0.15 U		0.15 U
MPA	TPH	Aromatic >C21-C35	mg/L					0.15 U		0.15 U		0.15 U	0.15 U		0.15 U
MPA	TPH	Aromatic >C8-C10	mg/L					0.15 U		0.15 U		0.15 U	0.15 U		0.15 U
MPA	TPH	TPH-DRO	mg/L												
MPA	TPH	TPH-GRO	mg/L												
MPA	TPH	TPH-ORO	mg/L												
MPA	Other	Bicarbonate Alkalinity	mg/L CaCO3					295		120		690	224		384
MPA	Other	Bromide	mg/L					22.6							
MPA	Other	Carbonate Alkalinity	mg/L CaCO3					1 U		1 U		1 U	1 U		1 U
MPA	Other	Chlorides	mg/L					18100	1320	1570		928	2130		801
MPA	Other	Field Turbidity	NTU									212	77		331
MPA	Other	Sodium	mg/L												
MPA	Other	Specific Conductance	umhos/cm						4410	5530					
MPA	Other	Sulfate	mg/L					1 U		176		5 U	53.9		5 U
MPA	Other	TDS	mg/L					35500	2510	3240		2110	4060		1820

Notes:
VOC = Volatile Organic Compound; TPH = Total Petroleum Hydrocarbon; GRO = Gasoline-range Organic; DRO = Diesel-range Organic, ORO = Oil-range Organic; TDS = Total Dissolved Solids.
All samples evaluated are included. Parent and field duplicate samples presented separately.
Detection limits present for non-detected samples.
U = Not detected.
J = Estimated.

Table A.1 All Groundwater Samples

Sampler	Chemical Group	Parameter	Aquifer:	Shallow Sand - Confining Unit											
			Sample Location:	HP-MPA-04-T	HP-MPA-05-T	HP-MPA-06-T	HP-MPA-07-T	HP-MPA-07-T	HP-MPA-08-T	HP-MPA-09-T	HP-MPA-10-T	MW1	MW1	MW2	MW3
			Sample Date:	9/30/2010	9/30/2010	9/30/2010	10/1/2010	10/1/2010	10/1/2010	10/1/2010	10/1/2010	3/5/2010	3/5/2010	3/5/2010	3/5/2010
			Screening Interval (ft bgs):	42 - 45	42 - 45	42 - 45		42 - 45	42 - 45	42 - 45	42 - 45		44 - 54	42 - 52	37.5 - 47.5
			Unit												
ICON	VOC	Benzene	mg/L	0.005 U	0.005 U	0.005 U		0.005 U	0.005 U	0.005 U	0.005 U		0.029	0.005 U	0.005 U
ICON	VOC	Ethylbenzene	mg/L	0.005 U	0.005 U	0.005 U		0.005 U	0.005 U	0.005 U	0.005 U		0.005 U	0.005 U	0.005 U
ICON	VOC	Toluene	mg/L	0.01 U	0.01 U	0.01 U		0.01 U	0.01 U	0.01 U	0.01 U		0.01 U	0.01 U	0.01 U
ICON	VOC	Xylenes	mg/L	0.05 U	0.05 U	0.05 U		0.05 U	0.05 U	0.05 U	0.05 U		0.05 U	0.05 U	0.05 U
ICON	Dissolved Metals	Arsenic	mg/L												
ICON	Dissolved Metals	Barium	mg/L												
ICON	Dissolved Metals	Cadmium	mg/L												
ICON	Dissolved Metals	Chromium	mg/L												
ICON	Dissolved Metals	Lead	mg/L												
ICON	Dissolved Metals	Mercury	mg/L												
ICON	Dissolved Metals	Selenium	mg/L												
ICON	Dissolved Metals	Strontium	mg/L												
ICON	Dissolved Metals	Zinc	mg/L												
ICON	Metals	Arsenic	mg/L	0.01 U	0.032	0.01 U		0.014	0.019	0.019	0.019		0.01 U	0.022	0.01 U
ICON	Metals	Barium	mg/L	0.67	0.59	0.72		0.47	1.4	0.66	0.88		15.4	0.943	8.96
ICON	Metals	Cadmium	mg/L	0.005 U	0.005 U	0.005 U		0.005 U	0.005 U	0.005 U	0.005 U		0.005 U	0.005 U	0.005 U
ICON	Metals	Calcium	mg/L	130	97	160		91	150	70	120				
ICON	Metals	Chromium	mg/L	0.01 U	0.014	0.01 U		0.01 U	0.01	0.01 U	0.01 U		0.01 U	0.01 U	0.01 U
ICON	Metals	Lead	mg/L	0.01 U	0.01 U	0.01 U		0.01 U	0.01 U	0.01 U	0.01 U		0.01 U	0.01 U	0.01 U
ICON	Metals	Magnesium	mg/L	47	50	59		44	80	88	42				
ICON	Metals	Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U		0.0002 U	0.0002 U	0.0002 U	0.0002 U		0.0002 U	0.0002 U	0.0002 U
ICON	Metals	Potassium	mg/L	5.1	7.1	5 U		5 U	14	21	5 U				
ICON	Metals	Selenium	mg/L	0.034	0.035	0.061		0.035	0.041	0.061	0.032		0.07	0.03	0.071
ICON	Metals	Sodium	mg/L	350	390	330		450	570	810	380				
ICON	Metals	Strontium	mg/L	1	0.82	1.1		0.74	1.5	1.2	1.1		14.4	0.877	9.54
ICON	Metals	Zinc	mg/L	0.1	0.073	0.082		0.092	0.054	0.1	0.072		0.014	0.015	0.016
ICON	TPH	TPH-DRO	mg/L	0.13 U	0.13 U	0.13 U		0.13 U	0.13 U	0.14 U	0.13 U		0.133 U	0.133 U	0.133 U
ICON	TPH	TPH-GRO	mg/L	0.15 U	0.15 U	0.15 U		0.15 U	0.15 U	0.15 U	0.15 U		0.15 U	0.15 U	0.15 U
ICON	TPH	TPH-ORO	mg/L	0.12 U	0.12 U	0.12 U		0.12 U	0.12 U	0.12 U	0.12 U		0.122 U	0.122 U	0.122 U
ICON	Other	Bicarbonate Alkalinity	mg/L CaCO3	460	360	320		450	420	230	460				
ICON	Other	Bromide	mg/L												
ICON	Other	Carbonate Alkalinity	mg/L CaCO3	10 U	10 U	10 U		10 U	10 U	10 U	10 U				
ICON	Other	Chlorides	mg/L	920	890	1100		834	100	2200	820		9580	852	10700
ICON	Other	Field EC	uS										21280	3061	22720
ICON	Other	Field pH	std units										6.83	7.46	6.17
ICON	Other	Field Turbidity	NTU	796	1748	275		226	27.5	35.8	1057		1.9	0.68	0.78
ICON	Other	Sulfate	mg/L												
ICON	Other	TDS	mg/L	2200	2000	2700		1800	3300	4400	1900		18400	1860	16300
MPA	VOC	Benzene	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.00508	0.005 U	0.028	0.028	0.005 U	0.00136 J
MPA	VOC	Ethylbenzene	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
MPA	VOC	Toluene	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.00577	0.00646	0.005 U	0.005 U	0.005 U	0.005 U
MPA	VOC	Xylenes	mg/L	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
MPA	Dissolved Metals	Arsenic	mg/L	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U				
MPA	Dissolved Metals	Barium	mg/L	0.84	0.52	0.86	0.5	0.49	2.17	1.62	1.02				
MPA	Dissolved Metals	Cadmium	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U				
MPA	Dissolved Metals	Calcium	mg/L	170	119	206	105	104	238	178	146				
MPA	Dissolved Metals	Chromium	mg/L	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U				
MPA	Dissolved Metals	Iron	mg/L	4.5	1.98	1.93	2.51	2.6	5.25	3.57	2.11				
MPA	Dissolved Metals	Lead	mg/L	0.015 U	0.015 U	0.015 U	0.015 U	0.015 U	0.015 U	0.015 U	0.015 U				
MPA	Dissolved Metals	Magnesium	mg/L	62.6	59.8	77.8	50.4	50.4	104	112	52.7				
MPA	Dissolved Metals	Manganese	mg/L	0.5	0.5	0.52	0.4	0.4	0.49	0.76	0.31				
MPA	Dissolved Metals	Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U		0.0002 U	0.0002 U	0.0002 U	0.0002 U				
MPA	Dissolved Metals	Potassium	mg/L	6.01	7.55	5.53	4.07	4.11	12.9	18.6	5.35				
MPA	Dissolved Metals	Selenium	mg/L	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U				
MPA	Dissolved Metals	Sodium	mg/L	451	479	463	472	491	1730	1140	485				

Table A.1 All Groundwater Samples

Sampler	Chemical Group	Parameter	Aquifer:	Shallow Sand - Confining Unit											
			Sample Location:	HP-MPA-04-T	HP-MPA-05-T	HP-MPA-06-T	HP-MPA-07-T	HP-MPA-07-T	HP-MPA-08-T	HP-MPA-09-T	HP-MPA-10-T	MW1	MW1	MW2	MW3
			Sample Date:	9/30/2010	9/30/2010	9/30/2010	10/1/2010	10/1/2010	10/1/2010	10/1/2010	10/1/2010	3/5/2010	3/5/2010	3/5/2010	3/5/2010
			Screening Interval (ft bgs):	42 - 45	42 - 45	42 - 45		42 - 45	42 - 45	42 - 45	42 - 45		44 - 54	42 - 52	37.5 - 47.5
			Unit												
MPA	Dissolved Metals	Strontium	mg/L	1.24	0.9	1.37	0.79	0.78	2.21	2.68	1.24				
MPA	Dissolved Metals	Zinc	mg/L	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U				
MPA	Metals	Arsenic	mg/L	0.01	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.032	0.01 U	0.01 U	0.019	0.01 U
MPA	Metals	Barium	mg/L	1.3	0.51	1.21	0.63	0.61	2.04	1.59	1.42	14.2	13.7	1.04	6.95
MPA	Metals	Cadmium	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
MPA	Metals	Calcium	mg/L	198	113	202	107	107	223	170	185				
MPA	Metals	Chromium	mg/L	0.074	0.01 U	0.014	0.33	0.029	0.01 U	0.01 U	0.081	0.01 U	0.01 U	0.01 U	0.01 U
MPA	Metals	Iron	mg/L	27.4	2.6	6.88	13	11.1	7.19	5.92	34.7				
MPA	Metals	Lead	mg/L	0.027	0.015 U	0.015 U	0.015 U	0.015 U	0.015 U	0.015 U	0.032	0.0072 B	0.0057 B	0.015 U	0.0035 B
MPA	Metals	Magnesium	mg/L	65.1	56.8	74.1	52.1	51.8	97.7	106	59.7				
MPA	Metals	Manganese	mg/L	0.86	0.49	0.6	0.51	0.5	0.47	0.76	0.92				
MPA	Metals	Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U		0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
MPA	Metals	Potassium	mg/L	7.57	7.53	5.84	5.7	5.19	12	18.2	8.17				
MPA	Metals	Selenium	mg/L	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
MPA	Metals	Sodium	mg/L	482	508	457	490	495	1700	1410	472				
MPA	Metals	Strontium	mg/L	1.35	0.9	1.37	0.82	0.82	2.07	2.57	1.35	12.7	13.4	0.93	7.3
MPA	Metals	Zinc	mg/L	0.091	0.02 U	0.02 U	0.053	0.053	0.02 U	0.02 U	0.12	0.02 U	0.02 U	0.02 U	0.02 U
MPA	TPH	Aliphatic >C10-C12	mg/L	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U				
MPA	TPH	Aliphatic >C12-C16	mg/L	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U				
MPA	TPH	Aliphatic >C16-C35	mg/L	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U				
MPA	TPH	Aliphatic >C8-C10	mg/L	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U				
MPA	TPH	Aliphatic C6-C8	mg/L	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U				
MPA	TPH	Aromatic >C10-C12	mg/L	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U				
MPA	TPH	Aromatic >C12-C16	mg/L	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U				
MPA	TPH	Aromatic >C16-C21	mg/L	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U				
MPA	TPH	Aromatic >C21-C35	mg/L	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U				
MPA	TPH	Aromatic >C8-C10	mg/L	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U				
MPA	TPH	TPH-DRO	mg/L									0.15 U	0.15 U	0.15 U	0.15 U
MPA	TPH	TPH-GRO	mg/L									0.15 U	0.15 U	0.15 U	0.15 U
MPA	TPH	TPH-ORO	mg/L									0.15 U	0.15 U	0.15 U	0.15 U
MPA	Other	Bicarbonate Alkalinity	mg/L CaCO3	447	345	330	476	410	603	270	426				
MPA	Other	Bromide	mg/L									19.3 B	19.2 B	3.18	23.9
MPA	Other	Carbonate Alkalinity	mg/L CaCO3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U				
MPA	Other	Chlorides	mg/L	817	831	957	817	808	1520	2350	850	9040	9150	960	9100
MPA	Other	Field Turbidity	NTU	470	27	313		390	28	27	1000				
MPA	Other	Sodium	mg/L												
MPA	Other	Specific Conductance	umhos/cm												
MPA	Other	Sulfate	mg/L	5 U	21.7	16.4	5 U	5 U	10.1	69.1	5 U				
MPA	Other	TDS	mg/L	1660	1680	1920	1810	1570	3090	4520	1680	17300	17000	2010	17200

Notes:

VOC = Volatile Organic Compound; TPH = Total Petroleum Hydrocarbon; GRO = Gasoline-range Organic; DRO = Diesel-range Organic, ORO = Oil-range Organic; TDS = Total Dissolved Solids.

All samples evaluated are included. Parent and field duplicate samples presented separately.

Detection limits present for non-detected samples.

U = Not detected.

J = Estimated.

Table A.1 All Groundwater Samples

Sampler	Chemical Group	Parameter	Aquifer:	Shallow Sand - Confining Unit										Intermediate Sand - Confining Unit		
			Sample Location:	MW-6S	PURVIS HEBERT	PURVIS HEBERT	PURVIS HEBERT	PURVIS HEBERT	SB-1-MW-S	SB-1-MW-S	SB-1-MW-S	SB-2-MW-S	SB-2-MW-S	SB-3-MW-S	HP-MPA-02-I	HP-MPA-03-I
			Sample Date:	5/12/2010	9/1/2010	9/1/2010	9/1/2010	4/21/2014	4/21/2014	5/7/2010	6/8/2010	5/11/2010	5/7/2010	5/12/2010	9/29/2010	10/4/2010
			Screening Interval (ft bgs):	47 - 50						44 - 55	44 - 55	42 - 52	42 - 52	37 - 47	72 - 75	72 - 75
			Unit													
ICON	VOC	Benzene	mg/L	0.005 U			0.005 U			0.016	0.014	0.005 U		0.005 U	0.005 U	0.005 U
ICON	VOC	Ethylbenzene	mg/L	0.005 U			0.005 U			0.005 U	0.005 U	0.005 U		0.005 U	0.005 U	0.005 U
ICON	VOC	Toluene	mg/L	0.01 U			0.01 U			0.01 U	0.01 U	0.01 U		0.01 U	0.01 U	0.01 U
ICON	VOC	Xylenes	mg/L	0.05 U			0.05 U			0.05 U	0.05 U	0.05 U		0.05 U	0.05 U	0.05 U
ICON	Dissolved Metals	Arsenic	mg/L	0.01 U										0.01 U		
ICON	Dissolved Metals	Barium	mg/L	0.702										4.83		
ICON	Dissolved Metals	Cadmium	mg/L	0.005 U										0.005 U		
ICON	Dissolved Metals	Chromium	mg/L	0.01 U										0.01 U		
ICON	Dissolved Metals	Lead	mg/L	0.01 U										0.01 U		
ICON	Dissolved Metals	Mercury	mg/L													
ICON	Dissolved Metals	Selenium	mg/L	0.043										0.104		
ICON	Dissolved Metals	Strontium	mg/L	0.595										6.84		
ICON	Dissolved Metals	Zinc	mg/L	0.02										0.01 U		
ICON	Metals	Arsenic	mg/L				0.01 U			0.01 U		0.01 U			0.01 U	0.01 U
ICON	Metals	Barium	mg/L				0.25			4.81		1.23			1.48	0.605
ICON	Metals	Cadmium	mg/L				0.005 U			0.005 U		0.005 U			0.005 U	0.005 U
ICON	Metals	Calcium	mg/L												160	97
ICON	Metals	Chromium	mg/L				0.01 U			0.01 U		0.01 U			0.01 U	0.0105
ICON	Metals	Lead	mg/L				0.01 U			0.01 U		0.01 U			0.01 U	0.01 U
ICON	Metals	Magnesium	mg/L												54	36
ICON	Metals	Mercury	mg/L							0.0002 U		0.0002 U			0.0002 U	0.0002 U
ICON	Metals	Potassium	mg/L												5 U	5.6
ICON	Metals	Selenium	mg/L				0.02 U			0.058		0.02 U			0.0891	0.0699
ICON	Metals	Sodium	mg/L												390	380
ICON	Metals	Strontium	mg/L				0.55			5.42		1.46			1.33	0.909
ICON	Metals	Zinc	mg/L				0.042			0.017		0.024			0.0983	0.0358
ICON	TPH	TPH-DRO	mg/L	0.136 U			0.136 U			0.136 U		0.134 U		0.134 U	0.13 U	0.13 U
ICON	TPH	TPH-GRO	mg/L	0.15 U			0.15 U			0.15 U		0.15 U		0.15 U	0.15 U	0.15 U
ICON	TPH	TPH-ORO	mg/L	0.126 U			0.126 U			0.126 U		0.124 U		0.124 U	0.12 U	0.12 U
ICON	Other	Bicarbonate Alkalinity	mg/L CaCO3	360						562		300		382	310	360
ICON	Other	Bromide	mg/L	1.93						2 U		0.2 U		0.2 U		
ICON	Other	Carbonate Alkalinity	mg/L CaCO3	10 U						10 U		10 U		10 U	10 U	10 U
ICON	Other	Chlorides	mg/L	746			824			5470		1060		6180	1300	820
ICON	Other	Field EC	uS													
ICON	Other	Field pH	std units													
ICON	Other	Field Turbidity	NTU												96	
ICON	Other	Sulfate	mg/L	0.41									9.83	4.88		
ICON	Other	TDS	mg/L	1440			1800			7880		5100		12800	2500	1800
MPA	VOC	Benzene	mg/L	0.005 U			0.005 U	0.001 U	0.015	0.017	0.015	0.005 U		0.005 U	0.005 U	0.005 U
MPA	VOC	Ethylbenzene	mg/L	0.005 U			0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U		0.005 U	0.005 U	0.005 U
MPA	VOC	Toluene	mg/L	0.005 U			0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U		0.005 U	0.00574	0.00774
MPA	VOC	Xylenes	mg/L	0.01 U			0.01 U	0.015 U	0.015 U	0.01 U	0.01 U	0.01 U		0.01 U	0.01 U	0.005 U
MPA	Dissolved Metals	Arsenic	mg/L	0.0016 B				0.01 U	0.01 U	0.01 U		0.00086 B		0.01 U	0.01 U	0.01 U
MPA	Dissolved Metals	Barium	mg/L	0.99				0.24	3.52	5.61		1.34		6.06	0.99	1.58
MPA	Dissolved Metals	Cadmium	mg/L					0.005 U							0.005 U	0.005 U
MPA	Dissolved Metals	Calcium	mg/L	95.7						568		187		831	123	186
MPA	Dissolved Metals	Chromium	mg/L					0.01 U							0.01 U	0.01 U
MPA	Dissolved Metals	Iron	mg/L	7.75				10.9	8.75	15.4		5.77		13.9	4.67	5.36
MPA	Dissolved Metals	Lead	mg/L					0.015 U							0.015 U	0.015 U
MPA	Dissolved Metals	Magnesium	mg/L	32.2						220		67.1		333	45.9	63
MPA	Dissolved Metals	Manganese	mg/L	0.21				1.69	2.13	3.12		0.56		2.85	0.28	0.37
MPA	Dissolved Metals	Mercury	mg/L					0.0002 U							0.0002 U	0.0002 U
MPA	Dissolved Metals	Potassium	mg/L	5.52						10.4		6.15		13.8	4.76	5.72
MPA	Dissolved Metals	Selenium	mg/L	0.04 U						0.04 U		0.04 U		0.04 U	0.04 U	0.04 U
MPA	Dissolved Metals	Sodium	mg/L	424						1840		544		2080	352	445

Table A.1 All Groundwater Samples

Sampler	Chemical Group	Parameter	Aquifer:	Shallow Sand - Confining Unit										Intermediate Sand - Confining Unit		
			Sample Location:	MW-6S	PURVIS HEBERT	PURVIS HEBERT	PURVIS HEBERT	PURVIS HEBERT	SB-1-MW-S	SB-1-MW-S	SB-1-MW-S	SB-2-MW-S	SB-2-MW-S	SB-3-MW-S	HP-MPA-02-I	HP-MPA-03-I
			Sample Date:	5/12/2010	9/1/2010	9/1/2010	9/1/2010	4/21/2014	4/21/2014	5/7/2010	6/8/2010	5/11/2010	5/7/2010	5/12/2010	9/29/2010	10/4/2010
			Screening Interval (ft bgs):	47 - 50						44 - 55	44 - 55	42 - 52	42 - 52	37 - 47	72 - 75	72 - 75
			Unit													
MPA	Dissolved Metals	Strontium	mg/L					0.47							0.91	1.42
MPA	Dissolved Metals	Zinc	mg/L					0.062							0.02 U	0.03
MPA	Metals	Arsenic	mg/L	0.0025 B			0.01 U	0.01 U	0.01 U	0.01 U		0.0023 B		0.01 U	0.01 U	0.01 U
MPA	Metals	Barium	mg/L	1.1			0.28	0.22	3.32	5.02		1.46		6.51	1.5	1.8
MPA	Metals	Cadmium	mg/L				0.005 U	0.005 U							0.005 U	0.005 U
MPA	Metals	Calcium	mg/L	97			88.6	61.5	358	520		200		860	124	195
MPA	Metals	Chromium	mg/L				0.01 U	0.01 U							0.045	0.063
MPA	Metals	Iron	mg/L	19.7			13.5	10.5	8.99	15.6		7.92		17.4	16.3	18.7
MPA	Metals	Lead	mg/L				0.015 U	0.015 U							0.015 U	0.015 U
MPA	Metals	Magnesium	mg/L	33			56.3	41.9	148	201		70.3		356	47.4	67.8
MPA	Metals	Manganese	mg/L	0.36			2.42	1.57	2.01	2.96		0.61		3.28	0.49	0.53
MPA	Metals	Mercury	mg/L				0.0002 U	0.0002 U							0.0002 U	0.0002 U
MPA	Metals	Potassium	mg/L	6.6			7.89	6.09	9	10.3		6.33		13.7	5.99	6.83
MPA	Metals	Selenium	mg/L	0.04 U			0.04 U			0.04 U		0.04 U		0.04 U	0.04 U	0.04 U
MPA	Metals	Sodium	mg/L	429				309	1260	1710		581		2250	379	473
MPA	Metals	Strontium	mg/L				0.66	0.47							0.97	1.51
MPA	Metals	Zinc	mg/L				0.035	0.053							0.037	0.19
MPA	TPH	Aliphatic >C10-C12	mg/L	0.15 U			0.15 U	0.15 U	0.15 U	0.15 U		0.15 U		0.15 U	0.15 U	0.15 U
MPA	TPH	Aliphatic >C12-C16	mg/L	0.15 U			0.15 U	0.15 U	0.15 U	0.15 U		0.15 U		0.15 U	0.15 U	0.15 U
MPA	TPH	Aliphatic >C16-C35	mg/L	0.15 U			0.15 U	0.15 U	0.15 U	0.15 U		0.15 U		0.15 U	0.15 U	0.15 U
MPA	TPH	Aliphatic >C8-C10	mg/L	0.15 U			0.15 U	0.15 U	0.15 U	0.15 U		0.15 U		0.15 U	0.15 U	0.15 U
MPA	TPH	Aliphatic C6-C8	mg/L	0.15 U			0.15 U	0.15 U	0.15 U	0.15 U		0.15 U		0.15 U	0.15 U	0.15 U
MPA	TPH	Aromatic >C10-C12	mg/L	0.15 U			0.15 U	0.15 U	0.15 U	0.15 U		0.15 U		0.15 U	0.15 U	0.15 U
MPA	TPH	Aromatic >C12-C16	mg/L	0.15 U			0.15 U	0.15 U	0.15 U	0.15 U		0.15 U		0.15 U	0.15 U	0.15 U
MPA	TPH	Aromatic >C16-C21	mg/L	0.15 U			0.15 U	0.15 U	0.15 U	0.15 U		0.15 U		0.15 U	0.15 U	0.15 U
MPA	TPH	Aromatic >C21-C35	mg/L	0.15 U			0.15 U	0.15 U	0.15 U	0.15 U		0.15 U		0.15 U	0.15 U	0.15 U
MPA	TPH	Aromatic >C8-C10	mg/L	0.15 U			0.15 U	0.15 U	0.15 U	0.15 U		0.15 U		0.15 U	0.15 U	0.15 U
MPA	TPH	TPH-DRO	mg/L													
MPA	TPH	TPH-GRO	mg/L													
MPA	TPH	TPH-ORO	mg/L													
MPA	Other	Bicarbonate Alkalinity	mg/L CaCO3	474			225	177	384	349		602		385	352	351
MPA	Other	Bromide	mg/L					2.71	13.4							
MPA	Other	Carbonate Alkalinity	mg/L CaCO3	1 U			1 U	1 U	1 U	1 U		1 U		1 U	1 U	1 U
MPA	Other	Chlorides	mg/L	772	827	804	851	555	3120	4160		1220		7160	641	959
MPA	Other	Field Turbidity	NTU	624.7											96	1111
MPA	Other	Sodium	mg/L				389									
MPA	Other	Specific Conductance	umhos/cm		3080	2930	3210									
MPA	Other	Sulfate	mg/L	5 U			90	89.1	4 U	5 U		10.6		2.4 B	5 U	5 U
MPA	Other	TDS	mg/L	1590	1810	1730	1780	1240	5400	7780		2530		12000	1260	2220

Notes:

VOC = Volatile Organic Compound; TPH = Total Petroleum Hydrocarbon; GRO = Gasoline-range Organic; DRO = Diesel-range Organic, ORO = Oil-range Organic; TDS = Total Dissolved Solids.

All samples evaluated are included. Parent and field duplicate samples presented separately.

Detection limits present for non-detected samples.

U = Not detected.

J = Estimated.

Table A.1 All Groundwater Samples

Sampler	Chemical Group	Parameter	Aquifer:	Intermediate Sand - Confining Unit											
			Sample Location:	HP-MPA-04-I	HP-MPA-04-I	HP-MPA-05-I	HP-MPA-06-I	HP-MPA-07-I	HP-MPA-08-I	HP-MPA-09-I	HP-MPA-10-I	MW-4D	MW-5D	MW-5D	MW-6D
			Sample Date:	10/4/2010	10/4/2010	10/6/2010	10/6/2010	10/5/2010	10/5/2010	10/6/2010	10/6/2010	5/12/2010	5/12/2010	5/7/2010	5/12/2010
			Screening Interval (ft bgs):	70 - 72	80 - 83	72 - 75	72 - 75	72 - 75	72 - 75	72 - 75	72 - 75	75 - 77	75 - 77	75 - 77	75 - 77
			Unit												
ICON	VOC	Benzene	mg/L		0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U		0.005 U
ICON	VOC	Ethylbenzene	mg/L		0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U		0.005 U
ICON	VOC	Toluene	mg/L		0.01	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U		0.01 U
ICON	VOC	Xylenes	mg/L		0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U		0.05 U
ICON	Dissolved Metals	Arsenic	mg/L									0.01 U	0.01 U		0.01 U
ICON	Dissolved Metals	Barium	mg/L									0.465	0.821		0.836
ICON	Dissolved Metals	Cadmium	mg/L									0.005 U	0.005 U		0.005 U
ICON	Dissolved Metals	Chromium	mg/L									0.01 U	0.01 U		0.01 U
ICON	Dissolved Metals	Lead	mg/L									0.01 U	0.01 U		0.01 U
ICON	Dissolved Metals	Mercury	mg/L												
ICON	Dissolved Metals	Selenium	mg/L									0.04	0.038		0.04
ICON	Dissolved Metals	Strontium	mg/L									0.54	0.861		0.55
ICON	Dissolved Metals	Zinc	mg/L									0.01 U	0.013		0.01 U
ICON	Metals	Arsenic	mg/L		0.01 U	0.0142	0.0127	0.01 U	0.01 U	0.01 U	0.0255				
ICON	Metals	Barium	mg/L		0.605	0.543	1	0.878	0.607	1.48	0.717				
ICON	Metals	Cadmium	mg/L		0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U				
ICON	Metals	Calcium	mg/L		97	83	100	88	72	140	76				
ICON	Metals	Chromium	mg/L		0.0105	0.01 U	0.01 U	0.0102	0.01 U	0.01 U	0.02				
ICON	Metals	Lead	mg/L		0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U				
ICON	Metals	Magnesium	mg/L		36	33	37	34	41	46	25				
ICON	Metals	Mercury	mg/L		0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U				
ICON	Metals	Potassium	mg/L		5.6	5 U	5.1	5 U	8.6	5 U	6.2				
ICON	Metals	Selenium	mg/L		0.0699	0.0584	0.0368	0.0976	0.0704	0.0754	0.0428				
ICON	Metals	Sodium	mg/L		380	330	440	370	390	520	330				
ICON	Metals	Strontium	mg/L		0.909	0.792	1	0.863	0.749	1.23	0.689				
ICON	Metals	Zinc	mg/L		0.0358	0.0204	0.0192	0.0371	0.0133	0.0289	0.0272				
ICON	TPH	TPH-DRO	mg/L		0.13 U	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U	0.131 U	0.135 U		0.133 U
ICON	TPH	TPH-GRO	mg/L		0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U		0.15 U
ICON	TPH	TPH-ORO	mg/L		0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.121 U	0.125 U		0.122 U
ICON	Other	Bicarbonate Alkalinity	mg/L CaCO3		360	320	370	370	280	280	340	288	298		430
ICON	Other	Bromide	mg/L									0.2 U	0.2 U		2.09
ICON	Other	Carbonate Alkalinity	mg/L CaCO3		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U		10 U
ICON	Other	Chlorides	mg/L		820	760	990	850	830	1500	690	426	923		550
ICON	Other	Field EC	uS												
ICON	Other	Field pH	std units												
ICON	Other	Field Turbidity	NTU	1351	2119	217	3519	854	193	1470	3477				
ICON	Other	Sulfate	mg/L									0.21	0.26	0.2 U	32.7
ICON	Other	TDS	mg/L		1800	1600	1900	1700	1600	2800	1400	1030	1860		1540
MPA	VOC	Benzene	mg/L	0.005 U		0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U		0.005 U
MPA	VOC	Ethylbenzene	mg/L	0.005 U		0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U		0.005 U
MPA	VOC	Toluene	mg/L	0.011		0.00711	0.00657	0.00757	0.00635	0.00822	0.0072	0.005 U	0.005 U		0.005 U
MPA	VOC	Xylenes	mg/L	0.005 U		0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.01 U	0.01 U		0.01 U
MPA	Dissolved Metals	Arsenic	mg/L	0.01 U		0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.0012 B	0.01 U		0.01 U
MPA	Dissolved Metals	Barium	mg/L		0.76	0.59	1.02	0.9	0.64	1.64	0.78	0.62	1.09		1.14
MPA	Dissolved Metals	Cadmium	mg/L		0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U				
MPA	Dissolved Metals	Calcium	mg/L		129	107	117	102	85.3	167	96.4	112	140		86.1
MPA	Dissolved Metals	Chromium	mg/L		0.041	0.01 U	0.01 U	0.011	0.01 U	0.01 U	0.01 U				
MPA	Dissolved Metals	Iron	mg/L		12	3.21	4.99	5.79	3.41	7.45	4.37	5.84	5.16		4.07
MPA	Dissolved Metals	Lead	mg/L		0.015 U	0.015 U	0.015 U	0.015 U	0.015 U	0.015 U	0.015 U				
MPA	Dissolved Metals	Magnesium	mg/L		43	39.1	40.6	37.7	46.9	55.8	30.7	41.3	45.3		28.9
MPA	Dissolved Metals	Manganese	mg/L		0.36	0.23	0.24	0.29	0.24	0.36	0.2	0.26	0.27		0.14
MPA	Dissolved Metals	Mercury	mg/L		0.0002 U		6.51	0.0002 U	11.5	0.0002 U	0.0002 U				
MPA	Dissolved Metals	Potassium	mg/L		6.7	5.24	0.0002 U	4.76	0.0002 U	7.16	8.07	4.57	5.97		5.1
MPA	Dissolved Metals	Selenium	mg/L		0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U		0.04 U
MPA	Dissolved Metals	Sodium	mg/L		449	387	491	391	465	624	416	199	454		435

Table A.1 All Groundwater Samples

Sampler	Chemical Group	Parameter	Aquifer:	Intermediate Sand - Confining Unit											
			Sample Location:	HP-MPA-04-I	HP-MPA-04-I	HP-MPA-05-I	HP-MPA-06-I	HP-MPA-07-I	HP-MPA-08-I	HP-MPA-09-I	HP-MPA-10-I	MW-4D	MW-5D	MW-5D	MW-6D
			Sample Date:	10/4/2010	10/4/2010	10/6/2010	10/6/2010	10/5/2010	10/5/2010	10/6/2010	10/6/2010	5/12/2010	5/12/2010	5/7/2010	5/12/2010
			Screening Interval (ft bgs):	70 - 72	80 - 83	72 - 75	72 - 75	72 - 75	72 - 75	72 - 75	72 - 75	75 - 77	75 - 77	75 - 77	75 - 77
			Unit												
MPA	Dissolved Metals	Strontium	mg/L		1.02	0.86	1	0.87	0.78	1.37	0.77				
MPA	Dissolved Metals	Zinc	mg/L		0.081	0.02 U	0.02 U	0.034	0.02 U	0.02 U	0.02 U				
MPA	Metals	Arsenic	mg/L	0.01 U		0.01 U	0.013	0.01 U	0.01 U	0.01 U	0.028	0.0047 B	0.0099 B		0.0041 B
MPA	Metals	Barium	mg/L		1.02	0.7	1.45	1.1	0.89	1.93	1.42	0.79	1.32		1.31
MPA	Metals	Cadmium	mg/L		0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U				
MPA	Metals	Calcium	mg/L		136	102	145	110	129	176	132	118	143		89.4
MPA	Metals	Chromium	mg/L		0.18	0.031	0.21	0.095	0.034	0.13	0.34				
MPA	Metals	Iron	mg/L		40.9	11.6	49.8	22.7	31.7	31.1	82.8	20.3	33		20.3
MPA	Metals	Lead	mg/L		0.032	0.015 U	0.028	0.015 U	0.027	0.015 U	0.057				
MPA	Metals	Magnesium	mg/L		47.1	39.7	49.6	42.2	66.3	61	45.5	44.3	47.9		31.4
MPA	Metals	Manganese	mg/L		0.69	0.42	1.01	0.46	0.83	0.86	1.74	0.45	0.73		0.33
MPA	Metals	Mercury	mg/L		0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U				
MPA	Metals	Potassium	mg/L		8.31	5.61	8.59	6.06	13.1	8.99	11.9	6.18	8.23		7.01
MPA	Metals	Selenium	mg/L		0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U		0.04 U
MPA	Metals	Sodium	mg/L		460	380	488	429	466	626		200	442		445
MPA	Metals	Strontium	mg/L		1.05	0.83	1.1	0.93	0.84	1.41	0.88				
MPA	Metals	Zinc	mg/L		0.34	0.067	0.24	0.22	0.13	0.16	0.35				
MPA	TPH	Aliphatic >C10-C12	mg/L		0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U		0.15 U
MPA	TPH	Aliphatic >C12-C16	mg/L		0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U		0.15 U
MPA	TPH	Aliphatic >C16-C35	mg/L		0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U		0.15 U
MPA	TPH	Aliphatic >C8-C10	mg/L		0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U		0.15 U
MPA	TPH	Aliphatic C6-C8	mg/L		0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U		0.15 U
MPA	TPH	Aromatic >C10-C12	mg/L		0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U		0.15 U
MPA	TPH	Aromatic >C12-C16	mg/L		0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U		0.15 U
MPA	TPH	Aromatic >C16-C21	mg/L		0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U		0.15 U
MPA	TPH	Aromatic >C21-C35	mg/L		0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U		0.15 U
MPA	TPH	Aromatic >C8-C10	mg/L		0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U		0.15 U
MPA	TPH	TPH-DRO	mg/L												
MPA	TPH	TPH-GRO	mg/L												
MPA	TPH	TPH-ORO	mg/L												
MPA	Other	Bicarbonate Alkalinity	mg/L CaCO3	379		407	457	402	339	405	442	328	364		588
MPA	Other	Bromide	mg/L												
MPA	Other	Carbonate Alkalinity	mg/L CaCO3	1 U		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U		1 U
MPA	Other	Chlorides	mg/L	809		629	851	696	737	1110	613	447	944		598
MPA	Other	Field Turbidity	NTU		862	285	441	497	88	759	461	292	1286		548.6
MPA	Other	Sodium	mg/L								383				
MPA	Other	Specific Conductance	umhos/cm												
MPA	Other	Sulfate	mg/L	5 U		5 U	5 U	5 U	30	5 U	5 U	5 U	5 U		37.8
MPA	Other	TDS	mg/L	1900		1530	2030	1710	1870	2610	1520	1230	2110		1500

Notes:

VOC = Volatile Organic Compound; TPH = Total Petroleum Hydrocarbon; GRO = Gasoline-range Organic; DRO = Diesel-range Organic, ORO = Oil-range Organic; TDS = Total Dissolved Solids.

All samples evaluated are included. Parent and field duplicate samples presented separately.

Detection limits present for non-detected samples.

U = Not detected.

J = Estimated.

Table A.1 All Groundwater Samples

Sampler	Chemical Group	Parameter	Aquifer:	Deep Sand - Confining Unit		
			Sample Location:	SB-1-MW-D	MW-1C	MW-1C
			Sample Date:	5/6/2010	5/13/2010	6/2/2010
			Screening Interval (ft bgs):	72 - 74	97 - 100	97 - 100
			Unit			
ICON	VOC	Benzene	mg/L	0.005 U	0.005 U	
ICON	VOC	Ethylbenzene	mg/L	0.005 U	0.005 U	
ICON	VOC	Toluene	mg/L	0.01 U	0.01 U	
ICON	VOC	Xylenes	mg/L	0.05 U	0.05 U	
ICON	Dissolved Metals	Arsenic	mg/L	0.01 U	0.01 U	
ICON	Dissolved Metals	Barium	mg/L	1.53	0.908	
ICON	Dissolved Metals	Cadmium	mg/L	0.005 U	0.005 U	
ICON	Dissolved Metals	Chromium	mg/L	0.01 U	0.01 U	
ICON	Dissolved Metals	Lead	mg/L	0.01 U	0.01 U	
ICON	Dissolved Metals	Mercury	mg/L	0.0002 U		
ICON	Dissolved Metals	Selenium	mg/L	0.053	0.031	
ICON	Dissolved Metals	Strontium	mg/L	1.42	0.824	
ICON	Dissolved Metals	Zinc	mg/L	0.188	0.01 U	
ICON	Metals	Arsenic	mg/L			
ICON	Metals	Barium	mg/L			
ICON	Metals	Cadmium	mg/L			
ICON	Metals	Calcium	mg/L			
ICON	Metals	Chromium	mg/L			
ICON	Metals	Lead	mg/L			
ICON	Metals	Magnesium	mg/L			
ICON	Metals	Mercury	mg/L			
ICON	Metals	Potassium	mg/L			
ICON	Metals	Selenium	mg/L			
ICON	Metals	Sodium	mg/L			
ICON	Metals	Strontium	mg/L			
ICON	Metals	Zinc	mg/L			
ICON	TPH	TPH-DRO	mg/L	0.14 U	0.131 U	
ICON	TPH	TPH-GRO	mg/L	0.15 U	0.15 U	
ICON	TPH	TPH-ORO	mg/L	0.146 U	0.121 U	
ICON	Other	Bicarbonate Alkalinity	mg/L CaCO3	288	340	
ICON	Other	Bromide	mg/L	0.2 U		2 U
ICON	Other	Carbonate Alkalinity	mg/L CaCO3	10 U	10 U	
ICON	Other	Chlorides	mg/L	1310	888	
ICON	Other	Field EC	uS			
ICON	Other	Field pH	std units			
ICON	Other	Field Turbidity	NTU	454.7		
ICON	Other	Sulfate	mg/L	2.19	3.03	
ICON	Other	TDS	mg/L		1820	
MPA	VOC	Benzene	mg/L	0.00185 J	0.005 U	
MPA	VOC	Ethylbenzene	mg/L	0.005 U	0.005 U	
MPA	VOC	Toluene	mg/L	0.005 U	0.005 U	
MPA	VOC	Xylenes	mg/L	0.01 U	0.01 U	
MPA	Dissolved Metals	Arsenic	mg/L	0.01 U	0.01 U	
MPA	Dissolved Metals	Barium	mg/L	1.81	1.12	
MPA	Dissolved Metals	Cadmium	mg/L			
MPA	Dissolved Metals	Calcium	mg/L	188	120	
MPA	Dissolved Metals	Chromium	mg/L			
MPA	Dissolved Metals	Iron	mg/L	9.28	4.51	
MPA	Dissolved Metals	Lead	mg/L			
MPA	Dissolved Metals	Magnesium	mg/L	68.2	42.7	
MPA	Dissolved Metals	Manganese	mg/L	0.63	0.21	
MPA	Dissolved Metals	Mercury	mg/L			
MPA	Dissolved Metals	Potassium	mg/L	5.96	5.84	
MPA	Dissolved Metals	Selenium	mg/L	0.04 U	0.04 U	
MPA	Dissolved Metals	Sodium	mg/L	563	467	

Table A.1 All Groundwater Samples

Sampler	Chemical Group	Parameter	Aquifer:	Deep Sand - Confining Unit		
			Sample Location:	SB-1-MW-D	MW-1C	MW-1C
			Sample Date:	5/6/2010	5/13/2010	6/2/2010
			Screening Interval (ft bgs):	72 - 74	97 - 100	97 - 100
			Unit			
MPA	Dissolved Metals	Strontium	mg/L			
MPA	Dissolved Metals	Zinc	mg/L			
MPA	Metals	Arsenic	mg/L	0.017	0.01 U	
MPA	Metals	Barium	mg/L	2.11	1.18	
MPA	Metals	Cadmium	mg/L			
MPA	Metals	Calcium	mg/L	204	124	
MPA	Metals	Chromium	mg/L			
MPA	Metals	Iron	mg/L	44.4	7.45	
MPA	Metals	Lead	mg/L			
MPA	Metals	Magnesium	mg/L	75.9	43.8	
MPA	Metals	Manganese	mg/L	0.97	0.24	
MPA	Metals	Mercury	mg/L			
MPA	Metals	Potassium	mg/L	7.55	6.03	
MPA	Metals	Selenium	mg/L	0.04 U	0.04 U	
MPA	Metals	Sodium	mg/L	628	494	
MPA	Metals	Strontium	mg/L			
MPA	Metals	Zinc	mg/L			
MPA	TPH	Aliphatic >C10-C12	mg/L	0.15 U	0.15 U	
MPA	TPH	Aliphatic >C12-C16	mg/L	0.15 U	0.15 U	
MPA	TPH	Aliphatic >C16-C35	mg/L	0.15 U	0.15 U	
MPA	TPH	Aliphatic >C8-C10	mg/L	0.15 U	0.15 U	
MPA	TPH	Aliphatic C6-C8	mg/L	0.15 U	0.15 U	
MPA	TPH	Aromatic >C10-C12	mg/L	0.15 U	0.15 U	
MPA	TPH	Aromatic >C12-C16	mg/L	0.15 U	0.15 U	
MPA	TPH	Aromatic >C16-C21	mg/L	0.15 U	0.15 U	
MPA	TPH	Aromatic >C21-C35	mg/L	0.15 U	0.15 U	
MPA	TPH	Aromatic >C8-C10	mg/L	0.15 U	0.15 U	
MPA	TPH	TPH-DRO	mg/L			
MPA	TPH	TPH-GRO	mg/L			
MPA	TPH	TPH-ORO	mg/L			
MPA	Other	Bicarbonate Alkalinity	mg/L CaCO3	356	351	
MPA	Other	Bromide	mg/L			
MPA	Other	Carbonate Alkalinity	mg/L CaCO3	1 U	1 U	
MPA	Other	Chlorides	mg/L	1420	1000	
MPA	Other	Field Turbidity	NTU		37.73	
MPA	Other	Sodium	mg/L			
MPA	Other	Specific Conductance	umhos/cm			
MPA	Other	Sulfate	mg/L	5 U	5 U	
MPA	Other	TDS	mg/L	2800	2150	

Notes:

VOC = Volatile Organic Compound; TPH = Total Petroleum Hydrocarbon; GRO = Gasoline-range Organic; DRO = Diesel-range Organic, ORO = Oil-range Organic; TDS = Total Dissolved Solids.

All samples evaluated are included. Parent and field duplicate samples presented separately.

Detection limits present for non-detected samples.

U = Not detected.

J = Estimated.

Table A.2 All Soil/Sediment (0-3 ft bgs) Samples

Sampler	Chemical Group	Parameter	Station:	AB13	AB13	AB13	AB13	AB14	B12	B14	B17
			Sample ID:	AB13	MPA-AB13	AB13 SO-E	AB13	AB14	B12	B14	B17
			Sample Date:	11/13/2006	5/20/2010	8/1/2010	8/1/2010	11/13/2006	8/10/2006	8/10/2006	8/10/2006
			Sample Depth (ft bgs):	0 - 3	0 - 3	0 - 3	0 - 3	0 - 3	0 - 1.5	0 - 1	0 - 3
			Used?:	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
			Unit								
ICON	VOC	Benzene	mg/kg								
ICON	VOC	Ethylbenzene	mg/kg								
ICON	VOC	Toluene	mg/kg								
ICON	VOC	Xylenes	mg/kg								
ICON	Metals	Arsenic	mg/kg	12.9	5.41			5.51			7.75
ICON	Metals	Barium	mg/kg	551				200			453
ICON	Metals	Cadmium	mg/kg	0.45				0.22			0.24
ICON	Metals	Chromium	mg/kg	7.73				12.8			11.9
ICON	Metals	Lead	mg/kg	8.11				14.4			12.3
ICON	Metals	Mercury	mg/kg								
ICON	Metals	Selenium	mg/kg								1.99 U
ICON	Metals	Silver	mg/kg								
ICON	Metals	Strontium	mg/kg	459				121			
ICON	Metals	TT Barium	mg/kg	850				295			556
ICON	Metals	Zinc	mg/kg	24.8				63.9			
ICON	PCB	Aroclor-1016	mg/kg								
ICON	PCB	Aroclor-1221	mg/kg								
ICON	PCB	Aroclor-1232	mg/kg								
ICON	PCB	Aroclor-1242	mg/kg								
ICON	PCB	Aroclor-1248	mg/kg								
ICON	PCB	Aroclor-1254	mg/kg								
ICON	PCB	Aroclor-1260	mg/kg								
ICON	PCB	Total PCBs	mg/kg								
ICON	SVOC	2-Methylnaphthalene	mg/kg								
ICON	SVOC	Fluoranthene	mg/kg								
ICON	SVOC	Fluorene	mg/kg								
ICON	SVOC	Phenanthrene	mg/kg								
ICON	TPH	HEM, Oil & Grease	%								
ICON	TPH	TPH-DRO	mg/kg	71.43 U				26.88 U	43.1 U	24.9	
ICON	TPH	TPH-GRO	mg/kg								
ICON	TPH	TPH-ORO	mg/kg	357.14 U				134.41 U	215.52 U	100.4 U	
MPA	Metals	Arsenic	mg/kg		11.5	1.33	15.86	1.28			
MPA	Metals	Barium	mg/kg								
MPA	Metals	Cadmium	mg/kg								
MPA	Metals	Chromium	mg/kg								
MPA	Metals	Lead	mg/kg								
MPA	Metals	Mercury	mg/kg								
MPA	Metals	Selenium	mg/kg								
MPA	Metals	Silver	mg/kg								
MPA	Metals	Strontium	mg/kg								
MPA	Metals	TT Barium	mg/kg								
MPA	Metals	Zinc	mg/kg								
MPA	PCB	Aroclor-1016	mg/kg								
MPA	PCB	Aroclor-1221	mg/kg								
MPA	PCB	Aroclor-1232	mg/kg								
MPA	PCB	Aroclor-1242	mg/kg								
MPA	PCB	Aroclor-1248	mg/kg								
MPA	PCB	Aroclor-1254	mg/kg								

Table A.2 All Soil/Sediment (0-3 ft bgs) Samples

Sampler	Chemical Group	Parameter	Station:	AB13	AB13	AB13	AB13	AB14	B12	B14	B17
			Sample ID:	AB13	MPA-AB13	AB13 SO-E	AB13	AB14	B12	B14	B17
			Sample Date:	11/13/2006	5/20/2010	8/1/2010	8/1/2010	11/13/2006	8/10/2006	8/10/2006	8/10/2006
			Sample Depth (ft bgs):	0 - 3	0 - 3	0 - 3	0 - 3	0 - 3	0 - 1.5	0 - 1	0 - 3
			Used?:	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
			Unit								
MPA	PCB	Aroclor-1260	mg/kg								
MPA	SVOC	2-Methylnaphthalene	mg/kg								
MPA	SVOC	Acenaphthene	mg/kg								
MPA	SVOC	Acenaphthylene	mg/kg								
MPA	SVOC	Anthracene	mg/kg								
MPA	SVOC	Benzo(a)anthracene	mg/kg								
MPA	SVOC	Benzo(a)pyrene	mg/kg								
MPA	SVOC	Benzo(b)fluoranthene	mg/kg								
MPA	SVOC	Benzo(k)fluoranthene	mg/kg								
MPA	SVOC	Chrysene	mg/kg								
MPA	SVOC	Dibenz(a,h)anthracene	mg/kg								
MPA	SVOC	Fluoranthene	mg/kg								
MPA	SVOC	Fluorene	mg/kg								
MPA	SVOC	Indeno(1,2,3-cd)pyrene	mg/kg								
MPA	SVOC	Naphthalene	mg/kg								
MPA	SVOC	Phenanthrene	mg/kg								
MPA	SVOC	Pyrene	mg/kg								
MPA	TPH	Aliphatic >C10-C12	mg/kg								
MPA	TPH	Aliphatic >C12-C16	mg/kg								
MPA	TPH	Aliphatic >C16-C35	mg/kg								
MPA	TPH	Aliphatic >C8-C10	mg/kg								
MPA	TPH	Aliphatic C6-C8	mg/kg								
MPA	TPH	Aromatic >C10-C12	mg/kg								
MPA	TPH	Aromatic >C12-C16	mg/kg								
MPA	TPH	Aromatic >C16-C21	mg/kg								
MPA	TPH	Aromatic >C21-C35	mg/kg								
MPA	TPH	Aromatic >C8-C10	mg/kg								
MPA	TPH	HEM, Oil & Grease	%								
MPA	TPH	TPH-DRO	mg/kg								
MPA	TPH	TPH-ORO	mg/kg								

Notes:

PCB = Polychlorinated Biphenyl; VOC = Volatile Organic Compound; SVOC = Semivolatile Organic Compound; TPH = Total Petroleum Hydrocarbon; DRO = Diesel-range Organic; ORO = Oil-range Organic.

All units presented in dry weight.

All samples evaluated are included. Parent and field duplicate samples presented separately.

Only post remediation samples used in risk assessment.

Detection limits present for non-detected samples.

U = Not detected.

B = Conc. < Contractual detection limit, but conc. > Instrument detection limit.

* = Field Duplicate.

J = Estimated.

Table A.2 All Soil/Sediment (0-3 ft bgs) Samples

Sampler	Chemical Group	Parameter	Station:	B17	B19	B19	B21	B4	B4	B5	B5
			Sample ID:	B17	B19	B19	B21	B-4 Rerun	B4	B-5	B5
			Sample Date:	8/10/2006	8/10/2006	8/10/2006	8/10/2006	8/9/2006	8/9/2006	8/9/2006	
			Sample Depth (ft bgs):	0 - 3	1 - 2.5	1 - 2.5	0 - 2	0 - 1	0 - 1	0 - 1.5	0 - 1.5
			Used?:	No - Rerun	Yes	No - Rerun	Yes	No - Rerun	Yes	No - Rerun	Yes
			Unit								
ICON	VOC	Benzene	mg/kg								
ICON	VOC	Ethylbenzene	mg/kg								
ICON	VOC	Toluene	mg/kg								
ICON	VOC	Xylenes	mg/kg								
ICON	Metals	Arsenic	mg/kg	40.8	15.4	123		40.4	10	22.6	6.57
ICON	Metals	Barium	mg/kg	2390	989	7910			631		
ICON	Metals	Cadmium	mg/kg	1.24	0.42	3.36			0.77		
ICON	Metals	Chromium	mg/kg	62.6							
ICON	Metals	Lead	mg/kg	64.6					28.7		
ICON	Metals	Mercury	mg/kg								
ICON	Metals	Selenium	mg/kg	10.5 U	1.99 U	15.9 U			4.72 U		
ICON	Metals	Silver	mg/kg								
ICON	Metals	Strontium	mg/kg						59.3		
ICON	Metals	TT Barium	mg/kg		1300						
ICON	Metals	Zinc	mg/kg								
ICON	PCB	Aroclor-1016	mg/kg								
ICON	PCB	Aroclor-1221	mg/kg								
ICON	PCB	Aroclor-1232	mg/kg								
ICON	PCB	Aroclor-1242	mg/kg								
ICON	PCB	Aroclor-1248	mg/kg								
ICON	PCB	Aroclor-1254	mg/kg								
ICON	PCB	Aroclor-1260	mg/kg								
ICON	PCB	Total PCBs	mg/kg								
ICON	SVOC	2-Methylnaphthalene	mg/kg								
ICON	SVOC	Fluoranthene	mg/kg								
ICON	SVOC	Fluorene	mg/kg								
ICON	SVOC	Phenanthrene	mg/kg								
ICON	TPH	HEM, Oil & Grease	%								
ICON	TPH	TPH-DRO	mg/kg				42.37 U		2037.04		112
ICON	TPH	TPH-GRO	mg/kg								
ICON	TPH	TPH-ORO	mg/kg				211.86 U		1606.48		139
MPA	Metals	Arsenic	mg/kg								
MPA	Metals	Barium	mg/kg								
MPA	Metals	Cadmium	mg/kg								
MPA	Metals	Chromium	mg/kg								
MPA	Metals	Lead	mg/kg								
MPA	Metals	Mercury	mg/kg								
MPA	Metals	Selenium	mg/kg								
MPA	Metals	Silver	mg/kg								
MPA	Metals	Strontium	mg/kg								
MPA	Metals	TT Barium	mg/kg								
MPA	Metals	Zinc	mg/kg								
MPA	PCB	Aroclor-1016	mg/kg								
MPA	PCB	Aroclor-1221	mg/kg								
MPA	PCB	Aroclor-1232	mg/kg								
MPA	PCB	Aroclor-1242	mg/kg								
MPA	PCB	Aroclor-1248	mg/kg								
MPA	PCB	Aroclor-1254	mg/kg								

Table A.2 All Soil/Sediment (0-3 ft bgs) Samples

Sampler	Chemical Group	Parameter	Station:	B17	B19	B19	B21	B4	B4	B5	B5
			Sample ID:	B17	B19	B19	B21	B-4 Rerun	B4	B-5	B5
			Sample Date:	8/10/2006	8/10/2006	8/10/2006	8/10/2006	8/9/2006	8/9/2006	8/9/2006	
			Sample Depth (ft bgs):	0 - 3	1 - 2.5	1 - 2.5	0 - 2	0 - 1	0 - 1	0 - 1.5	0 - 1.5
			Used?:	No - Rerun	Yes	No - Rerun	Yes	No - Rerun	Yes	No - Rerun	Yes
			Unit								
MPA	PCB	Aroclor-1260	mg/kg								
MPA	SVOC	2-Methylnaphthalene	mg/kg								
MPA	SVOC	Acenaphthene	mg/kg								
MPA	SVOC	Acenaphthylene	mg/kg								
MPA	SVOC	Anthracene	mg/kg								
MPA	SVOC	Benzo(a)anthracene	mg/kg								
MPA	SVOC	Benzo(a)pyrene	mg/kg								
MPA	SVOC	Benzo(b)fluoranthene	mg/kg								
MPA	SVOC	Benzo(k)fluoranthene	mg/kg								
MPA	SVOC	Chrysene	mg/kg								
MPA	SVOC	Dibenz(a,h)anthracene	mg/kg								
MPA	SVOC	Fluoranthene	mg/kg								
MPA	SVOC	Fluorene	mg/kg								
MPA	SVOC	Indeno(1,2,3-cd)pyrene	mg/kg								
MPA	SVOC	Naphthalene	mg/kg								
MPA	SVOC	Phenanthrene	mg/kg								
MPA	SVOC	Pyrene	mg/kg								
MPA	TPH	Aliphatic >C10-C12	mg/kg								
MPA	TPH	Aliphatic >C12-C16	mg/kg								
MPA	TPH	Aliphatic >C16-C35	mg/kg								
MPA	TPH	Aliphatic >C8-C10	mg/kg								
MPA	TPH	Aliphatic C6-C8	mg/kg								
MPA	TPH	Aromatic >C10-C12	mg/kg								
MPA	TPH	Aromatic >C12-C16	mg/kg								
MPA	TPH	Aromatic >C16-C21	mg/kg								
MPA	TPH	Aromatic >C21-C35	mg/kg								
MPA	TPH	Aromatic >C8-C10	mg/kg								
MPA	TPH	HEM, Oil & Grease	%								
MPA	TPH	TPH-DRO	mg/kg								
MPA	TPH	TPH-ORO	mg/kg								

Notes:

PCB = Polychlorinated Biphenyl; VOC = Volatile Organic Compound; SVOC = Semivolatile Organic Compound; TPH = Total Petroleum Hydrocarbon; DRO = Diesel-range Organic; ORO = Oil-range Organic.

All units presented in dry weight.

All samples evaluated are included. Parent and field duplicate samples presented separately.

Only post remediation samples used in risk assessment.

Detection limits present for non-detected samples.

U = Not detected.

B = Conc. < Contractual detection limit, but conc. > Instrument detection limit.

* = Field Duplicate.

J = Estimated.

Table A.2 All Soil/Sediment (0-3 ft bgs) Samples

Sampler	Chemical Group	Parameter	Station:	B5	B6	B9	B9	SED-1	SED-10	SED-11	SED-11
			Sample ID:	B5	B6	B9 Rerun	B9	SED-1	SED-10	SED-11	SED-11
			Sample Date:	8/9/2006	8/9/2006	8/9/2006	8/9/2006	2/25/2010	2/25/2010	5/6/2010	2/25/2010
			Sample Depth (ft bgs):	0 - 1.5	1.5 - 3	0 - 0.5	0 - 0.5	0 - 2	0 - 2	0 - 0.5	0 - 2
			Used?:	No - Rerun	Yes	No - Rerun	Yes	Yes	Yes	Yes	Yes
			Unit								
ICON	VOC	Benzene	mg/kg								
ICON	VOC	Ethylbenzene	mg/kg								
ICON	VOC	Toluene	mg/kg								
ICON	VOC	Xylenes	mg/kg								
ICON	Metals	Arsenic	mg/kg		5.17	27.6	8.17	7.36	5.2	4.8	6.5
ICON	Metals	Barium	mg/kg		220		368	428	769	713	1260
ICON	Metals	Cadmium	mg/kg		0.35		0.64	0.5 U		0.5 U	
ICON	Metals	Chromium	mg/kg					19.4		13.6	
ICON	Metals	Lead	mg/kg		17.2		23.1	22.3		19.3	
ICON	Metals	Mercury	mg/kg					0.14	0.2	0.1 U	0.19
ICON	Metals	Selenium	mg/kg		3.07 U		4.01 U	0.2 U	1.99 U	1.99 U	1.99 U
ICON	Metals	Silver	mg/kg								
ICON	Metals	Strontium	mg/kg		77.9		64.1	56.3		45.1	
ICON	Metals	TT Barium	mg/kg							1600	
ICON	Metals	Zinc	mg/kg							51.4	
ICON	PCB	Aroclor-1016	mg/kg							1240 U	
ICON	PCB	Aroclor-1221	mg/kg							1240 U	
ICON	PCB	Aroclor-1232	mg/kg							1240 U	
ICON	PCB	Aroclor-1242	mg/kg							1240 U	
ICON	PCB	Aroclor-1248	mg/kg							1240 U	
ICON	PCB	Aroclor-1254	mg/kg							1240 U	
ICON	PCB	Aroclor-1260	mg/kg							1240 U	
ICON	PCB	Total PCBs	mg/kg								
ICON	SVOC	2-Methylnaphthalene	mg/kg								
ICON	SVOC	Fluoranthene	mg/kg								
ICON	SVOC	Fluorene	mg/kg								
ICON	SVOC	Phenanthrene	mg/kg								
ICON	TPH	HEM, Oil & Grease	%								
ICON	TPH	TPH-DRO	mg/kg	386.21	26.53 U		51.56		352.6	200	960.11
ICON	TPH	TPH-GRO	mg/kg								
ICON	TPH	TPH-ORO	mg/kg	479.31	132.63 U		195.31 U		410.4	208	740.74
MPA	Metals	Arsenic	mg/kg					3.93 B	4.37	4.39 B	7.68
MPA	Metals	Barium	mg/kg					379.44	691.1	549.71	2020.53
MPA	Metals	Cadmium	mg/kg					0.04 B		0.58 U	
MPA	Metals	Chromium	mg/kg					3.5		14.47	
MPA	Metals	Lead	mg/kg					22.48		18.77	
MPA	Metals	Mercury	mg/kg					0.09	0.09	0.1	0.09
MPA	Metals	Selenium	mg/kg					7.48 U	4.16 U	4.68 U	1.11 B
MPA	Metals	Silver	mg/kg								
MPA	Metals	Strontium	mg/kg					59.81		44.15	
MPA	Metals	TT Barium	mg/kg								
MPA	Metals	Zinc	mg/kg							51.75	
MPA	PCB	Aroclor-1016	mg/kg								
MPA	PCB	Aroclor-1221	mg/kg								
MPA	PCB	Aroclor-1232	mg/kg								
MPA	PCB	Aroclor-1242	mg/kg								
MPA	PCB	Aroclor-1248	mg/kg								
MPA	PCB	Aroclor-1254	mg/kg								

Table A.2 All Soil/Sediment (0-3 ft bgs) Samples

Sampler	Chemical Group	Parameter	Station:	B5	B6	B9	B9	SED-1	SED-10	SED-11	SED-11
			Sample ID:	B5	B6	B9 Rerun	B9	SED-1	SED-10	SED-11	SED-11
			Sample Date:	8/9/2006	8/9/2006	8/9/2006	8/9/2006	2/25/2010	2/25/2010	5/6/2010	2/25/2010
			Sample Depth (ft bgs):	0 - 1.5	1.5 - 3	0 - 0.5	0 - 0.5	0 - 2	0 - 2	0 - 0.5	0 - 2
			Used?:	No - Rerun	Yes	No - Rerun	Yes	Yes	Yes	Yes	Yes
			Unit								
MPA	PCB	Aroclor-1260	mg/kg								
MPA	SVOC	2-Methylnaphthalene	mg/kg							0.96 U	
MPA	SVOC	Acenaphthene	mg/kg							0.96 U	
MPA	SVOC	Acenaphthylene	mg/kg							0.96 U	
MPA	SVOC	Anthracene	mg/kg							0.96 U	
MPA	SVOC	Benzo(a)anthracene	mg/kg							0.96 U	
MPA	SVOC	Benzo(a)pyrene	mg/kg							0.96 U	
MPA	SVOC	Benzo(b)fluoranthene	mg/kg							0.96 U	
MPA	SVOC	Benzo(k)fluoranthene	mg/kg							0.96 U	
MPA	SVOC	Chrysene	mg/kg							0.96 U	
MPA	SVOC	Dibenz(a,h)anthracene	mg/kg							0.96 U	
MPA	SVOC	Fluoranthene	mg/kg							0.96 U	
MPA	SVOC	Fluorene	mg/kg							0.96 U	
MPA	SVOC	Indeno(1,2,3-cd)pyrene	mg/kg							0.96 U	
MPA	SVOC	Naphthalene	mg/kg							0.96 U	
MPA	SVOC	Phenanthrene	mg/kg							0.96 U	
MPA	SVOC	Pyrene	mg/kg							0.96 U	
MPA	TPH	Aliphatic >C10-C12	mg/kg								
MPA	TPH	Aliphatic >C12-C16	mg/kg								
MPA	TPH	Aliphatic >C16-C35	mg/kg								
MPA	TPH	Aliphatic >C8-C10	mg/kg								
MPA	TPH	Aliphatic C6-C8	mg/kg								
MPA	TPH	Aromatic >C10-C12	mg/kg								
MPA	TPH	Aromatic >C12-C16	mg/kg								
MPA	TPH	Aromatic >C16-C21	mg/kg								
MPA	TPH	Aromatic >C21-C35	mg/kg								
MPA	TPH	Aromatic >C8-C10	mg/kg								
MPA	TPH	HEM, Oil & Grease	%								
MPA	TPH	TPH-DRO	mg/kg						130.89 U		146.63 U
MPA	TPH	TPH-ORO	mg/kg						130.89 U		146.63 U

Notes:

PCB = Polychlorinated Biphenyl; VOC = Volatile Organic Compound; SVOC = Semivolatile Organic Compound; TPH = Total Petroleum Hydrocarbon; DRO = Diesel-range Organic; ORO = Oil-range Organic.

All units presented in dry weight.

All samples evaluated are included. Parent and field duplicate samples presented separately.

Only post remediation samples used in risk assessment.

Detection limits present for non-detected samples.

U = Not detected.

B = Conc. < Contractual detection limit, but conc. > Instrument detection limit.

* = Field Duplicate.

J = Estimated.

Table A.2 All Soil/Sediment (0-3 ft bgs) Samples

Sampler	Chemical Group	Parameter	Station:	SED-12	SED-13	SED-13	SED-14	SED-15	SED-15	SED-15
			Sample ID:	SED-12	SED-13	SED-13	SED-14	MPA-SED-15	MPA-SED-15E	MPA-SED-15E2
			Sample Date:	2/25/2010	5/6/2010	2/26/2010	2/26/2010			
			Sample Depth (ft bgs):	0 - 2	0 - 0.5	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2
			Used?:	Yes	Yes	Yes	Yes	No - Excavated	Yes - Step out	Yes - Step out
			Unit							
ICON	VOC	Benzene	mg/kg							
ICON	VOC	Ethylbenzene	mg/kg							
ICON	VOC	Toluene	mg/kg							
ICON	VOC	Xylenes	mg/kg							
ICON	Metals	Arsenic	mg/kg	3.8	3.11	4.32	3.33			
ICON	Metals	Barium	mg/kg	933	586	773	1180			
ICON	Metals	Cadmium	mg/kg		0.5 U					
ICON	Metals	Chromium	mg/kg		15.7					
ICON	Metals	Lead	mg/kg		18.1					
ICON	Metals	Mercury	mg/kg	0.13	0.1 U	0.23	0.1			
ICON	Metals	Selenium	mg/kg	1.99 U	2 U	1.99 U	1.99 U			
ICON	Metals	Silver	mg/kg							
ICON	Metals	Strontium	mg/kg		49.4					
ICON	Metals	TT Barium	mg/kg		1070					
ICON	Metals	Zinc	mg/kg		61.4					
ICON	PCB	Aroclor-1016	mg/kg		163 U					
ICON	PCB	Aroclor-1221	mg/kg		163 U					
ICON	PCB	Aroclor-1232	mg/kg		163 U					
ICON	PCB	Aroclor-1242	mg/kg		163 U					
ICON	PCB	Aroclor-1248	mg/kg		163 U					
ICON	PCB	Aroclor-1254	mg/kg		163 U					
ICON	PCB	Aroclor-1260	mg/kg		163 U					
ICON	PCB	Total PCBs	mg/kg							
ICON	SVOC	2-Methylnaphthalene	mg/kg							
ICON	SVOC	Fluoranthene	mg/kg							
ICON	SVOC	Fluorene	mg/kg							
ICON	SVOC	Phenanthrene	mg/kg							
ICON	TPH	HEM, Oil & Grease	%							
ICON	TPH	TPH-DRO	mg/kg	717.61	168					
ICON	TPH	TPH-GRO	mg/kg							
ICON	TPH	TPH-ORO	mg/kg	644.52	205 U					
MPA	Metals	Arsenic	mg/kg	3.43 B	5.02	4.47 B	3.56 B			
MPA	Metals	Barium	mg/kg	1015.58	909.09	631.58	1021.35			
MPA	Metals	Cadmium	mg/kg		0.73 U					
MPA	Metals	Chromium	mg/kg		18.51					
MPA	Metals	Lead	mg/kg		22.04					
MPA	Metals	Mercury	mg/kg	0.07	0.11	0.07	0.07			
MPA	Metals	Selenium	mg/kg	1.53 B	5.82 U	1.65 B	1.42 B			
MPA	Metals	Silver	mg/kg							
MPA	Metals	Strontium	mg/kg		55.27					
MPA	Metals	TT Barium	mg/kg							
MPA	Metals	Zinc	mg/kg		65.09					
MPA	PCB	Aroclor-1016	mg/kg							
MPA	PCB	Aroclor-1221	mg/kg							
MPA	PCB	Aroclor-1232	mg/kg							
MPA	PCB	Aroclor-1242	mg/kg							
MPA	PCB	Aroclor-1248	mg/kg							
MPA	PCB	Aroclor-1254	mg/kg							

Table A.2 All Soil/Sediment (0-3 ft bgs) Samples

Sampler	Chemical Group	Parameter	Station:	SED-12	SED-13	SED-13	SED-14	SED-15	SED-15	SED-15
			Sample ID:	SED-12	SED-13	SED-13	SED-14	MPA-SED-15	MPA-SED-15E	MPA-SED-15E2
			Sample Date:	2/25/2010	5/6/2010	2/26/2010	2/26/2010			
			Sample Depth (ft bgs):	0 - 2	0 - 0.5	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2
			Used?:	Yes	Yes	Yes	Yes	No - Excavated	Yes - Step out	Yes - Step out
			Unit							
MPA	PCB	Aroclor-1260	mg/kg							
MPA	SVOC	2-Methylnaphthalene	mg/kg		1.2 U					
MPA	SVOC	Acenaphthene	mg/kg		1.2 U					
MPA	SVOC	Acenaphthylene	mg/kg		1.2 U					
MPA	SVOC	Anthracene	mg/kg		1.2 U					
MPA	SVOC	Benzo(a)anthracene	mg/kg		1.2 U					
MPA	SVOC	Benzo(a)pyrene	mg/kg		1.2 U					
MPA	SVOC	Benzo(b)fluoranthene	mg/kg		1.2 U					
MPA	SVOC	Benzo(k)fluoranthene	mg/kg		1.2 U					
MPA	SVOC	Chrysene	mg/kg		1.2 U					
MPA	SVOC	Dibenz(a,h)anthracene	mg/kg		1.2 U					
MPA	SVOC	Fluoranthene	mg/kg		1.2 U					
MPA	SVOC	Fluorene	mg/kg		1.2 U					
MPA	SVOC	Indeno(1,2,3-cd)pyrene	mg/kg		1.2 U					
MPA	SVOC	Naphthalene	mg/kg		1.2 U					
MPA	SVOC	Phenanthrene	mg/kg		1.2 U					
MPA	SVOC	Pyrene	mg/kg		1.2 U					
MPA	TPH	Aliphatic >C10-C12	mg/kg					21.03 J	33.77 U	33.77 U
MPA	TPH	Aliphatic >C12-C16	mg/kg					217.04	22.51 U	22.51 U
MPA	TPH	Aliphatic >C16-C35	mg/kg					3985.11	22.51 U	22.51 U
MPA	TPH	Aliphatic >C8-C10	mg/kg							
MPA	TPH	Aliphatic C6-C8	mg/kg							
MPA	TPH	Aromatic >C10-C12	mg/kg					22.51 U	22.51 U	22.51 U
MPA	TPH	Aromatic >C12-C16	mg/kg					33.77 U	33.77 U	33.77 U
MPA	TPH	Aromatic >C16-C21	mg/kg					33.77 U	33.77 U	33.77 U
MPA	TPH	Aromatic >C21-C35	mg/kg					33.77 U	33.77 U	33.77 U
MPA	TPH	Aromatic >C8-C10	mg/kg							
MPA	TPH	HEM, Oil & Grease	%							
MPA	TPH	TPH-DRO	mg/kg	155.76 U						
MPA	TPH	TPH-ORO	mg/kg	155.76 U						

Notes:

PCB = Polychlorinated Biphenyl; VOC = Volatile Organic Compound; SVOC = Semivolatile Organic Compound; TPH = Total Petroleum Hydrocarbon; DRO = Diesel-range Organic; ORO = Oil-range Organic.

All units presented in dry weight.

All samples evaluated are included. Parent and field duplicate samples presented separately.

Only post remediation samples used in risk assessment.

Detection limits present for non-detected samples.

U = Not detected.

B = Conc. < Contractual detection limit, but conc. > Instrument detection limit.

* = Field Duplicate.

J = Estimated.

Table A.2 All Soil/Sediment (0-3 ft bgs) Samples

Sampler	Chemical Group	Parameter	Station:	SED-15	SED-15	SED-15	SED-15	SED-15	SED-15	SED-15
			Sample ID:	MPA-SED-15N	MPA-SED-15W	MPA-SED-15W2	SED15	SED-115*	SED-15	SED-15 E
			Sample Date:				5/6/2010	5/6/2010	5/6/2010	6/8/2010
			Sample Depth (ft bgs):	0 - 2	0 - 2	0 - 2	0 - 0.5	0 - 0.5	0 - 0.5	0 - 2
			Used?:	Yes - Step out	Yes - Step out	Yes - Step out	No - Excavated	No - Excavated	No - Excavated	Yes - Step out
			Unit							
ICON	VOC	Benzene	mg/kg							
ICON	VOC	Ethylbenzene	mg/kg							
ICON	VOC	Toluene	mg/kg							
ICON	VOC	Xylenes	mg/kg							
ICON	Metals	Arsenic	mg/kg				2.76			
ICON	Metals	Barium	mg/kg				470			
ICON	Metals	Cadmium	mg/kg				0.5 U			
ICON	Metals	Chromium	mg/kg				12.3			
ICON	Metals	Lead	mg/kg				16.7			
ICON	Metals	Mercury	mg/kg				0.24			
ICON	Metals	Selenium	mg/kg				1.99 U			
ICON	Metals	Silver	mg/kg							
ICON	Metals	Strontium	mg/kg				40.3			
ICON	Metals	TT Barium	mg/kg				831			
ICON	Metals	Zinc	mg/kg				51.3			
ICON	PCB	Aroclor-1016	mg/kg				151 U			
ICON	PCB	Aroclor-1221	mg/kg				151 U			
ICON	PCB	Aroclor-1232	mg/kg				151 U			
ICON	PCB	Aroclor-1242	mg/kg				151 U			
ICON	PCB	Aroclor-1248	mg/kg				151 U			
ICON	PCB	Aroclor-1254	mg/kg				151 U			
ICON	PCB	Aroclor-1260	mg/kg				151 U			
ICON	PCB	Total PCBs	mg/kg							
ICON	SVOC	2-Methylnaphthalene	mg/kg							
ICON	SVOC	Fluoranthene	mg/kg							
ICON	SVOC	Fluorene	mg/kg							
ICON	SVOC	Phenanthrene	mg/kg							
ICON	TPH	HEM, Oil & Grease	%							
ICON	TPH	TPH-DRO	mg/kg				93.7			467.65
ICON	TPH	TPH-GRO	mg/kg							
ICON	TPH	TPH-ORO	mg/kg				189 U			336.71
MPA	Metals	Arsenic	mg/kg					4.81 B	6.75	
MPA	Metals	Barium	mg/kg					781.48	943.09	
MPA	Metals	Cadmium	mg/kg					0.74 U	0.81 U	
MPA	Metals	Chromium	mg/kg					17.11	17.97	
MPA	Metals	Lead	mg/kg					22.44	23.66	
MPA	Metals	Mercury	mg/kg					0.15	0.17	
MPA	Metals	Selenium	mg/kg					0.74 U	6.5 U	
MPA	Metals	Silver	mg/kg							
MPA	Metals	Strontium	mg/kg					52.96	65.45	
MPA	Metals	TT Barium	mg/kg							
MPA	Metals	Zinc	mg/kg					65.93	73.17	
MPA	PCB	Aroclor-1016	mg/kg							
MPA	PCB	Aroclor-1221	mg/kg							
MPA	PCB	Aroclor-1232	mg/kg							
MPA	PCB	Aroclor-1242	mg/kg							
MPA	PCB	Aroclor-1248	mg/kg							
MPA	PCB	Aroclor-1254	mg/kg							

Table A.2 All Soil/Sediment (0-3 ft bgs) Samples

Sampler	Chemical Group	Parameter	Station:	SED-15	SED-15	SED-15	SED-15	SED-15	SED-15	SED-15
			Sample ID:	MPA-SED-15N	MPA-SED-15W	MPA-SED-15W2	SED15	SED-115*	SED-15	SED-15 E
			Sample Date:				5/6/2010	5/6/2010	5/6/2010	6/8/2010
			Sample Depth (ft bgs):	0 - 2	0 - 2	0 - 2	0 - 0.5	0 - 0.5	0 - 0.5	0 - 2
			Used?:	Yes - Step out	Yes - Step out	Yes - Step out	No - Excavated	No - Excavated	No - Excavated	Yes - Step out
			Unit							
MPA	PCB	Aroclor-1260	mg/kg							
MPA	SVOC	2-Methylnaphthalene	mg/kg					1.41 U	1.32 U	
MPA	SVOC	Acenaphthene	mg/kg					1.41 U	1.32 U	
MPA	SVOC	Acenaphthylene	mg/kg					1.41 U	1.32 U	
MPA	SVOC	Anthracene	mg/kg					1.41 U	1.32 U	
MPA	SVOC	Benzo(a)anthracene	mg/kg					1.41 U	1.32 U	
MPA	SVOC	Benzo(a)pyrene	mg/kg					1.41 U	1.32 U	
MPA	SVOC	Benzo(b)fluoranthene	mg/kg					1.41 U	1.32 U	
MPA	SVOC	Benzo(k)fluoranthene	mg/kg					1.41 U	1.32 U	
MPA	SVOC	Chrysene	mg/kg					1.41 U	1.32 U	
MPA	SVOC	Dibenz(a,h)anthracene	mg/kg					1.41 U	1.32 U	
MPA	SVOC	Fluoranthene	mg/kg					1.41 U	1.32 U	
MPA	SVOC	Fluorene	mg/kg					1.41 U	1.32 U	
MPA	SVOC	Indeno(1,2,3-cd)pyrene	mg/kg					1.41 U	1.32 U	
MPA	SVOC	Naphthalene	mg/kg					1.41 U	1.32 U	
MPA	SVOC	Phenanthrene	mg/kg					1.41 U	1.32 U	
MPA	SVOC	Pyrene	mg/kg					1.41 U	1.32 U	
MPA	TPH	Aliphatic >C10-C12	mg/kg	33.77 U	33.77 U	33.77 U				
MPA	TPH	Aliphatic >C12-C16	mg/kg	22.51 U	22.51 U	22.51 U				
MPA	TPH	Aliphatic >C16-C35	mg/kg	22.51 U	22.51 U	22.51 U				
MPA	TPH	Aliphatic >C8-C10	mg/kg							
MPA	TPH	Aliphatic C6-C8	mg/kg							
MPA	TPH	Aromatic >C10-C12	mg/kg	22.51 U	22.51 U	22.51 U				
MPA	TPH	Aromatic >C12-C16	mg/kg	33.77 U	33.77 U	33.77 U				
MPA	TPH	Aromatic >C16-C21	mg/kg	33.77 U	33.77 U	33.77 U				
MPA	TPH	Aromatic >C21-C35	mg/kg	33.77 U	33.77 U	33.77 U				
MPA	TPH	Aromatic >C8-C10	mg/kg							
MPA	TPH	HEM, Oil & Grease	%							
MPA	TPH	TPH-DRO	mg/kg							
MPA	TPH	TPH-ORO	mg/kg							

Notes:

PCB = Polychlorinated Biphenyl; VOC = Volatile Organic Compound; SVOC = Semivolatile Organic Compound; TPH = Total Petroleum Hydrocarbon; DRO = Diesel-range Organic; ORO = Oil-range Organic.

All units presented in dry weight.

All samples evaluated are included. Parent and field duplicate samples presented separately.

Only post remediation samples used in risk assessment.

Detection limits present for non-detected samples.

U = Not detected.

B = Conc. < Contractual detection limit, but conc. > Instrument detection limit.

* = Field Duplicate.

J = Estimated.

Table A.2 All Soil/Sediment (0-3 ft bgs) Samples

Sampler	Chemical Group	Parameter	Station:	SED-15	SED-15	SED-15	SED-15	SED-15	SED-15	SED-15
			Sample ID:	SED-15 E2	SED-15 N	SED-15 W	SED-15	SP-MPA-01	SP-MPA-01	SP-MPA-02
			Sample Date:	6/8/2010	6/8/2010	6/8/2010	2/26/2010	10/5/2010	10/5/2010	10/5/2010
			Sample Depth (ft bgs):	0 - 2	0 - 2	0 - 2	0 - 2	0 - 0.5	0.5 - 2	0 - 0.5
			Used?:	Yes - Step out	Yes - Step out	Yes - Step out	No - Excavated	Yes	Yes	Yes
			Unit							
ICON	VOC	Benzene	mg/kg							
ICON	VOC	Ethylbenzene	mg/kg							
ICON	VOC	Toluene	mg/kg							
ICON	VOC	Xylenes	mg/kg							
ICON	Metals	Arsenic	mg/kg				3.09			
ICON	Metals	Barium	mg/kg				2670			
ICON	Metals	Cadmium	mg/kg				1.07			
ICON	Metals	Chromium	mg/kg				501			
ICON	Metals	Lead	mg/kg				179			
ICON	Metals	Mercury	mg/kg				1.04			
ICON	Metals	Selenium	mg/kg				2 U			
ICON	Metals	Silver	mg/kg							
ICON	Metals	Strontium	mg/kg				160			
ICON	Metals	TT Barium	mg/kg							
ICON	Metals	Zinc	mg/kg							
ICON	PCB	Aroclor-1016	mg/kg							
ICON	PCB	Aroclor-1221	mg/kg							
ICON	PCB	Aroclor-1232	mg/kg							
ICON	PCB	Aroclor-1242	mg/kg							
ICON	PCB	Aroclor-1248	mg/kg							
ICON	PCB	Aroclor-1254	mg/kg							
ICON	PCB	Aroclor-1260	mg/kg							
ICON	PCB	Total PCBs	mg/kg							
ICON	SVOC	2-Methylnaphthalene	mg/kg							
ICON	SVOC	Fluoranthene	mg/kg							
ICON	SVOC	Fluorene	mg/kg							
ICON	SVOC	Phenanthrene	mg/kg							
ICON	TPH	HEM, Oil & Grease	%							
ICON	TPH	TPH-DRO	mg/kg	141.93	71.32	46.77 U	110792.95			
ICON	TPH	TPH-GRO	mg/kg							
ICON	TPH	TPH-ORO	mg/kg	162.74	131.64	116.91 U	48017.62			
MPA	Metals	Arsenic	mg/kg				6.01			
MPA	Metals	Barium	mg/kg				1776.57			
MPA	Metals	Cadmium	mg/kg				0.43 B			
MPA	Metals	Chromium	mg/kg				297.18			
MPA	Metals	Lead	mg/kg				130.8			
MPA	Metals	Mercury	mg/kg				0.61			
MPA	Metals	Selenium	mg/kg				1.02 B			
MPA	Metals	Silver	mg/kg							
MPA	Metals	Strontium	mg/kg				136.01			
MPA	Metals	TT Barium	mg/kg							
MPA	Metals	Zinc	mg/kg							
MPA	PCB	Aroclor-1016	mg/kg							
MPA	PCB	Aroclor-1221	mg/kg							
MPA	PCB	Aroclor-1232	mg/kg							
MPA	PCB	Aroclor-1242	mg/kg							
MPA	PCB	Aroclor-1248	mg/kg							
MPA	PCB	Aroclor-1254	mg/kg							

Table A.2 All Soil/Sediment (0-3 ft bgs) Samples

Sampler	Chemical Group	Parameter	Station:	SED-15	SED-15	SED-15	SED-15	SED-15	SED-15	SED-15
			Sample ID:	SED-15 E2	SED-15 N	SED-15 W	SED-15	SP-MPA-01	SP-MPA-01	SP-MPA-02
			Sample Date:	6/8/2010	6/8/2010	6/8/2010	2/26/2010	10/5/2010	10/5/2010	10/5/2010
			Sample Depth (ft bgs):	0 - 2	0 - 2	0 - 2	0 - 2	0 - 0.5	0.5 - 2	0 - 0.5
			Used?:	Yes - Step out	Yes - Step out	Yes - Step out	No - Excavated	Yes	Yes	Yes
			Unit							
MPA	PCB	Aroclor-1260	mg/kg							
MPA	SVOC	2-Methylnaphthalene	mg/kg							
MPA	SVOC	Acenaphthene	mg/kg							
MPA	SVOC	Acenaphthylene	mg/kg							
MPA	SVOC	Anthracene	mg/kg							
MPA	SVOC	Benzo(a)anthracene	mg/kg							
MPA	SVOC	Benzo(a)pyrene	mg/kg							
MPA	SVOC	Benzo(b)fluoranthene	mg/kg							
MPA	SVOC	Benzo(k)fluoranthene	mg/kg							
MPA	SVOC	Chrysene	mg/kg							
MPA	SVOC	Dibenz(a,h)anthracene	mg/kg							
MPA	SVOC	Fluoranthene	mg/kg							
MPA	SVOC	Fluorene	mg/kg							
MPA	SVOC	Indeno(1,2,3-cd)pyrene	mg/kg							
MPA	SVOC	Naphthalene	mg/kg							
MPA	SVOC	Phenanthrene	mg/kg							
MPA	SVOC	Pyrene	mg/kg							
MPA	TPH	Aliphatic >C10-C12	mg/kg				2646.42	37 U	36 U	43 U
MPA	TPH	Aliphatic >C12-C16	mg/kg				19674.62	24.57 U	26.02	28.57 U
MPA	TPH	Aliphatic >C16-C35	mg/kg				37744.03	25 U	81.93	29 U
MPA	TPH	Aliphatic >C8-C10	mg/kg					37 U	36 U	43 U
MPA	TPH	Aliphatic C6-C8	mg/kg					37 U	36 U	43 U
MPA	TPH	Aromatic >C10-C12	mg/kg				342.73	25 U	24 U	29 U
MPA	TPH	Aromatic >C12-C16	mg/kg				3991.32	37 U	36 U	43 U
MPA	TPH	Aromatic >C16-C21	mg/kg				4707.16	37 U	36 U	43 U
MPA	TPH	Aromatic >C21-C35	mg/kg				4273.32	37 U	36 U	43 U
MPA	TPH	Aromatic >C8-C10	mg/kg					25 U	24 U	29 U
MPA	TPH	HEM, Oil & Grease	%							
MPA	TPH	TPH-DRO	mg/kg				98698.48			
MPA	TPH	TPH-ORO	mg/kg				7201.74 J			

Notes:

PCB = Polychlorinated Biphenyl; VOC = Volatile Organic Compound; SVOC = Semivolatile Organic Compound; TPH = Total Petroleum Hydrocarbon; DRO = Diesel-range Organic; ORO = Oil-range Organic.

All units presented in dry weight.

All samples evaluated are included. Parent and field duplicate samples presented separately.

Only post remediation samples used in risk assessment.

Detection limits present for non-detected samples.

U = Not detected.

B = Conc. < Contractual detection limit, but conc. > Instrument detection limit.

* = Field Duplicate.

J = Estimated.

Table A.2 All Soil/Sediment (0-3 ft bgs) Samples

Sampler	Chemical Group	Parameter	Station:	SED-15	SED-15	SED-15	SED-15	SED-15	SED-16
			Sample ID:	SP-MPA-02	SP-MPA-03	SP-MPA-03	SP-MPA-04	SP-MPA-04	SED-16
			Sample Date:	10/5/2010	10/5/2010	10/5/2010	10/6/2010	10/6/2010	2/26/2010
			Sample Depth (ft bgs):	0.5 - 2	0 - 0.5	0.5 - 2	0 - 0.5	0.5 - 2	0 - 2
			Used?:	Yes	Yes - Step out	Yes - Step out	Yes	Yes	Yes
			Unit						
ICON	VOC	Benzene	mg/kg						
ICON	VOC	Ethylbenzene	mg/kg						
ICON	VOC	Toluene	mg/kg						
ICON	VOC	Xylenes	mg/kg						
ICON	Metals	Arsenic	mg/kg						5.09
ICON	Metals	Barium	mg/kg						270
ICON	Metals	Cadmium	mg/kg						
ICON	Metals	Chromium	mg/kg						
ICON	Metals	Lead	mg/kg						
ICON	Metals	Mercury	mg/kg						0.6
ICON	Metals	Selenium	mg/kg						1.99 U
ICON	Metals	Silver	mg/kg						
ICON	Metals	Strontium	mg/kg						
ICON	Metals	TT Barium	mg/kg						
ICON	Metals	Zinc	mg/kg						
ICON	PCB	Aroclor-1016	mg/kg						
ICON	PCB	Aroclor-1221	mg/kg						
ICON	PCB	Aroclor-1232	mg/kg						
ICON	PCB	Aroclor-1242	mg/kg						
ICON	PCB	Aroclor-1248	mg/kg						
ICON	PCB	Aroclor-1254	mg/kg						
ICON	PCB	Aroclor-1260	mg/kg						
ICON	PCB	Total PCBs	mg/kg						
ICON	SVOC	2-Methylnaphthalene	mg/kg						
ICON	SVOC	Fluoranthene	mg/kg						
ICON	SVOC	Fluorene	mg/kg						
ICON	SVOC	Phenanthrene	mg/kg						
ICON	TPH	HEM, Oil & Grease	%						
ICON	TPH	TPH-DRO	mg/kg						330.84
ICON	TPH	TPH-GRO	mg/kg						
ICON	TPH	TPH-ORO	mg/kg						551.4
MPA	Metals	Arsenic	mg/kg						5.24 B
MPA	Metals	Barium	mg/kg						324.32
MPA	Metals	Cadmium	mg/kg						
MPA	Metals	Chromium	mg/kg						
MPA	Metals	Lead	mg/kg						
MPA	Metals	Mercury	mg/kg						0.09
MPA	Metals	Selenium	mg/kg						2.11 B
MPA	Metals	Silver	mg/kg						
MPA	Metals	Strontium	mg/kg						
MPA	Metals	TT Barium	mg/kg						
MPA	Metals	Zinc	mg/kg						
MPA	PCB	Aroclor-1016	mg/kg						
MPA	PCB	Aroclor-1221	mg/kg						
MPA	PCB	Aroclor-1232	mg/kg						
MPA	PCB	Aroclor-1242	mg/kg						
MPA	PCB	Aroclor-1248	mg/kg						
MPA	PCB	Aroclor-1254	mg/kg						

Table A.2 All Soil/Sediment (0-3 ft bgs) Samples

Sampler	Chemical Group	Parameter	Station:	SED-15	SED-15	SED-15	SED-15	SED-15	SED-16
			Sample ID:	SP-MPA-02	SP-MPA-03	SP-MPA-03	SP-MPA-04	SP-MPA-04	SED-16
			Sample Date:	10/5/2010	10/5/2010	10/5/2010	10/6/2010	10/6/2010	2/26/2010
			Sample Depth (ft bgs):	0.5 - 2	0 - 0.5	0.5 - 2	0 - 0.5	0.5 - 2	0 - 2
			Used?:	Yes	Yes - Step out	Yes - Step out	Yes	Yes	Yes
			Unit						
MPA	PCB	Aroclor-1260	mg/kg						
MPA	SVOC	2-Methylnaphthalene	mg/kg						
MPA	SVOC	Acenaphthene	mg/kg						
MPA	SVOC	Acenaphthylene	mg/kg						
MPA	SVOC	Anthracene	mg/kg						
MPA	SVOC	Benzo(a)anthracene	mg/kg						
MPA	SVOC	Benzo(a)pyrene	mg/kg						
MPA	SVOC	Benzo(b)fluoranthene	mg/kg						
MPA	SVOC	Benzo(k)fluoranthene	mg/kg						
MPA	SVOC	Chrysene	mg/kg						
MPA	SVOC	Dibenz(a,h)anthracene	mg/kg						
MPA	SVOC	Fluoranthene	mg/kg						
MPA	SVOC	Fluorene	mg/kg						
MPA	SVOC	Indeno(1,2,3-cd)pyrene	mg/kg						
MPA	SVOC	Naphthalene	mg/kg						
MPA	SVOC	Phenanthrene	mg/kg						
MPA	SVOC	Pyrene	mg/kg						
MPA	TPH	Aliphatic >C10-C12	mg/kg	43 U	27 U	44 U	19 U	24 U	
MPA	TPH	Aliphatic >C12-C16	mg/kg	28.49 U	17.99 U	29.5 U	12.85 U	15.82 U	
MPA	TPH	Aliphatic >C16-C35	mg/kg	28 U	18 U	29 U	10 U	10 U	
MPA	TPH	Aliphatic >C8-C10	mg/kg	43 U	27 U	44 U	19 U	24 U	
MPA	TPH	Aliphatic C6-C8	mg/kg	43 U	27 U	44 U	19 U	24 U	
MPA	TPH	Aromatic >C10-C12	mg/kg	28 U	18 U	29 U	13 U	16 U	
MPA	TPH	Aromatic >C12-C16	mg/kg	43 U	27 U	44 U	19 U	24 U	
MPA	TPH	Aromatic >C16-C21	mg/kg	43 U	27 U	44 U	19 U	24 U	
MPA	TPH	Aromatic >C21-C35	mg/kg	43 U	27 U	44 U	19 U	24 U	
MPA	TPH	Aromatic >C8-C10	mg/kg	28 U	18 U	29 U	13 U	16 U	
MPA	TPH	HEM, Oil & Grease	%						
MPA	TPH	TPH-DRO	mg/kg						270.27 U
MPA	TPH	TPH-ORO	mg/kg						270.27 U

Notes:

PCB = Polychlorinated Biphenyl; VOC = Volatile Organic Compound; SVOC = Semivolatile Organic Compound; TPH = Total Petroleum Hydrocarbon; DRO = Diesel-range Organic; ORO = Oil-range Organic.

All units presented in dry weight.

All samples evaluated are included. Parent and field duplicate samples presented separately.

Only post remediation samples used in risk assessment.

Detection limits present for non-detected samples.

U = Not detected.

B = Conc. < Contractual detection limit, but conc. > Instrument detection limit.

* = Field Duplicate.

J = Estimated.

Table A.2 All Soil/Sediment (0-3 ft bgs) Samples

Sampler	Chemical Group	Parameter	Station:	SED-17	SED-18	SED-19	SED-19	SED-2	SED-20	SED-21	SED-22
			Sample ID:	SED-17	SED-18	SED-19	SED-19	SED-2	SED-20	SED-21	SED-22
			Sample Date:	2/26/2010	2/26/2010	5/6/2010	2/26/2010	2/25/2010	2/26/2010	2/26/2010	2/26/2010
			Sample Depth (ft bgs):	0 - 2	0 - 2	0 - 0.5	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2
			Used?:	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
			Unit								
ICON	VOC	Benzene	mg/kg								
ICON	VOC	Ethylbenzene	mg/kg								
ICON	VOC	Toluene	mg/kg								
ICON	VOC	Xylenes	mg/kg								
ICON	Metals	Arsenic	mg/kg	3.31	5.48	2.3	4.74	8.29	5.11	3.61	3.14
ICON	Metals	Barium	mg/kg	1720	1430	516	2610	308	686	578	639
ICON	Metals	Cadmium	mg/kg			0.5 U		0.5 U			
ICON	Metals	Chromium	mg/kg			13.8		19.2			
ICON	Metals	Lead	mg/kg			17		21			
ICON	Metals	Mercury	mg/kg	0.14	0.15	0.16	0.22	0.1 U	0.19	0.1 U	0.1 U
ICON	Metals	Selenium	mg/kg	2 U	1.98 U	1.99 U	1.99 U	1.98 U	2 U	1.98 U	1.99 U
ICON	Metals	Silver	mg/kg								
ICON	Metals	Strontium	mg/kg			47.4		59.2			
ICON	Metals	TT Barium	mg/kg			1210					
ICON	Metals	Zinc	mg/kg			57.1					
ICON	PCB	Aroclor-1016	mg/kg			1870 U					
ICON	PCB	Aroclor-1221	mg/kg			1870 U					
ICON	PCB	Aroclor-1232	mg/kg			1870 U					
ICON	PCB	Aroclor-1242	mg/kg			1870 U					
ICON	PCB	Aroclor-1248	mg/kg			1870 U					
ICON	PCB	Aroclor-1254	mg/kg			1870 U					
ICON	PCB	Aroclor-1260	mg/kg			1870 U					
ICON	PCB	Total PCBs	mg/kg								
ICON	SVOC	2-Methylnaphthalene	mg/kg								
ICON	SVOC	Fluoranthene	mg/kg								
ICON	SVOC	Fluorene	mg/kg								
ICON	SVOC	Phenanthrene	mg/kg								
ICON	TPH	HEM, Oil & Grease	%								
ICON	TPH	TPH-DRO	mg/kg	981.25	1823.53	93.9 U	7532.05		341.46	456.95	403.79
ICON	TPH	TPH-GRO	mg/kg								
ICON	TPH	TPH-ORO	mg/kg	603.12	1164.71	235 U	2557.69		304.88	447.02	362.78
MPA	Metals	Arsenic	mg/kg	4.42 B	6.91	3.7 B	4.89	5.17 B	4.77 B	3.47 B	4.58 B
MPA	Metals	Barium	mg/kg	1729.37	2139	509.26	4887.01	333.91	803.92	485.8	823.72
MPA	Metals	Cadmium	mg/kg			0.93 U	0.56 U	1.26			
MPA	Metals	Chromium	mg/kg			20.51	17.57	8.74			
MPA	Metals	Lead	mg/kg			23.43	37.57	26.22			
MPA	Metals	Mercury	mg/kg	0.07	0.12	0.18	0.21	0.06	0.08	0.04	0.07
MPA	Metals	Selenium	mg/kg	1.52 B	1.58 B	7.41 U	0.9 B	6.96 U	1.24 B	1.17 B	1.54 B
MPA	Metals	Silver	mg/kg								
MPA	Metals	Strontium	mg/kg			58.33	116.95	54.78			
MPA	Metals	TT Barium	mg/kg								
MPA	Metals	Zinc	mg/kg			70.37					
MPA	PCB	Aroclor-1016	mg/kg								
MPA	PCB	Aroclor-1221	mg/kg								
MPA	PCB	Aroclor-1232	mg/kg								
MPA	PCB	Aroclor-1242	mg/kg								
MPA	PCB	Aroclor-1248	mg/kg								
MPA	PCB	Aroclor-1254	mg/kg								

Table A.2 All Soil/Sediment (0-3 ft bgs) Samples

Sampler	Chemical Group	Parameter	Station:	SED-17	SED-18	SED-19	SED-19	SED-2	SED-20	SED-21	SED-22
			Sample ID:	SED-17	SED-18	SED-19	SED-19	SED-2	SED-20	SED-21	SED-22
			Sample Date:	2/26/2010	2/26/2010	5/6/2010	2/26/2010	2/25/2010	2/26/2010	2/26/2010	2/26/2010
			Sample Depth (ft bgs):	0 - 2	0 - 2	0 - 0.5	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2
			Used?:	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
			Unit								
MPA	PCB	Aroclor-1260	mg/kg								
MPA	SVOC	2-Methylnaphthalene	mg/kg			1.52 U					
MPA	SVOC	Acenaphthene	mg/kg			1.52 U					
MPA	SVOC	Acenaphthylene	mg/kg			1.52 U					
MPA	SVOC	Anthracene	mg/kg			1.52 U					
MPA	SVOC	Benzo(a)anthracene	mg/kg			1.52 U					
MPA	SVOC	Benzo(a)pyrene	mg/kg			1.52 U					
MPA	SVOC	Benzo(b)fluoranthene	mg/kg			1.52 U					
MPA	SVOC	Benzo(k)fluoranthene	mg/kg			1.52 U					
MPA	SVOC	Chrysene	mg/kg			1.52 U					
MPA	SVOC	Dibenz(a,h)anthracene	mg/kg			1.52 U					
MPA	SVOC	Fluoranthene	mg/kg			1.52 U					
MPA	SVOC	Fluorene	mg/kg			1.52 U					
MPA	SVOC	Indeno(1,2,3-cd)pyrene	mg/kg			1.52 U					
MPA	SVOC	Naphthalene	mg/kg			1.52 U					
MPA	SVOC	Phenanthrene	mg/kg			1.52 U					
MPA	SVOC	Pyrene	mg/kg			1.52 U					
MPA	TPH	Aliphatic >C10-C12	mg/kg		57.92 U		18.39 J				
MPA	TPH	Aliphatic >C12-C16	mg/kg		44.4		261.86				
MPA	TPH	Aliphatic >C16-C35	mg/kg		182.63		1248.59				
MPA	TPH	Aliphatic >C8-C10	mg/kg								
MPA	TPH	Aliphatic C6-C8	mg/kg								
MPA	TPH	Aromatic >C10-C12	mg/kg		38.61 U		28.25 U				
MPA	TPH	Aromatic >C12-C16	mg/kg		57.92 U		29.38 J				
MPA	TPH	Aromatic >C16-C21	mg/kg		57.92 U		85.88				
MPA	TPH	Aromatic >C21-C35	mg/kg		57.92 U		155.65				
MPA	TPH	Aromatic >C8-C10	mg/kg								
MPA	TPH	HEM, Oil & Grease	%								
MPA	TPH	TPH-DRO	mg/kg	165.02 U	311.58		2141.24		163.4 U	157.73 U	160.26 U
MPA	TPH	TPH-ORO	mg/kg	165.02 U	24.71 J		432.2		163.4 U	157.73 U	160.26 U

Notes:

PCB = Polychlorinated Biphenyl; VOC = Volatile Organic Compound; SVOC = Semivolatile Organic Compound; TPH = Total Petroleum Hydrocarbon; DRO = Diesel-range Organic; ORO = Oil-range Organic.

All units presented in dry weight.

All samples evaluated are included. Parent and field duplicate samples presented separately.

Only post remediation samples used in risk assessment.

Detection limits present for non-detected samples.

U = Not detected.

B = Conc. < Contractual detection limit, but conc. > Instrument detection limit.

* = Field Duplicate.

J = Estimated.

Table A.2 All Soil/Sediment (0-3 ft bgs) Samples

Sampler	Chemical Group	Parameter	Station:	SED-23	SED-24	SED-24	SED-25	SED-26	SED-26	SED-27	SED-28
			Sample ID:	SED-23	SED-24	SED-24	SED-25	SED-26	SED-26	SED-27	SED-28
			Sample Date:	3/2/2010	5/5/2010	3/2/2010	3/2/2010	5/5/2010	3/2/2010	3/2/2010	3/2/2010
			Sample Depth (ft bgs):	0 - 2	0 - 0.5	0 - 2	0 - 2	0 - 0.5	0 - 2	0 - 2	0 - 2
			Used?:	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
			Unit								
ICON	VOC	Benzene	mg/kg								
ICON	VOC	Ethylbenzene	mg/kg								
ICON	VOC	Toluene	mg/kg								
ICON	VOC	Xylenes	mg/kg								
ICON	Metals	Arsenic	mg/kg	6.73	3.15	4.97	5.95	3.28	4.77	4.95	5.04
ICON	Metals	Barium	mg/kg	888	434	706	1070	406	791	548	495
ICON	Metals	Cadmium	mg/kg		0.5 U			0.5 U			0.5 U
ICON	Metals	Chromium	mg/kg		12.7			11.6			17.5
ICON	Metals	Lead	mg/kg		18			16.7			17.9
ICON	Metals	Mercury	mg/kg	0.1 U	0.1 U	0.1 U	0.1 U	0.31	0.45	0.1 U	1.21
ICON	Metals	Selenium	mg/kg	1.98 U	1.99 U	1.98 U	1.99 U	1.99 U	1.99 U	1.98 U	1.99 U
ICON	Metals	Silver	mg/kg								
ICON	Metals	Strontium	mg/kg		41.5			44.2			
ICON	Metals	TT Barium	mg/kg		1270			918			
ICON	Metals	Zinc	mg/kg		50.3			50.7			
ICON	PCB	Aroclor-1016	mg/kg		128 U			134 U			
ICON	PCB	Aroclor-1221	mg/kg		128 U			134 U			
ICON	PCB	Aroclor-1232	mg/kg		128 U			134 U			
ICON	PCB	Aroclor-1242	mg/kg		128 U			134 U			
ICON	PCB	Aroclor-1248	mg/kg		128 U			134 U			
ICON	PCB	Aroclor-1254	mg/kg		128 U			134 U			
ICON	PCB	Aroclor-1260	mg/kg		128 U			134 U			
ICON	PCB	Total PCBs	mg/kg								
ICON	SVOC	2-Methylnaphthalene	mg/kg								
ICON	SVOC	Fluoranthene	mg/kg								
ICON	SVOC	Fluorene	mg/kg								
ICON	SVOC	Phenanthrene	mg/kg								
ICON	TPH	HEM, Oil & Grease	%								
ICON	TPH	TPH-DRO	mg/kg	5202.49	175	710.53	2982.04	2360	28385.42	660.52	36137.34
ICON	TPH	TPH-GRO	mg/kg								
ICON	TPH	TPH-ORO	mg/kg	2825.55	176	703.35	1577.84	1440	12421.88	645.76	14420.6
MPA	Metals	Arsenic	mg/kg	3.76 B	10.48	4.14 B	4.13 B	5.13	4.27 B	3.3 B	3.27 B
MPA	Metals	Barium	mg/kg	1234.46	1197.6	885.06	1449.1	538.22	1086.46	584.23	485.98
MPA	Metals	Cadmium	mg/kg		0.03 B			0.64 U			0.22 B
MPA	Metals	Chromium	mg/kg		14.76			17.17			6.54
MPA	Metals	Lead	mg/kg		25.15			23.06			19.44
MPA	Metals	Mercury	mg/kg	0.07	0.11	0.11	0.08	0.16	0.32	0.08	0.61
MPA	Metals	Selenium	mg/kg	1.61 B	4.79 U	1.72 B	1.56 B	5.1 U	0.84 B	0.97 B	7.43 U
MPA	Metals	Silver	mg/kg								
MPA	Metals	Strontium	mg/kg		68.86			53.82			292.99
MPA	Metals	TT Barium	mg/kg								
MPA	Metals	Zinc	mg/kg		61.98			64.01			
MPA	PCB	Aroclor-1016	mg/kg								
MPA	PCB	Aroclor-1221	mg/kg								
MPA	PCB	Aroclor-1232	mg/kg								
MPA	PCB	Aroclor-1242	mg/kg								
MPA	PCB	Aroclor-1248	mg/kg								
MPA	PCB	Aroclor-1254	mg/kg								

Table A.2 All Soil/Sediment (0-3 ft bgs) Samples

Sampler	Chemical Group	Parameter	Station:	SED-23	SED-24	SED-24	SED-25	SED-26	SED-26	SED-27	SED-28
			Sample ID:	SED-23	SED-24	SED-24	SED-25	SED-26	SED-26	SED-27	SED-28
			Sample Date:	3/2/2010	5/5/2010	3/2/2010	3/2/2010	5/5/2010	3/2/2010	3/2/2010	3/2/2010
			Sample Depth (ft bgs):	0 - 2	0 - 0.5	0 - 2	0 - 2	0 - 0.5	0 - 2	0 - 2	0 - 2
			Used?:	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
			Unit								
MPA	PCB	Aroclor-1260	mg/kg								
MPA	SVOC	2-Methylnaphthalene	mg/kg		0.97 U			1.04 U			
MPA	SVOC	Acenaphthene	mg/kg		0.97 U			1.04 U			
MPA	SVOC	Acenaphthylene	mg/kg		0.97 U			1.04 U			
MPA	SVOC	Anthracene	mg/kg		0.97 U			1.04 U			
MPA	SVOC	Benzo(a)anthracene	mg/kg		0.97 U			1.04 U			
MPA	SVOC	Benzo(a)pyrene	mg/kg		0.97 U			1.04 U			
MPA	SVOC	Benzo(b)fluoranthene	mg/kg		0.97 U			1.04 U			
MPA	SVOC	Benzo(k)fluoranthene	mg/kg		0.97 U			1.04 U			
MPA	SVOC	Chrysene	mg/kg		0.97 U			1.04 U			
MPA	SVOC	Dibenz(a,h)anthracene	mg/kg		0.97 U			1.04 U			
MPA	SVOC	Fluoranthene	mg/kg		0.97 U			1.04 U			
MPA	SVOC	Fluorene	mg/kg		0.97 U			1.04 U			
MPA	SVOC	Indeno(1,2,3-cd)pyrene	mg/kg		0.97 U			1.04 U			
MPA	SVOC	Naphthalene	mg/kg		0.97 U			1.04 U			
MPA	SVOC	Phenanthrene	mg/kg		0.97 U			1.04 U			
MPA	SVOC	Pyrene	mg/kg		0.97 U			1.04 U			
MPA	TPH	Aliphatic >C10-C12	mg/kg	42.37 U			44.91 U		90.49	53.76 U	514.02 J
MPA	TPH	Aliphatic >C12-C16	mg/kg	102.54			62.87		815.56	24.34 J	560.75
MPA	TPH	Aliphatic >C16-C35	mg/kg	1129.94			289.82		2564.84	275.27	12570.09
MPA	TPH	Aliphatic >C8-C10	mg/kg								
MPA	TPH	Aliphatic C6-C8	mg/kg								
MPA	TPH	Aromatic >C10-C12	mg/kg	28.25 U			29.94 U		14.52 J	35.84 U	30.84 J
MPA	TPH	Aromatic >C12-C16	mg/kg	20.28 J			44.91 U		273.49	53.76 U	789.72
MPA	TPH	Aromatic >C16-C21	mg/kg	96.05			44.91 U		463.98	53.76 U	1355.14
MPA	TPH	Aromatic >C21-C35	mg/kg	184.75			44.91 U		518.73	53.76 U	2023.36
MPA	TPH	Aromatic >C8-C10	mg/kg								
MPA	TPH	HEM, Oil & Grease	%								
MPA	TPH	TPH-DRO	mg/kg	1169.49		143.68 U	252.69		6772.33	379.93	25327.1
MPA	TPH	TPH-ORO	mg/kg	310.73		143.68 U	25.09 J		1014.41	71.68 J	4233.64

Notes:

PCB = Polychlorinated Biphenyl; VOC = Volatile Organic Compound; SVOC = Semivolatile Organic Compound; TPH = Total Petroleum Hydrocarbon; DRO = Diesel-range Organic; ORO = Oil-range Organic.

All units presented in dry weight.

All samples evaluated are included. Parent and field duplicate samples presented separately.

Only post remediation samples used in risk assessment.

Detection limits present for non-detected samples.

U = Not detected.

B = Conc. < Contractual detection limit, but conc. > Instrument detection limit.

* = Field Duplicate.

J = Estimated.

Table A.2 All Soil/Sediment (0-3 ft bgs) Samples

Sampler	Chemical Group	Parameter	Station:	SED-29	SED-3	SED-30	SED-30	SED-30	SED-31	SED-31	SED-32
			Sample ID:	SED-29	SED-3	SED-120*	SED-30	SED-30	SED-31	SED-31	SED-32
			Sample Date:	3/2/2010	2/25/2010	5/7/2010	3/2/2010	5/7/2010	5/5/2010	3/1/2010	3/1/2010
			Sample Depth (ft bgs):	0 - 2	0 - 2	0 - 0.5	0 - 2	0 - 0.5	0 - 0.5	0 - 2	0 - 2
			Used?:	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
			Unit								
ICON	VOC	Benzene	mg/kg								
ICON	VOC	Ethylbenzene	mg/kg								
ICON	VOC	Toluene	mg/kg								
ICON	VOC	Xylenes	mg/kg								
ICON	Metals	Arsenic	mg/kg	4.47	8.72			4.97	4.8	3.13	4.47
ICON	Metals	Barium	mg/kg	539	315			493	554	585	460
ICON	Metals	Cadmium	mg/kg	0.5 U	0.5 U			0.5 U	0.5 U		
ICON	Metals	Chromium	mg/kg	16.9	15.2			17	12.9		
ICON	Metals	Lead	mg/kg	16.3	19.9			16.6	18.5		
ICON	Metals	Mercury	mg/kg	0.1 U	0.1 U			0.1 U	0.12	0.12	0.13
ICON	Metals	Selenium	mg/kg	1.98 U	1.99 U			1.98 U	1.99 U	1.99 U	1.99 U
ICON	Metals	Silver	mg/kg								
ICON	Metals	Strontium	mg/kg	223	60.2			220	43.6		
ICON	Metals	TT Barium	mg/kg						1390	873	635
ICON	Metals	Zinc	mg/kg						49.7		
ICON	PCB	Aroclor-1016	mg/kg					223.03 U	124 U		
ICON	PCB	Aroclor-1221	mg/kg					223.03 U	124 U		
ICON	PCB	Aroclor-1232	mg/kg					223.03 U	124 U		
ICON	PCB	Aroclor-1242	mg/kg					223.03 U	124 U		
ICON	PCB	Aroclor-1248	mg/kg					223.03 U	124 U		
ICON	PCB	Aroclor-1254	mg/kg					223.03 U	124 U		
ICON	PCB	Aroclor-1260	mg/kg					223.03 U	124 U		
ICON	PCB	Total PCBs	mg/kg								
ICON	SVOC	2-Methylnaphthalene	mg/kg								
ICON	SVOC	Fluoranthene	mg/kg								
ICON	SVOC	Fluorene	mg/kg								
ICON	SVOC	Phenanthrene	mg/kg								
ICON	TPH	HEM, Oil & Grease	%								
ICON	TPH	TPH-DRO	mg/kg	9156.63			41111.11	14325.84	160	4949.83	5162.45
ICON	TPH	TPH-GRO	mg/kg								
ICON	TPH	TPH-ORO	mg/kg	7771.08			22116.4	8146.07	156 U	2234.11	1292.42
MPA	Metals	Arsenic	mg/kg	7.69 U	8.82 B	3.66 B	3.6 B		8.03	1.16 B	2.21 B
MPA	Metals	Barium	mg/kg	658.65	334.72	754.29	856.12		1096.88	544.22	473.31
MPA	Metals	Cadmium	mg/kg	0.11 B	1.39 U	0.22 B	0.27 B		0.06 B		
MPA	Metals	Chromium	mg/kg	13.7	2.78 U	35.83	26.76		17		
MPA	Metals	Lead	mg/kg	20.19	26.74	34	32.37		24.75		
MPA	Metals	Mercury	mg/kg	0.11	0.14	0.41	0.08 B		0.16	0.04	0.04
MPA	Metals	Selenium	mg/kg	7.69 U	11.04 U	9.14 U	11.44 U		5 U	0.88 B	0.93 B
MPA	Metals	Silver	mg/kg								
MPA	Metals	Strontium	mg/kg	213.94	79.17	442.29	380.58		63.12		
MPA	Metals	TT Barium	mg/kg								
MPA	Metals	Zinc	mg/kg			414.29			64.69		
MPA	PCB	Aroclor-1016	mg/kg								
MPA	PCB	Aroclor-1221	mg/kg								
MPA	PCB	Aroclor-1232	mg/kg								
MPA	PCB	Aroclor-1242	mg/kg								
MPA	PCB	Aroclor-1248	mg/kg								
MPA	PCB	Aroclor-1254	mg/kg								

Table A.2 All Soil/Sediment (0-3 ft bgs) Samples

Sampler	Chemical Group	Parameter	Station:	SED-29	SED-3	SED-30	SED-30	SED-30	SED-31	SED-31	SED-32
			Sample ID:	SED-29	SED-3	SED-120*	SED-30	SED-30	SED-31	SED-31	SED-32
			Sample Date:	3/2/2010	2/25/2010	5/7/2010	3/2/2010	5/7/2010	5/5/2010	3/1/2010	3/1/2010
			Sample Depth (ft bgs):	0 - 2	0 - 2	0 - 0.5	0 - 2	0 - 0.5	0 - 0.5	0 - 2	0 - 2
			Used?:	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
			Unit								
MPA	PCB	Aroclor-1260	mg/kg								
MPA	SVOC	2-Methylnaphthalene	mg/kg			1.89 U			1.02 U		
MPA	SVOC	Acenaphthene	mg/kg			1.89 U			1.02 U		
MPA	SVOC	Acenaphthylene	mg/kg			1.89 U			1.02 U		
MPA	SVOC	Anthracene	mg/kg			1.89 U			1.02 U		
MPA	SVOC	Benzo(a)anthracene	mg/kg			1.89 U			1.02 U		
MPA	SVOC	Benzo(a)pyrene	mg/kg			1.89 U			1.02 U		
MPA	SVOC	Benzo(b)fluoranthene	mg/kg			1.89 U			1.02 U		
MPA	SVOC	Benzo(k)fluoranthene	mg/kg			1.89 U			1.02 U		
MPA	SVOC	Chrysene	mg/kg			1.89 U			1.02 U		
MPA	SVOC	Dibenz(a,h)anthracene	mg/kg			1.89 U			1.02 U		
MPA	SVOC	Fluoranthene	mg/kg			1.89 U			1.02 U		
MPA	SVOC	Fluorene	mg/kg			0.92 J			1.02 U		
MPA	SVOC	Indeno(1,2,3-cd)pyrene	mg/kg			1.89 U			1.02 U		
MPA	SVOC	Naphthalene	mg/kg			1.89 U			1.02 U		
MPA	SVOC	Phenanthrene	mg/kg			1.89 U			1.02 U		
MPA	SVOC	Pyrene	mg/kg			1.89 U			1.02 U		
MPA	TPH	Aliphatic >C10-C12	mg/kg	72.12 U			128.78 J			32.18 J	93.59
MPA	TPH	Aliphatic >C12-C16	mg/kg	257.69			2604.32			296.94	914.59
MPA	TPH	Aliphatic >C16-C35	mg/kg	2254.81			9712.23			1323.13	2619.22
MPA	TPH	Aliphatic >C8-C10	mg/kg								
MPA	TPH	Aliphatic C6-C8	mg/kg								
MPA	TPH	Aromatic >C10-C12	mg/kg	48.08 U			71.94 U			34.01 U	35.59 U
MPA	TPH	Aromatic >C12-C16	mg/kg	72.12 U			184.17			51.02 U	59.07
MPA	TPH	Aromatic >C16-C21	mg/kg	290.38			719.42			131.63	238.08
MPA	TPH	Aromatic >C21-C35	mg/kg	879.81			1546.76			205.44	349.82
MPA	TPH	Aromatic >C8-C10	mg/kg								
MPA	TPH	HEM, Oil & Grease	%								
MPA	TPH	TPH-DRO	mg/kg	4951.92			12733.81			1500	3220.64
MPA	TPH	TPH-ORO	mg/kg	1379.81			2805.76			295.92	629.89

Notes:

PCB = Polychlorinated Biphenyl; VOC = Volatile Organic Compound; SVOC = Semivolatile Organic Compound; TPH = Total Petroleum Hydrocarbon; DRO = Diesel-range Organic; ORO = Oil-range Organic.

All units presented in dry weight.

All samples evaluated are included. Parent and field duplicate samples presented separately.

Only post remediation samples used in risk assessment.

Detection limits present for non-detected samples.

U = Not detected.

B = Conc. < Contractual detection limit, but conc. > Instrument detection limit.

* = Field Duplicate.

J = Estimated.

Table A.2 All Soil/Sediment (0-3 ft bgs) Samples

Sampler	Chemical Group	Parameter	Station:	SED-33	SED-4	SED-5	SED-6	SED-6	SED-6	SED-6
			Sample ID:	SED-33	SED-4	SED-5	Hg-MPA-01	Hg-MPA-01	Hg-MPA-01	Hg-MPA-01
			Sample Date:	3/1/2010	2/25/2010	2/25/2010	10/6/2010	10/6/2010	10/6/2010	10/6/2010
			Sample Depth (ft bgs):	0 - 2	0 - 2	0 - 2	0 - 0.5	0.5 - 2	0.5 - 2	0 - 0.5
			Used?:	Yes	Yes	Yes	Yes	Yes	Yes - step out	Yes - step out
			Unit							
ICON	VOC	Benzene	mg/kg							
ICON	VOC	Ethylbenzene	mg/kg							
ICON	VOC	Toluene	mg/kg							
ICON	VOC	Xylenes	mg/kg							
ICON	Metals	Arsenic	mg/kg	3.21	5.42	4.75				
ICON	Metals	Barium	mg/kg	395	662	216				
ICON	Metals	Cadmium	mg/kg		0.59	0.5 U				
ICON	Metals	Chromium	mg/kg		16.4	15.3				
ICON	Metals	Lead	mg/kg		22.4	15.4				
ICON	Metals	Mercury	mg/kg	0.1 U	0.22	0.62	0.39	0.53		
ICON	Metals	Selenium	mg/kg	1.99 U	1.98 U	1.99 U				
ICON	Metals	Silver	mg/kg							
ICON	Metals	Strontium	mg/kg		91.7	58.9				
ICON	Metals	TT Barium	mg/kg	490						
ICON	Metals	Zinc	mg/kg							
ICON	PCB	Aroclor-1016	mg/kg							
ICON	PCB	Aroclor-1221	mg/kg							
ICON	PCB	Aroclor-1232	mg/kg							
ICON	PCB	Aroclor-1242	mg/kg							
ICON	PCB	Aroclor-1248	mg/kg							
ICON	PCB	Aroclor-1254	mg/kg							
ICON	PCB	Aroclor-1260	mg/kg							
ICON	PCB	Total PCBs	mg/kg		0.1 U	0.08 U				
ICON	SVOC	2-Methylnaphthalene	mg/kg							
ICON	SVOC	Fluoranthene	mg/kg							
ICON	SVOC	Fluorene	mg/kg							
ICON	SVOC	Phenanthrene	mg/kg							
ICON	TPH	HEM, Oil & Grease	%							
ICON	TPH	TPH-DRO	mg/kg	488.72	743.52	228.3				
ICON	TPH	TPH-GRO	mg/kg							
ICON	TPH	TPH-ORO	mg/kg	207.14	948.19	283.02				
MPA	Metals	Arsenic	mg/kg	2.6 B	1.58 B	6.18				
MPA	Metals	Barium	mg/kg	670	341.75	122.8				
MPA	Metals	Cadmium	mg/kg		0.34 U	0.4 U				
MPA	Metals	Chromium	mg/kg		5.27	0.8 U				
MPA	Metals	Lead	mg/kg		11.9	14.86				
MPA	Metals	Mercury	mg/kg	0.08	0.04	0.04			0.29	0.25
MPA	Metals	Selenium	mg/kg	7.95 U	2.68 U	3.18 U				
MPA	Metals	Silver	mg/kg							
MPA	Metals	Strontium	mg/kg		59.09	36.2				
MPA	Metals	TT Barium	mg/kg							
MPA	Metals	Zinc	mg/kg							
MPA	PCB	Aroclor-1016	mg/kg		0.07 U	0.08 U				
MPA	PCB	Aroclor-1221	mg/kg		0.07 U	0.08 U				
MPA	PCB	Aroclor-1232	mg/kg		0.07 U	0.08 U				
MPA	PCB	Aroclor-1242	mg/kg		0.07 U	0.08 U				
MPA	PCB	Aroclor-1248	mg/kg		0.07 U	0.08 U				
MPA	PCB	Aroclor-1254	mg/kg		0.07 U	0.08 U				

Table A.2 All Soil/Sediment (0-3 ft bgs) Samples

Sampler	Chemical Group	Parameter	Station:	SED-33	SED-4	SED-5	SED-6	SED-6	SED-6	SED-6
			Sample ID:	SED-33	SED-4	SED-5	Hg-MPA-01	Hg-MPA-01	Hg-MPA-01	Hg-MPA-01
			Sample Date:	3/1/2010	2/25/2010	2/25/2010	10/6/2010	10/6/2010	10/6/2010	10/6/2010
			Sample Depth (ft bgs):	0 - 2	0 - 2	0 - 2	0 - 0.5	0.5 - 2	0.5 - 2	0 - 0.5
			Used?:	Yes	Yes	Yes	Yes	Yes	Yes - step out	Yes - step out
			Unit							
MPA	PCB	Aroclor-1260	mg/kg		0.07 U	0.08 U				
MPA	SVOC	2-Methylnaphthalene	mg/kg							
MPA	SVOC	Acenaphthene	mg/kg							
MPA	SVOC	Acenaphthylene	mg/kg							
MPA	SVOC	Anthracene	mg/kg							
MPA	SVOC	Benzo(a)anthracene	mg/kg							
MPA	SVOC	Benzo(a)pyrene	mg/kg							
MPA	SVOC	Benzo(b)fluoranthene	mg/kg							
MPA	SVOC	Benzo(k)fluoranthene	mg/kg							
MPA	SVOC	Chrysene	mg/kg							
MPA	SVOC	Dibenz(a,h)anthracene	mg/kg							
MPA	SVOC	Fluoranthene	mg/kg							
MPA	SVOC	Fluorene	mg/kg							
MPA	SVOC	Indeno(1,2,3-cd)pyrene	mg/kg							
MPA	SVOC	Naphthalene	mg/kg							
MPA	SVOC	Phenanthrene	mg/kg							
MPA	SVOC	Pyrene	mg/kg							
MPA	TPH	Aliphatic >C10-C12	mg/kg	75 U						
MPA	TPH	Aliphatic >C12-C16	mg/kg	204.5						
MPA	TPH	Aliphatic >C16-C35	mg/kg	466						
MPA	TPH	Aliphatic >C8-C10	mg/kg							
MPA	TPH	Aliphatic C6-C8	mg/kg							
MPA	TPH	Aromatic >C10-C12	mg/kg	50 U						
MPA	TPH	Aromatic >C12-C16	mg/kg	75 U						
MPA	TPH	Aromatic >C16-C21	mg/kg	75 U						
MPA	TPH	Aromatic >C21-C35	mg/kg	75 U						
MPA	TPH	Aromatic >C8-C10	mg/kg							
MPA	TPH	HEM, Oil & Grease	%							
MPA	TPH	TPH-DRO	mg/kg	775	84.18 U	100 U				
MPA	TPH	TPH-ORO	mg/kg	176.5 J	84.18 U	100 U				

Notes:

PCB = Polychlorinated Biphenyl; VOC = Volatile Organic Compound; SVOC = Semivolatile Organic Compound; TPH = Total Petroleum Hydrocarbon; DRO = Diesel-range Organic; ORO = Oil-range Organic.

All units presented in dry weight.

All samples evaluated are included. Parent and field duplicate samples presented separately.

Only post remediation samples used in risk assessment.

Detection limits present for non-detected samples.

U = Not detected.

B = Conc. < Contractual detection limit, but conc. > Instrument detection limit.

* = Field Duplicate.

J = Estimated.

Table A.2 All Soil/Sediment (0-3 ft bgs) Samples

Sampler	Chemical Group	Parameter	Station:	SED-6	SED-6	SED-6	SED-6	SED-6	SED-6
			Sample ID:	Hg-MPA-02	Hg-MPA-02	Hg-MPA-02	Hg-MPA-02	Hg-MPA-03	Hg-MPA-03
			Sample Date:	10/6/2010	10/6/2010	10/6/2010	10/6/2010	10/6/2010	10/6/2010
			Sample Depth (ft bgs):	0 - 0.5	0.5 - 2	0 - 0.5	0.5 - 2	0 - 0.5	0.5 - 2
			Used?:	Yes	Yes	Yes - step out	Yes - step out	Yes	Yes
			Unit						
ICON	VOC	Benzene	mg/kg						
ICON	VOC	Ethylbenzene	mg/kg						
ICON	VOC	Toluene	mg/kg						
ICON	VOC	Xylenes	mg/kg						
ICON	Metals	Arsenic	mg/kg						
ICON	Metals	Barium	mg/kg						
ICON	Metals	Cadmium	mg/kg						
ICON	Metals	Chromium	mg/kg						
ICON	Metals	Lead	mg/kg						
ICON	Metals	Mercury	mg/kg	0.28	0.47			0.2	0.26
ICON	Metals	Selenium	mg/kg						
ICON	Metals	Silver	mg/kg						
ICON	Metals	Strontium	mg/kg						
ICON	Metals	TT Barium	mg/kg						
ICON	Metals	Zinc	mg/kg						
ICON	PCB	Aroclor-1016	mg/kg						
ICON	PCB	Aroclor-1221	mg/kg						
ICON	PCB	Aroclor-1232	mg/kg						
ICON	PCB	Aroclor-1242	mg/kg						
ICON	PCB	Aroclor-1248	mg/kg						
ICON	PCB	Aroclor-1254	mg/kg						
ICON	PCB	Aroclor-1260	mg/kg						
ICON	PCB	Total PCBs	mg/kg						
ICON	SVOC	2-Methylnaphthalene	mg/kg						
ICON	SVOC	Fluoranthene	mg/kg						
ICON	SVOC	Fluorene	mg/kg						
ICON	SVOC	Phenanthrene	mg/kg						
ICON	TPH	HEM, Oil & Grease	%						
ICON	TPH	TPH-DRO	mg/kg						
ICON	TPH	TPH-GRO	mg/kg						
ICON	TPH	TPH-ORO	mg/kg						
MPA	Metals	Arsenic	mg/kg						
MPA	Metals	Barium	mg/kg						
MPA	Metals	Cadmium	mg/kg						
MPA	Metals	Chromium	mg/kg						
MPA	Metals	Lead	mg/kg						
MPA	Metals	Mercury	mg/kg			0.32	0.21		
MPA	Metals	Selenium	mg/kg						
MPA	Metals	Silver	mg/kg						
MPA	Metals	Strontium	mg/kg						
MPA	Metals	TT Barium	mg/kg						
MPA	Metals	Zinc	mg/kg						
MPA	PCB	Aroclor-1016	mg/kg						
MPA	PCB	Aroclor-1221	mg/kg						
MPA	PCB	Aroclor-1232	mg/kg						
MPA	PCB	Aroclor-1242	mg/kg						
MPA	PCB	Aroclor-1248	mg/kg						
MPA	PCB	Aroclor-1254	mg/kg						

Table A.2 All Soil/Sediment (0-3 ft bgs) Samples

Sampler	Chemical Group	Parameter	Station:	SED-6	SED-6	SED-6	SED-6	SED-6	SED-6
			Sample ID:	Hg-MPA-02	Hg-MPA-02	Hg-MPA-02	Hg-MPA-02	Hg-MPA-03	Hg-MPA-03
			Sample Date:	10/6/2010	10/6/2010	10/6/2010	10/6/2010	10/6/2010	10/6/2010
			Sample Depth (ft bgs):	0 - 0.5	0.5 - 2	0 - 0.5	0.5 - 2	0 - 0.5	0.5 - 2
			Used?:	Yes	Yes	Yes - step out	Yes - step out	Yes	Yes
			Unit						
MPA	PCB	Aroclor-1260	mg/kg						
MPA	SVOC	2-Methylnaphthalene	mg/kg						
MPA	SVOC	Acenaphthene	mg/kg						
MPA	SVOC	Acenaphthylene	mg/kg						
MPA	SVOC	Anthracene	mg/kg						
MPA	SVOC	Benzo(a)anthracene	mg/kg						
MPA	SVOC	Benzo(a)pyrene	mg/kg						
MPA	SVOC	Benzo(b)fluoranthene	mg/kg						
MPA	SVOC	Benzo(k)fluoranthene	mg/kg						
MPA	SVOC	Chrysene	mg/kg						
MPA	SVOC	Dibenz(a,h)anthracene	mg/kg						
MPA	SVOC	Fluoranthene	mg/kg						
MPA	SVOC	Fluorene	mg/kg						
MPA	SVOC	Indeno(1,2,3-cd)pyrene	mg/kg						
MPA	SVOC	Naphthalene	mg/kg						
MPA	SVOC	Phenanthrene	mg/kg						
MPA	SVOC	Pyrene	mg/kg						
MPA	TPH	Aliphatic >C10-C12	mg/kg						
MPA	TPH	Aliphatic >C12-C16	mg/kg						
MPA	TPH	Aliphatic >C16-C35	mg/kg						
MPA	TPH	Aliphatic >C8-C10	mg/kg						
MPA	TPH	Aliphatic C6-C8	mg/kg						
MPA	TPH	Aromatic >C10-C12	mg/kg						
MPA	TPH	Aromatic >C12-C16	mg/kg						
MPA	TPH	Aromatic >C16-C21	mg/kg						
MPA	TPH	Aromatic >C21-C35	mg/kg						
MPA	TPH	Aromatic >C8-C10	mg/kg						
MPA	TPH	HEM, Oil & Grease	%						
MPA	TPH	TPH-DRO	mg/kg						
MPA	TPH	TPH-ORO	mg/kg						

Notes:

PCB = Polychlorinated Biphenyl; VOC = Volatile Organic Compound; SVOC = Semivolatile Organic Compound; TPH = Total Petroleum Hydrocarbon; DRO = Diesel-range Organic; ORO = Oil-range Organic.

All units presented in dry weight.

All samples evaluated are included. Parent and field duplicate samples presented separately.

Only post remediation samples used in risk assessment.

Detection limits present for non-detected samples.

U = Not detected.

B = Conc. < Contractual detection limit, but conc. > Instrument detection limit.

* = Field Duplicate.

J = Estimated.

Table A.2 All Soil/Sediment (0-3 ft bgs) Samples

Sampler	Chemical Group	Parameter	Station:	SED-6	SED-6	SED-6	SED-6	SED-6	SED-6	SED-6
			Sample ID:	Hg-MPA-03	Hg-MPA-03	Hg-MPA-04	Hg-MPA-04	Hg-MPA-04	Hg-MPA-04	Hg-MPA-05
			Sample Date:	10/6/2010	10/6/2010	10/6/2010	10/6/2010	10/6/2010	10/6/2010	10/6/2010
			Sample Depth (ft bgs):	0 - 0.5	0.5 - 2	0 - 0.5	0.5 - 2	0 - 0.5	0.5 - 2	0 - 0.5
			Used?:	Yes - step out	Yes - step out	Yes	Yes	Yes - step out	Yes - step out	Yes - step out
			Unit							
ICON	VOC	Benzene	mg/kg							
ICON	VOC	Ethylbenzene	mg/kg							
ICON	VOC	Toluene	mg/kg							
ICON	VOC	Xylenes	mg/kg							
ICON	Metals	Arsenic	mg/kg							
ICON	Metals	Barium	mg/kg							
ICON	Metals	Cadmium	mg/kg							
ICON	Metals	Chromium	mg/kg							
ICON	Metals	Lead	mg/kg							
ICON	Metals	Mercury	mg/kg			0.14	0.1 U			
ICON	Metals	Selenium	mg/kg							
ICON	Metals	Silver	mg/kg							
ICON	Metals	Strontium	mg/kg							
ICON	Metals	TT Barium	mg/kg							
ICON	Metals	Zinc	mg/kg							
ICON	PCB	Aroclor-1016	mg/kg							
ICON	PCB	Aroclor-1221	mg/kg							
ICON	PCB	Aroclor-1232	mg/kg							
ICON	PCB	Aroclor-1242	mg/kg							
ICON	PCB	Aroclor-1248	mg/kg							
ICON	PCB	Aroclor-1254	mg/kg							
ICON	PCB	Aroclor-1260	mg/kg							
ICON	PCB	Total PCBs	mg/kg							
ICON	SVOC	2-Methylnaphthalene	mg/kg							
ICON	SVOC	Fluoranthene	mg/kg							
ICON	SVOC	Fluorene	mg/kg							
ICON	SVOC	Phenanthrene	mg/kg							
ICON	TPH	HEM, Oil & Grease	%							
ICON	TPH	TPH-DRO	mg/kg							
ICON	TPH	TPH-GRO	mg/kg							
ICON	TPH	TPH-ORO	mg/kg							
MPA	Metals	Arsenic	mg/kg							
MPA	Metals	Barium	mg/kg							
MPA	Metals	Cadmium	mg/kg							
MPA	Metals	Chromium	mg/kg							
MPA	Metals	Lead	mg/kg							
MPA	Metals	Mercury	mg/kg	0.17	0.18			0.12	0.05	0.25
MPA	Metals	Selenium	mg/kg							
MPA	Metals	Silver	mg/kg							
MPA	Metals	Strontium	mg/kg							
MPA	Metals	TT Barium	mg/kg							
MPA	Metals	Zinc	mg/kg							
MPA	PCB	Aroclor-1016	mg/kg							
MPA	PCB	Aroclor-1221	mg/kg							
MPA	PCB	Aroclor-1232	mg/kg							
MPA	PCB	Aroclor-1242	mg/kg							
MPA	PCB	Aroclor-1248	mg/kg							
MPA	PCB	Aroclor-1254	mg/kg							

Table A.2 All Soil/Sediment (0-3 ft bgs) Samples

Sampler	Chemical Group	Parameter	Station:	SED-6	SED-6	SED-6	SED-6	SED-6	SED-6	SED-6
			Sample ID:	Hg-MPA-03	Hg-MPA-03	Hg-MPA-04	Hg-MPA-04	Hg-MPA-04	Hg-MPA-04	Hg-MPA-05
			Sample Date:	10/6/2010	10/6/2010	10/6/2010	10/6/2010	10/6/2010	10/6/2010	10/6/2010
			Sample Depth (ft bgs):	0 - 0.5	0.5 - 2	0 - 0.5	0.5 - 2	0 - 0.5	0.5 - 2	0 - 0.5
			Used?:	Yes - step out	Yes - step out	Yes	Yes	Yes - step out	Yes - step out	Yes - step out
			Unit							
MPA	PCB	Aroclor-1260	mg/kg							
MPA	SVOC	2-Methylnaphthalene	mg/kg							
MPA	SVOC	Acenaphthene	mg/kg							
MPA	SVOC	Acenaphthylene	mg/kg							
MPA	SVOC	Anthracene	mg/kg							
MPA	SVOC	Benzo(a)anthracene	mg/kg							
MPA	SVOC	Benzo(a)pyrene	mg/kg							
MPA	SVOC	Benzo(b)fluoranthene	mg/kg							
MPA	SVOC	Benzo(k)fluoranthene	mg/kg							
MPA	SVOC	Chrysene	mg/kg							
MPA	SVOC	Dibenz(a,h)anthracene	mg/kg							
MPA	SVOC	Fluoranthene	mg/kg							
MPA	SVOC	Fluorene	mg/kg							
MPA	SVOC	Indeno(1,2,3-cd)pyrene	mg/kg							
MPA	SVOC	Naphthalene	mg/kg							
MPA	SVOC	Phenanthrene	mg/kg							
MPA	SVOC	Pyrene	mg/kg							
MPA	TPH	Aliphatic >C10-C12	mg/kg							
MPA	TPH	Aliphatic >C12-C16	mg/kg							
MPA	TPH	Aliphatic >C16-C35	mg/kg							
MPA	TPH	Aliphatic >C8-C10	mg/kg							
MPA	TPH	Aliphatic C6-C8	mg/kg							
MPA	TPH	Aromatic >C10-C12	mg/kg							
MPA	TPH	Aromatic >C12-C16	mg/kg							
MPA	TPH	Aromatic >C16-C21	mg/kg							
MPA	TPH	Aromatic >C21-C35	mg/kg							
MPA	TPH	Aromatic >C8-C10	mg/kg							
MPA	TPH	HEM, Oil & Grease	%							
MPA	TPH	TPH-DRO	mg/kg							
MPA	TPH	TPH-ORO	mg/kg							

Notes:

PCB = Polychlorinated Biphenyl; VOC = Volatile Organic Compound; SVOC = Semivolatile Organic Compound; TPH = Total Petroleum Hydrocarbon; DRO = Diesel-range Organic; ORO = Oil-range Organic.

All units presented in dry weight.

All samples evaluated are included. Parent and field duplicate samples presented separately.

Only post remediation samples used in risk assessment.

Detection limits present for non-detected samples.

U = Not detected.

B = Conc. < Contractual detection limit, but conc. > Instrument detection limit.

* = Field Duplicate.

J = Estimated.

Table A.2 All Soil/Sediment (0-3 ft bgs) Samples

Sampler	Chemical Group	Parameter	Station:	SED-6	SED-6	SED-7	SED-8	SED-8	SED-9	SED-9	SS1	SS1
			Sample ID:	Hg-MPA-05	SED-6	SED-7	SED-8	SED-8	SED9	SED-9	SS1	SS1
			Sample Date:	10/6/2010	2/25/2010	2/25/2010	5/6/2010	2/25/2010	2/25/2010	5/5/2010	4/25/2006	4/25/2006
			Sample Depth (ft bgs):	0.5 - 2	0 - 2	0 - 2	0 - 0.5	0 - 2	0 - 2	0 - 0.5	0 - 2.1	2.1 - 2.5
			Used?:	Yes - step out	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
			Unit									
ICON	VOC	Benzene	mg/kg									
ICON	VOC	Ethylbenzene	mg/kg									
ICON	VOC	Toluene	mg/kg									
ICON	VOC	Xylenes	mg/kg									
ICON	Metals	Arsenic	mg/kg		8.06	3.93	5.65	4	5.11	3.36		
ICON	Metals	Barium	mg/kg		522	686	720	587	493	455		
ICON	Metals	Cadmium	mg/kg		1.21	0.5 U	0.5 U	0.5 U		0.5 U		
ICON	Metals	Chromium	mg/kg		24.1	19	12.4	18		13.8		
ICON	Metals	Lead	mg/kg		55.2	19.9	18.9	20.1		19.6		
ICON	Metals	Mercury	mg/kg		14.3	0.12	0.12	0.1 U	0.17	0.1 U		
ICON	Metals	Selenium	mg/kg		1.98 U	1.98 U	1.99 U	1.99 U	1.99 U	1.99 U		
ICON	Metals	Silver	mg/kg									
ICON	Metals	Strontium	mg/kg		140	48.3	43.7	51.3		43.5		
ICON	Metals	TT Barium	mg/kg				1470			1360		
ICON	Metals	Zinc	mg/kg				48.3			54.3		
ICON	PCB	Aroclor-1016	mg/kg				103 U			1360 U		
ICON	PCB	Aroclor-1221	mg/kg				103 U			1360 U		
ICON	PCB	Aroclor-1232	mg/kg				103 U			1360 U		
ICON	PCB	Aroclor-1242	mg/kg				103 U			1360 U		
ICON	PCB	Aroclor-1248	mg/kg				103 U			1360 U		
ICON	PCB	Aroclor-1254	mg/kg				103 U			1360 U		
ICON	PCB	Aroclor-1260	mg/kg				103 U			1360 U		
ICON	PCB	Total PCBs	mg/kg		1.19 U			1.29 U				
ICON	SVOC	2-Methylnaphthalene	mg/kg									
ICON	SVOC	Fluoranthene	mg/kg									
ICON	SVOC	Fluorene	mg/kg									
ICON	SVOC	Phenanthrene	mg/kg									
ICON	TPH	HEM, Oil & Grease	%									
ICON	TPH	TPH-DRO	mg/kg		1022.73	536.18	344	352.94	168.82	92.3	110	46
ICON	TPH	TPH-GRO	mg/kg									
ICON	TPH	TPH-ORO	mg/kg		3068.18	1039.47	315	315.03	302.94	172 U	134 U	134 U
MPA	Metals	Arsenic	mg/kg		3.31	3.47 B	4.06 B	4.42 B	3.92 B	6.61		
MPA	Metals	Barium	mg/kg		226.53	726.11	496.14	741.43	457.39	671.05		
MPA	Metals	Cadmium	mg/kg		2.1	0.1 B	0.51 U	0.62 U		0.66 U		
MPA	Metals	Chromium	mg/kg		3.57	6.91	14.76	4.67		13.95		
MPA	Metals	Lead	mg/kg		18.73	20.99	21.18	22.77		20.36		
MPA	Metals	Mercury	mg/kg	0.13	0.88	0.08	0.1	0.07	0.06	0.12		
MPA	Metals	Selenium	mg/kg		3.27 U	5.1 U	4.11 U	4.98 U	4.55 U	5.26 U		
MPA	Metals	Silver	mg/kg									
MPA	Metals	Strontium	mg/kg		80.2	47.13	41.13	48.91		46.05		
MPA	Metals	TT Barium	mg/kg									
MPA	Metals	Zinc	mg/kg				52.96			53.62		
MPA	PCB	Aroclor-1016	mg/kg		0.41 U			0.62 U				
MPA	PCB	Aroclor-1221	mg/kg		0.41 U			0.62 U				
MPA	PCB	Aroclor-1232	mg/kg		0.41 U			0.62 U				
MPA	PCB	Aroclor-1242	mg/kg		0.41 U			0.62 U				
MPA	PCB	Aroclor-1248	mg/kg		0.41 U			0.62 U				
MPA	PCB	Aroclor-1254	mg/kg		0.41 U			0.62 U				

Table A.2 All Soil/Sediment (0-3 ft bgs) Samples

Sampler	Chemical Group	Parameter	Station:	SED-6	SED-6	SED-7	SED-8	SED-8	SED-9	SED-9	SS1	SS1
			Sample ID:	Hg-MPA-05	SED-6	SED-7	SED-8	SED-8	SED9	SED-9	SS1	SS1
			Sample Date:	10/6/2010	2/25/2010	2/25/2010	5/6/2010	2/25/2010	2/25/2010	5/5/2010	4/25/2006	4/25/2006
			Sample Depth (ft bgs):	0.5 - 2	0 - 2	0 - 2	0 - 0.5	0 - 2	0 - 2	0 - 0.5	0 - 2.1	2.1 - 2.5
			Used?:	Yes - step out	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
			Unit									
MPA	PCB	Aroclor-1260	mg/kg		0.41 U			0.62 U				
MPA	SVOC	2-Methylnaphthalene	mg/kg				0.83 U			1.07 U		
MPA	SVOC	Acenaphthene	mg/kg				0.83 U			1.07 U		
MPA	SVOC	Acenaphthylene	mg/kg				0.83 U			1.07 U		
MPA	SVOC	Anthracene	mg/kg				0.83 U			1.07 U		
MPA	SVOC	Benzo(a)anthracene	mg/kg				0.83 U			1.07 U		
MPA	SVOC	Benzo(a)pyrene	mg/kg				0.83 U			1.07 U		
MPA	SVOC	Benzo(b)fluoranthene	mg/kg				0.83 U			0.06 J		
MPA	SVOC	Benzo(k)fluoranthene	mg/kg				0.83 U			1.07 U		
MPA	SVOC	Chrysene	mg/kg				0.83 U			0.07 J		
MPA	SVOC	Dibenz(a,h)anthracene	mg/kg				0.83 U			1.07 U		
MPA	SVOC	Fluoranthene	mg/kg				0.83 U			1.07 U		
MPA	SVOC	Fluorene	mg/kg				0.83 U			1.07 U		
MPA	SVOC	Indeno(1,2,3-cd)pyrene	mg/kg				0.83 U			0.31 J		
MPA	SVOC	Naphthalene	mg/kg				0.83 U			1.07 U		
MPA	SVOC	Phenanthrene	mg/kg				0.83 U			1.07 U		
MPA	SVOC	Pyrene	mg/kg				0.83 U			1.07 U		
MPA	TPH	Aliphatic >C10-C12	mg/kg									
MPA	TPH	Aliphatic >C12-C16	mg/kg									
MPA	TPH	Aliphatic >C16-C35	mg/kg									
MPA	TPH	Aliphatic >C8-C10	mg/kg									
MPA	TPH	Aliphatic C6-C8	mg/kg									
MPA	TPH	Aromatic >C10-C12	mg/kg									
MPA	TPH	Aromatic >C12-C16	mg/kg									
MPA	TPH	Aromatic >C16-C21	mg/kg									
MPA	TPH	Aromatic >C21-C35	mg/kg									
MPA	TPH	Aromatic >C8-C10	mg/kg									
MPA	TPH	HEM, Oil & Grease	%									
MPA	TPH	TPH-DRO	mg/kg		67.14 J	159.24 U		155.76 U	142.05 U			
MPA	TPH	TPH-ORO	mg/kg		100.2 J	159.24 U		155.76 U	142.05 U			

Notes:

PCB = Polychlorinated Biphenyl; VOC = Volatile Organic Compound; SVOC = Semivolatile Organic Compound; TPH = Total Petroleum Hydrocarbon; DRO = Diesel-range Organic; ORO = Oil-range Organic.

All units presented in dry weight.

All samples evaluated are included. Parent and field duplicate samples presented separately.

Only post remediation samples used in risk assessment.

Detection limits present for non-detected samples.

U = Not detected.

B = Conc. < Contractual detection limit, but conc. > Instrument detection limit.

* = Field Duplicate.

J = Estimated.

Table A.2 All Soil/Sediment (0-3 ft bgs) Samples

Sampler	Chemical Group	Parameter	Station:	SS10	SS10	SS10	SS11	SS13	SS13	SS14	SS14	SS15
			Sample ID:	SS10	SS10	SS10	SS11	SS13	SS13	SS14	SS14	SS15
			Sample Date:	2/26/2010	4/27/2006	4/27/2006	4/27/2006	4/28/2006	4/28/2006	4/28/2006	4/28/2006	4/28/2006
			Sample Depth (ft bgs):	0 - 2	0 - 1.5	1.5 - 2.5	0 - 2.5	0 - 1	1 - 2.75	0 - 0.8	0.8 - 1.7	0 - 3
			Used?:	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
			Unit									
ICON	VOC	Benzene	mg/kg				0.06 U					
ICON	VOC	Ethylbenzene	mg/kg				0.35 U					
ICON	VOC	Toluene	mg/kg				0.35 U					
ICON	VOC	Xylenes	mg/kg				1.06 U					
ICON	Metals	Arsenic	mg/kg	8.03			5.28					
ICON	Metals	Barium	mg/kg	843			2750					
ICON	Metals	Cadmium	mg/kg	0.52								
ICON	Metals	Chromium	mg/kg	14.7			25.1					
ICON	Metals	Lead	mg/kg	28.3			63.6					
ICON	Metals	Mercury	mg/kg	0.28								
ICON	Metals	Selenium	mg/kg	1.99 U								
ICON	Metals	Silver	mg/kg									
ICON	Metals	Strontium	mg/kg	65.3			64.8					
ICON	Metals	TT Barium	mg/kg									
ICON	Metals	Zinc	mg/kg				194					
ICON	PCB	Aroclor-1016	mg/kg									
ICON	PCB	Aroclor-1221	mg/kg									
ICON	PCB	Aroclor-1232	mg/kg									
ICON	PCB	Aroclor-1242	mg/kg									
ICON	PCB	Aroclor-1248	mg/kg									
ICON	PCB	Aroclor-1254	mg/kg									
ICON	PCB	Aroclor-1260	mg/kg									
ICON	PCB	Total PCBs	mg/kg									
ICON	SVOC	2-Methylnaphthalene	mg/kg				0.47 U					
ICON	SVOC	Fluoranthene	mg/kg				0.47 U					
ICON	SVOC	Fluorene	mg/kg				0.47 U					
ICON	SVOC	Phenanthrene	mg/kg				0.47 U					
ICON	TPH	HEM, Oil & Grease	%									
ICON	TPH	TPH-DRO	mg/kg	379	152	16.1 U	326	29.2 U	31	17.8 U	44.2 U	28 U
ICON	TPH	TPH-GRO	mg/kg				70.6 U					
ICON	TPH	TPH-ORO	mg/kg	263	134	80.4 U	317	146 U	129 U	89.1 U	221 U	140 U
MPA	Metals	Arsenic	mg/kg	6.52								
MPA	Metals	Barium	mg/kg	996.69								
MPA	Metals	Cadmium	mg/kg	0.31 B								
MPA	Metals	Chromium	mg/kg	4.64								
MPA	Metals	Lead	mg/kg	23.31								
MPA	Metals	Mercury	mg/kg	0.15								
MPA	Metals	Selenium	mg/kg	1.32 B								
MPA	Metals	Silver	mg/kg									
MPA	Metals	Strontium	mg/kg	61.26								
MPA	Metals	TT Barium	mg/kg									
MPA	Metals	Zinc	mg/kg									
MPA	PCB	Aroclor-1016	mg/kg									
MPA	PCB	Aroclor-1221	mg/kg									
MPA	PCB	Aroclor-1232	mg/kg									
MPA	PCB	Aroclor-1242	mg/kg									
MPA	PCB	Aroclor-1248	mg/kg									
MPA	PCB	Aroclor-1254	mg/kg									

Table A.2 All Soil/Sediment (0-3 ft bgs) Samples

Sampler	Chemical Group	Parameter	Station:	SS10	SS10	SS10	SS11	SS13	SS13	SS14	SS14	SS15
			Sample ID:	SS10	SS10	SS10	SS11	SS13	SS13	SS14	SS14	SS15
			Sample Date:	2/26/2010	4/27/2006	4/27/2006	4/27/2006	4/28/2006	4/28/2006	4/28/2006	4/28/2006	4/28/2006
			Sample Depth (ft bgs):	0 - 2	0 - 1.5	1.5 - 2.5	0 - 2.5	0 - 1	1 - 2.75	0 - 0.8	0.8 - 1.7	0 - 3
			Used?:	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
			Unit									
MPA	PCB	Aroclor-1260	mg/kg									
MPA	SVOC	2-Methylnaphthalene	mg/kg									
MPA	SVOC	Acenaphthene	mg/kg									
MPA	SVOC	Acenaphthylene	mg/kg									
MPA	SVOC	Anthracene	mg/kg									
MPA	SVOC	Benzo(a)anthracene	mg/kg									
MPA	SVOC	Benzo(a)pyrene	mg/kg									
MPA	SVOC	Benzo(b)fluoranthene	mg/kg									
MPA	SVOC	Benzo(k)fluoranthene	mg/kg									
MPA	SVOC	Chrysene	mg/kg									
MPA	SVOC	Dibenz(a,h)anthracene	mg/kg									
MPA	SVOC	Fluoranthene	mg/kg									
MPA	SVOC	Fluorene	mg/kg									
MPA	SVOC	Indeno(1,2,3-cd)pyrene	mg/kg									
MPA	SVOC	Naphthalene	mg/kg									
MPA	SVOC	Phenanthrene	mg/kg									
MPA	SVOC	Pyrene	mg/kg									
MPA	TPH	Aliphatic >C10-C12	mg/kg	49.67 U								
MPA	TPH	Aliphatic >C12-C16	mg/kg	80.46								
MPA	TPH	Aliphatic >C16-C35	mg/kg	202.65								
MPA	TPH	Aliphatic >C8-C10	mg/kg									
MPA	TPH	Aliphatic C6-C8	mg/kg									
MPA	TPH	Aromatic >C10-C12	mg/kg	33.11 U								
MPA	TPH	Aromatic >C12-C16	mg/kg	49.67 U								
MPA	TPH	Aromatic >C16-C21	mg/kg	49.67 U								
MPA	TPH	Aromatic >C21-C35	mg/kg	49.67 U								
MPA	TPH	Aromatic >C8-C10	mg/kg									
MPA	TPH	HEM, Oil & Grease	%									
MPA	TPH	TPH-DRO	mg/kg	463.58								
MPA	TPH	TPH-ORO	mg/kg	30.56 J								

Notes:

PCB = Polychlorinated Biphenyl; VOC = Volatile Organic Compound; SVOC = Semivolatile Organic Compound; TPH = Total Petroleum Hydrocarbon; DRO = Diesel-range Organic; ORO = Oil-range Organic.

All units presented in dry weight.

All samples evaluated are included. Parent and field duplicate samples presented separately.

Only post remediation samples used in risk assessment.

Detection limits present for non-detected samples.

U = Not detected.

B = Conc. < Contractual detection limit, but conc. > Instrument detection limit.

* = Field Duplicate.

J = Estimated.

Table A.2 All Soil/Sediment (0-3 ft bgs) Samples

Sampler	Chemical Group	Parameter	Station:	SS2	SS2	SS3	SS3	SS3	SS4	SS4	SS5
			Sample ID:	SS2	SS2	SS3	SS3	SS3	SS4	SS4	SS5
			Sample Date:	4/25/2006	4/25/2006	4/25/2006	4/25/2006	4/25/2006	4/26/2006	4/26/2006	4/26/2006
			Sample Depth (ft bgs):	0 - 1	1 - 1.5	0 - 0.6	0.6 - 2.2	2.2 - 2.6	0 - 0.6	0.6 - 2.7	0 - 2.15
			Used?:	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
			Unit								
ICON	VOC	Benzene	mg/kg			0.11 U	0.1 U	0.12 U			0.09 U
ICON	VOC	Ethylbenzene	mg/kg			0.67 U	0.61 U	0.72 U			0.59 U
ICON	VOC	Toluene	mg/kg			0.67 U	0.61 U	0.72 U			0.59 U
ICON	VOC	Xylenes	mg/kg			2.01 U	1.84 U	2.17 U			1.76 U
ICON	Metals	Arsenic	mg/kg			8.79	10.9	9.61			11.4
ICON	Metals	Barium	mg/kg			1600	2330	1610			7450
ICON	Metals	Cadmium	mg/kg								
ICON	Metals	Chromium	mg/kg			17.9	16.4	7.15			21.8
ICON	Metals	Lead	mg/kg			28.8	27.2	13.3			117
ICON	Metals	Mercury	mg/kg								
ICON	Metals	Selenium	mg/kg								
ICON	Metals	Silver	mg/kg								
ICON	Metals	Strontium	mg/kg			74.3	96.1	87.1			140
ICON	Metals	TT Barium	mg/kg								
ICON	Metals	Zinc	mg/kg			92.5	75.9	47.7			174
ICON	PCB	Aroclor-1016	mg/kg								
ICON	PCB	Aroclor-1221	mg/kg								
ICON	PCB	Aroclor-1232	mg/kg								
ICON	PCB	Aroclor-1242	mg/kg								
ICON	PCB	Aroclor-1248	mg/kg								
ICON	PCB	Aroclor-1254	mg/kg								
ICON	PCB	Aroclor-1260	mg/kg								
ICON	PCB	Total PCBs	mg/kg								
ICON	SVOC	2-Methylnaphthalene	mg/kg			0.88 U	0.88 U	0.96 U			0.78 U
ICON	SVOC	Fluoranthene	mg/kg			0.88 U	0.88 U	0.96 U			0.78 U
ICON	SVOC	Fluorene	mg/kg			0.88 U	0.88 U	0.96 U			0.78 U
ICON	SVOC	Phenanthrene	mg/kg			0.88 U	0.88 U	0.96 U			0.78 U
ICON	TPH	HEM, Oil & Grease	%								
ICON	TPH	TPH-DRO	mg/kg	230	47.4 U	121	115	128	40 U	53	185
ICON	TPH	TPH-GRO	mg/kg			134 U	123 U	145 U			118 U
ICON	TPH	TPH-ORO	mg/kg	169	237 U	134 U	123 U	145 U	200 U	160 U	118 U
MPA	Metals	Arsenic	mg/kg								
MPA	Metals	Barium	mg/kg								
MPA	Metals	Cadmium	mg/kg								
MPA	Metals	Chromium	mg/kg								
MPA	Metals	Lead	mg/kg								
MPA	Metals	Mercury	mg/kg								
MPA	Metals	Selenium	mg/kg								
MPA	Metals	Silver	mg/kg								
MPA	Metals	Strontium	mg/kg								
MPA	Metals	TT Barium	mg/kg								
MPA	Metals	Zinc	mg/kg								
MPA	PCB	Aroclor-1016	mg/kg								
MPA	PCB	Aroclor-1221	mg/kg								
MPA	PCB	Aroclor-1232	mg/kg								
MPA	PCB	Aroclor-1242	mg/kg								
MPA	PCB	Aroclor-1248	mg/kg								
MPA	PCB	Aroclor-1254	mg/kg								

Table A.2 All Soil/Sediment (0-3 ft bgs) Samples

Sampler	Chemical Group	Parameter	Station:	SS2	SS2	SS3	SS3	SS3	SS4	SS4	SS5
			Sample ID:	SS2	SS2	SS3	SS3	SS3	SS4	SS4	SS5
			Sample Date:	4/25/2006	4/25/2006	4/25/2006	4/25/2006	4/25/2006	4/26/2006	4/26/2006	4/26/2006
			Sample Depth (ft bgs):	0 - 1	1 - 1.5	0 - 0.6	0.6 - 2.2	2.2 - 2.6	0 - 0.6	0.6 - 2.7	0 - 2.15
			Used?:	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
			Unit								
MPA	PCB	Aroclor-1260	mg/kg								
MPA	SVOC	2-Methylnaphthalene	mg/kg								
MPA	SVOC	Acenaphthene	mg/kg								
MPA	SVOC	Acenaphthylene	mg/kg								
MPA	SVOC	Anthracene	mg/kg								
MPA	SVOC	Benzo(a)anthracene	mg/kg								
MPA	SVOC	Benzo(a)pyrene	mg/kg								
MPA	SVOC	Benzo(b)fluoranthene	mg/kg								
MPA	SVOC	Benzo(k)fluoranthene	mg/kg								
MPA	SVOC	Chrysene	mg/kg								
MPA	SVOC	Dibenz(a,h)anthracene	mg/kg								
MPA	SVOC	Fluoranthene	mg/kg								
MPA	SVOC	Fluorene	mg/kg								
MPA	SVOC	Indeno(1,2,3-cd)pyrene	mg/kg								
MPA	SVOC	Naphthalene	mg/kg								
MPA	SVOC	Phenanthrene	mg/kg								
MPA	SVOC	Pyrene	mg/kg								
MPA	TPH	Aliphatic >C10-C12	mg/kg								
MPA	TPH	Aliphatic >C12-C16	mg/kg								
MPA	TPH	Aliphatic >C16-C35	mg/kg								
MPA	TPH	Aliphatic >C8-C10	mg/kg								
MPA	TPH	Aliphatic C6-C8	mg/kg								
MPA	TPH	Aromatic >C10-C12	mg/kg								
MPA	TPH	Aromatic >C12-C16	mg/kg								
MPA	TPH	Aromatic >C16-C21	mg/kg								
MPA	TPH	Aromatic >C21-C35	mg/kg								
MPA	TPH	Aromatic >C8-C10	mg/kg								
MPA	TPH	HEM, Oil & Grease	%								
MPA	TPH	TPH-DRO	mg/kg								
MPA	TPH	TPH-ORO	mg/kg								

Notes:

PCB = Polychlorinated Biphenyl; VOC = Volatile Organic Compound; SVOC = Semivolatile Organic Compound; TPH = Total Petroleum Hydrocarbon; DRO = Diesel-range Organic; ORO = Oil-range Organic.

All units presented in dry weight.

All samples evaluated are included. Parent and field duplicate samples presented separately.

Only post remediation samples used in risk assessment.

Detection limits present for non-detected samples.

U = Not detected.

B = Conc. < Contractual detection limit, but conc. > Instrument detection limit.

* = Field Duplicate.

J = Estimated.

Table A.2 All Soil/Sediment (0-3 ft bgs) Samples

Sampler	Chemical Group	Parameter	Station:	SS6	SS6	SS7	SS7	SS8	SS8	SS8
			Sample ID:	SS6	SS6	SS7	SS7	Hg-MPA-06	Hg-MPA-06	Hg-MPA-06
			Sample Date:	4/26/2006	4/26/2006	4/26/2006	4/26/2006	10/7/2010	10/7/2010	10/7/2010
			Sample Depth (ft bgs):	0 - 1.65	1.65 - 2.5	0 - 1.4	1.4 - 2.5	0.5 - 2	0 - 0.5	0 - 0.5
			Used?:	Yes	Yes	Yes	Yes	Yes	Yes	Yes - step out
			Unit							
ICON	VOC	Benzene	mg/kg			0.14 U	0.1 U			
ICON	VOC	Ethylbenzene	mg/kg			0.88 U	0.65 U			
ICON	VOC	Toluene	mg/kg			0.88 U	0.65 U			
ICON	VOC	Xylenes	mg/kg			2.65 U	1.96 U			
ICON	Metals	Arsenic	mg/kg			22	21.5			
ICON	Metals	Barium	mg/kg			15700	13500			
ICON	Metals	Cadmium	mg/kg							
ICON	Metals	Chromium	mg/kg			20	13.3			
ICON	Metals	Lead	mg/kg			67.5	117			
ICON	Metals	Mercury	mg/kg					0.81	0.22	
ICON	Metals	Selenium	mg/kg							
ICON	Metals	Silver	mg/kg							
ICON	Metals	Strontium	mg/kg			231	337			
ICON	Metals	TT Barium	mg/kg							
ICON	Metals	Zinc	mg/kg			111	98.1			
ICON	PCB	Aroclor-1016	mg/kg							
ICON	PCB	Aroclor-1221	mg/kg							
ICON	PCB	Aroclor-1232	mg/kg							
ICON	PCB	Aroclor-1242	mg/kg							
ICON	PCB	Aroclor-1248	mg/kg							
ICON	PCB	Aroclor-1254	mg/kg							
ICON	PCB	Aroclor-1260	mg/kg							
ICON	PCB	Total PCBs	mg/kg							
ICON	SVOC	2-Methylnaphthalene	mg/kg			1.17 U	5.29			
ICON	SVOC	Fluoranthene	mg/kg			1.17 U	1.3			
ICON	SVOC	Fluorene	mg/kg			1.17 U	1.69			
ICON	SVOC	Phenanthrene	mg/kg			1.17 U	4.87			
ICON	TPH	HEM, Oil & Grease	%							
ICON	TPH	TPH-DRO	mg/kg	89	54	386	1770			
ICON	TPH	TPH-GRO	mg/kg			177 U	131 U			
ICON	TPH	TPH-ORO	mg/kg	171 U	233 U	553	496			
MPA	Metals	Arsenic	mg/kg							
MPA	Metals	Barium	mg/kg							
MPA	Metals	Cadmium	mg/kg							
MPA	Metals	Chromium	mg/kg							
MPA	Metals	Lead	mg/kg							
MPA	Metals	Mercury	mg/kg							0.13
MPA	Metals	Selenium	mg/kg							
MPA	Metals	Silver	mg/kg							
MPA	Metals	Strontium	mg/kg							
MPA	Metals	TT Barium	mg/kg							
MPA	Metals	Zinc	mg/kg							
MPA	PCB	Aroclor-1016	mg/kg							
MPA	PCB	Aroclor-1221	mg/kg							
MPA	PCB	Aroclor-1232	mg/kg							
MPA	PCB	Aroclor-1242	mg/kg							
MPA	PCB	Aroclor-1248	mg/kg							
MPA	PCB	Aroclor-1254	mg/kg							

Table A.2 All Soil/Sediment (0-3 ft bgs) Samples

Sampler	Chemical Group	Parameter	Station:	SS6	SS6	SS7	SS7	SS8	SS8	SS8
			Sample ID:	SS6	SS6	SS7	SS7	Hg-MPA-06	Hg-MPA-06	Hg-MPA-06
			Sample Date:	4/26/2006	4/26/2006	4/26/2006	4/26/2006	10/7/2010	10/7/2010	10/7/2010
			Sample Depth (ft bgs):	0 - 1.65	1.65 - 2.5	0 - 1.4	1.4 - 2.5	0.5 - 2	0 - 0.5	0 - 0.5
			Used?:	Yes	Yes	Yes	Yes	Yes	Yes	Yes - step out
			Unit							
MPA	PCB	Aroclor-1260	mg/kg							
MPA	SVOC	2-Methylnaphthalene	mg/kg							
MPA	SVOC	Acenaphthene	mg/kg							
MPA	SVOC	Acenaphthylene	mg/kg							
MPA	SVOC	Anthracene	mg/kg							
MPA	SVOC	Benzo(a)anthracene	mg/kg							
MPA	SVOC	Benzo(a)pyrene	mg/kg							
MPA	SVOC	Benzo(b)fluoranthene	mg/kg							
MPA	SVOC	Benzo(k)fluoranthene	mg/kg							
MPA	SVOC	Chrysene	mg/kg							
MPA	SVOC	Dibenz(a,h)anthracene	mg/kg							
MPA	SVOC	Fluoranthene	mg/kg							
MPA	SVOC	Fluorene	mg/kg							
MPA	SVOC	Indeno(1,2,3-cd)pyrene	mg/kg							
MPA	SVOC	Naphthalene	mg/kg							
MPA	SVOC	Phenanthrene	mg/kg							
MPA	SVOC	Pyrene	mg/kg							
MPA	TPH	Aliphatic >C10-C12	mg/kg							
MPA	TPH	Aliphatic >C12-C16	mg/kg							
MPA	TPH	Aliphatic >C16-C35	mg/kg							
MPA	TPH	Aliphatic >C8-C10	mg/kg							
MPA	TPH	Aliphatic C6-C8	mg/kg							
MPA	TPH	Aromatic >C10-C12	mg/kg							
MPA	TPH	Aromatic >C12-C16	mg/kg							
MPA	TPH	Aromatic >C16-C21	mg/kg							
MPA	TPH	Aromatic >C21-C35	mg/kg							
MPA	TPH	Aromatic >C8-C10	mg/kg							
MPA	TPH	HEM, Oil & Grease	%							
MPA	TPH	TPH-DRO	mg/kg							
MPA	TPH	TPH-ORO	mg/kg							

Notes:

PCB = Polychlorinated Biphenyl; VOC = Volatile Organic Compound; SVOC = Semivolatile Organic Compound; TPH = Total Petroleum Hydrocarbon; DRO = Diesel-range Organic; ORO = Oil-range Organic.

All units presented in dry weight.

All samples evaluated are included. Parent and field duplicate samples presented separately.

Only post remediation samples used in risk assessment.

Detection limits present for non-detected samples.

U = Not detected.

B = Conc. < Contractual detection limit, but conc. > Instrument detection limit.

* = Field Duplicate.

J = Estimated.

Table A.2 All Soil/Sediment (0-3 ft bgs) Samples

Sampler	Chemical Group	Parameter	Station:	SS8	SS8	SS8	SS8	SS8	SS8
			Sample ID:	Hg-MPA-06	Hg-MPA-07	Hg-MPA-07	Hg-MPA-07	Hg-MPA-07	Hg-MPA-08
			Sample Date:	10/7/2010	10/7/2010	10/7/2010	10/7/2010	10/7/2010	10/7/2010
			Sample Depth (ft bgs):	0.5 - 2	0 - 0.5	0.5 - 2	0 - 0.5	0.5 - 2	0 - 0.5
			Used?:	Yes - step out	Yes	Yes	Yes - step out	Yes - step out	Yes
			Unit						
ICON	VOC	Benzene	mg/kg						
ICON	VOC	Ethylbenzene	mg/kg						
ICON	VOC	Toluene	mg/kg						
ICON	VOC	Xylenes	mg/kg						
ICON	Metals	Arsenic	mg/kg						
ICON	Metals	Barium	mg/kg						
ICON	Metals	Cadmium	mg/kg						
ICON	Metals	Chromium	mg/kg						
ICON	Metals	Lead	mg/kg						
ICON	Metals	Mercury	mg/kg		0.2	16.7			0.17
ICON	Metals	Selenium	mg/kg						
ICON	Metals	Silver	mg/kg						
ICON	Metals	Strontium	mg/kg						
ICON	Metals	TT Barium	mg/kg						
ICON	Metals	Zinc	mg/kg						
ICON	PCB	Aroclor-1016	mg/kg						
ICON	PCB	Aroclor-1221	mg/kg						
ICON	PCB	Aroclor-1232	mg/kg						
ICON	PCB	Aroclor-1242	mg/kg						
ICON	PCB	Aroclor-1248	mg/kg						
ICON	PCB	Aroclor-1254	mg/kg						
ICON	PCB	Aroclor-1260	mg/kg						
ICON	PCB	Total PCBs	mg/kg						
ICON	SVOC	2-Methylnaphthalene	mg/kg						
ICON	SVOC	Fluoranthene	mg/kg						
ICON	SVOC	Fluorene	mg/kg						
ICON	SVOC	Phenanthrene	mg/kg						
ICON	TPH	HEM, Oil & Grease	%						
ICON	TPH	TPH-DRO	mg/kg						
ICON	TPH	TPH-GRO	mg/kg						
ICON	TPH	TPH-ORO	mg/kg						
MPA	Metals	Arsenic	mg/kg						
MPA	Metals	Barium	mg/kg						
MPA	Metals	Cadmium	mg/kg						
MPA	Metals	Chromium	mg/kg						
MPA	Metals	Lead	mg/kg						
MPA	Metals	Mercury	mg/kg	0.11			0.12	0.34	
MPA	Metals	Selenium	mg/kg						
MPA	Metals	Silver	mg/kg						
MPA	Metals	Strontium	mg/kg						
MPA	Metals	TT Barium	mg/kg						
MPA	Metals	Zinc	mg/kg						
MPA	PCB	Aroclor-1016	mg/kg						
MPA	PCB	Aroclor-1221	mg/kg						
MPA	PCB	Aroclor-1232	mg/kg						
MPA	PCB	Aroclor-1242	mg/kg						
MPA	PCB	Aroclor-1248	mg/kg						
MPA	PCB	Aroclor-1254	mg/kg						

Table A.2 All Soil/Sediment (0-3 ft bgs) Samples

Sampler	Chemical Group	Parameter	Station:	SS8	SS8	SS8	SS8	SS8	SS8
			Sample ID:	Hg-MPA-06	Hg-MPA-07	Hg-MPA-07	Hg-MPA-07	Hg-MPA-07	Hg-MPA-08
			Sample Date:	10/7/2010	10/7/2010	10/7/2010	10/7/2010	10/7/2010	10/7/2010
			Sample Depth (ft bgs):	0.5 - 2	0 - 0.5	0.5 - 2	0 - 0.5	0.5 - 2	0 - 0.5
			Used?:	Yes - step out	Yes	Yes	Yes - step out	Yes - step out	Yes
			Unit						
MPA	PCB	Aroclor-1260	mg/kg						
MPA	SVOC	2-Methylnaphthalene	mg/kg						
MPA	SVOC	Acenaphthene	mg/kg						
MPA	SVOC	Acenaphthylene	mg/kg						
MPA	SVOC	Anthracene	mg/kg						
MPA	SVOC	Benzo(a)anthracene	mg/kg						
MPA	SVOC	Benzo(a)pyrene	mg/kg						
MPA	SVOC	Benzo(b)fluoranthene	mg/kg						
MPA	SVOC	Benzo(k)fluoranthene	mg/kg						
MPA	SVOC	Chrysene	mg/kg						
MPA	SVOC	Dibenz(a,h)anthracene	mg/kg						
MPA	SVOC	Fluoranthene	mg/kg						
MPA	SVOC	Fluorene	mg/kg						
MPA	SVOC	Indeno(1,2,3-cd)pyrene	mg/kg						
MPA	SVOC	Naphthalene	mg/kg						
MPA	SVOC	Phenanthrene	mg/kg						
MPA	SVOC	Pyrene	mg/kg						
MPA	TPH	Aliphatic >C10-C12	mg/kg						
MPA	TPH	Aliphatic >C12-C16	mg/kg						
MPA	TPH	Aliphatic >C16-C35	mg/kg						
MPA	TPH	Aliphatic >C8-C10	mg/kg						
MPA	TPH	Aliphatic C6-C8	mg/kg						
MPA	TPH	Aromatic >C10-C12	mg/kg						
MPA	TPH	Aromatic >C12-C16	mg/kg						
MPA	TPH	Aromatic >C16-C21	mg/kg						
MPA	TPH	Aromatic >C21-C35	mg/kg						
MPA	TPH	Aromatic >C8-C10	mg/kg						
MPA	TPH	HEM, Oil & Grease	%						
MPA	TPH	TPH-DRO	mg/kg						
MPA	TPH	TPH-ORO	mg/kg						

Notes:

PCB = Polychlorinated Biphenyl; VOC = Volatile Organic Compound; SVOC = Semivolatile Organic Compound; TPH = Total Petroleum Hydrocarbon; DRO = Diesel-range Organic; ORO = Oil-range Organic.

All units presented in dry weight.

All samples evaluated are included. Parent and field duplicate samples presented separately.

Only post remediation samples used in risk assessment.

Detection limits present for non-detected samples.

U = Not detected.

B = Conc. < Contractual detection limit, but conc. > Instrument detection limit.

* = Field Duplicate.

J = Estimated.

Table A.2 All Soil/Sediment (0-3 ft bgs) Samples

Sampler	Chemical Group	Parameter	Station:	SS8	SS8	SS8	SS8	SS8	SS8
			Sample ID:	Hg-MPA-08	Hg-MPA-08	Hg-MPA-08	Hg-MPA-09	Hg-MPA-09	Hg-MPA-09
			Sample Date:	10/7/2010	10/7/2010	10/7/2010	10/7/2010	10/7/2010	10/7/2010
			Sample Depth (ft bgs):	0.5 - 2	0 - 0.5	0.5 - 2	0 - 0.5	0.5 - 2	0 - 0.5
			Used?:	Yes	Yes - step out	Yes - step out	Yes	Yes	Yes - step out
			Unit						
ICON	VOC	Benzene	mg/kg						
ICON	VOC	Ethylbenzene	mg/kg						
ICON	VOC	Toluene	mg/kg						
ICON	VOC	Xylenes	mg/kg						
ICON	Metals	Arsenic	mg/kg						
ICON	Metals	Barium	mg/kg						
ICON	Metals	Cadmium	mg/kg						
ICON	Metals	Chromium	mg/kg						
ICON	Metals	Lead	mg/kg						
ICON	Metals	Mercury	mg/kg	0.3			11	0.25	
ICON	Metals	Selenium	mg/kg						
ICON	Metals	Silver	mg/kg						
ICON	Metals	Strontium	mg/kg						
ICON	Metals	TT Barium	mg/kg						
ICON	Metals	Zinc	mg/kg						
ICON	PCB	Aroclor-1016	mg/kg						
ICON	PCB	Aroclor-1221	mg/kg						
ICON	PCB	Aroclor-1232	mg/kg						
ICON	PCB	Aroclor-1242	mg/kg						
ICON	PCB	Aroclor-1248	mg/kg						
ICON	PCB	Aroclor-1254	mg/kg						
ICON	PCB	Aroclor-1260	mg/kg						
ICON	PCB	Total PCBs	mg/kg						
ICON	SVOC	2-Methylnaphthalene	mg/kg						
ICON	SVOC	Fluoranthene	mg/kg						
ICON	SVOC	Fluorene	mg/kg						
ICON	SVOC	Phenanthrene	mg/kg						
ICON	TPH	HEM, Oil & Grease	%						
ICON	TPH	TPH-DRO	mg/kg						
ICON	TPH	TPH-GRO	mg/kg						
ICON	TPH	TPH-ORO	mg/kg						
MPA	Metals	Arsenic	mg/kg						
MPA	Metals	Barium	mg/kg						
MPA	Metals	Cadmium	mg/kg						
MPA	Metals	Chromium	mg/kg						
MPA	Metals	Lead	mg/kg						
MPA	Metals	Mercury	mg/kg		0.11	0.72			0.14
MPA	Metals	Selenium	mg/kg						
MPA	Metals	Silver	mg/kg						
MPA	Metals	Strontium	mg/kg						
MPA	Metals	TT Barium	mg/kg						
MPA	Metals	Zinc	mg/kg						
MPA	PCB	Aroclor-1016	mg/kg						
MPA	PCB	Aroclor-1221	mg/kg						
MPA	PCB	Aroclor-1232	mg/kg						
MPA	PCB	Aroclor-1242	mg/kg						
MPA	PCB	Aroclor-1248	mg/kg						
MPA	PCB	Aroclor-1254	mg/kg						

Table A.2 All Soil/Sediment (0-3 ft bgs) Samples

Sampler	Chemical Group	Parameter	Station:	SS8	SS8	SS8	SS8	SS8	SS8
			Sample ID:	Hg-MPA-08	Hg-MPA-08	Hg-MPA-08	Hg-MPA-09	Hg-MPA-09	Hg-MPA-09
			Sample Date:	10/7/2010	10/7/2010	10/7/2010	10/7/2010	10/7/2010	10/7/2010
			Sample Depth (ft bgs):	0.5 - 2	0 - 0.5	0.5 - 2	0 - 0.5	0.5 - 2	0 - 0.5
			Used?:	Yes	Yes - step out	Yes - step out	Yes	Yes	Yes - step out
			Unit						
MPA	PCB	Aroclor-1260	mg/kg						
MPA	SVOC	2-Methylnaphthalene	mg/kg						
MPA	SVOC	Acenaphthene	mg/kg						
MPA	SVOC	Acenaphthylene	mg/kg						
MPA	SVOC	Anthracene	mg/kg						
MPA	SVOC	Benzo(a)anthracene	mg/kg						
MPA	SVOC	Benzo(a)pyrene	mg/kg						
MPA	SVOC	Benzo(b)fluoranthene	mg/kg						
MPA	SVOC	Benzo(k)fluoranthene	mg/kg						
MPA	SVOC	Chrysene	mg/kg						
MPA	SVOC	Dibenz(a,h)anthracene	mg/kg						
MPA	SVOC	Fluoranthene	mg/kg						
MPA	SVOC	Fluorene	mg/kg						
MPA	SVOC	Indeno(1,2,3-cd)pyrene	mg/kg						
MPA	SVOC	Naphthalene	mg/kg						
MPA	SVOC	Phenanthrene	mg/kg						
MPA	SVOC	Pyrene	mg/kg						
MPA	TPH	Aliphatic >C10-C12	mg/kg						
MPA	TPH	Aliphatic >C12-C16	mg/kg						
MPA	TPH	Aliphatic >C16-C35	mg/kg						
MPA	TPH	Aliphatic >C8-C10	mg/kg						
MPA	TPH	Aliphatic C6-C8	mg/kg						
MPA	TPH	Aromatic >C10-C12	mg/kg						
MPA	TPH	Aromatic >C12-C16	mg/kg						
MPA	TPH	Aromatic >C16-C21	mg/kg						
MPA	TPH	Aromatic >C21-C35	mg/kg						
MPA	TPH	Aromatic >C8-C10	mg/kg						
MPA	TPH	HEM, Oil & Grease	%						
MPA	TPH	TPH-DRO	mg/kg						
MPA	TPH	TPH-ORO	mg/kg						

Notes:

PCB = Polychlorinated Biphenyl; VOC = Volatile Organic Compound; SVOC = Semivolatile Organic Compound; TPH = Total Petroleum Hydrocarbon; DRO = Diesel-range Organic; ORO = Oil-range Organic.

All units presented in dry weight.

All samples evaluated are included. Parent and field duplicate samples presented separately.

Only post remediation samples used in risk assessment.

Detection limits present for non-detected samples.

U = Not detected.

B = Conc. < Contractual detection limit, but conc. > Instrument detection limit.

* = Field Duplicate.

J = Estimated.

Table A.2 All Soil/Sediment (0-3 ft bgs) Samples

Sampler	Chemical Group	Parameter	Station:	SS8	SS8	SS8	SS8	SS8	SS8	SS9	WL-1
			Sample ID:	Hg-MPA-09	Hg-MPA-09*	SS-08	SS8	SS8	SS8	SS9	WL-1
			Sample Date:	10/7/2010	10/7/2010	2/26/2010	2/26/2010	4/27/2006	4/27/2006	4/27/2006	1/5/2015
			Sample Depth (ft bgs):	0.5 - 2	0.5 - 2	0 - 2	0 - 2	0 - 1.9	1.9 - 2.3	0 - 1.7	0 - 2
			Used?:	Yes - step out	Yes - step out	Yes	Yes	Yes	Yes	Yes	Yes
			Unit								
ICON	VOC	Benzene	mg/kg								
ICON	VOC	Ethylbenzene	mg/kg								
ICON	VOC	Toluene	mg/kg								
ICON	VOC	Xylenes	mg/kg								
ICON	Metals	Arsenic	mg/kg				8.12				3.41
ICON	Metals	Barium	mg/kg				871				319
ICON	Metals	Cadmium	mg/kg				0.54				0.58
ICON	Metals	Chromium	mg/kg				15.8				14.9
ICON	Metals	Lead	mg/kg				24.5				12.5
ICON	Metals	Mercury	mg/kg				0.86				0.62
ICON	Metals	Selenium	mg/kg				2 U				1.99 U
ICON	Metals	Silver	mg/kg								0.5 U
ICON	Metals	Strontium	mg/kg				65.3				
ICON	Metals	TT Barium	mg/kg								421
ICON	Metals	Zinc	mg/kg								45.2
ICON	PCB	Aroclor-1016	mg/kg								
ICON	PCB	Aroclor-1221	mg/kg								
ICON	PCB	Aroclor-1232	mg/kg								
ICON	PCB	Aroclor-1242	mg/kg								
ICON	PCB	Aroclor-1248	mg/kg								
ICON	PCB	Aroclor-1254	mg/kg								
ICON	PCB	Aroclor-1260	mg/kg								
ICON	PCB	Total PCBs	mg/kg								
ICON	SVOC	2-Methylnaphthalene	mg/kg								
ICON	SVOC	Fluoranthene	mg/kg								
ICON	SVOC	Fluorene	mg/kg								
ICON	SVOC	Phenanthrene	mg/kg								
ICON	TPH	HEM, Oil & Grease	%								0.97
ICON	TPH	TPH-DRO	mg/kg				829	124	21.3 U	37	2905
ICON	TPH	TPH-GRO	mg/kg								
ICON	TPH	TPH-ORO	mg/kg				450	115 U	107 U	131 U	2021.28
MPA	Metals	Arsenic	mg/kg			7.89					4.26
MPA	Metals	Barium	mg/kg			1041.55					251.4
MPA	Metals	Cadmium	mg/kg			0.17 B					0.58
MPA	Metals	Chromium	mg/kg			4.96					15.08
MPA	Metals	Lead	mg/kg			35.18					12.55
MPA	Metals	Mercury	mg/kg	0.13	0.15	1.63					0.76
MPA	Metals	Selenium	mg/kg			1.14 B					1.97 U
MPA	Metals	Silver	mg/kg								0.48 U
MPA	Metals	Strontium	mg/kg			74.52					
MPA	Metals	TT Barium	mg/kg								629.42
MPA	Metals	Zinc	mg/kg								45.07
MPA	PCB	Aroclor-1016	mg/kg								
MPA	PCB	Aroclor-1221	mg/kg								
MPA	PCB	Aroclor-1232	mg/kg								
MPA	PCB	Aroclor-1242	mg/kg								
MPA	PCB	Aroclor-1248	mg/kg								
MPA	PCB	Aroclor-1254	mg/kg								

Table A.2 All Soil/Sediment (0-3 ft bgs) Samples

Sampler	Chemical Group	Parameter	Station:	SS8	SS8	SS8	SS8	SS8	SS8	SS9	WL-1
			Sample ID:	Hg-MPA-09	Hg-MPA-09*	SS-08	SS8	SS8	SS8	SS9	WL-1
			Sample Date:	10/7/2010	10/7/2010	2/26/2010	2/26/2010	4/27/2006	4/27/2006	4/27/2006	1/5/2015
			Sample Depth (ft bgs):	0.5 - 2	0.5 - 2	0 - 2	0 - 2	0 - 1.9	1.9 - 2.3	0 - 1.7	0 - 2
			Used?:	Yes - step out	Yes - step out	Yes	Yes	Yes	Yes	Yes	Yes
			Unit								
MPA	PCB	Aroclor-1260	mg/kg								
MPA	SVOC	2-Methylnaphthalene	mg/kg								
MPA	SVOC	Acenaphthene	mg/kg								
MPA	SVOC	Acenaphthylene	mg/kg								
MPA	SVOC	Anthracene	mg/kg								
MPA	SVOC	Benzo(a)anthracene	mg/kg								
MPA	SVOC	Benzo(a)pyrene	mg/kg								
MPA	SVOC	Benzo(b)fluoranthene	mg/kg								
MPA	SVOC	Benzo(k)fluoranthene	mg/kg								
MPA	SVOC	Chrysene	mg/kg								
MPA	SVOC	Dibenz(a,h)anthracene	mg/kg								
MPA	SVOC	Fluoranthene	mg/kg								
MPA	SVOC	Fluorene	mg/kg								
MPA	SVOC	Indeno(1,2,3-cd)pyrene	mg/kg								
MPA	SVOC	Naphthalene	mg/kg								
MPA	SVOC	Phenanthrene	mg/kg								
MPA	SVOC	Pyrene	mg/kg								
MPA	TPH	Aliphatic >C10-C12	mg/kg			41.55 U					27.93 U
MPA	TPH	Aliphatic >C12-C16	mg/kg			32.69					18.62 U
MPA	TPH	Aliphatic >C16-C35	mg/kg			130.19					18.62 U
MPA	TPH	Aliphatic >C8-C10	mg/kg								27.93 U
MPA	TPH	Aliphatic C6-C8	mg/kg								27.93 U
MPA	TPH	Aromatic >C10-C12	mg/kg			27.7 U					18.62 U
MPA	TPH	Aromatic >C12-C16	mg/kg			41.55 U					27.93 U
MPA	TPH	Aromatic >C16-C21	mg/kg			41.55 U					27.93 U
MPA	TPH	Aromatic >C21-C35	mg/kg			41.55 U					27.93 U
MPA	TPH	Aromatic >C8-C10	mg/kg								18.62 U
MPA	TPH	HEM, Oil & Grease	%								1.06
MPA	TPH	TPH-DRO	mg/kg			182.27					
MPA	TPH	TPH-ORO	mg/kg			138.5 U					

Notes:

PCB = Polychlorinated Biphenyl; VOC = Volatile Organic Compound; SVOC = Semivolatile Organic Compound; TPH = Total Petroleum Hydrocarbon; DRO = Diesel-range Organic; ORO = Oil-range Organic.

All units presented in dry weight.

All samples evaluated are included. Parent and field duplicate samples presented separately.

Only post remediation samples used in risk assessment.

Detection limits present for non-detected samples.

U = Not detected.

B = Conc. < Contractual detection limit, but conc. > Instrument detection limit.

* = Field Duplicate.

J = Estimated.

Table A.2 All Soil/Sediment (0-3 ft bgs) Samples

Sampler	Chemical Group	Parameter	Station:	WL-2	WL-3	WL-4	WL-5	WL-6	WL-7	WL-8
			Sample ID:	WL-2	WL-3	WL-4	WL-5	WL-6	WL-7	WL-8
			Sample Date:	1/5/2015	1/6/2015	1/6/2015	1/6/2015	1/6/2015	1/6/2015	1/7/2015
			Sample Depth (ft bgs):	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2
			Used?:	Yes	Yes	Yes	Yes	Yes	Yes	Yes
			Unit							
ICON	VOC	Benzene	mg/kg							
ICON	VOC	Ethylbenzene	mg/kg							
ICON	VOC	Toluene	mg/kg							
ICON	VOC	Xylenes	mg/kg							
ICON	Metals	Arsenic	mg/kg	0.99 U	4.11	3.15	4.88	4.29		
ICON	Metals	Barium	mg/kg	180	351	492	1070	641		
ICON	Metals	Cadmium	mg/kg	0.5 U	2.7	0.5 U	0.57	0.5 U		
ICON	Metals	Chromium	mg/kg	12.6	20.6	12.4	13.3	11.5		
ICON	Metals	Lead	mg/kg	15.9	99.9	20.3	20.9	15.3		
ICON	Metals	Mercury	mg/kg	0.1	4.29	0.1 U	0.1 U	0.1		
ICON	Metals	Selenium	mg/kg	1.99 U	1.99 U	1.99 U	1.99 U	1.98 U		
ICON	Metals	Silver	mg/kg	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U		
ICON	Metals	Strontium	mg/kg							
ICON	Metals	TT Barium	mg/kg	274	697	632	1680	844		
ICON	Metals	Zinc	mg/kg	70.2	1370	51	171	54.4		
ICON	PCB	Aroclor-1016	mg/kg							
ICON	PCB	Aroclor-1221	mg/kg							
ICON	PCB	Aroclor-1232	mg/kg							
ICON	PCB	Aroclor-1242	mg/kg							
ICON	PCB	Aroclor-1248	mg/kg							
ICON	PCB	Aroclor-1254	mg/kg							
ICON	PCB	Aroclor-1260	mg/kg							
ICON	PCB	Total PCBs	mg/kg							
ICON	SVOC	2-Methylnaphthalene	mg/kg							
ICON	SVOC	Fluoranthene	mg/kg							
ICON	SVOC	Fluorene	mg/kg							
ICON	SVOC	Phenanthrene	mg/kg							
ICON	TPH	HEM, Oil & Grease	%	0.1	5.61	1.22	3.7	0.53		
ICON	TPH	TPH-DRO	mg/kg	293.55	1216.64	2045.85	13837.21	1072.83		
ICON	TPH	TPH-GRO	mg/kg							
ICON	TPH	TPH-ORO	mg/kg	201.61	1029.83	1689.96	11608.53	846.46		
MPA	Metals	Arsenic	mg/kg	0.91	1.07	4.25	4.33	5.69	3.49	6.14
MPA	Metals	Barium	mg/kg	223.64	234.44	658.12	1028.02	761.22	135.95	163.35
MPA	Metals	Cadmium	mg/kg	0.42 U	3.54	0.56 U	0.58 U	0.53 U	0.34 U	0.37 U
MPA	Metals	Chromium	mg/kg	12.41	8.99	13.57	11.47	12.29	8.29	10.16
MPA	Metals	Lead	mg/kg	11.01	149.67	20.73	18.21	18.22	8.88	12.39
MPA	Metals	Mercury	mg/kg	0.16 U	7.55	0.21 U	0.22 U	0.2 U	0.13 U	0.14 U
MPA	Metals	Selenium	mg/kg	1.63 U	1.38 U	2.26 U	2.31 U	2.08 U	1.37 U	1.45 U
MPA	Metals	Silver	mg/kg	0.42 U	0.34 U	0.56 U	0.58 U	0.53 U	0.34 U	0.37 U
MPA	Metals	Strontium	mg/kg							
MPA	Metals	TT Barium	mg/kg	559.11	928.48	1378.21	3081.9	1634.69	528.1	2798.3
MPA	Metals	Zinc	mg/kg	59.58	2185.43	44.44	111.85	58.78	23.14	28.98
MPA	PCB	Aroclor-1016	mg/kg							
MPA	PCB	Aroclor-1221	mg/kg							
MPA	PCB	Aroclor-1232	mg/kg							
MPA	PCB	Aroclor-1242	mg/kg							
MPA	PCB	Aroclor-1248	mg/kg							
MPA	PCB	Aroclor-1254	mg/kg							

Table A.2 All Soil/Sediment (0-3 ft bgs) Samples

Sampler	Chemical Group	Parameter	Station:	WL-2	WL-3	WL-4	WL-5	WL-6	WL-7	WL-8
			Sample ID:	WL-2	WL-3	WL-4	WL-5	WL-6	WL-7	WL-8
			Sample Date:	1/5/2015	1/6/2015	1/6/2015	1/6/2015	1/6/2015	1/6/2015	1/7/2015
			Sample Depth (ft bgs):	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2
			Used?:	Yes	Yes	Yes	Yes	Yes	Yes	Yes
			Unit							
MPA	PCB	Aroclor-1260	mg/kg							
MPA	SVOC	2-Methylnaphthalene	mg/kg							
MPA	SVOC	Acenaphthene	mg/kg							
MPA	SVOC	Acenaphthylene	mg/kg							
MPA	SVOC	Anthracene	mg/kg							
MPA	SVOC	Benzo(a)anthracene	mg/kg							
MPA	SVOC	Benzo(a)pyrene	mg/kg							
MPA	SVOC	Benzo(b)fluoranthene	mg/kg							
MPA	SVOC	Benzo(k)fluoranthene	mg/kg							
MPA	SVOC	Chrysene	mg/kg							
MPA	SVOC	Dibenz(a,h)anthracene	mg/kg							
MPA	SVOC	Fluoranthene	mg/kg							
MPA	SVOC	Fluorene	mg/kg							
MPA	SVOC	Indeno(1,2,3-cd)pyrene	mg/kg							
MPA	SVOC	Naphthalene	mg/kg							
MPA	SVOC	Phenanthrene	mg/kg							
MPA	SVOC	Pyrene	mg/kg							
MPA	TPH	Aliphatic >C10-C12	mg/kg	23.96 U	467.55	32.05 U	32.33 U	30.61 U	19.61 U	21.31 U
MPA	TPH	Aliphatic >C12-C16	mg/kg	101.12	3311.26	21.37 U	325.43	20.41 U	13.07 U	14.2 U
MPA	TPH	Aliphatic >C16-C35	mg/kg	220.45	9417.22	21.37 U	1094.83	20.41 U	13.07 U	14.2 U
MPA	TPH	Aliphatic >C8-C10	mg/kg	23.96 U	19.87 U	32.05 U	32.33 U	30.61 U	19.61 U	21.31 U
MPA	TPH	Aliphatic C6-C8	mg/kg	23.96 U	19.87 U	32.05 U	32.33 U	30.61 U	19.61 U	21.31 U
MPA	TPH	Aromatic >C10-C12	mg/kg	15.97 U	98.54	21.37 U	21.55 U	20.41 U	13.07 U	14.2 U
MPA	TPH	Aromatic >C12-C16	mg/kg	23.96 U	533.77	32.05 U	32.33 U	30.61 U	19.61 U	21.31 U
MPA	TPH	Aromatic >C16-C21	mg/kg	23.96 U	1417.22	32.05 U	32.33 U	30.61 U	19.61 U	21.31 U
MPA	TPH	Aromatic >C21-C35	mg/kg	23.96 U	1814.57	32.05 U	32.33 U	30.61 U	19.61 U	21.31 U
MPA	TPH	Aromatic >C8-C10	mg/kg	15.97 U	13.25 U	21.37 U	21.55 U	20.41 U	13.07 U	14.2 U
MPA	TPH	HEM, Oil & Grease	%	0.1	4.97	0.93	2.9	0.68	0.05 U	0.05 U
MPA	TPH	TPH-DRO	mg/kg							
MPA	TPH	TPH-ORO	mg/kg							

Notes:

PCB = Polychlorinated Biphenyl; VOC = Volatile Organic Compound; SVOC = Semivolatile Organic Compound; TPH = Total Petroleum Hydrocarbon; DRO = Diesel-range Organic; ORO = Oil-range Organic.

All units presented in dry weight.

All samples evaluated are included. Parent and field duplicate samples presented separately.

Only post remediation samples used in risk assessment.

Detection limits present for non-detected samples.

U = Not detected.

B = Conc. < Contractual detection limit, but conc. > Instrument detection limit.

* = Field Duplicate.

J = Estimated.

Table A.3 All Surface Water Samples

Sampler	Chemical Group	Parameter	Sample Location:	SW-01	SW-02	SW-03	SW-04	SW-05	SW-06	SW-07	SW-09	SW-10	SW-20
			Sample Date:	5/6/2010	5/5/2010	5/5/2010	5/5/2010	5/5/2010	5/6/2010	5/6/2010	5/6/2010	5/6/2010	5/7/2010
			Unit										
ICON	Metals	Arsenic	mg/L	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	
ICON	Metals	Barium	mg/L	0.284	0.285	0.262	0.245	0.265	0.346	0.413	0.378	0.345	
ICON	Metals	Cadmium	mg/L	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	
ICON	Metals	Chromium	mg/L	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	
ICON	Metals	Lead	mg/L	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	
ICON	Metals	Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	
ICON	Metals	Selenium	mg/L	0.035	0.034	0.039	0.033	0.037	0.048	0.032	0.036	0.039	
ICON	Metals	Strontium	mg/L	0.554	0.637	0.558	0.614	0.602	0.729	0.778	0.829	0.721	
ICON	Metals	Zinc	mg/L	0.017	0.013	0.015	0.012	0.012	0.016	0.01 U	0.01 U	0.02	
ICON	TPH	TPH-DRO	mg/L	0.135 U	0.135 U	0.134 U	0.135 U	0.135 U	0.135 U	0.134 U	0.134 U	0.133 U	1.34
ICON	TPH	TPH-ORO	mg/L	0.125 U	0.125 U	0.124 U	0.125 U	0.135 U	0.135 U	0.124 U	0.124 U	0.173	1.11
ICON	Other	Chlorides	mg/L	1530	1560	1490	1530	1630	1920	2130	2410	2200	2700
ICON	Other	Hardness	mgCaCO3	495	578	502	558	545	653	692	746	646	
ICON	Other	Harness, Calcium	mgCaCO3	102	120	104	115	113	132	142	150	130	
ICON	Other	TDS	mg/L	2580	2740	2670	2960	2660	3630	3260	3450	3220	4820
MPA	Dissolved Metals	Arsenic	mg/L	0.0008 U	0.0008 U	0.0008 U	0.0008 U	0.0008 U	0.0008 U	0.0008 U	0.0008 U	0.0008 U	0.0075 B
MPA	Dissolved Metals	Barium	mg/L	0.28	0.28	0.29	0.26	0.26	0.37	0.42	0.37	0.35	1.1
MPA	Dissolved Metals	Cadmium	mg/L	0.0003 U	0.0003 U	0.0002 U	0.0004 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
MPA	Dissolved Metals	Chromium	mg/L	0.0017 B	0.0016 B	0.0018 B	0.0017 B	0.0018 B	0.0021 B	0.002 B	0.0024 B	0.0022 B	0.0051 B
MPA	Dissolved Metals	Lead	mg/L	0.0015 U	0.0015 U	0.0015 U	0.0015 U	0.0015 U	0.0015 U	0.0015 U	0.0015 U	0.0015 U	0.0088
MPA	Dissolved Metals	Mercury	mg/L	0.0001 U	0.0001 B	0.0001 B	0.0001 B	0.0001 B	0.0001 B	0.0001 B	0.0001 B	0.0001 B	0.0001 U
MPA	Dissolved Metals	Selenium	mg/L	0.0037 U	0.0037 U	0.0037 U	0.0037 U	0.0037 U	0.0037 U	0.0037 U	0.0037 U	0.0037 U	0.0037 U
MPA	Dissolved Metals	Strontium	mg/L	0.69	0.74	0.71	0.73	0.69	0.91	0.93	1	0.88	1.66
MPA	Dissolved Metals	Zinc	mg/L	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.0095 B	0.004 U	0.023
MPA	Metals	Arsenic	mg/L	0.0008 U	0.0008 U	0.0008 U	0.0008 U	0.0019 B	0.0008 U	0.0008 U	0.0008 U	0.0008 U	0.013
MPA	Metals	Barium	mg/L	0.28	0.29	0.3	0.27	0.29	0.39	0.45	0.42	0.38	1.23
MPA	Metals	Cadmium	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
MPA	Metals	Calcium	mg/L	38.4	44.1	43.3	44.6	43.1	54.3	56.1	58.6	50.6	73.9
MPA	Metals	Chromium	mg/L	0.0026 B	0.0023 B	0.0026 B	0.0022 B	0.0025 B	0.0025 B	0.0025 B	0.0027 B	0.0022 B	0.0075 B
MPA	Metals	Iron	mg/L	1.26	0.8	1.08	0.49	0.85	0.94	0.94	1.12	1.09	11.3
MPA	Metals	Lead	mg/L	0.0015 U	0.0015 U	0.0015 U	0.0015 U	0.0015 U	0.0015 U	0.0015 U	0.0015 U	0.0015 U	0.021
MPA	Metals	Magnesium	mg/L	88.2	100	98.3	103	99.1	127	130	140	120	149
MPA	Metals	Manganese	mg/L	0.23	0.27	0.3	0.16	0.31	0.46	0.61	0.51	0.48	0.83
MPA	Metals	Mercury	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
MPA	Metals	Potassium	mg/L	29.2	33.3	32.7	34.4	33.1	38.6	40.7	42.6	37.2	59.6
MPA	Metals	Selenium	mg/L	0.0037 U	0.0037 U	0.0037 U	0.0037 U	0.0037 U	0.0037 U	0.0037 U	0.0037 U	0.0037 U	0.0037 U
MPA	Metals	Sodium	mg/L	631	727	771	808	769	935	981	915	917	1230
MPA	Metals	Strontium	mg/L	0.64	0.71	0.7	0.72	0.72	0.9	0.95	0.99	0.86	1.74
MPA	Metals	Zinc	mg/L	0.0062 B	0.0045 B	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.067
MPA	SVOC	2-Methylnaphthalene	mg/L	0.0000519 U	0.0000527 U	0.0000527 U	0.0000525 U	0.0000514 U	0.0000522 U	0.0000519 U	0.0000519 U	0.0000519 U	0.0000514 U
MPA	SVOC	Acenaphthene	mg/L	0.0000137 U	0.0000139 U	0.0000139 U	0.0000138 U	0.0000135 U	0.0000137 U	0.0000137 U	0.0000137 U	0.0000137 U	0.0000135 U
MPA	SVOC	Acenaphthylene	mg/L	0.0000149 U	0.0000151 U	0.0000151 U	0.0000151 U	0.0000147 U	0.000015 U	0.0000149 U	0.0000149 U	0.0000149 U	0.0000147 U
MPA	SVOC	Anthracene	mg/L	0.00000918 U	0.00000933 U	0.00000933 U	0.00000918 U	0.00000928 U	0.00000909 U	0.00000923 U	0.00000918 U	0.00000918 U	0.00000909 U
MPA	SVOC	Benzo(a)anthracene	mg/L	0.0000503 U	0.0000511 U	0.0000511 U	0.0000508 U	0.0000498 U	0.0000506 U	0.0000503 U	0.0000503 U	0.0000503 U	0.0000498 U
MPA	SVOC	Benzo(a)pyrene	mg/L	0.0000137 U	0.0000139 U	0.0000139 U	0.0000138 U	0.0000135 U	0.0000137 U	0.0000137 U	0.0000137 U	0.0000137 U	0.0000135 U
MPA	SVOC	Benzo(b)fluoranthene	mg/L	0.0000328 U	0.0000333 U	0.0000333 U	0.0000331 U	0.0000324 U	0.0000329 U	0.0000328 U	0.0000328 U	0.0000328 U	0.0000324 U
MPA	SVOC	Benzo(k)fluoranthene	mg/L	0.0000223 U	0.0000227 U	0.0000227 U	0.0000226 U	0.0000221 U	0.0000225 U	0.0000223 U	0.0000223 U	0.0000223 U	0.0000221 U
MPA	SVOC	Chrysene	mg/L	0.000043 U	0.0000436 U	0.0000436 U	0.0000434 U	0.0000425 U	0.0000432 U	0.000046 U	0.000046 U	0.000046 U	0.0000425 U
MPA	SVOC	Dibenz(a,h)anthracene	mg/L	0.0000195 U	0.0000198 U	0.0000198 U	0.0000197 U	0.0000193 U	0.0000196 U	0.0000195 U	0.0000195 U	0.0000195 U	0.0000193 U
MPA	SVOC	Fluoranthene	mg/L	0.0000134 U	0.0000136 U	0.0000136 U	0.0000135 U	0.0000132 U	0.0000134 U	0.0000134 U	0.0000134 U	0.0000134 U	0.0000132 U
MPA	SVOC	Fluorene	mg/L	0.0000184 U	0.0000187 U	0.0000187 U	0.0000186 U	0.0000182 U	0.0000185 U	0.0000184 U	0.0000184 U	0.0000184 U	0.0000182 U

Table A.3 All Surface Water Samples

Sampler	Chemical Group	Parameter	Sample Location:	SW-01	SW-02	SW-03	SW-04	SW-05	SW-06	SW-07	SW-09	SW-10	SW-20
			Sample Date:	5/6/2010	5/5/2010	5/5/2010	5/5/2010	5/5/2010	5/6/2010	5/6/2010	5/6/2010	5/6/2010	5/7/2010
			Unit										
MPA	SVOC	Indeno(1,2,3-cd)pyrene	mg/L	0.0000171 U	0.0000174 U	0.0000174 U	0.0000173 U	0.000017 U	0.0000172 U	0.0000171 U	0.0000171 U	0.0000171 U	0.000011 U
MPA	SVOC	Naphthalene	mg/L	0.0000283 U	0.0000287 U	0.0000287 U	0.0000286 U	0.000023 U	0.0000284 U	0.0000283 U	0.0000283 U	0.0000283 U	0.000023 U
MPA	SVOC	Phenanthrene	mg/L	0.0000166 U	0.0000169 U	0.0000169 U	0.0000168 U	0.0000165 U	0.0000167 U	0.0000166 U	0.0000166 U	0.0000166 U	0.0000165 U
MPA	SVOC	Pyrene	mg/L	0.0000181 U	0.0000183 U	0.0000183 U	0.0000182 U	0.0000179 U	0.0000182 U	0.0000181 U	0.0000181 U	0.0000181 U	0.0000179 U
MPA	Other	Bicarbonate Alkalinity	mg/L CaCO3						60		67.4		
MPA	Other	Carbonate Alkalinity	mg/L CaCO3						0.17 U		0.17 U		
MPA	Other	Chlorides	mg/L	1210	1330	1250	1420	1290	1610	1640	1870	1610	2220
MPA	Other	Hardness	mg/L	378	432	424	441	425	541	554	591	619	677
MPA	Other	Salinity	ppt	2.4							3.7	3.2	
MPA	Other	Sodium	mg/L	631	727	771	808	769	935	981	915	917	1230
MPA	Other	Sulfate	mg/L	105							83.9	106	
MPA	Other	TDS	mg/L	2710	2900	2780	3050	2880	3800	3590	4220	3520	4920

Notes:

TPH = Total Petroleum Hydrocarbon; DRO = Diesel-range Organic; ORO = Oil-range Organic; SVOC = Semivolatile Organic Compound; TDS = Total Dissolved Solids.

All samples evaluated are included. Parent and field duplicate samples presented separately.

Detection limits present for non-detected samples.

U = Not detected.

B = Conc. < Contractual detection limit, but Conc. > Instrument detection limit.

Table A.4 Crab Tissue Samples (MPA Data)

Crab Data - By Body Part

Body Part	Parameter	Exposure Area:	Market							Site				
		Location ID:	EWL-BIL-C	EWL-BR-C	EWL-DES-C	EWL-HOU-C	EWL-LC-C	EWL-LC-C	EWL-NO-C	EWL-T-01A-C	EWL-T-01-C	EWL-T-02-C	EWL-T-03-C	EWL-T-03-C
		Units					Field Dup	Parent					Field Dup	Parent
Exoskeleton	Inorganic arsenic	mg/kg wwt	0.125	0.106	0.028	0.062	0.2	0.221	0.052	0.071	0.134	0.123	0.181	0.157
Exoskeleton	Methyl mercury	mg/kg wwt	0.0105	0.0098	0.00447J	0.00466J	0.013	0.0156	0.0165	0.0198	0.0227	0.015	0.0267	0.021
Exoskeleton	Arsenic	mg/kg wwt	1.37	1	0.367	0.635	0.964	0.985	0.416	0.239	0.359	0.369	0.57	0.347
Exoskeleton	Barium	mg/kg wwt	78.1	87.4	341	244	67.7	69.3	246	634	1420	720	715	1030
Exoskeleton	Mercury	mg/kg wwt	0.0152	0.0087	0.0041	0.0086	0.0154	0.0161	0.0146	0.0241	0.0286	0.0209	0.0252	0.0266
Exoskeleton	Total Solids	% wgt	50.3	47	52.3	59.1	47.9	47.9	47.2	44	45.6	45.8	44	43.6
Exoskeleton	Percent of whole body	%		0.48			0.48	0.48	0.51	0.46	0.44	0.47	0.44	0.44
Exoskeleton	Tissue wgt	g-ww	679.48	540.07	528.3	395.44	1024.23	1024.23	699.32	841.17	521.89	1988.61	1026.32	1026.32
Exoskeleton	Lipids	%	0.15	0.3	0.15	0.1	0.36	0.39	0.28	0.21	0.25	0.16	0.29	0.23
Hepatopancreas	Inorganic arsenic	mg/kg wwt	0.072	0.049	0.028	0.036	0.055	0.062	0.05	0.03	0.041	0.052	0.033	0.041
Hepatopancreas	Methyl mercury	mg/kg wwt	0.0148	0.0047	0.00579	0.0104	0.0087	0.0098	0.0085	0.0316	0.0231	0.0193	0.0179	0.0186
Hepatopancreas	Arsenic	mg/kg wwt	3.95	2.56	0.994	2.15	3.08	3.22	1.34	0.677	1.06	1.19	1.02	0.906
Hepatopancreas	Barium	mg/kg wwt	1.19	1.58	4.91	2.61	0.957	1.03	6.05	13.8	29.3	15.3	26.1	19.7
Hepatopancreas	Mercury	mg/kg wwt	0.0347	0.0108	0.0098	0.0173	0.0403	0.0439	0.0172	0.0445	0.0377	0.0284	0.0313	0.0306
Hepatopancreas	Total Solids	% wgt	23.1	22.5	19.6	23.5	29	29.2	24.3	19.3	25.8	22.9	21.9	21.6
Hepatopancreas	Lipids - metals analysis	%	7.1	8.1	7.8	9.2	8.5	9.5	6.1	3.6	5.7	8.7	5.1	5.4
Hepatopancreas	Lipids - TPH analysis	%	7.2	7.9	6.4	9	10.4	9.9	9.4	3.9	3.2	8.8	7.2	8.6
Hepatopancreas	TPH - Diesel (C10-C28)	mg/kg wwt	143	245	105	180	424	619	419	67.3	233	112	483	283
Hepatopancreas	TPH (C08-C16)	mg/kg wwt	22.4U	23.7U	22.7U	28.4U	267	354	197	21.6U	70.3	22.2U	294	190
Hepatopancreas	TPH (C08-C28)	mg/kg wwt	143	248	105	180	458	682	463	69.3	249	116	557	314
Hepatopancreas	TPH (C08-C40)	mg/kg wwt	775	618	448	738	896	1400	729	466	499	486	977	762
Hepatopancreas	TPH (C16-C28)	mg/kg wwt	140	241	88.1	174	292	410	298	59.4	167	90.8	299	184
Hepatopancreas	o-Terphenyl (S)	%		0			0	0	0	0	0	0	0	0
Hepatopancreas	Percent of whole body	%		0.07			0.07	0.07	0.06	0.06	0.06	0.06	0.06	0.06
Hepatopancreas	Tissue wgt	g-ww	93.81	77	47.4	61.7	157.38	157.38	75.45	107.73	71.93	262.89	146.04	146.04
Meat	Inorganic arsenic	mg/kg wwt	0.014J	0.008J	0.005J	0.008J	0.007J	0.008J	0.006U	0.005U	0.005U	0.005U	0.006U	0.006U
Meat	Methyl mercury	mg/kg wwt	0.0279	0.0119	0.0117	0.0292	0.0184	0.02	0.016	0.0286	0.0688	0.0323	0.03	0.0696
Meat	Arsenic	mg/kg wwt	1.78	1.06	0.237	0.989	0.933	0.839	0.408	0.117	0.172	0.164	0.185	0.151
Meat	Barium	mg/kg wwt	0.477	1.08	1.33	1.31	1	0.786	2.5	4.92	8.18	8.08	16.5	7.16
Meat	Mercury	mg/kg wwt	0.0494	0.032	0.0173	0.0332	0.0504	0.0501	0.0536	0.0772	0.0899	0.068	0.105	0.102
Meat	Total Solids	% wgt	18.6	17.5	15.9	17.6	21.9	21.7	17	13.9	15.5	16	16.3	16.1
Meat	Lipids - metals analysis	%	0.16	0.53	0.16	0.37	0.74	0.59	0.38	0.3	0.45	0.36	0.53	0.35
Meat	Lipids - TPH analysis	%	0.4	0.4	0.4	0.4	0.79	0.64	0.25	0.025	0.29	0.2	0.27	0.15
Meat	TPH - Diesel (C10-C28)	mg/kg wwt	4.9J	9.6U	9.2J	8.4J	17.3U	15.1U	14.4U	4.5U	9.4U	5U	12.4U	15.3U
Meat	TPH (C08-C16)	mg/kg wwt	3.5U	9.6U	5.6U	5.3U	17.3U	15.1U	14.4U	4.5U	9.4U	5U	12.4U	15.3U
Meat	TPH (C08-C28)	mg/kg wwt	5J	9.6U	9.6J	8.5J	17.3U	15.1U	14.4U	4.5U	9.4U	5U	12.4U	15.3U
Meat	TPH (C08-C40)	mg/kg wwt	96.9	135	125	105	179	261	192	13.1	159	142	105	111
Meat	TPH (C16-C28)	mg/kg wwt	4.4J	9.6U	8.1J	7.5J	17.3U	15.1U	14.4U	4.5U	9.4U	5U	12.4U	15.3U
Meat	o-Terphenyl (S)	%		62			58	68	65	9	63	61	65	60
Meat	Percent of whole body	%		0.28			0.28	0.28	0.28	0.32	0.29	0.31	0.29	0.29
Meat	Tissue wgt	g-ww	490.46	312	497.76	436.88	595.48	595.48	377.42	576.03	352.63	1288.99	682.22	682.22
Other soft tissue	Inorganic arsenic	mg/kg wwt	0.041	0.055	0.046	0.029	0.058	0.056	0.073	0.038	0.074	0.041	0.065	0.051
Other soft tissue	Methyl mercury	mg/kg wwt	0.00862	0.0035	0.00385	0.00605	0.0071	0.0055	0.0047	0.0119	0.0102	0.0092	0.0126	0.0117
Other soft tissue	Arsenic	mg/kg wwt	2.6	1.21	0.354	0.904	1.57	1.47	0.483	0.255	0.37	0.379	0.32	0.32
Other soft tissue	Barium	mg/kg wwt	4.43	7.3	12.4	8.74	5.05	4.88	11.3	28.8	41	33.8	58	60.5
Other soft tissue	Mercury	mg/kg wwt	0.0105	0.005	0.0039	0.0069	0.0134	0.0134	0.006	0.0156	0.0121	0.0127	0.0144	0.0138
Other soft tissue	Total Solids	% wgt	21.2	12.4	11	12.2	23.8	24.1	10.8	11.4	10.2	13.1	12.5	12.3
Other soft tissue	Lipids	%	2.6	0.65	0.65	0.64	2.9	3	0.3	0.13	0.48	0.62	0.52	0.38
Other soft tissue	Percent of whole body	%		0.18			0.17	0.17	0.16	0.16	0.21	0.16	0.21	0.21
Other soft tissue	Tissue wgt	g-ww	215.12	201.1	192.35	195.42	359.68	359.68	217.53	292.96	251.67	651.18	498.48	498.48
Whole Body	TPH - Diesel (C10-C28)	mg/kg wwt	8.8	12.2	3.4U	7.9		10U	7.5	4.4J	8.2	7.3		4.9J
Whole Body	TPH (C08-C16)	mg/kg wwt	3.4U	3.5U	3.4U	3.5U		10U	3.5U	3.5U	3.3U	3.3U		3.3U
Whole Body	TPH (C08-C28)	mg/kg wwt	8.9	12.3	3.4U	8		10U	7.6	4.5J	8.3	7.4		5J
Whole Body	TPH (C08-C40)	mg/kg wwt	132	139	75	98.5		198	123	129	102	131		126
Whole Body	TPH (C16-C28)	mg/kg wwt	3.4U	11.3	3.4U	3.5U		10U	6.5J	3.5U	7.6	6.4J		4.5J
Whole Body	Lipids	%	0.7	0.48	0.14	0.55		0.58	0.16	0.35	0.29	0.26		0.13

Table A.4 Crab Tissue Samples (MPA Data)

Crab Data - Edible Tissue

Body Part	Parameter	Exposure Area:	Market							Site				
		Location ID:	EWL-BIL-C	EWL-BR-C	EWL-DES-C	EWL-HOU-C	EWL-LC-C	EWL-LC-C	EWL-NO-C	EWL-T-01A-C	EWL-T-01-C	EWL-T-02-C	EWL-T-03-C	EWL-T-03-C
		Units					Field Dup	Parent					Field Dup	Parent
Hepa+Meat	Inorganic arsenic	mg/kg wwt	0.023	0.016	0.0070	0.011	0.0091		0.013	0.0045	0.0111	0.0130	0.0057	
Hepa+Meat	Methyl mercury	mg/kg wwt	0.026	0.010	0.011	0.027	0.0086		0.015	0.015	0.061	0.030	0.022	
Hepa+Meat	Arsenic	mg/kg wwt	2.1	1.4	0.30	1.1	0.68		0.56	0.103	0.32	0.34	0.15	
Hepa+Meat	Barium	mg/kg wwt	0.59	1.2	1.6	1.5	0.46		3.1	3.2	11.8	9.3	6.9	
Hepa+Meat	Mercury	mg/kg wwt	0.047	0.028	0.017	0.031	0.024		0.048	0.036	0.081	0.061	0.045	
Hepa+Meat	TPH - Diesel (C10-C28)	mg/kg wwt	27	56	18	30	61		82	7.2	47	23.1	39	
Hepa+Meat	TPH (C08-C16)	mg/kg wwt	6.5U	12.4U	7.09U	8.16U	39		45	3.6U	19.7	7.91U	27	
Hepa+Meat	TPH-DRO (C8-C28)	mg/kg wwt	27	57	18	30	66		89	7.4	50	23.8	44	
Hepa+Meat	TPH (C08-C40)	mg/kg wwt	206	231	153	183	207		281	42	217	200	121	
Hepa+Meat	TPH (C16-C28)	mg/kg wwt	26	55	15	28	43		62	6.6	36	19.5	27	

Notes:

TPH = Total Petroleum Hydrocarbon; DRO = Diesel-range Organic.

All samples evaluated are included.

Parent and field duplicate samples presented separately.

Detection limits present for non-detected samples.

U = Not detected.

J = Estimated.

(S) = Surrogate.

Table A.4 Crab Tissue Samples (MPA Data)

Crab Data - By Body Part

Body Part	Parameter	Exposure Area:	Site										Site Reference	
		Location ID:	EWL-T-04-C	EWL-T-05-C	EWL-T-06-C	EWL-T-07-C	EWL-T-08-C	EWL-T-09-C	EWL-T-10-C	EWL-T-10-C	EWL-T-11-C	EWL-T-12-C	EWL-TR-01-C	EWL-TR-02-C
		Units							Field Dup	Parent				
Exoskeleton	Inorganic arsenic	mg/kg wwt	0.109	0.099	0.19	0.144	0.221	0.13	0.232	0.154	0.107	0.088	0.167	0.05
Exoskeleton	Methyl mercury	mg/kg wwt	0.0175	0.0206	0.016	0.0162	0.0323	0.0262	0.0214	0.0237	0.0259	0.0149	0.0153	0.0143
Exoskeleton	Arsenic	mg/kg wwt	0.257	0.31	0.387	0.304	0.417	0.309	0.607	0.42	0.29	0.351	0.39	0.201J
Exoskeleton	Barium	mg/kg wwt	646	943	882	846	749	814	886	979	802	949	690	565
Exoskeleton	Mercury	mg/kg wwt	0.0229	0.0219	0.0289	0.0243	0.0235	0.0143	0.0226	0.0227	0.0274	0.0196	0.0224	0.0193
Exoskeleton	Total Solids	% wgt	44	47.2	46.3	46.2	44.6	46.7	48.4	47.5	47.8	50	45.2	46.3
Exoskeleton	Percent of whole body	%	0.46	0.44	0.46	0.47	0.45	0.43	0.46	0.46	0.44	0.47	0.49	0.47
Exoskeleton	Tissue wgt	g-ww	653.97	759.36	604.11	779.98	827	650.54	1119.35	1119.35	475.16	719.89	615.16	684.6
Exoskeleton	Lipids	%	0.31	0.26	0.26	0.24	0.19	0.2	0.24	0.25	0.3	0.32	0.21	0.14
Hepatopancreas	Inorganic arsenic	mg/kg wwt	0.065	0.058	0.035	0.051	0.051	0.036	0.033	0.034	0.079	0.048	0.06	0.048
Hepatopancreas	Methyl mercury	mg/kg wwt	0.0171	0.0187	0.0202	0.0224	0.0388	0.025	0.013	0.0217	0.009	0.0118	0.0236	0.0141
Hepatopancreas	Arsenic	mg/kg wwt	0.948	1.3	0.913	1.07	0.86	0.879	1.33	1.13	1.14	1.23	1.12	0.899
Hepatopancreas	Barium	mg/kg wwt	15.8	19.9	24.5	21	18.1	19.9	32.7	31	19.2	26.4	19.5	17.9
Hepatopancreas	Mercury	mg/kg wwt	0.0334	0.0341	0.0412	0.0341	0.0419	0.0325	0.0261	0.0212	0.0214	0.0318	0.0295	0.0195
Hepatopancreas	Total Solids	% wgt	20.9	26.9	25.6	23.7	23.9	19.6	30.2	30	23.1	28.2	23	21.7
Hepatopancreas	Lipids - metals analysis	%	3.7	11	5.8	6.3	8.1	4.9	8.3	7.8	7.7	8.4	6.7	4.7
Hepatopancreas	Lipids - TPH analysis	%	4	30.6	10.5	7.3	7	14.4	11.3	11.2	11.1	12.5	6.7	6.9
Hepatopancreas	TPH - Diesel (C10-C28)	mg/kg wwt	10.8J	925	178	143	394	215	387	459	549	331		197
Hepatopancreas	TPH (C08-C16)	mg/kg wwt	5.8U	136U	34.1U	47.1	90	54U	136	148	111	60.6J		61.1
Hepatopancreas	TPH (C08-C28)	mg/kg wwt	11.2J	939	180	153	415	217	421	494	567	339		215
Hepatopancreas	TPH (C08-C40)	mg/kg wwt	46.6	3290	812	512	741	1210	767	985	1100	685		569
Hepatopancreas	TPH (C16-C28)	mg/kg wwt	9.9J	856	174	101	300	209	282	345	443	277		143
Hepatopancreas	o-Terphenyl (S)	%	10	0	0	0	0	0	0	0	0	0		0
Hepatopancreas	Percent of whole body	%	0.06	0.06	0.06	0.06	0.05	0.07	0.07	0.07	0.07	0.07	0.06	0.07
Hepatopancreas	Tissue wgt	g-ww	79.16	105.94	76.35	103.62	101.3	102.56	158.72	158.72	71.13	107.41	78.71	96.92
Meat	Inorganic arsenic	mg/kg wwt	0.005U	0.006U	0.006U	0.006U	0.005J	0.005U	0.007J	0.006U	0.005U	0.006U	0.006J	0.005U
Meat	Methyl mercury	mg/kg wwt	0.0477	0.054	0.0497	0.046	0.0439	0.0473	0.0229	0.0467	0.0377	0.0166	0.0391	0.0323
Meat	Arsenic	mg/kg wwt	0.137	0.159	0.17	0.161	0.128	0.163	0.248	0.17	0.159	0.251	0.209	0.177
Meat	Barium	mg/kg wwt	4.83	4.28	4.88	9.08	8.89	5.55	4.71	5.16	6.47	5.13	6	5.59
Meat	Mercury	mg/kg wwt	0.0646	0.078	0.0841	0.0707	0.0689	0.0699	0.0894	0.0918	0.0733	0.058	0.0662	0.0597
Meat	Total Solids	% wgt	14.8	17.1	16.8	16.4	14	15.4	17.2	17.2	15.9	18.6	14.9	15.6
Meat	Lipids - metals analysis	%	0.28	0.39	0.27	0.4	0.34	0.51	0.51	0.37	0.35	0.4	0.42	0.34
Meat	Lipids - TPH analysis	%	0.097	0.15	0.097	0.17	0.087	0.26	0.24	0.15	0.41	0.078	0.32	0.023
Meat	TPH - Diesel (C10-C28)	mg/kg wwt	5.5U	5.1U	8U	6.5U	5U	6.7U	10.7U	14.4U	12.9U	4.4U	8.7U	4.7U
Meat	TPH (C08-C16)	mg/kg wwt	5.5U	5.1U	8U	6.5U	5U	6.7U	10.7U	14.4U	12.9U	4.4U	8.7U	4.7U
Meat	TPH (C08-C28)	mg/kg wwt	5.5U	5.1U	8U	6.5U	5U	6.7U	10.7U	14.4U	12.9U	4.4U	8.7U	4.7U
Meat	TPH (C08-C40)	mg/kg wwt	110	121	49.1	133	51.3	164	127	152	226	79.2	200	20.1
Meat	TPH (C16-C28)	mg/kg wwt	5.5U	5.1U	8U	6.5U	5U	6.7U	10.7U	14.4U	12.9U	4.4U	8.7U	4.7U
Meat	o-Terphenyl (S)	%	64	53	47	60	38	65	62	65	69	56	62	11
Meat	Percent of whole body	%	0.29	0.30	0.30	0.30	0.32	0.32	0.30	0.30	0.32	0.31	0.30	0.26
Meat	Tissue wgt	g-ww	410.36	513.63	390.12	497.24	589.73	476.66	714.98	714.98	344.33	481.09	370.59	386.97
Other soft tissue	Inorganic arsenic	mg/kg wwt	0.102	0.034	0.087	0.032	0.087	0.065	0.089	0.096	0.072	0.043	0.043	0.031
Other soft tissue	Methyl mercury	mg/kg wwt	0.0083	0.0084	0.0081	0.0068	0.014	0.0113	0.009	0.0049	0.0053	0.0024	0.0114	0.0089
Other soft tissue	Arsenic	mg/kg wwt	0.337	0.275	0.296	0.381	0.281	0.282	0.419	0.381	0.505	0.368	0.376	0.269
Other soft tissue	Barium	mg/kg wwt	46.5	42.9	50.5	39.1	50.7	33.2	75.2	94.7	57.2	64.7	37.3	41.5
Other soft tissue	Mercury	mg/kg wwt	0.0119	0.0121	0.013	0.01	0.0152	0.0101	0.0128	0.012	0.0099	0.0126	0.0107	0.0104
Other soft tissue	Total Solids	% wgt	10.5	12.5	12.6	10.8	10.5	9.63	13.2	12.9	12.7	14.5	13.6	10.1
Other soft tissue	Lipids	%	0.49	0.41	0.39	0.84	0.75	0.51	0.57	0.5	1.41	0.95	0.6	0.49
Other soft tissue	Percent of whole body	%	0.19	0.19	0.19	0.18	0.18	0.18	0.17	0.17	0.18	0.15	0.15	0.20
Other soft tissue	Tissue wgt	g-ww	267.35	330.27	250.91	295.65	337.59	271.67	421.94	421.94	197.52	235.08	185.72	296.57
Whole Body	TPH - Diesel (C10-C28)	mg/kg wwt	9.1	5.2J	8	7U	4.9J			3.3U	9.9	6.8U	3.6U	7.1U
Whole Body	TPH (C08-C16)	mg/kg wwt	3.5U	3.5U	3.7U	7U	3.5U			3.3U	3.5U	6.8U	3.6U	7.1U
Whole Body	TPH (C08-C28)	mg/kg wwt	9.2	5.5J	8.6	7U	5J			3.4J	10.1	6.8U	3.6U	7.1U
Whole Body	TPH (C08-C40)	mg/kg wwt	137	95	143	145	123			107	100	133	98.7	156
Whole Body	TPH (C16-C28)	mg/kg wwt	8	3.5U		7U	3.5U			3.3U	8.7	6.8U	3.6U	7.1U
Whole Body	Lipids	%	0.22	0.37	0.28	0.32	0.31			0.19	0.22	0.31	0.18	0.55

Table A.4 Crab Tissue Samples (MPA Data)

Crab Data - Edible Tissue

Body Part	Parameter	Exposure Area:	Site										Site Reference	
		Location ID:	EWL-T-04-C	EWL-T-05-C	EWL-T-06-C	EWL-T-07-C	EWL-T-08-C	EWL-T-09-C	EWL-T-10-C	EWL-T-10-C	EWL-T-11-C	EWL-T-12-C	EWL-TR-01-C	EWL-TR-02-C
		Units							Field Dup	Parent				
Hepa+Meat	Inorganic arsenic	mg/kg wwt	0.0147	0.0149	0.0107	0.0138	0.0117	0.0105	0.0057		0.0177	0.0137	0.0155	0.0136
Hepa+Meat	Methyl mercury	mg/kg wwt	0.043	0.048	0.045	0.042	0.043	0.043	0.016		0.033	0.0157	0.036	0.0287
Hepa+Meat	Arsenic	mg/kg wwt	0.268	0.35	0.29	0.32	0.235	0.29	0.20		0.33	0.43	0.37	0.32
Hepa+Meat	Barium	mg/kg wwt	6.6	7.0	8.1	11.1	10.2	8.1	4.9		8.6	9.0	8.4	8.1
Hepa+Meat	Mercury	mg/kg wwt	0.060	0.070	0.077	0.064	0.065	0.063	0.039		0.064	0.053	0.060	0.052
Hepa+Meat	TPH - Diesel (C10-C28)	mg/kg wwt	6.4	162	36	30	62	44	44		105	64	7.18U	43
Hepa+Meat	TPH (C08-C16)	mg/kg wwt	5.55U	27.48U	12.27U	13.5	17.5	15.08U	18		30	14.7	7.18U	16.0
Hepa+Meat	TPH-DRO (C8-C28)	mg/kg wwt	6.4	165	36	32	65	44	47		108	65	7.18U	47
Hepa+Meat	TPH (C08-C40)	mg/kg wwt	100	663	174	198	152	349	137		376	190	165	130
Hepa+Meat	TPH (C16-C28)	mg/kg wwt	6.2	151	35	22.8	48	43	34		87	54	7.18U	32

Notes:

TPH = Total Petroleum Hydrocarbon; DRO = Diesel-range Organic.

All samples evaluated are included.

Parent and field duplicate samples presented separately.

Detection limits present for non-detected samples.

U = Not detected.

J = Estimated.

(S) = Surrogate.

Table A.4 Crab Tissue Samples (MPA Data)

Crab Data - By Body Part

Body Part	Parameter	Exposure Area:	Site Reference							
		Location ID:	EWL-TR-03A-C	EWL-TR-03-C	EWL-TR-04-C	EWL-TR-05-C	EWL-TR-06-C	EWL-TR-07-C	EWL-TR-08-C	EWL-TR-09-C
		Units								
Exoskeleton	Inorganic arsenic	mg/kg wwt	0.075	0.087	0.067	0.165	0.386	0.074	0.117	0.123
Exoskeleton	Methyl mercury	mg/kg wwt	0.0214	0.0208	0.0191	0.0091	0.0196	0.0116	0.0154	0.0088
Exoskeleton	Arsenic	mg/kg wwt	0.263	0.334	0.354	0.37	0.594	0.366	0.397	0.353
Exoskeleton	Barium	mg/kg wwt	867	863	850	723	894	858	837	1130
Exoskeleton	Mercury	mg/kg wwt	0.0269	0.0263	0.0244	0.0123	0.0249	0.0142	0.0126	0.0218
Exoskeleton	Total Solids	% wgt	48	44.3	47.4	45.2	49.8	49.2	47.6	47.6
Exoskeleton	Percent of whole body	%	0.45	0.45	0.47	0.46	0.43	0.45	0.45	0.46
Exoskeleton	Tissue wgt	g-ww	597.66	682.78	859.74	643.41	417.46	707.52	560.36	586.29
Exoskeleton	Lipids	%	0.18	0.2	0.21	0.27	0.25	0.24	0.23	0.3
Hepatopancreas	Inorganic arsenic	mg/kg wwt	0.042	0.059	0.061	0.054	0.047	0.052	0.066	0.052
Hepatopancreas	Methyl mercury	mg/kg wwt	0.0169	0.0152	0.024	0.0064	0.0126	0.0093	0.0065	0.0082
Hepatopancreas	Arsenic	mg/kg wwt	1.29	0.896	0.991	1.5	1.09	1.31	1.78	1.95
Hepatopancreas	Barium	mg/kg wwt	22.7	23.7	33.1	21.7	27.3	24.2	29.8	23.7
Hepatopancreas	Mercury	mg/kg wwt	0.0318	0.0272	0.0353	0.0394	0.0259	0.0309	0.0315	0.0556
Hepatopancreas	Total Solids	% wgt	25.2	22.6	27.3	26.8	20.2	25	26.8	31.6
Hepatopancreas	Lipids - metals analysis	%	9.6	6.6	8.8	9.6	5.4	6.3	12.9	13
Hepatopancreas	Lipids - TPH analysis	%	15.3	9.3	14	11.2	7.4	7.1	398	17.2
Hepatopancreas	TPH - Diesel (C10-C28)	mg/kg wwt	414	154	331	119	163	378	188	500
Hepatopancreas	TPH (C08-C16)	mg/kg wwt	135	34.3U	91.6	53.9U	21.7U	85.5	441	100
Hepatopancreas	TPH (C08-C28)	mg/kg wwt	443	156	352	122	171	395	756	522
Hepatopancreas	TPH (C08-C40)	mg/kg wwt	799	751	762	545	612	1010	254	890
Hepatopancreas	TPH (C16-C28)	mg/kg wwt	305	145	262	82J	144	302	441	393
Hepatopancreas	o-Terphenyl (S)	%	0	0	0	0	0	0		0
Hepatopancreas	Percent of whole body	%	0.07	0.06	0.06	0.07	0.07	0.06	0.08	0.08
Hepatopancreas	Tissue wgt	g-ww	95.3	98.16	101.61	103.08	70.32	98.95	103.14	108.54
Meat	Inorganic arsenic	mg/kg wwt	0.006U	0.005U	0.006U	0.006U	0.009J	0.006U	0.006U	0.007U
Meat	Methyl mercury	mg/kg wwt	0.0204	0.029	0.0403	0.0247	0.0608	0.0254	0.0257	0.019
Meat	Arsenic	mg/kg wwt	0.23	0.14	0.162	0.196	0.251	0.299	0.202	0.181
Meat	Barium	mg/kg wwt	10.1	6.5	8.94	13.7	13.1	4.08	6.77	9.46
Meat	Mercury	mg/kg wwt	0.0953	0.0692	0.0796	0.0476	0.106	0.0517	0.0473	0.0551
Meat	Total Solids	% wgt	17	15.4	17.2	17.8	16.9	16.7	18.3	19.1
Meat	Lipids - metals analysis	%	0.39	0.38	0.41	0.26	0.31	0.47	0.56	0.41
Meat	Lipids - TPH analysis	%	0.22	0.071	0.18	0.17	0.17	0.15	0.2	0.19
Meat	TPH - Diesel (C10-C28)	mg/kg wwt	5.2U	4.9U	4.6U	4.8U	7.4U	4.8U	5U	5.2U
Meat	TPH (C08-C16)	mg/kg wwt	5.2U	4.9U	4.6U	4.8U	7.4U	4.8U	5U	5.2U
Meat	TPH (C08-C28)	mg/kg wwt	5.2U	4.9U	4.6U	4.8U	7.4U	4.8U	5U	5.2U
Meat	TPH (C08-C40)	mg/kg wwt	154	51.6	95.4	122	128	72.6	142	166
Meat	TPH (C16-C28)	mg/kg wwt	5.2U	4.9U	4.6U	4.8U	7.4U	4.8U	5U	5.2U
Meat	o-Terphenyl (S)	%	67	15	54	66	68	61	64	62
Meat	Percent of whole body	%	0.32	0.28	0.32	0.31	0.34	0.34	0.32	0.32
Meat	Tissue wgt	g-ww	421.76	429.18	597.61	425.39	327.25	533.92	402.52	405.71
Other soft tissue	Inorganic arsenic	mg/kg wwt	0.031	0.032	0.036	0.038	0.152	0.039	0.032	0.035
Other soft tissue	Methyl mercury	mg/kg wwt	0.0109	0.0095	0.0139	0.0061	0.0141	0.0063	0.0059	0.0086
Other soft tissue	Arsenic	mg/kg wwt	0.448	0.254	0.341	0.435	0.549	0.387	0.565	0.589
Other soft tissue	Barium	mg/kg wwt	58.8	38.9	47.4	35.4	66.4	33.6	51.3	54.8
Other soft tissue	Mercury	mg/kg wwt	0.0139	0.0101	0.0149	0.0087	0.0181	0.0084	0.0076	0.0213
Other soft tissue	Total Solids	% wgt	13.5	10	11.9	13.2	15.1	12.9	16.9	19.2
Other soft tissue	Lipids	%	0.81	0.53	0.62	0.45	0.71	0.48	0.88	1.2
Other soft tissue	Percent of whole body	%	0.16	0.20	0.15	0.16	0.15	0.15	0.14	0.14
Other soft tissue	Tissue wgt	g-ww	210.12	306.53	280.04	215.03	146.36	233.43	176.81	183.62
Whole Body	TPH - Diesel (C10-C28)	mg/kg wwt	5.9J	7.3U	19J	14.9		9.9J	10.7J	11U
Whole Body	TPH (C08-C16)	mg/kg wwt	3.6U	7.3U	10.7U	7U		7.1U	10.7U	11U
Whole Body	TPH (C08-C28)	mg/kg wwt	6.1J	7.3U	19.4J	15.1		10J	10.8J	11U
Whole Body	TPH (C08-C40)	mg/kg wwt	128	167	263	143		161	177	229
Whole Body	TPH (C16-C28)	mg/kg wwt	3.6U	7.3U	17.8J	14J		9.4J	10.7U	11U
Whole Body	Lipids	%	0.37	0.47	0.5	0.63		0.43	0.75	0.85

Table A.4 Crab Tissue Samples (MPA Data)

Crab Data - Edible Tissue

Body Part	Parameter	Exposure Area:	Site Reference							
		Location ID:	EWL-TR-03A-C	EWL-TR-03-C	EWL-TR-04-C	EWL-TR-05-C	EWL-TR-06-C	EWL-TR-07-C	EWL-TR-08-C	EWL-TR-09-C
		Units								
Hepa+Meat	Inorganic arsenic	mg/kg wwt	0.0126	0.0151	0.0140	0.0154	0.0157	0.0132	0.0182	0.0165
Hepa+Meat	Methyl mercury	mg/kg wwt	0.0198	0.0264	0.038	0.0211	0.052	0.0229	0.0218	0.0167
Hepa+Meat	Arsenic	mg/kg wwt	0.43	0.281	0.28	0.45	0.40	0.46	0.52	0.55
Hepa+Meat	Barium	mg/kg wwt	12.4	9.7	12.5	15.3	15.6	7.2	11.5	12.5
Hepa+Meat	Mercury	mg/kg wwt	0.084	0.061	0.073	0.046	0.092	0.048	0.044	0.055
Hepa+Meat	TPH - Diesel (C10-C28)	mg/kg wwt	81	33	52	27	35	63	85	110
Hepa+Meat	TPH (C08-C16)	mg/kg wwt	29	10.37U	17.2	14.38U	9.93U	17.4	42	25
Hepa+Meat	TPH-DRO (C8-C28)	mg/kg wwt	86	33	55	28	36	66	94	114
Hepa+Meat	TPH (C08-C40)	mg/kg wwt	273	182	192	205	214	219	267	319
Hepa+Meat	TPH (C16-C28)	mg/kg wwt	60	31	42	19.9	32	51	56	87

Notes:

TPH = Total Petroleum Hydrocarbon; DRO = Diesel-range Organic.

All samples evaluated are included.

Parent and field duplicate samples presented separately.

Detection limits present for non-detected samples.

U = Not detected.

J = Estimated.

(S) = Surrogate.

Appendix B

Risk Assessment Calculations

List of Tables

Table B.1 Excess Lifetime Cancer Risk and Non-cancer Hazard by Chemical and Pathway for Adult Recreator – Incidental Ingestion of Soil/Sediment

With TPH-Fraction Data

Constituent of Concern	Soil/ Sediment EPC (mg/kg)	Oral Bioavailability (B) (Unitless)	Daily Intake: Cancer (DI_c) (mg/kg-d)	Daily Intake: Non-cancer (DI_{nc}) (mg/kg-d)	Cancer Slope Factor (SF) $(mg/kg\text{-}d)^{-1}$	Reference Dose (RfD) (mg/kg-d)	Cancer Risk $CR = DI_c \times SF$	Percentage Contribution to Total Cancer Risk	Hazard Quotient $HQ = DI_{nc} \div RfD$	Percentage Contribution to Total Non-cancer Hazard	Non-cancer RfD Endpoint
Metals											
Arsenic	6.5E+00	6.0E-01	2.6E-07	7.0E-07	1.5E+00	3.0E-04	3.9E-07	100%	2.3E-03	7.5%	Skin
Barium	2.4E+03	1.0E+00	1.6E-04	4.3E-04	NA	2.0E-01	NA		2.2E-03	6.9%	Kidney
Mercury	1.0E+00	1.0E+00	6.8E-08	1.8E-07	NA	3.0E-04	NA		6.1E-04	2.0%	Immunological
Total Petroleum Hydrocarbons											
Aliphatic >C10-C12	1.2E+02	1.0E+00	8.1E-06	2.2E-05	NA	1.0E-02	NA		2.2E-03	7.0%	Liver
Aliphatic >C12-C16	1.0E+03	1.0E+00	6.8E-05	1.8E-04	NA	1.0E-02	NA		1.8E-02	59%	Liver
Aliphatic >C16-C35	4.3E+03	1.0E+00	2.9E-04	7.7E-04	NA	3.0E+00	NA		2.6E-04	<1%	Liver
Aromatic >C10-C12	2.6E+01	1.0E+00	1.7E-06	4.7E-06	NA	3.0E-02	NA		1.6E-04	<1%	Blood
Aromatic >C12-C16	1.6E+02	1.0E+00	1.1E-05	2.9E-05	NA	3.0E-02	NA		9.8E-04	3.1%	Blood
Aromatic >C16-C21	3.7E+02	1.0E+00	2.4E-05	6.5E-05	NA	4.0E-02	NA		1.6E-03	5.3%	Liver
Aromatic >C21-C35	5.7E+02	1.0E+00	3.8E-05	1.0E-04	NA	4.0E-02	NA		2.6E-03	8.2%	Liver
					Total Cancer Risk:		3.9E-07	**Hazard Index:**	3.1E-02		
					Highest Contributor:		Arsenic (100%)		Aliphatic >C12-C16 (59%)		

Target Organ Specific Hazard Index (with TPH-Fraction Data):

Blood	1.1E-03
Immunological	6.1E-04
Kidney	2.2E-03
Liver	2.5E-02
Skin	2.3E-03

With TPH-Range Data

Constituent of Concern	Soil/ Sediment EPC (mg/kg)	Oral Bioavailability (B) (Unitless)	Daily Intake: Cancer (DI_c) (mg/kg-d)	Daily Intake: Non-cancer (DI_{nc}) (mg/kg-d)	Cancer Slope Factor (SF) $(mg/kg\text{-}d)^{-1}$	Reference Dose (RfD) (mg/kg-d)	Cancer Risk $CR = DI_c \times SF$	Percentage Contribution to Total Cancer Risk	Hazard Quotient $HQ = DI_{nc} \div RfD$	Percentage Contribution to Total Non-cancer Hazard	Non-Cancer RfD Endpoint
Metals											
Arsenic	6.5E+00	6.0E-01	2.6E-07	7.0E-07	1.5E+00	3.0E-04	3.9E-07	100%	2.3E-03	1.8%	Skin
Barium	2.4E+03	1.0E+00	1.6E-04	4.3E-04	NA	2.0E-01	NA		2.2E-03	1.7%	Kidney
Mercury	1.0E+00	1.0E+00	6.8E-08	1.8E-07	NA	3.0E-04	NA		6.1E-04	<1%	Immunological
Total Petroleum Hydrocarbons											
TPH-DRO	6.3E+03	1.0E+00	4.1E-04	1.1E-03	NA	1.0E-02	NA		1.1E-01	87%	Liver
TPH-ORO	2.4E+03	1.0E+00	1.6E-04	4.4E-04	NA	4.0E-02	NA		1.1E-02	8.5%	Liver
						Total Cancer Risk:	3.9E-07	**Hazard Index:**	1.3E-01		
						Highest Contributor:	Arsenic (100%)		TPH-DRO (87%)		

Notes:

$$\text{Intake Factor (IF)} = \frac{IR \times FR \times EF \times ED \times CF}{BW \times AT} = \begin{matrix} 6.6E\text{-}08 \text{ (Cancer)} \\ 1.8E\text{-}07 \text{ (Non-cancer)} \end{matrix}$$

IR	Ingestion Rate (mg/d)	50
FR	Fraction from Site	1
EF	Ingestion Exposure Frequency (d/yr)	104
ED	Ingestion Exposure Duration (yrs)	26
CF	Conversion Factor (kg/mg)	0.000001
BW	Body Weight (kg)	80
AT	Averaging Time - Cancer (d)	25,550
	Averaging Time - Non-cancer (d)	9,490

Target Organ Specific Hazard Index (with TPH-Range Data):

Immunological	6.1E-04
Kidney	2.2E-03
Liver	1.2E-01
Skin	2.3E-03

DI (mg/kg-d) = EPC x B x IF

EPC = Exposure Point Concentration; DRO = Diesel-Range Organic; NA = Not Available/Not Applicable; ORO = Oil-Range Organic; TPH = Total Petroleum Hydrocarbon; UCLM = Upper Confidence Limit on the Mean.

The 95% UCLM was used as the EPC, except when the UCLM is greater than the maximum, in which case, the maximum was used.

Table B.2 Excess Lifetime Cancer Risk and Non-cancer Hazard by Chemical and Pathway for Adult Recreator – Dermal Contact with Soil/Sediment

With TPH-Fraction Data

Constituent of Concern	Soil/ Sediment EPC (mg/kg)	Dermal Absorption Fraction (ABS) (Unitless)	Daily Intake: Cancer (DI_c) (mg/kg-d)	Daily Intake: Non-cancer (DI_{nc}) (mg/kg-d)	Cancer Slope Factor (SF) $(mg/kg\text{-}d)^{-1}$	Reference Dose (RfD) (mg/kg-d)	Cancer Risk $CR = DI_c \times SF$	Percentage Contribution to Total Cancer Risk	Hazard Quotient $HQ = DI_{nc} \div RfD$	Percentage Contribution to Total Non-cancer Hazard	Non-cancer RfD Endpoint
Metals											
Arsenic	6.5E+00	3.0E-02	3.6E-07	9.6E-07	1.5E+00	3.0E-04	5.4E-07	100%	3.2E-03	22%	Skin
Barium	2.4E+03	NA	NA	NA	NA	1.4E-02	NA		NA		Kidney
Mercury	1.0E+00	NA	NA	NA	NA	2.1E-05	NA		NA		Immunological
Total Petroleum Hydrocarbons											
Aliphatic >C10-C12	1.2E+02	NA	NA	NA	NA	1.0E-02	NA		NA		Liver
Aliphatic >C12-C16	1.0E+03	NA	NA	NA	NA	1.0E-02	NA		NA		Liver
Aliphatic >C16-C35	4.3E+03	NA	NA	NA	NA	3.0E+00	NA		NA		Liver
Aromatic >C10-C12	2.6E+01	NA	NA	NA	NA	3.0E-02	NA		NA		Blood
Aromatic >C12-C16	1.6E+02	NA	NA	NA	NA	3.0E-02	NA		NA		Blood
Aromatic >C16-C21	3.7E+02	1.0E-01	6.7E-05	1.8E-04	NA	4.0E-02	NA		4.5E-03	31%	Liver
Aromatic >C21-C35	5.7E+02	1.0E-01	1.0E-04	2.8E-04	NA	4.0E-02	NA		7.1E-03	48%	Liver

Total Cancer Risk: 5.4E-07 **Hazard Index:** 1.5E-02

Highest Contributor: Arsenic (100%) Aromatic >C21-C35 (48%)

Target Organ Specific Hazard Index (with TPH-Fraction Data):

Blood	0.0E+00
Immunological	0.0E+00
Kidney	0.0E+00
Liver	1.2E-02
Skin	3.2E-03

With TPH-Range Data

Constituent of Concern	Soil/ Sediment EPC (mg/kg)	Dermal Absorption Fraction (ABS) (Unitless)	Daily Intake: Cancer (DI_c) (mg/kg-d)	Daily Intake: Non-cancer (DI_{nc}) (mg/kg-d)	Cancer Slope Factor (SF) $(mg/kg\text{-}d)^{-1}$	Reference Dose (RfD) (mg/kg-d)	Cancer Risk $CR = DI_c \times SF$	Percentage Contribution to Total Cancer Risk	Hazard Quotient $HQ = DI_{nc} \div RfD$	Percentage Contribution to Total Non-cancer Hazard	Non-Cancer RfD Endpoint
Metals											
Arsenic	6.5E+00	3.0E-02	3.6E-07	9.6E-07	1.5E+00	3.0E-04	5.4E-07	100%	3.2E-03	<1%	Skin
Barium	2.4E+03	NA	NA	NA	NA	1.4E-02	NA		NA		Kidney
Mercury	1.0E+00	NA	NA	NA	NA	2.1E-05	NA		NA		Immunological
Total Petroleum Hydrocarbons											
TPH-DRO	6.3E+03	1.0E-01	1.1E-03	3.1E-03	NA	1.0E-02	NA		3.1E-01	90%	Liver
TPH-ORO	2.4E+03	1.0E-01	4.5E-04	1.2E-03	NA	4.0E-02	NA		3.0E-02	9%	Liver
						Total Cancer Risk:	5.4E-07	**Hazard Index:**	3.4E-01		
						Highest Contributor:	Arsenic (100%)		TPH-DRO (90%)		

Notes:

$$\text{Intake Factor (IF)} = \frac{SA \times AF \times EF \times ED \times CF}{BW \times AT} = \begin{matrix} 1.8E\text{-}06 \text{ (Cancer)} \\ 4.9E\text{-}06 \text{ (Non-cancer)} \end{matrix}$$

SA	Surface Area Exposed to Soil/Sediment (cm^2/d)	6,910
AF	Skin Adherence Factor (mg/cm^2)	0.2
EF	Dermal Exposure Frequency (d/yr)	104
ED	Dermal Exposure Duration (yrs)	26
CF	Conversion Factor (kg/mg)	0.000001
BW	Body Weight (kg)	80
AT	Averaging Time - Cancer (d)	25,550
	Averaging Time - Non-cancer (d)	9,490

Target Organ Specific Hazard Index (with TPH-Range Data):

Immunological	0.0E+00
Kidney	0.0E+00
Liver	3.4E-01
Skin	3.2E-03

DI (mg/kg-d) = EPC x ABS x IF

EPC = Exposure Point Concentration; DRO = Diesel-Range Organic; NA = Not Available/Not Applicable; ORO = Oil-Range Organic; TPH = Total Petroleum Hydrocarbon; UCLM = Upper Confidence Limit on the Mean.

The 95% UCLM was used as the EPC, except when the UCLM is greater than the maximum, in which case, the maximum was used.

Table B.3 Dermal Absorption of Water

Chemical Group	Parameter	MW (g/mole)	$LogK_{ow}$ (Unitless)	Kp (cm/hour)	B (Unitless)	Dsc (cm^2/hour)	Lag Time (τ_{event}) (hours/event)	t* (hours)	b (Unitless)	c (Unitless)	Surface Water – Recreator				Groundwater – Recreator			
											t_{event} (hours/event)	FA (Unitless)	Conc. (mg/L)	DA (mg/cm^2-event)	t_{event} (hours/event)	FA (Unitless)	Conc. (mg/L)	DA (mg/cm^2-event)
Metals	Arsenic	7.5E+01		1.0E-03							4.0	1.0	0.0081	3.2E-08	2.0	1.0	0.028	5.6E-08
Metals	Barium	1.4E+02		1.0E-03							4.0	1.0	0.59	2.3E-06	2.0	1.0	14	2.8E-05
Metals	Chromium	5.2E+01		1.0E-03							4.0	1.0	0.0066	2.6E-08	2.0	1.0	0.33	6.6E-07
Metals	Iron	5.6E+01		1.0E-03							4.0	1.0	6.5	2.6E-05	2.0	1.0	83	1.7E-04
Metals	Lead	2.1E+02		1.0E-04							4.0	1.0	0.021	8.4E-09	2.0	1.0	0.034	6.7E-09
Metals	Manganese	5.5E+01		1.0E-03							4.0	1.0	0.53	2.1E-06	2.0	1.0	3.0	5.9E-06
Metals	Selenium	7.9E+01		1.0E-03							4.0	1.0	0.022	8.8E-08	2.0	1.0	0.089	1.8E-07
Metals	Strontium	8.8E+01		1.0E-03							4.0	1.0	1.1	4.3E-06	2.0	1.0	13	2.5E-05
VOCs	Benzene	7.8E+01	2.1E+00	1.5E-02	5.1E-02	5.7E-07	2.9E-01	3.3E-01	3.7E-01	7.0E-01	4.0	1.0			2.0	1.0	0.028	1.1E-06
TPH	TPH-DRO	1.3E+02	5.7E+00	1.7E+00	*Outside Predictive Domain*						4.0	1.0	1.3	NA	2.0	1.0	0.84	NA
TPH	TPH-ORO	1.7E+02	6.1E+00	2.0E+00	*Outside Predictive Domain*						4.0	1.0	1.1	NA	2.0	1.0	0.45	NA

Notes:

DRO = Diesel-Range Organic; ORO = Oil-Range Organic; TPH = Total Petroleum Hydrocarbon; US EPA = United States Environmental Protection Agency.

l_{sc} = Apparent thickness of strateum corneum (cm) = 0.001

Exposure Duration (ED) = t_{event} = Water Contact Duration (hours).

Conversion Factor (L/cm^3)= 0.001

MW = Molecular Weight (g/mole).

$LogK_{ow}$ = Octanol/water partition coefficient (unitless).

Kp = Strateum corneum (sc) permeability constant (cm/hour).

B = Ratio of permeability of chemical in strateum corneum to permeability in viable epidermis (unitless).

Dsc = Effective diffusivity for chemical transfer through the skin (cm^2/hour).

t* = Time to reach steady state (hours).

b & c = Parameters used to calculate time to reach steady state.

FA = Fraction Absorbed (unitless).

DA = Absorbed Dose (mg/cm^2-event).

$$B = K_p \frac{\sqrt{MW}}{2.6} \qquad b = \frac{2(1+B)^2}{\pi} - c \qquad c = \frac{1+3B+3B^2}{3(1+B)}$$

$$D_{sc} = 10^{(-2.8-0.0056\,MW)} \times l_{sc} \qquad \tau_{event} = \frac{l_{sc}^2}{6D_{sc}}$$

$$If\ B \le 0.6\ then\ t^* = 2.4\tau_{event}$$

$$If\ B > 0.6\ then\ t^* = 6\tau_{event}\left(b - \sqrt{b^2 - c^2}\right)$$

$$If\ t_{event} \le t^*\ then\ DA_{event} = 2\,FA \times K_p \times C_w \sqrt{\frac{6\tau_{event} \times t_{event}}{\pi}}$$

$$If\ t_{event} > t^*\ then\ DA_{event} = FA \times K_p \times C_w \times \left[\frac{t_{event}}{1+B} + 2\tau_{event}\left(\frac{1+3B+3B^2}{(1+B)^2}\right)\right]$$

TPH-DRO and TPH-ORO are outside the Effective Predictive Domain of US EPA's model and therefore could not be evaluated using US EPA (2004) Dermal Guidance.

MW, Log K_{ow}, and Kp of medium aliphatics and high aliphatics were used as a surrogates for TPH-DRO and TPH-ORO, respectively.

Table B.4 Excess Lifetime Cancer Risk and Non-cancer Hazard by Chemical and Pathway for Adult Recreator – Dermal Contact with Surface Water

Constituent of Concern	Absorbed Dose (DA) (mg/cm^2-event)	Dermally Absorbed Dose: Cancer (DAD_c) (mg/kg-d)	Dermally Absorbed Dose: Non-cancer (DAD_{nc}) (mg/kg-d)	Cancer Slope Factor (SF) $(mg/kg\text{-}d)^{-1}$	Reference Dose (RfD) (mg/kg-d)	Cancer Risk $CR = DAD_c \times SF$	Percentage Contribution to Total Cancer Risk	Hazard Quotient $HQ = DAD_{nc} \div RfD$	Percent Contribution to Total Non-cancer Hazard	Non-cancer RfD Endpoint
Metals										
Arsenic	3.2E-08	3.0E-07	7.9E-07	1.5E+00	3.0E-04	4.4E-07	100%	2.6E-03	4.2%	Skin
Barium	2.3E-06	2.1E-05	5.8E-05	NA	1.4E-02	NA		4.1E-03	6.5%	Kidney
Iron	2.6E-05	2.4E-04	6.4E-04	NA	7.0E-01	NA		9.2E-04	1.5%	Gastrointestinal
Lead	8.4E-09	7.7E-08	2.1E-07	NA	NA	NA		NA		NA
Manganese	2.1E-06	1.9E-05	5.2E-05	NA	9.6E-04	NA		5.5E-02	87%	Central Nervous System
Selenium	8.8E-08	8.0E-07	2.2E-06	NA	5.0E-03	NA		4.3E-04	<1%	Skin
Strontium	4.3E-06	3.9E-05	1.1E-04	NA	6.0E-01	NA		1.8E-04	<1%	Bone
Total Petroleum Hydrocarbons										
TPH-DRO	NA	NA	NA	NA	1.0E-02	NA		NA		Liver
TPH-ORO	NA	NA	NA	NA	4.0E-02	NA		NA		Liver
				Total Cancer Risk:		4.4E-07	**Hazard Index:**	6.3E-02		
				Highest Contributor:		Arsenic (100%)		Manganese (87%)		

Notes:

$$\text{Intake Factor (IF)} = \frac{SA \times EF \times ED \times EV}{BW \times AT} = \begin{matrix} 9.1E+00 \text{ (Cancer)} \\ 2.5E+01 \text{ (Non-cancer)} \end{matrix}$$

SA	Surface Area Exposed to Surface water (cm^2)	6910
EF	Exposure Frequency (d/yr)	104
ED	Exposure Duration (yr)	26
BW	Body Weight (kg)	80
EV	Events per day (event/d)	1.0
AT	Averaging Time - Cancer (d)	25,550
	Averaging Time - Non-cancer (d)	9,490

Target Organ Specific Hazard Index:

Bone	1.8E-04
Central Nervous System	5.5E-02
Gastrointestinal	9.2E-04
Kidney	4.1E-03
Liver	0.0E+00
Skin	3.1E-03

Absorbed Dose calculated and presented in Appendix Table B.4.

DAD (mg/kg-d) = DA x IF

DRO = Diesel-Range Organic; NA = Not Available/Not Applicable; ORO = Oil-Range Organic; TPH = Total Petroleum Hydrocarbon; US EPA = United States Environmental Protection Agency.

The dermal exposure route for lead was not evaluated, because this exposure route is typically insignificant. US EPA's Adult Lead Model (ALM) makes no provision for assessing dermal exposures (US EPA, 1996).

TPH-DRO and TPH-ORO are outside the Effective Predictive Domain and therefore could not be evaluated using US EPA (2004) Dermal Guidance.

Table B.5 Excess Lifetime Cancer Risk and Non-cancer Hazard by Chemical and Pathway for Adult Recreator – Dermal Contact with Groundwater (Maximum Concentrations from All Temporary or Permanent Wells Excluding the Peat Zone)

With TPH-Fraction Data

Constituent of Concern	Absorbed Dose (DA) (mg/cm^2-event)	Dermally Absorbed Dose: Cancer (DAD_c) (mg/kg-d)	Dermally Absorbed Dose: Non-cancer (DAD_{nc}) (mg/kg-d)	Cancer Slope Factor (SF) $(mg/kg\text{-}d)^{-1}$	Reference Dose (RfD) (mg/kg-d)	Cancer Risk $CR = DAD_c \times SF$	Percentage Contribution to Total Cancer Risk	Hazard Quotient $HQ = DAD_{nc} \div RfD$	Percentage Contribution to Total Non-cancer Hazard	Non-cancer RfD Endpoint
Metals										
Arsenic	5.6E-08	5.1E-07	1.4E-06	1.5E+00	3.0E-04	7.7E-07	59%	4.6E-03	2.1%	Skin
Barium	2.8E-05	2.6E-04	7.0E-04	NA	1.4E-02	NA		5.0E-02	23%	Kidney
Chromium	6.6E-07	6.0E-06	1.6E-05	NA	2.0E-02	NA		8.3E-04	<1%	None Reported
Iron	1.7E-04	1.5E-03	4.1E-03	NA	7.0E-01	NA		5.8E-03	2.6%	Gastrointestinal
Lead	6.7E-09	6.1E-08	1.6E-07	NA	NA	NA		NA		NA
Manganese	5.9E-06	5.4E-05	1.5E-04	NA	9.6E-04	NA		1.5E-01	69%	Central Nervous System
Selenium	1.8E-07	1.6E-06	4.4E-06	NA	5.0E-03	NA		8.8E-04	<1%	Skin
Strontium	2.5E-05	2.3E-04	6.3E-04	NA	6.0E-01	NA		1.0E-03	<1%	Bone
Volatile Organic Compounds										
Benzene	1.1E-06	9.6E-06	2.6E-05	5.5E-02	4.0E-03	5.3E-07	41%	6.5E-03	3%	Blood
Total Petroleum Hydrocarbons										
Aliphatic >C10-C12	ND			NA	1.0E-02					
Aliphatic >C12-C16	ND			NA	1.0E-02					
Aliphatic >C16-C35	ND			NA	3.0E+00					
Aromatic >C10-C12	ND			NA	3.0E-02					
Aromatic >C12-C16	ND			NA	3.0E-02					
Aromatic >C16-C21	ND			NA	4.0E-02					
Aromatic >C21-C35	ND			NA	4.0E-02					

Total Cancer Risk:	1.3E-06	**Hazard Index:**	2.2E-01
Highest Contributor:	Arsenic (59%)		Manganese (69%)

Target Organ Specific Hazard Index (with TPH-Fraction Data):

Blood	6.5E-03
Bone	1.0E-03
Central Nervous System	1.5E-01
Gastrointestinal	5.8E-03
Kidney	5.0E-02
None Reported	8.3E-04
Skin	5.5E-03

With TPH-Range Data

Constituent of Concern	Absorbed Dose (DA) (mg/cm^2-event)	Dermally Absorbed Dose: Cancer (DAD_c) (mg/kg-d)	Dermally Absorbed Dose: Non-cancer (DAD_{nc}) (mg/kg-d)	Cancer Slope Factor (SF) $(mg/kg\text{-}d)^{-1}$	Reference Dose (RfD) (mg/kg-d)	Cancer Risk $CR = DAD_c \times SF$	Percentage Contribution to Total Cancer Risk	Hazard Quotient $HQ = DAD_{nc} \div RfD$	Percentage Contribution to Total Non-cancer Hazard	Non-cancer RfD Endpoint
Metals										
Arsenic	5.6E-08	5.1E-07	1.4E-06	1.5E+00	3.0E-04	7.7E-07	59%	4.6E-03	2.1%	Skin
Barium	2.8E-05	2.6E-04	7.0E-04	NA	1.4E-02	NA		5.0E-02	23%	Kidney
Chromium	6.6E-07	6.0E-06	1.6E-05	NA	2.0E-02	NA		8.3E-04	<1%	None Reported
Iron	1.7E-04	1.5E-03	4.1E-03	NA	7.0E-01	NA		5.8E-03	2.6%	Gastrointestinal
Lead	6.7E-09	6.1E-08	1.6E-07	NA	NA	NA		NA		NA
Manganese	5.9E-06	5.4E-05	1.5E-04	NA	9.6E-04	NA		1.5E-01	69%	Central Nervous System
Selenium	1.8E-07	1.6E-06	4.4E-06	NA	5.0E-03	NA		8.8E-04	<1%	Skin
Strontium	2.5E-05	2.3E-04	6.3E-04	NA	6.0E-01	NA		1.0E-03	<1%	Bone
Volatile Organic Compounds										
Benzene	1.1E-06	9.6E-06	2.6E-05	5.5E-02	4.0E-03	5.3E-07	41%	6.5E-03	3%	Blood
Total Petroleum Hydrocarbons										
TPH-DRO	NA	NA	NA	NA	1.0E-02	NA		NA		Liver
TPH-ORO	NA	NA	NA	NA	4.0E-02	NA		NA		Liver
					Total Cancer Risk:	1.3E-06	**Hazard Index:**	2.2E-01		
					Highest Contributor:	Arsenic (59%)		Manganese (69%)		

Notes:

$$\text{Intake Factor (IF)} = \frac{SA \times EF \times ED \times EV}{BW \times AT}$$

	Cancer	Non-cancer
Intake Factor (IF) =	9.1E+00	2.5E+01

SA	Surface Area Exposed to Ground water (cm^2)	6,910
EF	Exposure Frequency (d/yr)	104
ED	Exposure Duration (yr)	26
BW	Body Weight (kg)	80
EV	Events per day (event/d)	1.0
AT	Averaging Time - Cancer (d)	25,550
	Averaging Time - Non-cancer (d)	9,490

Target Organ Specific Hazard Index (with TPH-Range Data):

Blood	6.5E-03
Bone	1.0E-03
Central Nervous System	1.5E-01
Gastrointestinal	5.8E-03
Kidney	5.0E-02
Liver	0.0E+00
None Reported	8.3E-04
Skin	5.5E-03

Absorbed Dose calculated and presented in Appendix Table B.4.

DAD (mg/kg-d) = DA x IF

DRO = Diesel-range Organic; ND = Not Detected; NA = Not Available/Not Applicable; ORO = Oil-range Organic; TPH = Total Petroleum Hydrocarbon; US EPA = United States Environmental Protection Agency.

The dermal exposure route for lead was not evaluated because this exposure route is typically insignificant. US EPA's Adult Lead Model (ALM) makes no provision for assessing dermal exposures (US EPA, 1996).

TPH-DRO and TPH-ORO are outside the Effective Predictive Domain and therefore could not be evaluated using US EPA (2004) Dermal Guidance.

Table B.6 Excess Lifetime Cancer Risk and Non-cancer Hazard by Chemical and Pathway for Adult Recreator – Groundwater Ingestion (Maximum Concentrations from the J. Guidry Well)

With TPH-Fraction Data

Constituent of Concern	Groundwater EPC (mg/L)	Daily Intake: Cancer (DI_c) (mg/kg-d)	Daily Intake: Non-cancer (DI_{nc}) (mg/kg-d)	Cancer Slope Factor (SF) $(mg/kg\text{-}d)^{-1}$	Reference Dose (RfD) (mg/kg-d)	Cancer Risk $CR = DI_c \times SF$	Percentage Contribution to Total Cancer Risk	Hazard Quotient $HQ = DI_{nc} \div RfD$	Percentage Contribution to Total Non-cancer Hazard	Non-cancer RfD Endpoint
Metals										
Arsenic	ND			1.5E+00	3.0E-04					
Barium	7.8E-01	2.6E-03	6.9E-03	NA	2.0E-01	NA		3.5E-02	41%	Kidney
Chromium	ND			NA	1.5E+00					
Iron	1.1E+00	3.6E-03	9.6E-03	NA	7.0E-01	NA		1.4E-02	16%	Gastrointestinal
Lead	ND			NA	NA					
Manganese	7.3E-02	2.4E-04	6.5E-04	NA	2.4E-02	NA		2.7E-02	32%	Central Nervous System
Selenium	ND			NA	5.0E-03					
Strontium	5.7E-01	1.9E-03	5.1E-03	NA	6.0E-01	NA		8.5E-03	10%	Bone
Volatile Organic Compounds										
Benzene	ND			5.5E-02	4.0E-03					
Total Petroleum Hydrocarbons										
Aliphatic >C10-C12	ND			NA	1.0E-02					
Aliphatic >C12-C16	ND			NA	1.0E-02					
Aliphatic >C16-C35	ND			NA	3.0E+00					
Aromatic >C10-C12	ND			NA	3.0E-02					
Aromatic >C12-C16	ND			NA	3.0E-02					
Aromatic >C16-C21	ND			NA	4.0E-02					
Aromatic >C21-C35	ND			NA	4.0E-02					

Total Cancer Risk: 0.0E+00 **Hazard Index:** 8.4E-02

Highest Contributor: Barium (41%)

Target Organ Specific Hazard Index (with TPH-Fraction Data):

Bone	8.5E-03
Central Nervous System	2.7E-02
Gastrointestinal	1.4E-02
Kidney	3.5E-02

With TPH-Range Data

Constituent of Concern	Groundwater EPC (mg/L)	Daily Intake Cancer (DI_c) (mg/kg-d)	Daily Intake Non-cancer (DI_{nc}) (mg/kg-d)	Cancer Slope Factor (SF) $(mg/kg\text{-}d)^{-1}$	Reference Dose (RfD) (mg/kg-d)	Cancer Risk $CR = DI_c \times SF$	Percent Contribution to Total Cancer Risk	Hazard Quotient $HQ = DI_{nc} \div RfD$	Percent Contribution to Total Non-cancer Hazard	Non-cancer RfD Endpoint
Metals										
Arsenic	ND			1.5E+00	3.0E-04					
Barium	7.8E-01	2.6E-03	6.9E-03	NA	2.0E-01	NA		3.5E-02	41%	Kidney
Chromium	ND			NA	1.5E+00					
Iron	1.1E+00	3.6E-03	9.6E-03	NA	7.0E-01	NA		1.4E-02	16%	Gastrointestinal
Lead	ND			NA	NA					
Manganese	7.3E-02	2.4E-04	6.5E-04	NA	2.4E-02	NA		2.7E-02	32%	Central Nervous System
Selenium	ND			NA	5.0E-03					
Strontium	5.7E-01	1.9E-03	5.1E-03	NA	6.0E-01	NA		8.5E-03	10%	Bone
Volatile Organic Compounds										
Benzene	ND			5.5E-02	4.0E-03					
Total Petroleum Hydrocarbons										
TPH-DRO	ND			NA	1.0E-02					
TPH-ORO	ND			NA	4.0E-02					
				Total Cancer Risk:		0.0E+00	**Hazard Index:**	8.4E-02		
				Highest Contributor:				Barium (41%)		

Notes:

Intake Factor (IF) = $\frac{IR\text{-}G \times EF \times ED}{BW \times AT}$	=	3.3E-03 (Cancer)	8.9E-03 (Non-cancer)

IR-G	Ingestion Rate (L/d)	2.5
EF	Ingestion Exposure Frequency (d/yr)	104
ED	Ingestion Exposure Duration (yrs)	26
BW	Body Weight (kg)	80
AT	Averaging Time - Cancer (d)	25,550
	Averaging Time - Non-cancer (d)	9,490

Target Organ Specific Hazard Index (with TPH-Range Data):

Bone	8.5E-03
Central Nervous System	2.7E-02
Gastrointestinal	1.4E-02
Kidney	3.5E-02

DI (mg/kg-d) = EPC x IF

DRO = Diesel-Range Organic; EPC = Exposure Point Concentration; ND = Not Detected; NA = Not Available/Not Applicable; ND = Not Detected; ORO = Oil-Range Organic; TPH = Total Petroleum Hydrocarbon.

Table B.7 Excess Lifetime Cancer Risk and Non-cancer Hazard by Chemical and Pathway for Adult Recreator – Groundwater Inhalation (Maximum Concentrations from All Temporary and Permanent Wells Excluding the Peat Zone)

With TPH-Fraction Data

Constituent of Concern	Groundwater EPC (mg/L)	Volatilized Concentration (mg/m^3)	Daily Exposure: Cancer (DE_c) ($\mu g/m^3$)	Daily Exposure: Non-cancer (DE_{nc}) (mg/m^3)	Inhalation Unit Risk (IUR) $(\mu g/m^3)^{-1}$	Reference Concentration (RfC) (mg/m^3)	Cancer Risk $CR = DE_c \times SF$	Percentage Contribution to Total Cancer Risk	Hazard Quotient $HQ = DE_{nc} \div RfD$	Percentage Contribution to Total Non-cancer Hazard	Non-Cancer RfC Endpoint
Metals											
Arsenic	2.8E-02	NA	NA	NA	4.3E-03	1.5E-05	NA		NA		
Barium	1.4E+01	NA	NA	NA	NA	5.0E-04	NA		NA		
Chromium	3.3E-01	NA	NA	NA	NA	NA	NA		NA		
Iron	8.3E+01	NA	NA	NA	NA	NA	NA		NA		
Lead	3.4E-02	NA	NA	NA	NA	NA	NA		NA		
Manganese	3.0E+00	NA	NA	NA	NA	5.0E-05	NA		NA		
Selenium	8.9E-02	NA	NA	NA	NA	2.0E-02	NA		NA		
Strontium	1.3E+01	NA	NA	NA	NA	NA	NA		NA		
VOCs											
Benzene	2.8E-02	1.4E-02	1.2E-01	3.3E-04	7.8E-06	3.0E-02	9.6E-07	100%	1.1E-02	100%	Blood
Total Petroleum Hydrocarbons											
Aliphatic >C10-C12	ND				NA	1.0E-01					
Aliphatic >C12-C16	ND				NA	1.0E-01					
Aliphatic >C16-C35	ND				NA	NA					
Aromatic >C10-C12	ND				NA	1.0E-01					
Aromatic >C12-C16	ND				NA	1.0E-01					
Aromatic >C16-C21	ND				NA	NA					
Aromatic >C21-C35	ND				NA	NA					

Total Cancer Risk: 9.6E-07 **Hazard Index:** 1.1E-02

Highest Contributor: Benzene (100%) Benzene (100%)

Target Organ Specific Hazard Index (with TPH-Fraction Data):

Blood 1.1E-02

With TPH-Range Data

Constituent of Concern	Groundwater EPC (mg/L)	Volatilized Concentration (mg/m^3)	Daily Exposure: Cancer (DE_c) ($\mu g/m^3$)	Daily Exposure: Non-cancer (DE_{nc}) (mg/m^3)	Inhalation Unit Risk (IUR) $(\mu g/m^3)^{-1}$	Reference Concentration (RfC) (mg/m^3)	Cancer Risk $CR = DE_c \times SF$	Percentage Contribution to Total Cancer Risk	Hazard Quotient $HQ = DE_{nc} \div RfD$	Percentage Contribution to Total Non-cancer Hazard	Non-Cancer RfC Endpoint
Metals											
Arsenic	2.8E-02	NA	NA	NA	4.3E-03	1.5E-05	NA		NA		
Barium	1.4E+01	NA	NA	NA	NA	5.0E-04	NA		NA		
Chromium	3.3E-01	NA	NA	NA	NA	NA	NA		NA		
Iron	8.3E+01	NA	NA	NA	NA	NA	NA		NA		
Lead	3.4E-02	NA	NA	NA	NA	NA	NA		NA		
Manganese	3.0E+00	NA	NA	NA	NA	5.0E-05	NA		NA		
Selenium	8.9E-02	NA	NA	NA	NA	2.0E-02	NA		NA		
Strontium	1.3E+01	NA	NA	NA	NA	NA	NA		NA		
Volatile Organic Compounds											
Benzene	2.8E-02	1.4E-02	1.2E-01	3.3E-04	7.8E-06	3.0E-02	9.6E-07	100%	1.1E-02	100%	Blood
Total Petroleum Hydrocarbons											
TPH-DRO	8.4E-01	NA	NA	NA	NA	1.0E-01	NA		NA		
TPH-ORO	4.5E-01	NA	NA	NA	NA	NA	NA		NA		
						Total Cancer Risk:	9.6E-07	**Hazard Index:**	1.1E-02		
						Highest Contributor:	Benzene (100%)		Benzene (100%)		

Notes:

Target Organ Specific Hazard Index (with TPH-Range Data):

Blood	1.1E-02

$$\text{Intake Factor (IF)} = \frac{EF \times ED \times ET \times CF1 \times CF2}{AT}$$

=	8.8E+00 (Cancer)	2.4E-02 (Non-cancer)

EF	Inhalation Exposure Frequency (d/yr)	104
ED	Inhalation Exposure Duration (yrs)	26
ET	Inhalation Exposure Time (hr/d)	2
CF1	Conversion Factor (µg/mg)	1000
CF2	Conversion Factor (d/hr)	0.042
AT	Averaging Time - Cancer (d)	25,550
	Averaging Time - Non-cancer (d)	9,490

DRO = Diesel-Range Organic; EPC = Exposure Point Concentration; ND = Not Detected; NA = Not Available/Not Applicable; ORO = Oil-Range Organic; TPH = Total Petroleum Hydrocarbon.

Volatilized Concentration (mg/m^3) = Groundwater EPC (mg/L) x Andelman Volatilization Factor (L/m^3)

DE = Volatilization Concentration x IF

Table B.8 Excess Lifetime Cancer Risk and Non-cancer Hazard by Chemical and Pathway for Adult Recreator – Fish/Shellfish Ingestion (Based on 30 g/day and Adjusted for Body Weight – 100% Collected from the Site)

Constituent of Concern	Crab EPC (mg/kg)	Daily Intake: Cancer (DI_c) (mg/kg-d)	Daily Intake: Non-cancer (DI_{nc}) (mg/kg-d)	Cancer Slope Factor (SF) $(mg/kg\text{-}d)^{-1}$	Reference Dose (RfD) (mg/kg-d)	Cancer Risk $CR = DI_c \times SF$	Percentage Contribution to Total Cancer Risk	Hazard Quotient $HQ = DI_{nc} \div RfD$	Percentage Contribution to Total Non-cancer Hazard	Non-cancer RfD Endpoint
Metals										
Inorganic Arsenic	1.3E-02	2.1E-06	5.7E-06	1.5E+00	3.0E-04	3.2E-06	100%	1.9E-02	2%	Skin
Methyl Mercury	4.2E-02	6.7E-06	1.8E-05	NA	1.0E-04	NA		1.8E-01	16%	Central Nervous System
Mercury	6.7E-02	1.1E-05	2.9E-05	NA	3.0E-04	NA		9.5E-02	8%	Immunological
Total Petroleum Hydrocarbons (Assuming 50% Aliphatics + 50% Aromatics)										
TPH (C08-C16)	1.8E+01									
Aliphatic	9.2E+00	1.5E-03	3.9E-03	NA	1.0E-02	NA		3.9E-01	34%	Liver
Aromatic	9.2E+00	1.5E-03	3.9E-03	NA	3.0E-02	NA		1.3E-01	11%	Blood
TPH (C16-C28)	6.3E+01									
Aliphatic	3.1E+01	5.0E-03	1.3E-02	NA	3.0E+00	NA		4.5E-03	<1%	Liver
Aromatic	3.1E+01	5.0E-03	1.3E-02	NA	4.0E-02	NA		3.4E-01	29%	Liver
				Total Cancer Risk:		3.2E-06	**Hazard Index:**	1.2E+00		
				Highest Contributor:		Inorganic Arsenic (100%)		TPH (C08-C16) (45%)		

Notes:

$$\text{Intake Factor (IF)} = \frac{\text{IR-F} \times \text{EF} \times \text{ED} \times \text{CF}}{\text{BW} \times \text{AT}} = \begin{array}{c|c} 1.6\text{E-}04 & 4.3\text{E-}04 \\ \text{(Cancer)} & \text{(Non-cancer)} \end{array}$$

IR-F	Fish/Shellfish Ingestion Rate (mg/d)	34,286	Based on 30 g/d for 365 d/yr and adjusted for body weight (LDHH *et al* ., 2012).
EF	Fish/Shellfish Ingestion Exposure Frequency (d/yr)	365	
ED	Fish/Shellfish Ingestion Exposure Duration (yrs)	26	
CF	Conversion Factor (kg/mg)	0.000001	
BW	Body Weight (kg)	80	
AT	Averaging Time - Cancer (d)	25,550	
	Averaging Time - Non-cancer (d)	9,490	

Target Organ Specific Hazard Index:	
Blood	1.3E-01
Central Nervous System	1.8E-01
Immunological	9.5E-02
Liver	7.3E-01
Skin	1.9E-02

EPC = Exposure Point Concentration; HI = Hazard Index; NA = Not Available/Not Applicable; TPH = Total Petroleum Hydrocarbon.

DI (mg/kg-d) = EPC x IF

Appendix C

Risk Assessment Calculations for Sensitivity Analyses

List of Tables

Table C.14 Excess Lifetime Cancer Risk and Non-cancer Hazard by Chemical and Pathway for Adult Recreator – Fish/Shellfish Ingestion (Based on 45 g/day and Adjusted for Body Weight – 100% Collected from the Site)

Table C.1 Estimated Cancer and Non-cancer Risks – Sensitivity Analysis

Adolescent Recreator

Exposure Pathway	Cancer Risk	Percent Contribution	COC Contributing Majority of Risk by Pathway (% Contribution)	Non-cancer Hazard	Percentage Contribution	COC Contributing Majority of Hazard by Pathway (% Contribution)
Incidental Ingestion of Soil/Sediment	1.1E-07	7.7%	Arsenic (100%)	4.4E-02	2.7%	Aliphatic >C12-C16 (59%)
Dermal Contact with Soil/Sediment	1.1E-07	8.1%	Arsenic (100%)	1.6E-02	<1%	Aromatic >C21-C35 (48%)
Dermal Contact with Surface Water	9.1E-08	6.6%	Arsenic (100%)	6.7E-02	4.1%	Manganese (87%)
Dermal Contact with Groundwater	2.7E-07	19%	Arsenic (59%)	2.4E-01	14.5%	Manganese (69%)
Ingestion of Groundwater	0.0E+00			9.4E-02	5.7%	Barium (41%)
Inhalation of Volatiles in Groundwater	1.9E-07	14%	Benzene (100%)	1.1E-02	<1%	Benzene (100%)
Ingestion of Fish/Shellfish	6.1E-07	44.6%	Inorganic Arsenic (100%)	1.2E+00	71%	TPH (C08-C16) (45%)
Total Cancer Risk (ELCR):	1E-06		**Total Hazard Index:**	2E+00		

Adolescent Recreator – Target Organ Hazard Index (TOSHI)

Endpoint	Incidental Ingestion of Soil/SD	Dermal Contact with Soil/SD	Dermal Contact with SW	Dermal Contact with GW	Ingestion of GW	Inhalation of GW	Ingestion of Fish/Shellfish	Total
Skin	3.3E-03	3.4E-03	3.3E-03	5.8E-03			1.9E-02	**3E-02**
Kidney	3.0E-03	0.0E+00	4.4E-03	5.3E-02	3.9E-02			**1E-01**
Gastrointestinal			9.8E-04	6.2E-03	1.5E-02			**2E-02**
Central Nervous System			5.8E-02	1.6E-01	3.0E-02		1.8E-01	**4E-01**
Bone			1.9E-04	1.1E-03	9.4E-03			**1E-02**
Blood	1.6E-03			6.9E-03		1.1E-02	1.3E-01	**2E-01**
Liver	3.5E-02	1.2E-02	0.0E+00	0.0E+00			7.3E-01	**8E-01**
Immunological	8.6E-04	0.0E+00					9.5E-02	**1E-01**
None Reported				8.9E-04				**9E-04**
Total:	**4.4E-02**	**1.6E-02**	**6.7E-02**	**2.4E-01**	**9.4E-02**	**1.1E-02**	**1.2E+00**	

Table C.2 Excess Lifetime Cancer Risk and Non-cancer Hazard by Chemical and Pathway for Adolescent Recreator – Incidental Ingestion of Soil/Sediment

Constituent of Concern	Soil/ Sediment EPC (mg/kg)	Oral Bioavailability (B) (Unitless)	Daily Intake: Cancer (DI_c) (mg/kg-d)	Daily Intake: Non-cancer (DI_{nc}) (mg/kg-d)	Cancer Slope Factor (SF) $(mg/kg\text{-}d)^{-1}$	Reference Dose (RfD) (mg/kg-d)	Cancer Risk $CR = DI_c \times SF$	Percentage Contribution to Total Cancer Risk	Hazard Quotient $HQ = DI_{nc} \div RfD$	Percentage Contribution to Total Non-cancer Hazard	Non-cancer RfD Endpoint
Metals											
Arsenic	6.5E+00	6.0E-01	7.0E-08	9.8E-07	1.5E+00	3.0E-04	1.1E-07	100%	3.3E-03	7.5%	Skin
Barium	2.4E+03	1.0E+00	4.3E-05	6.1E-04	NA	2.0E-01	NA		3.0E-03	6.9%	Kidney
Mercury	1.0E+00	1.0E+00	1.8E-08	2.6E-07	NA	3.0E-04	NA		8.6E-04	2.0%	Immunological
Total Petroleum Hydrocarbons											
Aliphatic >C10-C12	1.2E+02	1.0E+00	2.2E-06	3.1E-05	NA	1.0E-02	NA		3.1E-03	7.0%	Liver
Aliphatic >C12-C16	1.0E+03	1.0E+00	1.8E-05	2.6E-04	NA	1.0E-02	NA		2.6E-02	59%	Liver
Aliphatic >C16-C35	4.3E+03	1.0E+00	7.7E-05	1.1E-03	NA	3.0E+00	NA		3.6E-04	<1%	Liver
Aromatic >C10-C12	2.6E+01	1.0E+00	4.7E-07	6.6E-06	NA	3.0E-02	NA		2.2E-04	<1%	Blood
Aromatic >C12-C16	1.6E+02	1.0E+00	3.0E-06	4.1E-05	NA	3.0E-02	NA		1.4E-03	3.1%	Blood
Aromatic >C16-C21	3.7E+02	1.0E+00	6.6E-06	9.2E-05	NA	4.0E-02	NA		2.3E-03	5.3%	Liver
Aromatic >C21-C35	5.7E+02	1.0E+00	1.0E-05	1.4E-04	NA	4.0E-02	NA		3.6E-03	8.2%	Liver
						Total Cancer Risk:	1.1E-07	**Hazard Index:**	4.4E-02		
						Highest Contributor:	Arsenic (100%)		Aliphatic >C12-C16 (59%)		

Notes:

Intake Factor (IF) =	$\frac{IR \times FR \times EF \times ED \times CF}{BW \times AT}$	=	1.8E-08 (Cancer)	2.5E-07 (Non-cancer)
IR	Ingestion Rate (mg/d)			50
FR	Fraction from Site			1
EF	Ingestion Exposure Frequency (d/yr)			104
ED	Ingestion Exposure Duration (yrs)			5
CF	Conversion Factor (kg/mg)			0.000001
BW	Body Weight (kg)			57
AT	Averaging Time - Cancer (d)			25,550
	Averaging Time - Non-cancer (d)			1,825

Target Organ Specific Hazard Index:	
Blood	1.6E-03
Immunological	8.6E-04
Kidney	3.0E-03
Liver	3.5E-02
Skin	3.3E-03

DI (mg/kg-d) = EPC x B x IF

EPC = Exposure Point Concentration; NA = Not Available/Not Applicable; UCLM = Upper Confidence Limit on the Mean.

The 95% UCLM was used as the EPC, except when the UCLM is greater than the maximum, in which case, the maximum was used.

Table C.2 Excess Lifetime Cancer Risk and Non-cancer Hazard by Chemical and Pathway for Adolescent Recreator – Incidental Ingestion of Soil/Sediment

Constituent of Concern	Soil/ Sediment EPC (mg/kg)	Oral Bioavailability (B) (Unitless)	Daily Intake: Cancer (DI_c) (mg/kg-d)	Daily Intake: Non-cancer (DI_{nc}) (mg/kg-d)	Cancer Slope Factor (SF) $(mg/kg\text{-}d)^{-1}$	Reference Dose (RfD) (mg/kg-d)	Cancer Risk $CR = DI_c \times SF$	Percentage Contribution to Total Cancer Risk	Hazard Quotient $HQ = DI_{nc} \div RfD$	Percentage Contribution to Total Non-cancer Hazard	Non-cancer RfD Endpoint
Metals											
Arsenic	6.5E+00	6.0E-01	7.0E-08	9.8E-07	1.5E+00	3.0E-04	1.1E-07	100%	3.3E-03	7.5%	Skin
Barium	2.4E+03	1.0E+00	4.3E-05	6.1E-04	NA	2.0E-01	NA		3.0E-03	6.9%	Kidney
Mercury	1.0E+00	1.0E+00	1.8E-08	2.6E-07	NA	3.0E-04	NA		8.6E-04	2.0%	Immunological
Total Petroleum Hydrocarbons											
Aliphatic >C10-C12	1.2E+02	1.0E+00	2.2E-06	3.1E-05	NA	1.0E-02	NA		3.1E-03	7.0%	Liver
Aliphatic >C12-C16	1.0E+03	1.0E+00	1.8E-05	2.6E-04	NA	1.0E-02	NA		2.6E-02	59%	Liver
Aliphatic >C16-C35	4.3E+03	1.0E+00	7.7E-05	1.1E-03	NA	3.0E+00	NA		3.6E-04	<1%	Liver
Aromatic >C10-C12	2.6E+01	1.0E+00	4.7E-07	6.6E-06	NA	3.0E-02	NA		2.2E-04	<1%	Blood
Aromatic >C12-C16	1.6E+02	1.0E+00	3.0E-06	4.1E-05	NA	3.0E-02	NA		1.4E-03	3.1%	Blood
Aromatic >C16-C21	3.7E+02	1.0E+00	6.6E-06	9.2E-05	NA	4.0E-02	NA		2.3E-03	5.3%	Liver
Aromatic >C21-C35	5.7E+02	1.0E+00	1.0E-05	1.4E-04	NA	4.0E-02	NA		3.6E-03	8.2%	Liver
						Total Cancer Risk:	1.1E-07	**Hazard Index:**	4.4E-02		
						Highest Contributor:	Arsenic (100%)		Aliphatic >C12-C16 (59%)		

Notes:

Intake Factor (IF) =	$\frac{IR \times FR \times EF \times ED \times CF}{BW \times AT}$	=	1.8E-08 (Cancer)	2.5E-07 (Non-cancer)
IR	Ingestion Rate (mg/d)			50
FR	Fraction from Site			1
EF	Ingestion Exposure Frequency (d/yr)			104
ED	Ingestion Exposure Duration (yrs)			5
CF	Conversion Factor (kg/mg)			0.000001
BW	Body Weight (kg)			57
AT	Averaging Time - Cancer (d)			25,550
	Averaging Time - Non-cancer (d)			1,825

Target Organ Specific Hazard Index:	
Blood	1.6E-03
Immunological	8.6E-04
Kidney	3.0E-03
Liver	3.5E-02
Skin	3.3E-03

DI (mg/kg-d) = EPC x B x IF

EPC = Exposure Point Concentration; NA = Not Available/Not Applicable; UCLM = Upper Confidence Limit on the Mean.

The 95% UCLM was used as the EPC, except when the UCLM is greater than the maximum, in which case, the maximum was used.

Table C.3 Excess Lifetime Cancer Risk and Non-cancer Hazard by Chemical and Pathway for Adolescent Recreator – Dermal Contact with Soil/Sediment

Constituent of Concern	Soil/ Sediment EPC (mg/kg)	Dermal Absorption Fraction (ABS) (Unitless)	Daily Intake: Cancer (DI_c) (mg/kg-d)	Daily Intake: Non-cancer (DI_{nc}) (mg/kg-d)	Cancer Slope Factor (SF) $(mg/kg\text{-}d)^{-1}$	Reference Dose (RfD) (mg/kg-d)	Cancer Risk $CR = DI_c \times SF$	Percentage Contribution to Total Cancer Risk	Hazard Quotient $HQ = DI_{nc} \div RfD$	Percentage Contribution to Total Non-cancer Hazard	Non-Cancer RfD Endpoint
Metals											
Arsenic	6.5E+00	3.0E-02	7.4E-08	1.0E-06	1.5E+00	3.0E-04	1.1E-07	100.0%	3.4E-03	21.7%	Skin
Barium	2.4E+03	NA	NA	NA	NA	1.4E-02	NA		NA		Kidney
Mercury	1.0E+00	NA	NA	NA	NA	2.1E-05	NA		NA		Immunological
Total Petroleum Hydrocarbons											
Aliphatic >C10-C12	1.2E+02	NA	NA	NA	NA	1.0E-02	NA		NA		Liver
Aliphatic >C12-C16	1.0E+03	NA	NA	NA	NA	1.0E-02	NA		NA		Liver
Aliphatic >C16-C35	4.3E+03	NA	NA	NA	NA	3.0E+00	NA		NA		Liver
Aromatic >C10-C12	2.6E+01	NA	NA	NA	NA	3.0E-02	NA		NA		Blood
Aromatic >C12-C16	1.6E+02	NA	NA	NA	NA	3.0E-02	NA		NA		Blood
Aromatic >C16-C21	3.7E+02	1.0E-01	1.4E-05	1.9E-04	NA	4.0E-02	NA		4.8E-03	30.5%	Liver
Aromatic >C21-C35	5.7E+02	1.0E-01	2.2E-05	3.0E-04	NA	4.0E-02	NA		7.5E-03	47.7%	Liver
						Total Cancer Risk:	1.1E-07	**Hazard Index:**	1.6E-02		
						Highest Contributor:	Arsenic (100%)		Aromatic >C21-C35 (48%)		

Notes:

$$\text{Intake Factor (IF)} = \frac{SA \times AF \times EF \times ED \times CF}{BW \times AT} = \begin{matrix} 3.8E\text{-}07 \text{ (Cancer)} \\ 5.3E\text{-}06 \text{ (Non-cancer)} \end{matrix}$$

SA	Surface Area Exposed to Soil/Sediment (cm^2/d)	5,240
AF	Skin Adherence Factor (mg/cm^2)	0.2
EF	Dermal Exposure Frequency (d/yr)	104
ED	Dermal Exposure Duration (yrs)	5
CF	Conversion Factor (kg/mg)	0.000001
BW	Body Weight (kg)	57
AT	Averaging Time - Cancer (d)	25,550
	Averaging Time - Non-cancer (d)	1,825

Target Organ Specific Hazard Index:

Immunological	0.0E+00
Kidney	0.0E+00
Liver	1.2E-02
Skin	3.4E-03

DI (mg/kg-d) = EPC x ABS x IF

EPC = Exposure Point Concentration; NA = Not Available/Not Applicable; UCLM = Upper Confidence Limit on the Mean.

The 95% UCLM was used as the EPC, except when the UCLM is greater than the maximum, in which case, the maximum was used.

Table C.4 Excess Lifetime Cancer Risk and Non-cancer Hazard by Chemical and Pathway for Adolescent Recreator – Dermal Contact with Surface Water

Constituent of Concern	Absorbed Dose (DA) (mg/cm^2-event)	Dermally Absorbed Dose: Cancer (DAD_c) (mg/kg-d)	Dermally Absorbed Dose: Non-cancer (DAD_{nc}) (mg/kg-d)	Cancer Slope Factor (SF) $(mg/kg\text{-}d)^{-1}$	Reference Dose (RfD) (mg/kg-d)	Cancer Risk $CR = DAD_c \times SF$	Percentage Contribution to Total Cancer Risk	Hazard Quotient $HQ = DAD_{nc} \div RfD$	Percentage Contribution to Total Non-cancer Hazard	Non-Cancer RfD Endpoint
Metals										
Arsenic	3.2E-08	6.1E-08	8.5E-07	1.5E+00	3.0E-04	9.1E-08	100%	2.8E-03	4.2%	Skin
Barium	2.3E-06	4.4E-06	6.2E-05	NA	1.4E-02	NA		4.4E-03	6.5%	Kidney
Iron	2.6E-05	4.9E-05	6.8E-04	NA	7.0E-01	NA		9.8E-04	1.5%	Gastrointestinal
Lead	8.4E-09	1.6E-08	2.2E-07	NA	NA	NA		NA		NA
Manganese	2.1E-06	4.0E-06	5.6E-05	NA	9.6E-04	NA		5.8E-02	87%	Central Nervous System
Selenium	8.8E-08	1.7E-07	2.3E-06	NA	5.0E-03	NA		4.6E-04	<1%	Skin
Strontium	4.3E-06	8.0E-06	1.1E-04	NA	6.0E-01	NA		1.9E-04	<1%	Bone
TPH										
TPH-DRO	NA	NA	NA	NA	1.0E-02	NA		NA		Liver
TPH-ORO	NA	NA	NA	NA	4.0E-02	NA		NA		Liver
				Total Cancer Risk:		9.1E-08	**Hazard Index:**	6.7E-02		
				Highest Contributor:		Arsenic (100%)		Manganese (87%)		

Notes:

Intake Factor (IF) = $\frac{SA \times EF \times ED \times EV}{BW \times AT}$	=	1.9E+00 (Cancer)	2.6E+01 (Non-cancer)

SA	Surface Area Exposed to Surface water (cm^2)	5,240
EF	Exposure Frequency (d/yr)	104
ED	Exposure Duration (yr)	5
BW	Body Weight (kg)	57
EV	Events per day (event/d)	1.0
AT	Averaging Time - Cancer (d)	25,550
	Averaging Time - Non-cancer (d)	1,825

Target Organ Specific Hazard Index:

Bone	1.9E-04
Central Nervous System	5.8E-02
Gastrointestinal	9.8E-04
Kidney	4.4E-03
Liver	0.0E+00
Skin	3.3E-03

DAD (mg/kg-d) = DA x IF

DRO = Diesel-Range Organic; ORO = Oil-Range Organic; TPH = Total Petroleum Hydrocarbon; US EPA = United States Environmental Protection Agency.

The dermal exposure route for lead was not evaluated because this exposure route is typically insignificant. US EPA's Adult Lead Model (ALM) makes no provision for assessing dermal exposures (US EPA, 1996).

TPH-DRO and TPH-ORO are outside the Effective Predictive Domain and therefore could not be evaluated using US EPA (2004) Dermal Guidance.

Table C.5 Excess Lifetime Cancer Risk and Non-cancer Hazard by Chemical and Pathway for Adolescent Recreator – Dermal Contact with Groundwater (Maximum Concentrations from All Temporary and Permanent Wells Excluding the Peat Zone)

Constituent of Concern	Absorbed Dose (DA) (mg/cm^2-event)	Dermally Absorbed Dose: Cancer (DAD_c) (mg/kg-d)	Dermally Absorbed Dose: Non-cancer (DAD_{nc}) (mg/kg-d)	Cancer Slope Factor (SF) $(mg/kg\text{-}d)^{-1}$	Reference Dose (RfD) (mg/kg-d)	Cancer Risk $CR = DAD_c \times SF$	Percentage Contribution to Total Cancer Risk	Hazard Quotient $HQ = DAD_{nc} \div RfD$	Percentage Contribution to Total Non-cancer Hazard	Non-Cancer RfD Endpoint
Metals										
Arsenic	5.6E-08	1.1E-07	1.5E-06	1.5E+00	3.0E-04	1.6E-07	59%	4.9E-03	2.1%	Skin
Barium	2.8E-05	5.3E-05	7.5E-04	NA	1.4E-02	NA		5.3E-02	23%	Kidney
Chromium	6.6E-07	1.2E-06	1.7E-05	NA	2.0E-02	NA		8.9E-04	<1%	None Reported
Iron	1.7E-04	3.1E-04	4.4E-03	NA	7.0E-01	NA		6.2E-03	2.6%	Gastrointestinal
Lead	6.7E-09	1.3E-08	1.8E-07	NA	NA	NA		NA		NA
Manganese	5.9E-06	1.1E-05	1.6E-04	NA	9.6E-04	NA		1.6E-01	69%	Central Nervous System
Selenium	1.8E-07	3.3E-07	4.7E-06	NA	5.0E-03	NA		9.4E-04	<1%	Skin
Strontium	2.5E-05	4.8E-05	6.7E-04	NA	6.0E-01	NA		1.1E-03	<1%	Bone
Volatile Organic Compounds										
Benzene	1.1E-06	2.0E-06	2.8E-05	5.5E-02	4.0E-03	1.1E-07	41%	6.9E-03	3%	Blood
Total Petroleum Hydrocarbons										
Aliphatic >C10-C12	ND									
Aliphatic >C12-C16	ND									
Aliphatic >C16-C35	ND									
Aromatic >C10-C12	ND									
Aromatic >C12-C16	ND									
Aromatic >C16-C21	ND									
Aromatic >C21-C35	ND									
					Total Cancer Risk:	2.7E-07	**Hazard Index:**	2.4E-01		
					Highest Contributor:	Arsenic (59%)		Manganese (69%)		

Notes:

$$\text{Intake Factor (IF)} = \frac{SA \times EF \times ED \times EV}{BW \times AT}$$

	1.9E+00 (Cancer)	2.6E+01 (Non-cancer)
SA	Surface Area Exposed to Ground water (cm^2)	5,240
EF	Exposure Frequency (d/yr)	104
ED	Exposure Duration (yr)	5
BW	Body Weight (kg)	57
CF	Events per day (event/d)	1.0
AT	Averaging Time - Cancer (d)	25,550
	Averaging Time - Non-cancer (d)	1,825
ET	Exposure Time (hr/d)	2.0

Target Organ Specific Hazard Index:	
Blood	6.9E-03
Bone	1.1E-03
Central Nervous System	1.6E-01
Gastrointestinal	6.2E-03
Kidney	5.3E-02
Liver	0.0E+00
None Reported	8.9E-04
Skin	5.8E-03

DAD (mg/kg-d) = DA x IF

NA = Not Available/Not Applicable; ND = Not Detected; US EPA = United States Environmental Protection Agency.

The dermal exposure route for lead was not evaluated because this exposure route is typically insignificant. US EPA's Adult Lead Model (ALM) makes no provision for assessing dermal exposures (US EPA, 1996).

Table C.6 Excess Lifetime Cancer Risk and Non-cancer Hazard by Chemical and Pathway for Adolescent Recreator – Groundwater Ingestion (Maximum Concentrations from the J. Guidry Well)

Constituent of Concern	Groundwater EPC (mg/L)	Daily Intake: Cancer (DI_c) (mg/kg-d)	Daily Intake: Non-cancer (DI_{nc}) (mg/kg-d)	Cancer Slope Factor (SF) $(mg/kg\text{-}d)^{-1}$	Reference Dose (RfD) (mg/kg-d)	Cancer Risk $CR = DI_c \times SF$	Percentage Contribution to Total Cancer Risk	Hazard Quotient $HQ = DI_{nc} \div RfD$	Percentage Contribution to Total Non-cancer Hazard	Non-Cancer RfD Endpoint
Metals										
Arsenic	ND			1.5E+00	3.0E-04					
Barium	7.8E-01	5.5E-04	7.7E-03	NA	2.0E-01	NA		3.9E-02	41%	Kidney
Chromium	ND			NA	1.5E+00					
Iron	1.1E+00	7.6E-04	1.1E-02	NA	7.0E-01	NA		1.5E-02	16%	Gastrointestinal
Lead	ND			NA	NA					
Manganese	7.3E-02	5.2E-05	7.2E-04	NA	2.4E-02	NA		3.0E-02	32%	Central Nervous System
Selenium	ND			NA	5.0E-03					
Strontium	5.7E-01	4.0E-04	5.7E-03	NA	6.0E-01	NA		9.4E-03	10%	Bone
Volatile Organic Compounds										
Benzene	ND									
Total Petroleum Hydrocarbons										
Aliphatic >C10-C12	ND									
Aliphatic >C12-C16	ND									
Aliphatic >C16-C35	ND									
Aromatic >C10-C12	ND									
Aromatic >C12-C16	ND									
Aromatic >C16-C21	ND									
Aromatic >C21-C35	ND									
				Total Cancer Risk:		0.0E+00	**Hazard Index:**	9.4E-02		
				Highest Contributor:				Barium (41%)		

Notes:

$$\text{Intake Factor (IF)} = \frac{\text{IR-G} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT}}$$

	Cancer	Non-cancer
=	7.1E-04	9.9E-03

IR-G	Ingestion Rate (L/d)	1.976
EF	Ingestion Exposure Frequency (d/yr)	104
ED	Ingestion Exposure Duration (yrs)	5
BW	Body Weight (kg)	56.8
AT	Averaging Time - Cancer (d)	25,550
	Averaging Time - Non-cancer (d)	1,825

Target Organ Specific Hazard Index:

Bone	9.4E-03
Central Nervous System	3.0E-02
Gastrointestinal	1.5E-02
Kidney	3.9E-02

DI (mg/kg-d) = EPC x IF

EPC = Exposure Point Concentration; NA = Not Available/Not Applicable; ND = Not Detected.

Table C.7 Excess Lifetime Cancer Risk and Non-cancer Hazard by Chemical and Pathway for Adolescent Recreator – Inhalation of Volatiles in Groundwater (Maximum Concentrations from All Temporary and Permanent Wells Excluding the Peat Zone)

Constituent of Concern	Groundwater EPC (mg/L)	Volatilized Concentration (mg/m^3)	Daily Exposure: Cancer (DE_c) ($\mu g/m^3$)	Daily Exposure: Non-cancer (DE_{nc}) (mg/m^3)	Inhalation Unit Risk (IUR) $(\mu g/m^3)^{-1}$	Reference Concentration (RfC) (mg/m^3)	Cancer Risk $CR = DE_c \times SF$	Percentage Contribution to Total Cancer Risk	Hazard Quotient $HQ = DE_{nc} \div RfD$	Percentage Contribution to Total Non-cancer Hazard	Non-Cancer RfC Endpoint
Metals											
Arsenic	2.8E-02	NA	NA	NA	4.3E-03	1.5E-05	NA		NA		
Barium	1.4E+01	NA	NA	NA	NA	5.0E-04	NA		NA		
Chromium	3.3E-01	NA	NA	NA	NA	NA	NA		NA		
Iron	8.3E+01	NA	NA	NA	NA	NA	NA		NA		
Lead	3.4E-02	NA	NA	NA	NA	NA	NA		NA		
Manganese	3.0E+00	NA	NA	NA	NA	5.0E-05	NA		NA		
Selenium	8.9E-02	NA	NA	NA	NA	2.0E-02	NA		NA		
Strontium	1.3E+01	NA	NA	NA	NA	NA	NA		NA		
Volatile Organic Compounds											
Benzene	2.8E-02	1.4E-02	2.4E-02	3.3E-04	7.8E-06	3.0E-02	1.9E-07	100%	1.1E-02	100%	Blood
Total Petroleum Hydrocarbons											
Aliphatic >C10-C12	ND										
Aliphatic >C12-C16	ND										
Aliphatic >C16-C35	ND										
Aromatic >C10-C12	ND										
Aromatic >C12-C16	ND										
Aromatic >C16-C21	ND										
Aromatic >C21-C35	ND										

Total Cancer Risk: 1.9E-07 **Hazard Index:** 1.1E-02

Highest Contributor: Benzene (100%) Benzene (100%)

Notes:

Intake Factor (IF) = $\frac{EF \times ED \times CF}{AT}$ =	1.7E+00 (Cancer)	2.4E-02 (Non-cancer)

EF	Inhalation Exposure Frequency (d/yr)	104
ED	Inhalation Exposure Duration (yrs)	5
ET	Inhalation Exposure Time (hr/d)	2
CF1	Conversion Factor (d/hr)	0.042
CF	Conversion Factor (µg/mg)	1000
AT	Averaging Time - Cancer (d)	25,550
	Averaging Time - Non-cancer (d)	1,825

Target Organ Specific Hazard Index:

Blood 1.1E-02

Volatilized Concentration (mg/m^3) = Groundwater EPC (mg/L) x Andelman Volatilization Factor (L/m^3)

DE = Volatilization Concentration x IF

EPC = Exposure Point Concentration; NA = Not Available/Not Applicable; ND = Not Detected.

Table C.8 Excess Lifetime Cancer Risk and Non-cancer Hazard by Chemical and Pathway for Adolescent Recreator – Fish/Shellfish Ingestion (Based on 30 g/day and Adjusted for Body Weight – 100% Collected from the Site)

Constituent of Concern	Crab EPC (mg/kg)	Daily Intake: Cancer (DI_c) (mg/kg-d)	Daily Intake: Non-cancer (DI_{nc}) (mg/kg-d)	Cancer Slope Factor (SF) $(mg/kg\text{-}d)^{-1}$	Reference Dose (RfD) (mg/kg-d)	Cancer Risk $CR = DI_c \times SF$	Percent Contribution to Total Cancer Risk	Hazard Quotient $HQ = DI_{nc} \div RfD$	Percentage Contribution to Total Non-cancer Hazard	Non-Cancer RfD Endpoint
Metals										
Inorganic Arsenic	1.3E-02	4.1E-07	5.7E-06	1.5E+00	3.0E-04	6.1E-07	100%	1.9E-02	2%	Skin
Methyl Mercury	4.2E-02	1.3E-06	1.8E-05	NA	1.0E-04	NA		1.8E-01	16%	Central Nervous System
Mercury	6.7E-02	2.0E-06	2.9E-05	NA	3.0E-04	NA		9.5E-02	8%	Immunological
Total Petroleum Hydrocarbons (Assuming 50% Aliphatics + 50% Aromatics)										
TPH (C08-C16)	1.8E+01									
Aliphatic	9.2E+00	2.8E-04	3.9E-03	NA	1.0E-02	NA		3.9E-01	34%	Liver
Aromatic	9.2E+00	2.8E-04	3.9E-03	NA	3.0E-02	NA		1.3E-01	11%	Blood
TPH (C16-C28)	6.3E+01									
Aliphatic	3.1E+01	9.6E-04	1.3E-02	NA	3.0E+00	NA		4.5E-03	<1%	Liver
Aromatic	3.1E+01	9.6E-04	1.3E-02	NA	4.0E-02	NA		3.4E-01	29%	Liver
				Total Cancer Risk:		6.1E-07	**Hazard Index:**	1.2E+00		
				Highest Contributor:		Inorganic Arsenic (100%)		TPH (C08-C16) (45%)		

Notes:

$$\text{Intake Factor (IF)} = \frac{IR \times EF \times ED \times CF}{BW \times AT} = \begin{matrix} 3.1E\text{-}05 \text{ (Cancer)} \\ 4.3E\text{-}04 \text{ (Non-cancer)} \end{matrix}$$

IR-F	Fish/Shellfish Ingestion Rate (mg/d)	24,343	Based on 30 g/d for 365d/yr and adjusted for body weight (LDHH *et al.* , 2012).
EF	Fish/Shellfish Ingestion Exposure Frequency (d/yr)	365	
ED	Fish/Shellfish Ingestion Exposure Duration (yrs)	5	
CF	Conversion Factor (kg/mg)	0.000001	
BW	Body Weight (kg)	57	
AT	Averaging Time - Cancer (d)	25,550	
	Averaging Time - Non-cancer (d)	1,825	

Target Organ Specific Hazard Index:	
Blood	1.3E-01
Central Nervous System	1.8E-01
Immunological	9.5E-02
Liver	7.3E-01
Skin	1.9E-02

DI (mg/kg·d) = EPC x IF

EPC = Exposure Point Concentration; NA = Not Available/Not Applicable; TPH = Total Petroleum Hydrocarbon.

Table C.9 Excess Lifetime Cancer Risk and Non-cancer Hazard by Chemical and Pathway for Industrial Worker – Incidental Ingestion of Soil/Sediment

Constituent of Concern	Soil/ Sediment EPC (mg/kg)	Oral Bioavailability (B) (Unitless)	Daily Intake: Cancer (DI_c) (mg/kg-d)	Daily Intake: Non-cancer (DI_{nc}) (mg/kg-d)	Cancer Slope Factor (SF) $(mg/kg\text{-}d)^{-1}$	Reference Dose (RfD) (mg/kg-d)	Cancer Risk $CR = DI_c \times SF$	Percentage Contribution to Total Cancer Risk	Hazard Quotient $HQ = DI_{nc} \div RfD$	Percentage Contribution to Total Non-cancer Hazard	Non-Cancer RfD Endpoint
Metals											
Arsenic	6.5E+00	6.0E-01	1.2E-06	3.4E-06	1.5E+00	3.0E-04	1.8E-06	100%	1.1E-02	7.5%	Skin
Barium	2.4E+03	1.0E+00	7.4E-04	2.1E-03	NA	2.0E-01	NA		1.0E-02	6.9%	Kidney
Mercury	1.0E+00	1.0E+00	3.1E-07	8.8E-07	NA	3.0E-04	NA		2.9E-03	2.0%	Immunological
Total Petroleum Hydrocarbons											
Aliphatic >C10-C12	1.2E+02	1.0E+00	3.8E-05	1.1E-04	NA	1.0E-02	NA		1.1E-02	7.0%	Liver
Aliphatic >C12-C16	1.0E+03	1.0E+00	3.1E-04	8.8E-04	NA	1.0E-02	NA		8.8E-02	59%	Liver
Aliphatic >C16-C35	4.3E+03	1.0E+00	1.3E-03	3.7E-03	NA	3.0E+00	NA		1.2E-03	<1%	Liver
Aromatic >C10-C12	2.6E+01	1.0E+00	8.1E-06	2.3E-05	NA	3.0E-02	NA		7.5E-04	<1%	Blood
Aromatic >C12-C16	1.6E+02	1.0E+00	5.0E-05	1.4E-04	NA	3.0E-02	NA		4.7E-03	3.1%	Blood
Aromatic >C16-C21	3.7E+02	1.0E+00	1.1E-04	3.1E-04	NA	4.0E-02	NA		7.9E-03	5.3%	Liver
Aromatic >C21-C35	5.7E+02	1.0E+00	1.8E-04	4.9E-04	NA	4.0E-02	NA		1.2E-02	8.2%	Liver
						Total Cancer Risk:	1.8E-06	**Hazard Index:**	1.5E-01		
						Highest Contributor:	Arsenic (100%)		Aliphatic >C12-C16 (59%)		

Notes:

$$\text{Intake Factor (IF)} = \frac{IR \times FR \times EF \times ED \times CF}{BW \times AT}$$

=	3.1E-07 (Cancer)	8.6E-07 (Non-cancer)

IR	Ingestion Rate (mg/d)	100
FR	Fraction from Site	1
EF	Ingestion Exposure Frequency (d/yr)	250
ED	Ingestion Exposure Duration (yrs)	25
CF	Conversion Factor (kg/mg)	0.000001
BW	Body Weight (kg)	80
AT	Averaging Time - Cancer (d)	25,550
	Averaging Time - Non-cancer (d)	9,125

Target Organ Specific Hazard Index:

Blood	5.5E-03
Immunological	2.9E-03
Kidney	1.0E-02
Liver	1.2E-01
Skin	1.1E-02

DI (mg/kg-d) = EPC x B x IF

EPC = Exposure Point Concentration; NA = Not Available/Not Applicable; TPH = Total Petroleum Hydrocarbon; UCLM = Upper Confidence Limit on the Mean.

The 95% UCLM was used as the EPC, except when the UCLM is greater than the maximum, in which case, the maximum was used.

Table C.10 Excess Lifetime Cancer Risk and Non-cancer Hazard by Chemical and Pathway for Industrial Worker – Dermal Contact with Soil/Sediment

Constituent of Concern	Soil/ Sediment EPC (mg/kg)	Dermal Absorption Fraction (ABS) (Unitless)	Daily Intake: Cancer (DI_c) (mg/kg-d)	Daily Intake: Non-cancer (DI_{nc}) (mg/kg-d)	Cancer Slope Factor (SF) $(mg/kg\text{-}d)^{-1}$	Reference Dose (RfD) (mg/kg-d)	Cancer Risk $CR = DI_c \times SF$	Percentage Contribution to Total Cancer Risk	Hazard Quotient $HQ = DI_{nc} \div RfD$	Percentage Contribution to Total Non-cancer Hazard	Non-Cancer RfD Endpoint
Metals											
Arsenic	6.5E+00	3.0E-02	4.2E-07	1.2E-06	1.5E+00	3.0E-04	6.3E-07	100%	3.9E-03	22%	Skin
Barium	2.4E+03	NA	NA	NA	NA	1.4E-02	NA		NA		Kidney
Mercury	1.0E+00	NA	NA	NA	NA	2.1E-05	NA		NA		Immunological
Total Petroleum Hydrocarbons											
Aliphatic >C10-C12	1.2E+02	NA	NA	NA	NA	1.0E-02	NA		NA		Liver
Aliphatic >C12-C16	1.0E+03	NA	NA	NA	NA	1.0E-02	NA		NA		Liver
Aliphatic >C16-C35	4.3E+03	NA	NA	NA	NA	3.0E+00	NA		NA		Liver
Aromatic >C10-C12	2.6E+01	NA	NA	NA	NA	3.0E-02	NA		NA		Blood
Aromatic >C12-C16	1.6E+02	NA	NA	NA	NA	3.0E-02	NA		NA		Blood
Aromatic >C16-C21	3.7E+02	1.0E-01	7.9E-05	2.2E-04	NA	4.0E-02	NA		5.5E-03	31%	Liver
Aromatic >C21-C35	5.7E+02	1.0E-01	1.2E-04	3.5E-04	NA	4.0E-02	NA		8.7E-03	48%	Liver
						Total Cancer Risk:	6.3E-07	**Hazard Index:**	1.8E-02		
						Highest Contributor:	Arsenic (100%)		Aromatic >C21-C35 (48%)		

Notes:

$$\text{Intake Factor (IF)} = \frac{SA \times AF \times EF \times ED \times CF}{BW \times AT} = \begin{matrix} 2.2E\text{-}06 \text{ (Cancer)} \\ 6.0E\text{-}06 \text{ (Non-cancer)} \end{matrix}$$

SA	Surface Area Exposed to Soil/Sediment (cm^2/d)	3,527
AF	Skin Adherence Factor (mg/cm^2)	0.2
EF	Dermal Exposure Frequency (d/yr)	250
ED	Dermal Exposure Duration (yrs)	25
CF	Conversion Factor (kg/mg)	0.000001
BW	Body Weight (kg)	80
AT	Averaging Time - Cancer (d)	25,550
	Averaging Time - Non-cancer (d)	9,125

Target Organ Specific Hazard Index:

Blood	0.0E+00
Immunological	0.0E+00
Kidney	0.0E+00
Liver	1.4E-02
Skin	3.9E-03

DI (mg/kg-d) = EPC x ABS x IF

EPC = Exposure Point Concentration; NA = Not Available/Not Applicable; UCLM = Upper Confidence Limit on the Mean.

The 95% UCLM was used as the EPC, except when the UCLM is greater than the maximum, in which case, the maximum was used.

Table C.11 Excess Lifetime Cancer Risk and Non-cancer Hazard by Chemical and Pathway for Industrial Worker – Dermal Contact with Surface Water

Constituent of Concern	Absorbed Dose (DA) (mg/cm^2-event)	Dermally Absorbed Dose: Cancer (DAD_c) (mg/kg-d)	Dermally Absorbed Dose: Non-cancer (DAD_{nc}) (mg/kg-d)	Cancer Slope Factor (SF) $(mg/kg\text{-}d)^{-1}$	Reference Dose (RfD) (mg/kg-d)	Cancer Risk $CR = DAD_c \times SF$	Percentage Contribution to Total Cancer Risk	Hazard Quotient $HQ = DAD_{nc} \div RfD$	Percentage Contribution to Total Non-cancer Hazard	Non-Cancer RfD Endpoint
Metals										
Arsenic	8.1E-09	8.7E-08	2.4E-07	1.5E+00	3.0E-04	1.3E-07	100%	8.1E-04	4.2%	Skin
Barium	5.9E-07	6.3E-06	1.8E-05	NA	1.4E-02	NA		1.3E-03	6.5%	Kidney
Iron	6.5E-06	7.0E-05	2.0E-04	NA	7.0E-01	NA		2.8E-04	1.5%	Gastrointestinal
Lead	2.1E-09	2.3E-08	6.3E-08	NA	NA	NA		NA		NA
Manganese	5.3E-07	5.7E-06	1.6E-05	NA	9.6E-04	NA		1.7E-02	87%	Central Nervous System
Selenium	2.2E-08	2.4E-07	6.6E-07	NA	5.0E-03	NA		1.3E-04	<1%	Skin
Strontium	1.1E-06	1.2E-05	3.2E-05	NA	6.0E-01	NA		5.4E-05	<1%	Bone
Total Petroleum Hydrocarbons										
TPH-DRO	NA	NA	NA	NA	1.0E-02	NA		NA		Liver
TPH-ORO	NA	NA	NA	NA	4.0E-02	NA		NA		Liver
					Total Cancer Risk:	1.3E-07	**Hazard Index:**	1.9E-02		
					Highest Contributor:	Arsenic (100%)		Manganese (87%)		

Notes:

$$\text{Intake Factor (IF)} = \frac{SA \times EF \times ED \times EV}{BW \times AT} = \begin{matrix} 1.1E{+}01 \text{ (Cancer)} \\ 3.0E{+}01 \text{ (Non-cancer)} \end{matrix}$$

SA	Surface Area Exposed to Surface water (cm^2)	3,527
EF	Exposure Frequency (d/yr)	250
ED	Exposure Duration (yr)	25
BW	Body Weight (kg)	80
EV	Events per day (event/d)	1.0
AT	Averaging Time - Cancer (d)	25,550
	Averaging Time - Non-cancer (d)	9,125

Target Organ Specific Hazard Index:

Bone	5.4E-05
Central Nervous System	1.7E-02
Gastrointestinal	2.8E-04
Kidney	1.3E-03
Liver	0.0E+00
Skin	9.5E-04

DAD (mg/kg-d) = DA x IF

DRO = Diesel-Range Organic; NA = Not Available/Not Applicable; ORO = Oil-Range Organic; TPH = Total Petroleum Hydrocarbon; US EPA = United States Environmental Protection Agency.

The dermal exposure route for lead was not evaluated because this exposure route is typically insignificant. US EPA's Adult Lead Model (ALM) makes no provision for assessing dermal exposures (US EPA, 1996).

TPH-DRO and TPH-ORO are outside the Effective Predictive Domain and therefore could not be evaluated using US EPA (2004) Dermal Guidance.

Table C.12 Excess Lifetime Cancer Risk and Non-cancer Hazard by Chemical and Pathway for Industrial Worker – Dermal Contact with Groundwater (Maximum Concentrations from All Temporary and Permanent Wells Excluding the Peat Zone)

Constituent of Concern	Absorbed Dose (DA) (mg/cm^2-event)	Dermally Absorbed Dose: Cancer (DAD_c) (mg/kg-d)	Dermally Absorbed Dose: Non-cancer (DAD_{nc}) (mg/kg-d)	Cancer Slope Factor (SF) $(mg/kg\text{-}d)^{-1}$	Reference Dose (RfD) (mg/kg-d)	Cancer Risk $CR = DAD_c \times SF$	Percentage Contribution to Total Cancer Risk	Hazard Quotient $HQ = DAD_{nc} \div RfD$	Percentage Contribution to Total Non-cancer Hazard	Non-Cancer RfD Endpoint
Metals										
Arsenic	2.8E-08	3.0E-07	8.5E-07	1.5E+00	3.0E-04	4.5E-07	54%	2.8E-03	2.1%	Skin
Barium	1.4E-05	1.5E-04	4.3E-04	NA	1.4E-02	NA		3.1E-02	22%	Kidney
Chromium	3.3E-07	3.6E-06	1.0E-05	NA	2.0E-02	NA		5.1E-04	<1%	None Reported
Iron	8.3E-05	8.9E-04	2.5E-03	NA	7.0E-01	NA		3.6E-03	2.6%	Gastrointestinal
Lead	3.4E-09	3.6E-08	1.0E-07	NA	NA	NA		NA		NA
Manganese	3.0E-06	3.2E-05	8.9E-05	NA	9.6E-04	NA		9.3E-02	68%	Central Nervous System
Selenium	8.9E-08	9.6E-07	2.7E-06	NA	5.0E-03	NA		5.4E-04	<1%	Skin
Strontium	1.3E-05	1.4E-04	3.8E-04	NA	6.0E-01	NA		6.4E-04	<1%	Bone
Volatile Organic Compounds										
Benzene	6.5E-07	7.0E-06	2.0E-05	5.5E-02	4.0E-03	3.9E-07	46%	4.9E-03	4%	Blood
Total Petroleum Hydrocarbons										
Aliphatic >C10-C12	ND									
Aliphatic >C12-C16	ND									
Aliphatic >C16-C35	ND									
Aromatic >C10-C12	ND									
Aromatic >C12-C16	ND									
Aromatic >C16-C21	ND									
Aromatic >C21-C35	ND									
					Total Cancer Risk:	8.4E-07	**Hazard Index:**	1.4E-01		
					Highest Contributor:	Arsenic (54%)		Manganese (68%)		

Notes:

$$\text{Intake Factor (IF)} = \frac{SA \times EF \times ED \times EV}{BW \times AT}$$

	1.1E+01 (Cancer)	3.0E+01 (Non-cancer)

SA	Surface Area Exposed to Ground water (cm^2)	3,527
EF	Exposure Frequency (d/yr)	250
ED	Exposure Duration (yr)	25
BW	Body Weight (kg)	80
EV	Events per day (event/d)	1.0
AT	Averaging Time - Cancer (d)	25,550
	Averaging Time - Non-cancer (d)	9,125

Target Organ Specific Hazard Index:	
Blood	4.9E-03
Bone	6.4E-04
Central Nervous System	9.3E-02
Gastrointestinal	3.6E-03
Kidney	3.1E-02
Liver	0.0E+00
None Reported	5.1E-04
Skin	3.4E-03

DAD (mg/kg-d) = DA x IF

NA = Not Available/Not Applicable; ND = Not Detected; US EPA = United States Environmental Protection Agency.

The dermal exposure route for lead was not evaluated because this exposure route is typically insignificant. US EPA's Adult Lead Model (ALM) makes no provision for assessing dermal exposures (US EPA, 1996).

Table C.13 Excess Lifetime Cancer Risk and Non-cancer Hazard by Chemical and Pathway for Industrial Worker – Inhalation of Volatiles in Groundwater (Maximum Concentrations from All Temporary and Permanent Wells Excluding the Peat Zone)

Constituent of Concern	Groundwater EPC (mg/L)	Volatilized Concentration (mg/m^3)	Daily Exposure: Cancer (DE_c) ($\mu g/m^3$)	Daily Exposure: Non-cancer (DE_{nc}) (mg/m^3)	Inhalation Unit Risk (IUR) $(ug/m^3)^{-1}$	Reference Concentration (RfC) (mg/m^3)	Cancer Risk $CR = DE_c \times SF$	Percentage Contribution to Total Cancer Risk	Hazard Quotient $HQ = DE_{nc} \div RfD$	Percentage Contribution to Total Non-cancer Hazard	Non-Cancer RfC Endpoint
Metals											
Arsenic	2.8E-02	NA	NA	NA	4.3E-03	1.5E-05	NA		NA		
Barium	1.4E+01	NA	NA	NA	NA	5.0E-04	NA		NA		
Chromium	3.3E-01	NA	NA	NA	NA	NA	NA		NA		
Iron	8.3E+01	NA	NA	NA	NA	NA	NA		NA		
Lead	3.4E-02	NA	NA	NA	NA	NA	NA		NA		
Manganese	3.0E+00	NA	NA	NA	NA	5.0E-05	NA		NA		
Selenium	8.9E-02	NA	NA	NA	NA	2.0E-02	NA		NA		
Strontium	1.3E+01	NA	NA	NA	NA	NA	NA		NA		
Volatile Organic Compounds											
Benzene	2.8E-02	1.4E-02	1.4E-01	4.0E-04	7.8E-06	3.0E-02	1.1E-06	100%	1.3E-02	100%	Blood
Total Petroleum Hydrocarbons											
Aliphatic >C10-C12	ND										
Aliphatic >C12-C16	ND										
Aliphatic >C16-C35	ND										
Aromatic >C10-C12	ND										
Aromatic >C12-C16	ND										
Aromatic >C16-C21	ND										
Aromatic >C21-C35	ND										

Total Cancer Risk: 1.1E-06 **Hazard Index:** 1.3E-02

Highest Contributor: Benzene (100%) Benzene (100%)

Notes:

$$\text{Intake Factor (IF)} = \frac{EF \times ED \times CF1 \times CF2}{AT} = \begin{array}{c|c} \text{1.0E+01} & \text{2.9E-02} \\ \text{(Cancer)} & \text{(Non-cancer)} \end{array}$$

EF	Inhalation Exposure Frequency (d/yr)	250
ED	Inhalation Exposure Duration (yrs)	25
ET	Inhalation Exposure Time (hr/d)	1
CF1	Conversion Factor (d/hr)	0.042
CF2	Conversion Factor (µg/mg)	1000
AT	Averaging Time - Cancer (d)	25,550
	Averaging Time - Non-cancer (d)	9,125

Target Organ Specific Hazard Index:

Blood 1.3E-02

Volatilized Concentration (mg/m^3) = Groundwater EPC (mg/L) x Andelman Volatilization Factor (L/m^3)

DE = Volatilization Concentration x IF

EPC = Exposure Point Concentration; NA = Not Available/Not Applicable; ND = Not Detected.

Table C.14 Excess Lifetime Cancer Risk and Non-cancer Hazard by Chemical and Pathway for Adult Recreator – Fish/Shellfish Ingestion (Based on 45 g/day and Adjusted for Body Weight – 100% Collected from the Site)

Constituent of Concern	Crab EPC (mg/kg)	Daily Intake Cancer (DI_c) (mg/kg-d)	Daily Intake Non-cancer (DI_{nc}) (mg/kg-d)	Cancer Slope Factor (SF) $(mg/kg\text{-}d)^{-1}$	Reference Dose (RfD) (mg/kg-d)	Cancer Risk $CR = DI_c \times SF$	Percentage Contribution to Total Cancer Risk	Hazard Quotient $HQ = DI_{nc} \div RfD$	Percentage Contribution to Total Non-cancer Hazard	Non-Cancer RfD Endpoint
Metals										
Inorganic Arsenic	1.3E-02	3.2E-06	8.6E-06	1.5E+00	3.0E-04	4.8E-06	100%	2.9E-02	1.6%	Skin
Methyl Mercury	4.2E-02	1.0E-05	2.7E-05	NA	1.0E-04	NA		2.7E-01	15.6%	Central Nervous System
Mercury	6.7E-02	1.6E-05	4.3E-05	NA	3.0E-04	NA		1.4E-01	8.2%	Immunological
Total Petroleum Hydrocarbons (Assuming 50% Aliphatics + 50% Aromatics)										
TPH (C08-C16)	1.8E+01									
Aliphatic	9.2E+00	2.2E-03	5.9E-03	NA	1.0E-02	NA		5.9E-01	33.9%	Liver
Aromatic	9.2E+00	2.2E-03	5.9E-03	NA	3.0E-02	NA		2.0E-01	11.3%	Blood
TPH (C16-C28)	6.3E+01									
Aliphatic	3.1E+01	7.5E-03	2.0E-02	NA	3.0E+00	NA		6.8E-03	<1%	Liver
Aromatic	3.1E+01	7.5E-03	2.0E-02	NA	4.0E-02	NA		5.1E-01	29.0%	Liver
					Total Cancer Risk:	4.8E-06	**Hazard Index:**	1.7E+00		
					Highest Contributor:	Inorganic Arsenic (100%)		TPH (C08-C16) (45%)		

Notes:

$$\text{Intake Factor (IF)} = \frac{IR \times EF \times ED \times CF}{BW \times AT} = \begin{array}{c|c} \text{2.4E-04} & \text{6.5E-04} \\ \text{(Cancer)} & \text{(Non-cancer)} \end{array}$$

IR-F	Fish+Shellfish Ingestion Rate (mg/d)	51,639	Based on 70.6 g/day; 95th percentile total fish, Gulf of Mexico – collected by NHANES (US EPA, 2014b) for 365 d/yr and assuming 64% of all finfish and shellfish ingested was from recreational sources (Lincoln *et al.,* 2011) and adjusted for body weight.
EF	Fish/Shellfish Ingestion Exposure Frequency (d/yr)	365	
ED	Fish/Shellfish Ingestion Exposure Duration (yrs)	26	
CF	Conversion Factor (kg/mg)	0.000001	
BW	Body Weight (kg)	80	
AT	Averaging Time - Cancer (d)	25,550	
	Averaging Time - Non-cancer (d)	9,490	

Target Organ Specific Hazard Index:	
Blood	2.0E-01
Central Nervous System	2.7E-01
Immunological	1.4E-01
Liver	1.1E+00
Skin	2.9E-02

DI (mg/kg·d) = EPC x IF

EPC = Exposure Point Concentration;NA = Not Available/Not Applicable; NHANES = National Health and Nutrition Examination Survey; TPH = Total Petroleum Hydrocarbon.

Estimated Cancer and Non-cancer Risks for Adult Recreator (Including all Seafood Ingestion - Fish and Shellfish combined)

Exposure Pathway	Cancer Risk	Non-cancer Hazard
Incidental Ingestion of Soil/Sediment	3.9E-07	3.1E-02
Dermal Contact with Soil/Sediment	5.4E-07	1.5E-02
Dermal Contact with Surface Water	4.4E-07	6.3E-02
Dermal Contact with Groundwater	1.3E-06	2.2E-01
Ingestion of Groundwater	0.0E+00	8.4E-02
Inhalation of Volatiles in Groundwater	9.6E-07	1.1E-02
Fish+Shellfish ingestion (52 g/d)	4.8E-06	1.7E+00
Total:	8E-06	2

Target Organ Specific HI

Endpoint	Incidental Ingestion of Soil/SD	Dermal Contact with Soil/SD	Dermal Contact with SW	Dermal Contact with GW	Ingestion of GW	Inhalation of GW	Ingestion of Fish+Shellfish	Total
Blood	1.1E-03	0.0E+00		6.5E-03		1.1E-02	2.0E-01	**2E-01**
Bone			1.8E-04	1.0E-03	8.5E-03			**1E-02**
Central Nervous System			5.5E-02	1.5E-01	2.7E-02		2.7E-01	**5E-01**
Gastrointestinal			9.2E-04	5.8E-03	1.4E-02			**2E-02**
Immunological	6.1E-04	0.0E+00					1.4E-01	**1E-01**
Kidney	2.2E-03	0.0E+00	4.1E-03	5.0E-02	3.5E-02			**9E-02**
Liver	2.5E-02	1.2E-02	0.0E+00	0.0E+00			1.1E+00	**1E+00**
None Reported				8.3E-04				**8E-04**
Skin	2.3E-03	3.2E-03	3.1E-03	5.5E-03			2.9E-02	**4E-02**

Notes:

GW = Groundwater; SD = Sediment; SW = Surface Water.

Appendix D

***Curriculum Vitae* of Barbara D. Beck, Ph.D., DABT, Fellow ATS**

Barbara D. Beck, Ph.D., DABT, ATS
Principal
bbeck@gradientcorp.com

Areas of Expertise

Risk assessment, exposure assessment, toxicology, metals, inhaled pollutants, soil contaminants, historical knowledge of toxicology.

Education & Certifications

Ph.D., Molecular Biology and Microbiology, Tufts University, 1976.

A.B., Biology, Bryn Mawr College, 1968.

Diplomate, American Board of Toxicology (DABT), 1988; recertified 1994, 1999, 2004, 2009, 2014, current certification valid through 2019.

Fellow, Academy of Toxicological Sciences (ATS), 2002; recertified 2007, 2012.

Past President, Academy of Toxicological Sciences, June 2010-June 2011.

EU-Registered Toxicologist (ERT) *via* membership in the UK Register of Toxicologists, 2004; recertified 2007, 2009, 2012, 2015.

Professional Experience

1987 – Present GRADIENT, Cambridge, MA
Principal. Environmental consulting practice includes evaluation of chemical toxicity, health risk assessment for cancer and non-cancer endpoints, review of animal toxicology studies, and multi-media assessment of exposure to environmental chemicals. Special emphasis on metals and inhaled chemicals.

1985 – Present HARVARD T.H. CHAN SCHOOL OF PUBLIC HEALTH (formerly Harvard School of Public Health), Boston, MA
Visiting Scientist in the Molecular and Integrative Physiological Sciences Program in the Department of Environmental Health.

1985 – 1987 REGION I ENVIRONMENTAL PROTECTION AGENCY, Boston, MA
Regional Expert in Toxicology and Supervisory Scientist, Air Toxics Staff. Performed risk assessments for toxic air pollutants. General staff responsibilities included air impacts at waste sites, state air toxic programs, and US EPA radiation programs.

1979 – 1985 HARVARD SCHOOL OF PUBLIC HEALTH (now Harvard T.H. Chan School of Public Health), Cambridge, MA
Research Associate in Environmental Science and Physiology and Fellow in Interdisciplinary Programs in Health. Developed short-term animal bioassay for pulmonary toxicants. Editor and author of monograph on variations in susceptibility to inhaled pollutants for both cancer and non-cancer endpoints.

1978 – 1979 TUFTS UNIVERSITY SCHOOL OF MEDICINE, Boston, MA
Instructor in Protein Chemistry. Isolated phagocytosis inhibiting factor from immunoglobulin of individuals with inherited susceptibility to bacterial infections.

1977 – 1978 HARVARD UNIVERSITY, Cambridge, MA
Postdoctoral Fellow in Biology. Researched novel properties of bacterial protein elongation factor, EF-Tu, relevant to possible role as a structural protein.

1975 – 1976 UNIVERSITY OF MASSACHUSETTS MEDICAL SCHOOL, Worcester, MA
Postdoctoral Fellow in Microbiology. Isolated and analyzed messenger RNA from slime molds. Initiated project on elongation factor, EF-Tu.

1968 – 1969 TUFTS UNIVERSITY SCHOOL OF MEDICINE, Boston, MA
Research Assistant in Molecular Biology and Microbiology. Performed genetic and biochemical studies on bacterial lipopolysaccharide.

Professional Activities

- Member, Awards Committee, Society of Toxicology, May 2013-April 2015.
- Member, Massachusetts Department of Public Health Eastern Equine Encephalitis (EEE) Expert Panel, January-May 2012.
- Member, National Research Council's Committee on the Future Options for Management in the Nation's Subsurface Remediation Effort, November 2009-2012.
- President, Academy of Toxicological Sciences, July 2009-June 2010.
- Recipient, Lifetime Achievement Award, Awarded by the University of Massachusetts Amherst, School of Public Health and Health Sciences, 2009.
- Member, Massachusetts Department of Public Health Advisory Committee, 2007.
- Member, Executive Committee, International Dose-Response Society, 2006-April 2013.
- Councilor, Metals Specialty Section, Society of Toxicology, 2006-2007.
- Member, Board of Directors, Academy of Toxicological Sciences, 2005-2011.
- Member, Scientific Advisory Committee to the Manganese Health Research Program, 2004-2009.
- Member, Peer Review Committee, US EPA National Health and Environmental Effects Research Laboratory, Experimental Toxicology Division, 2003.
- Member, CIIT Science Advisory Committee, 2002-2004.
- Member, Program Committee, Society of Toxicology, 2001-2005.
- Member, American Chemistry Council Risk Assessment Methods Technical Implementation Panel, 1998-2001.
- Member, International Life Sciences Institute Steering Committee on Cumulative Risk Assessment, 1998.
- Member, Membership Committee, Society of Toxicology, 1997-2000.
- Member, American Water Works Association Research Foundation Peer Review Panel on Arsenic, 1997-1998.
- Member, Advisory Committee to Public Health Program, Florida A & M University, 1996-2002.
- Member, Risk Assessment Task Force, Society of Toxicology, 1996-2000; Chair, 1999-2000.
- Member, Continuing Education Committee, Society of Toxicology, 1996-1997.
- Member, Watertown, MA, Board of Health, 1995-Present; Former Chair.
- Chair of Session, Ecological and Human Health Protocols at GRI Meeting on Environmentally Acceptable Endpoints in Soil, Arlington, VA, 1995.
- Session Chair, International Conference on Arsenic, San Diego, CA, 1995.
- Rapporteur, US EPA Meeting on Risk Assessment for Chemical Mixtures, Research Triangle Park, NC, 1994.
- Member, Program Committee, Society of Toxicology, 1993-1996.
- Member, Arsenic Task Force, Society for Environmental Geochemistry and Health, 1993-1995.

- President, Risk Assessment Specialty Section, Society of Toxicology, 1994-1995.
- Vice President, Risk Assessment Specialty Section, Society of Toxicology, 1993-1994.
- Member, Work Group on Arsenic, Society for Environmental Geochemistry and Health, 1993.
- President, Northeast Chapter of the Society of Toxicology, 1992-1993.
- Member, Review Committee, US EPA Workshop on the Methodology for Deriving National Ambient Water Quality Criteria for the Protection of Human Health, 1992.
- Consultant to SAB Committee on Hazardous Air Pollutants, 1991.
- Member, Advisory Committee to Harvard Center for Risk Analysis, 1990-1993.
- Member, Committee on Public Communications, Society of Toxicology, 1990-1992.
- Councilor, Inhalation Specialty Section, Society of Toxicology, 1990-1992.
- Member, Advisory Committee to US EPA on Metal Bioavailability, 1990.
- Member, Technical Committee, Council for Health and Environmental Safety of Soils (CHESS), 1988-1990.
- President, Northeast Chapter, Society for Risk Analysis, 1987-1988.
- Member, Peer Review Committee, US EPA Inhalation RfD Document, 1987.
- Member, Maine Science Advisory Panel, 1986-1990.
- Member, US EPA Risk Assessment Forum, 1986-1987.
- Member, Rhode Island Air Toxics Advisory Committee, 1986-1987.
- Member, Massachusetts Visibility/Public Health Index Peer Review Team, 1986.
- Member, Massachusetts Air Toxics Guidelines Review Committee, 1985-1988.
- Member, Air Toxics Committee, Northeast States for Coordinated Air Use Management, 1985-1987.

Professional Affiliations

Academy of Toxicological Sciences; American Association for the Advancement of Science; American Thoracic Society; International Society of Exposure Analysis; Society of Environmental Geochemistry and Health; Society for Risk Analysis; New England Chapter of the Society for Risk Analysis; Society of Toxicology; Northeast Chapter of the Society of Toxicology

Projects

Law Firm: Evaluation of releases to air and soil from a pigment manufacturing facility in the southeast US and subsequent toxicological analysis of multiple constituents, including arsenic and dioxins. Conducted analysis of serum congener patterns to assess sources of dioxins.

Law Firm: Evaluation of potential human health risks for metals, including arsenic, barium, lead, and zinc, at a site used for manufacture of drilling muds.

US Dept. of Justice: Development of sampling plan and risk assessment for spray drift exposure to pesticides.

Law Firm: Evaluation of potential risks from manganese in air and soil near manufacturing facility as part of regulatory analysis.

Engineering Company: Evaluation of exposure to hexavalent chromium in outdoor air and soil and need for medical monitoring.

Health Canada: Peer review of exposure components of pilot program *Screening Assessment Document* for ethylbenzene. Peer review of toxicological analysis of aniline.

Perchlorate Study Group: Comments on scientific validity of US EPA RfD for perchlorate.

Automotive Manufacturing Facility: Risk communication regarding PCBs in soil and sediments; provided assistance to individuals in interpreting their blood PCB levels.

Law Firm: Evaluation of health significance to nearby residents of releases to air from an oil refinery during upset conditions.

Law Firm: Evaluated risks from perchloroethylene released into indoor air of nearby residents from a midwestern manufacturing facility. Also evaluated risks from PCBs in soil.

Gas Utility Companies: Analysis of exposures to and toxicological effects of elemental mercury in air.

Law Firm: Exposure and toxicological causation analysis involving multiple health effects claims and potential exposures to dioxins, benzene and pentachlorophenol at former manufacturing site in the Midwest.

Multiple Industrial Clients: Analysis of historical state of knowledge of asbestos exposure, toxicology, and risks.

Law Firm: Evaluation of effects of lead on different health endpoints, including neurocognitive changes and behavioral effects in children.

US EPA Region I: Compilation and review of air toxics monitoring studies in Region I with respect to adequacy in reflecting human exposure and in identifying relevant sources from a risk perspective.

Law Firm: Evaluation of risks associated with CCA-treated wood. Development of exposure studies for CCA-treated wood.

Utility Company: Evaluation of exposures and risks of coal fly ash.

Massachusetts Attorney General: Presentation on the use of risk assessment for the siting of an energy facility.

Law Firm: Evaluation of potential short-term and long-term human health risks from metals including zinc and organics (including mineral oils) from possible medical exposures.

Environmental Engineering Company: Human health and ecological risk assessment for PAHs, dioxins, and other compounds at a former chemical R&D facility, including development and oversight of sampling.

EPRI: Synthesis report of arsenic research studies. Toxicological analysis of methylmercury and lead; development of research plan.

Consumer Product Manufacturer: Toxicological evaluation of different preservatives and bittering agents for possible use in a consumer product.

US EPA, Office of Research and Development: Development of toxicity data base for inhalation exposure to the Hazardous Air Pollutants listed under the 1990 Clean Air Act Amendments.

Pesticide Registrant: Evaluation of carcinogenic mode-of-action and EU classification of a biocide.

Law Firm: Designed and conducted human volunteer study to evaluate the transfer of metals from smelter residue to hands. Incorporated data from study into risk assessment.

Wood Preservative Science Council: Evaluation of US EPA Stochastic Human Exposure Dose Simulation model.

Law Firm: Evaluated risks of dioxins, furans, and PCBs associated with impoundments and with fish in a southwest US river for a case involving claims of property damage and personal injury.

Law Firm Representing Municipality and Port Authority: Prepared risk assessment for proposed development at former MGP site, evaluating future exposures to construction workers and residents. Developed risk-based remedial targets.

Electronics Manufacturer: Risk communication to plant employees regarding exposures to TCE and DCE in groundwater.

Consumer Product Manufacturer: Evaluation of toxicity of hydrogen sulfide and risk communication on hydrogen sulfide at community meetings.

Law Firm: Evaluation of odors associated with releases from a landfill. Performed human health risk assessment for chemicals in air.

American Red Cross: Review of toxicity of new blood bag plasticizer and assessment of potential risks to blood product recipients.

Engineering Company/Army Corps of Engineers: Evaluation of health significance of metal exposures, especially iron, at historic mine site in New England.

Automotive Manufacturer: Community-based risk communication regarding PCBs in soil and sediment.

New Mexico Environment Dept.: Risk assessment for metals at copper mining and smelting site.

Chemical Manufacturers Association: Review of US EPA land disposal regulations Phase IV. Review of ozone risk assessment in US EPA ozone staff paper.

Health Effects Institute: Assessment of literature on carcinogenicity of inhaled diesel exhaust particulates, especially using urine mutagenicity. Review of literature on toxicity of carbon monoxide and effects on individuals with angina. Developed database of air pollutants from automobiles.

Multinational Manufacturer: Risk assessment and risk communication for perchloroethylene in drinking water at operating facility in Asia.

American Petroleum Institute: Role of risk assessment in Superfund remedy selection process and associated costs.

American Chemistry Council: Provided comments to EPA on health effects of ozone.

Pesticide Manufacturer: Evaluation of toxicity and environmental migration of organo-arsenicals. Probabilistic margin-of-exposure analysis for inorganic arsenic.

Industrial Client: Participation in advisory panel regarding health effects of inhaled and ingested hexavalent chromium.

Law Firm: Evaluation of possible air exposures and health studies at former phosphorous manufacturer in Florida.

Law Firm: Provided comments to US EPA on their Health Effects Documents for PFOA and PFOS.

American Lung Association of Maine: Technical advice on health effects of criteria and non-criteria air pollutants. Review of regulatory packages.

International Chemical Manufacturer: Evaluation of cancer classification systems and setting of occupational exposure limits in European countries and organizations.

Boston Medical Center: Coordination of study of potential effects of perchlorate in humans.

Zinc Corporation of America: Risk assessment using both environmental and epidemiological data for lead and cadmium in soil at a Superfund site.

Law Firm Representing a Manufacturing Company: Risk assessment for potential exposure to TCE in drinking water, including use of adjustment for mutagenicity.

Major Canadian Mining Company: Evaluation of arsenic exposure at mining/milling site using biological monitoring, risk assessment for arsenic, and communication with the public and regulatory agencies.

Law Firm Representing Utility Company: Prepared report regarding historical knowledge of toxicity of simple and complex cyanides, and of oxide box waste materials at former MGP sites. Prepared risk assessment for site.

New Jersey Dept. of Environmental Protection: Site assessment and risk assessment for specialty chemical manufacturing site in New Jersey involving volatile organic chemicals and DDT.

Law Firm: Assessment of toxicity and risks of MTBE, especially with respect to tap water exposure.

US EPA/Engineering Company: Development of work plan to conduct morbidity or mortality study, using readily available databases, for high ozone levels experienced in summer of 1988.

Law Firm Representing Smelter Owner: Evaluated health protectiveness of state cleanup levels for arsenic, lead, and cadmium in soil in class action case.

Chemical Manufacturer: Development of risk screening process for evaluating potential hazards at international sites as part of property transfer.

Major Consumer Product Manufacturer: Development and application of adult blood lead model to predict blood lead levels from discontinuous exposures to lead released from a consumer product.

Engineering Company: Risk assessment for lead, asbestos, PCBs, and other chemicals in soil and water at former brake lining manufacturing facility.

Law Firm: Risk support at multiple MGP sites, including evaluation of potential risks from VOCs in groundwater and evaluation of potential risks to workers from PAHs in soil.

Battery Manufacturing Company: Development and oversight on sample collection and analysis program for lead exposure, evaluation of existing blood lead and tooth lead data, and application of blood lead model.

Oil & Gas Company: Risk assessment support for several major mining-related Superfund sites in the western US. Evaluation of toxicology, epidemiology, and bioavailability of metals, including lead, arsenic, and cadmium. Development of cleanup levels.

International Lead Zinc Research and Organization: Development of probabilistic blood lead model.

Marine Shale Processors: Risk assessment of lead, other inorganics and organic compounds in aggregate produced by hazardous waste recycling. Evaluation of risks of air emissions during incineration process.

US EPA Region II: Participated in Monte Carlo exposure and risk analysis of PCBs in fish.

Remedial Trust Representing Consortium of PRPs: Evaluation of university and agency research plans involving groundwater modeling and remedial approaches at former manufacturing site. Evaluation of biomonitoring approaches for metals. Evaluation of arsenic risk assessment for site.

Coalition for Clean Air Act Implementation: Evaluation of technical issues, including use of composite scores, in 112(g), trading of hazardous air pollutants. Quantification of uncertainty in the composite source.

Canadian Mining Company: Risk assessment for multiple metals associated with tailings release at mine in Southeast Asia.

Mining/Smelting Company: Evaluation of multipathway risks associated with slag use. Comments on US EPA Hazardous Waste Identification Rule.

Consortium of Massachusetts Utility Companies: Review of toxicological knowledge of chemicals at MGP sites over time for Massachusetts generic rate setting case.

Law Firm: Evaluation of non-cancer risks from alkylphenols in groundwater at a wood tar site, based on structure activity relationships. Evaluation of risks from polycyclic aromatic hydrocarbons.

Pharmaceutical Company: Comment on *Federal Register* notice on delisting of incinerator ash from RCRA regulations. Reviewed applicability of model to dioxin-contaminated ash.

Northeast States for Coordinated Air Use Management: Technical assistance in organizing conference on use of bioassays in evaluating ambient air pollutants and presentation of report on use of short-term pulmonary bioassays in evaluation of toxicity and potential health effects of urban particulates.

Law Firm: Risk assessment for arsenic-contaminated soil. Assessed human health risks *via* inhalation and ingestion and ecological risks to deer populations.

Gas Research Institute: Assistance in preparation of exposure manual for MGP sites.

Law Firm: Regulatory analysis for perchlorate in drinking water well in Massachusetts.

State Agency: Impact analysis for a potential toxicological exposure of a biologic product related to manufacturing.

Publications – *Articles and Book Chapters*

Sidhu, MS; Desai, KP; Lynch, HN; Rhomberg, LR; Beck, BD; Venditti, FJ. 2015. "Mechanisms of action for arsenic in cardiovascular toxicity and implications for risk assessment." *Toxicology.* 331:78-99.

Mayfield, DB; Lewis, AS; Bailey, LA; Beck, BD. 2015. "Properties and effects of metals." In *Principles of Toxicology: Environmental and Industrial Applications, Third Edition*. (Eds.: Roberts, SM; James, RC; Williams, PL), Wiley, Hoboken, NJ, p283-307.

Beck, BD; Seeley, M; Calabrese, EJ. 2014. "Use of toxicology in the regulatory process." In *Hayes' Principles and Methods of Toxicology (Sixth Edition)*. (Eds.: Hayes, AW; Kruger, CL), CRC Press, Boca Raton, FL, p35-87.

Beyer, LA; Greenberg, G; Beck, BD. 2014. "Evaluation of potential exposure to metals in laundered shop towels." *Hum. Ecol. Risk Assess.* 20(1):111-136.

Cohen, SM; Arnold, LL; Beck, BD; Lewis, AS; Eldan, M. 2013. "Evaluation of the carcinogenicity of inorganic arsenic." *Crit. Rev. Toxicol.* 43(9):711-752.
****Awarded SOT Risk Assessment Specialty Section (RASS) One of the Best Published Papers 2013.**

Seeley, M; Wells, CS; Wannamaker, EJ; Mattuck, RL; Ren, S; Beck, BD. 2013. "Determining soil remedial action criteria for acute effects: The challenge of copper." *Regul. Toxicol. Pharmacol.* 65(1):47-59.

Beck, BD; Long, CM; Seeley, MR; Nascarella, MA. 2012. "A special issue on nanomaterial regulations and health effects." *Dose Response* 10:306-307.

Beyer, LA; Greenberg, G; Beck, BD. 2012. "Exposure to metals in laundered shop towels." *Safely Made* 3(3):1,8-21.

Hughes, MF; Beck, BD; Chen, Y; Lewis, AS; Thomas, DJ. 2011. "Arsenic exposure and toxicology: A historical perspective." *Toxicol. Sci.* 123(2):305-332.
****Received Level III Scientific and Technological Achievement Award in 2015 from US EPA.**

Beyer, LA; Beck, BD; Lewandowski, TA. 2011. "Historical perspective on the use of animal bioassays to predict carcinogenicity: Evolution in design and recognition of utility." *Crit. Rev. Toxicol.* 41(4):321-338.

Greenberg, GI; Beck, BD. 2011. "Use of years of potential life lost (YPLL) for risk assessment at hazardous waste sites." In *Encyclopedia of Environmental Health.* (Ed.: Nriagu, JO), Elsevier Press, Burlington, MA, p602–607.

Petito Boyce, C; Lewis, AS; Sax, SN; Beck, BD; Eldan, M; Cohen, SM. 2010. "Probabilistic modeling of dietary arsenic exposure [Letter]." *Environ. Health Perspect.* 118:A331.

Lewis, AS; Beck, BD. 2010. "Nonlinear low-dose extrapolations." In *Cancer Risk Assessment: Chemical Carcinogenesis, Hazard Evaluation, and Risk Quantification,* (Eds.: Hsu, CH; Stedeford, T), John Wiley & Sons, Inc., Hoboken, NJ, p659-680.

Meek, ME (Bette); Levy, L; Beck, BD; Danzeisen, R; Donohue, JM; Arnold, IMF; Krewski, D. 2010. "Risk assessment practice for essential metals." *J. Toxicol. Environ. Health A* 73(2):253-260.

Prueitt, RL; Beck, BD. 2010. Commentary on *Toxicity Testing in the 21st Century: A Vision and Strategy*. *Hum. Exp. Toxicol*. 29(1):7-9.

Prueitt, RL; Beck, BD. 2009. Commentary on *Toxicity Testing in the 21st Century: A Vision and Strategy*. *Belle Newsl.* 15(3):3-5.

Long, CM; Beck, BD. 2009. "Study of Chinese print workers claims to provide the first human evidence of the clinical toxicity of long-term nanoparticle exposures." *InterNano: Resources for Manufacturing* [online newsletter]. Accessed at http://www.internano.org/content/view/306/1/, October 29.

Bailey, LA; Goodman, JE; Beck, BD. 2009. "Proposal for a revised reference concentration (RfC) for manganese based on recent epidemiological studies." *Regul. Toxicol. Pharmacol.* 55:330-339.

Goodman, JE; Beyer, LA; Beck, BD. 2009. Comment on "Evaluation of evidence for infection as a mode of action for induction of rat lymphoma" by Caldwell *et al.* [Letter]. *Environ. Mol. Mutagen.* 50:4-5.

Petito Boyce, C; Lewis, AS; Sax, SN; Eldan, M; Cohen, SM; Beck, BD. 2008. "Probabilistic analysis of human health risks associated with background concentrations of inorganic arsenic: Use of a margin of exposure approach." *Hum. and Ecol. Risk Assess*. 14(6):1159-1201.
****Awarded HERA Paper of the Year 2008 in the category of Human Health Risk Assessment.**

Slayton, TM; Lewis, AS; Beck, BD. 2008. "Arsenic." In *Encyclopedia of Quantitative Risk Analysis and Assessment (Volumes 1-4)*. (Eds.: Melnick, EL; Everitt, BS), John Wiley & Sons, West Sussex, England, p28-38.

Kenyon, EM; Klimecki, WT; El-Masri, H; Conolly, RB; Clewell, HJ; Beck, BD. 2008. "How can biologically-based modeling of arsenic kinetics and dynamics inform the risk assessment process? – A workshop review." *Toxicol. Appl. Pharmacol.* 232:359-368.

Beck, BD; Seeley, MR. 2008. Commentary on "Hormesis and toxic torts." *Hum. Exp. Toxicol.* 27:115-116.

Beck, B. 2008. Letter to the editor re: "Effects of MTBE on Leydig cell tumors in Sprague-Dawley rats: Range of possible poly-3 results." *Regul. Toxicol. Pharmacol.* 50:430.

Saxe, JK; Wannamaker, EJ; Conklin, SW; Shupe, TF; Beck, BD. 2008. Reply to comment from Solo-Gabriele *et al.* on "Evaluating landfill disposal of chromated copper arsenate (CCA) treated wood and potential effects on groundwater: Evidence from Florida" by Jennifer K. Saxe, Eric J. Wannamaker, Scott W. Conklin, Todd F. Shupe and Barbara D. Beck [*Chemosphere* 66(3) (2007) 496-504]" *Chemosphere* 70:1932-1934.

Goodman, JE; Gaylor, D; Beyer, LA; Rhomberg, LR; Beck, BD. 2008. "Effects of MTBE on the reported incidence of Leydig cell tumors in Sprague-Dawley rats: Range of possible poly-3 results." *Regul. Toxicol. Pharmacol.* 50:273-284.

Beck, BD; Calabrese, EJ; Slayton, TM; Rudel, R. 2008. "The use of toxicology in the regulatory process." In *Principles and Methods of Toxicology, Fifth Edition*. (Ed.: Hayes, AW), Taylor & Francis, Philadelphia, PA, p45-102.

Petito Boyce, C; Lewis, AS; Butler, EL; Saxe, JK; Beck, BD. 2007. Letter to the editor re: Datta *et al.*, 2006: "Arsenic biogeochemistry and human health risk assessment in organo-arsenical pesticide-applied acidic and alkaline soils: An incubation study." *Sci. Total Environ.* 388(1-3):372-375.

Seeley, MR; Beck, BD. 2007. Commentary on "Hormesis and toxic torts." *Belle Newsl.* 14(2):16.

Bowers, TS; Beck, BD. 2007. Response to second comment by Bergdahl on "What is the meaning of non-linear dose-response relationships between blood lead concentration and IQ" and our earlier response. *Neurotoxicol*. 28:706.

Bowers, TS; Beck, BD. 2007. Response to comments by Bergdahl, Hornung *et al*., Jusko *et al*., and Svendsgaard *et al*. on "What is the meaning of non-linear dose-response relationships between blood lead concentration and IQ." *Neurotoxicol*. 28:196-201.

Saxe, JK; Wannamaker, EJ; Conklin, SW; Shupe, TF; Beck, BD. 2007. "Evaluating landfill disposal of chromated copper arsenate (CCA) treated wood and potential effects on groundwater: Evidence from Florida." *Chemosphere* 66:496-504.

Bowers, TS; Beck, BD. 2006. Response to comments on "What is the meaning of non-linear dose-response relationships between blood lead concentration and IQ?" [Letter to the Editor]. *Neurotoxicol.* 27(6):1123.

Bowers, TS; Beck, BD. 2006. "What is the meaning of non-linear dose-response relationships between blood lead concentrations and IQ?" *Neurotoxicol.* 27:520-524.

Beck, BD. 2006. "An evaluation of the US Environmental Protection Agency definition of a risk assessment." *Hum. Exp. Toxicol*. 25:3-5.

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Cohen, SM; Arnold, LL; Eldan, M; Schoen, AS; Beck, BD. 2005. "Methylated arsenicals: The implications of metabolism and carcinogenicity studies in rodents to human risk assessment." *Crit. Rev. Toxicol.* 36:99-133.

Beck, BD. 2005. "An evaluation of the EPA definition of a risk assessment." *Belle Newsl.* 13(1):4-6.

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Lewandowski, TA; Seeley, MR; Beck, BD. 2003. "The importance of interspecies differences in susceptibility to perchlorate for human health risk assessment." In *Proceedings of the Groundwater Resources Association of California Symposium: Perchlorate in Groundwater: Occurrence, Analysis & Treatment*, July.

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Publications – *Other Publications/Reports*

National Research Council, Division of Earth and Life Sciences, Water Science and Technology Board, Committee on Future Options for Management in the Nation's Subsurface Remediation Effort. 2012. Alternatives for Managing the Nation's Complex Contaminated Groundwater Sites. National Academies Press, Washington, DC, 339p. (Dr. Beck was a member of the panel that prepared this report under the auspices of the National Research Council.)

Beck, BD. 2009. "Congress should take risk-based approach to lead-content law." *Wall Street J.* 253(88):A14. April 16.

Valberg, PA; Beck, BD. 1993. "Recalculation of the Arsenic Cancer Slope Factor." Report to IRIS Information Submission Desk (US EPA), August 9.

Beck, BD; Goodman, G, Hemphill, CP. 1993. "Summary of Naphthalene Toxicity Information and Derivation of a Naphthalene Oral RfD." Draft report to US EPA Naphthalene RfD Work Group August 30.

Beck, BD. 1987. "Acute and Chronic Toxicity of Trichloroethylene," "Non-carcinogenic Risk Assessment," "The Role of Peroxisomal Proliferation in Trichloroethylene Hepatotoxicity and Carcinogenicity." Draft NESCAUM (Northeast States for Coordinated Air Use Management) Health Assessment Document.

Beck, BD. 1982. "The use of bioassays to assess the toxicity of particulates; evaluation of bioassays." In *Appendix 2: Toxic Effects of Airborne Particulates*, p119 - 167, Appendix to Report "Analysis of Health Effects Resulting from Population Exposures to Ambient Particulate Matter." Prepared by Harvard University, Energy and Environmental Policy Center, for US Dept. of Energy, Agreement No. DE-AC02-81EV10731.

Beck, BD. 1975. "*Activity of three murein hydrolases during the cell cycle of Escherichia coli. K-12.*" Ph.D. Dissertation, Tufts University.

Invited Lectures/Other Presentations – 1985-Present

11/14 – "Principles of Toxicology: Molecular and Translational Toxicology." Presented at the Harvard School of Public Health (now Harvard T.H. Chan School of Public Health), Boston, MA, November 24.

12/13 – "Inorganic Arsenic: Health Risk Assessment." Presented at the University of Connecticut, School of Pharmacy, Storrs, CT, December 11.

4/13 – "Risk Assessment Approaches and Application of IRIS Values: Consideration of Susceptibility and Variability." Presented at the National Research Council Inorganic Arsenic: Scientific Considerations for Hazard Identification and Dose-Response Analysis Workshop, Washington, DC, April 4.

4/12 – "Dose-Response Assessment for Arsenic: A Case Study for Why the LNT Doesn't Work." Presented at the 2012 Annual Meeting of the International Dose-Response Society, University of Massachusetts, Amherst, MA, April 25.

12/11 – "Inorganic Arsenic: Health Risk Assessment." Presented at the University of Connecticut, School of Pharmacy, Storrs, CT.

4/11 – Testimony of Barbara D. Beck, Ph.D., DABT, Fellow ATS, ERT regarding "Discussion Draft of H.R.___, a Bill that would Revise the Consumer Product Safety Improvement Act." Submitted to US House of Representatives, Committee on Energy and Commerce, Subcommittee on Commerce, Manufacturing, and Trade Hearing, April 7.

4/10 – "Medical Monitoring and Environmental Exposures." Presented in a session entitled "Presenting Effective Arguments to Courts Against Awarding Medical Monitoring Damages" at the American Conference Institute's Chemical Products Liability and Environmental Litigation Conference, Chicago, IL, April 28.

3/10 – "These Kids are Driving Me Crazy: The Science of Sensitive Subpopulations." Presented at the DRI Toxic Torts and Environmental Law Seminar, New Orleans, LA, March 18.

3/10 – "Weighing Complex Data in Risk Decisions: Concepts of Evidence-Based Toxicology." Roundtable discussion presented at the Society of Toxicology Annual Meeting, Salt Lake City, UT, March 9.

2/10 – "Buckyballs and Nanotubes: Insurance Issues Related to Nanotechnology." Panelist for talk presented at the American Bar Association's 18th Annual Insurance Coverage Litigation Committee Midyear Program. Phoenix, AZ, February 26.

1/10 – "Overview of Arsenic Epidemiology." Presented as part of the EPRI Arsenic Project Scientific Review Panel Meeting, Research Triangle Park, NC, January 28.

12/09 – "Current Risk from Exposure to Nanoparticles." Presented as part of webinar held by Day Pitney, LLP, December 9.

4/09 – "Testimony of Barbara D. Beck, Ph.D., DABT Regarding the Consumer Product Safety Improvement Act: The Need for a Risk-Based Approach." CPSIA Congressional Briefing, Washington, DC, April 1.

3/09 – "What is an Adverse Effect in the Age of 'Omics?" Roundtable discussion presented at the Society of Toxicology Annual Meeting, Baltimore, MD, March 18.

12/08 – "Inorganic Arsenic: Health Risks and Regulations." Presented at the University of Connecticut, School of Pharmacy, Storrs, CT.

5/08 – "Risk Assessment for Essential Metals: Considerations for 'The Path Forward.'" Presented at the Workshop on Health Risk Assessment of Essential Metals, Ottawa, Canada.

5/08 – "Nanotechnology: An Overview of Environmental Health & Safety Issues." Presented as part of webinar held by Day Pitney, LLP.

3/08 – "Challenge in Using Hazard-based Binning in Risk Assessment & Risk Management." Presented at the Society of Toxicology 47th Annual Meeting, Seattle, WA.

1/08 – "Determining Risks to Background Arsenic Using a Margin-of-Exposure Approach." Presented at the Society of Risk Analysis, New England Chapter Meeting, Boston, MA.

10/07 – "An Update on Risk Management Approaches for Nanotechnology: Recent Regulatory Activities and Trends Affecting Product Development." Presented at the Lux Executive Summit, Cambridge, MA.

9/07 – "Is Smaller Always Worse: What Do We Know Now About the Toxicity and Potential Risks of Nanoparticles? What More Do We Need to Know?" Presented at the PANWAT SOT Meeting, Seattle, WA.

7/07 – "The Role of Regulatory Science in Tort Litigation." Presented as part of the Environmental Law Institute's *Critical Developments in Toxic Torts Seminar Series*, Washington, DC.

3/07 – "Using Modeling to Inform the Risk Assessment Process for Arsenic." Presentation at the Society of Toxicology 46th Annual Meeting, Charlotte, NC.

2/07 – "Health Risks of Inorganic Arsenic: A Serious Threat or are there Better Ways to Spend our Resources?" Presented at the Risk Assessment Forum, Yale University, New Haven, CT.

12/06 – "Risk Assessment: An Overview." Presented at the University of Connecticut, School of Pharmacy, Storrs, CT.

12/06 – "Industry Challenges – Getting the Lead Out: Health Risk Considerations." Presented at Plumbing Manufacturers Association and Copper Development Association Roundtable, Chicago, IL.

10/06 – "Use of Nanoscale Zero-Valent Iron (NZVI) Particles for Groundwater Remediation: A Qualitative Risk Assessment." Presented at the University of Massachusetts Soils, Sediments, and Water Conference, Amherst, MA.

9/06 – "Overview of Science Issues Associated with Assessing Lead Health Effects." Presented at the Battery Council International Convention, Tucson, AZ.

4/06 – "Interpretation of Biomonitoring Studies to Assess Exposure and Risk of Inorganic Arsenic: Confounding by Other Sources of Arsenic." Presented at Toxicology and Risk Assessment Conference, Cincinnati, OH.

1/06 – "A Qualitative Risk Assessment to Evaluate the Remediation of Trichloroethylene by Nanoscale Zero-Valent Iron Particles." Presented at the 1st International Conference on Nanotoxicology: Biomedical Aspects, Miami, FL.

12/05 – "Regulation of Nanotechnology in the Environment and Workplace: Comparative Approaches." Presented at the 2005 Materials Research Society Meeting Session S9: Regulation of Nanotechnology and Nanomaterials, Boston, MA.

9/05 – "Recommendations for DMA Assessment." Presented on behalf of MAA Research Task Force, US EPA, Washington, DC.

9/05 – "Characterization of DMA Risk Using a Nonlinear Dose-Response Approach." Presented on behalf of MAA Research Task Force, US EPA, Washington, DC.

3/05 – "The Life of a Consultant." Society of Toxicology 44th Annual Meeting, New Orleans, LA.

3/04 – "Arsenic Methylation: Considerations for Risk Assessment." Society of Toxicology 43rd Annual Meeting, Baltimore, MD.

1/04 – "Lack of Relevance of DMA-Induced Rat Bladder Tumors for Human Risk Assessment: Metabolism and Disposition Studies of DMA and MMA." Presented to Office of Pesticide Programs, US EPA, Washington, DC.

12/03 – "Selected Comments on Draft EPA Exposure & Risk Assessments for CCA-Treated Wood Using SHEDS-Wood Model." Presented at FIFRA SAP Meeting, Washington, DC.

11/03 – "Risk Assessment: An Overview." University of Connecticut, School of Pharmacy, Storrs, CT.

10/03 – "Comparison of a Probabilistic/Mechanistic Approach to a Deterministic/Empirical Approach for Evaluating CCA-Treated Wood Exposures." Presented at 19th Annual International Conference on Soils, Sediments and Water, Amherst, MA.

4/03 – "Evaluation of Potential Human Health Risks from Copper Azole-Treated Wood." Presented at 99th Annual Meeting of the American Wood-Preservers' Association, Boston, MA.

11/02 – "A Case Study of Arsenic Risk Assessment and Risk Management." Presented at NIEHS DERT Science Retreat, Wilmington, NC.

10/02 – "CCA-Treated Wood: Science and Politics." Presented at University of Massachusetts, Amherst.

10/02 – "Research Activities to Refine Human Health Risk Assessment for CCA-Treated Wood." Presented to CPSC, Washington, DC.

8/02 – "Comments on EPA Background Documents Regarding SHEDS-Wood Model." Presented at Science Advisory Panel meeting, Washington, DC.

1/02 – "Principles of Toxicology." Harvard School of Public Health (now Harvard T.H. Chan School of Public Health), Boston, MA.

12/01 – "Risk Assessment: An Overview." University of Connecticut, School of Pharmacy, Storrs, CT.

10/01 – "Comments on EPA Background Documents Regarding CCA-Treated Wood." Presented to Scientific Advisory Panel, Washington, DC.

10/01 – "Statement by Barbara D. Beck re: Arsenic in Drinking Water: An Update on the Science, Benefits and Cost." Presented at Congressional Hearing, Washington, DC.

8/01 – "Focused Evaluation of Health Risks from Exposure to Arsenic Associated with CCA-Treated Wood." Presented to Consumer Product Safety Commission, Washington, DC.

6/01 – "Adult:Child Differences in the Intra-Species Uncertainty Factor: A Case Study Using Lead." Presented at the Fifth Annual Workshop on Evaluation of Default Safety Factors in Health Risk Assessment, UMDNJ-New Jersey Medical School, Newark, NJ.

3/01 – "Risk Assessment for Metals: Physiologically-Based Pharmacokinetic Models for Metals." Society of Toxicology 40th Annual Meeting, San Francisco, CA.

6/00 – "EPRI-Sponsored Arsenic Research Program – Application to Arsenic Cancer Risk Assessment." SEGH Fourth International Conference on Arsenic Exposure and Health Effects, San Diego, CA.

5/00 – Invited Participant/Speaker to the Fourth Annual Workshop on Evaluation of Uncertainty/Safety Factors in Health Risk Assessment, Nutley, NJ.

4/00 – "Development of a Stochastic Physiologically-Based Pharmacokinetic Model for Lead." Toxicology and Risk Assessment Approaches for the 21st Century Conference, Kings Island, OH.

6/99 – "The Development of a Stochastic Physiologically-Based Pharmacokinetic Model for Lead." US EPA Workshop on Lead Model Development: Probabilistic Risk Assessment and Biokinetic Modeling, Raleigh-Durham, NC.

6/99 – "The Development of a Stochastic Physiologically-Based Pharmacokinetic Model for Lead." WHO/IARC Conference on Lead Exposure, Reproductive Toxicity and Carcinogenicity, Gargnano, Italy.

3/99 – "Strategies for Prosecuting and Defending Toxic Tort Litigation – A Toxicologist's Perspective." ABA Annual Conference on Environmental Law, Keystone, CO.

3/99 – "Principles of Toxicology." Harvard Center for Risk Analysis Course "Analyzing Risk: Assessment and Management," Boston, MA.

2/99 – "Comments on EPA Perchlorate RfD Draft Document." Perchlorate Peer Review Workshop, San Bernardino City Council Chambers, San Bernardino, CA.

1/99 – "Risk Assessment: An Overview." Harvard School of Public Health (now Harvard T.H. Chan School of Public Health) Principles of Toxicology Course, Boston, MA.

12/98 – "Risk Assessment: An Overview." University of Connecticut Advanced Toxicology Course, Storrs, CT.

11/98 – "EPA's Proposed Residential Lead Standards." US EPA's Children's Health Protection Advisory Committee Meeting, New Carrolton, MD.

10/98 – "What are the Characteristics of a Well-designed Environmental Lead/Blood Lead Study?" National Environmental Policy Institute's Conference "Protecting Children's Health: Assessing the Relationship of Soil Lead to Blood Lead," Washington, DC.

10/98 – "Principles of Toxicology." Harvard Center for Risk Analysis Course "Analyzing Risk: Assessment and Management," Boston, MA.

10/98 – "Cumulative Risk – Case Study." American Law Institute-American Bar Association Course of Study, "Risk Assessment and Risk Management in Environmental Law," Washington, DC.

10/98 – "Introduction to Recent Developments in Risk Assessment: Aggregate Exposure and Cumulative Risk." American Law Institute-American Bar Association Course of Study, "Risk Assessment and Risk Management in Environmental Law," Washington, DC.

4/98 – "Principles of Toxicology." Harvard Center for Risk Analysis Course "Analyzing Risk: Assessment and Management," Boston, MA.

3/98 – "Impact of Arsenic (As_i) Metabolism on Human Populations: Dose-Response Relationships in Arsenic-Induced Cancers." Society of Toxicology 37th Annual Meeting, Seattle, WA.

3/98 – "Effective Risk Communication: Avoiding the Pitfalls." Continuing Education Course, Society of Toxicology 37th Annual Meeting, Seattle, WA.

12/97 – "Key Issues Raised by EPA's Proposed Ozone Standards and Supporting Analysis." Society for Risk Analysis, Annual Meeting and Exposition, Washington, DC.

5/97 – "Testimony on Analysis of Risk Assessment Used by the EPA in Support of Its Proposed Ozone Standards." Before the Joint Hearing of the Health and Environment Subcommittee and the Oversight and Investigations Subcommittee, Commerce Committee, US House of Representatives, Washington, DC.

3/97 – "Principles of Toxicology." Harvard Center for Risk Analysis Course "Analyzing Risk: Assessment and Management," Boston, MA.

12/96 – "Risk Assessment for Criteria Pollutants *versus* Other Noncarcinogens: The Difference Between Implicit and Explicit Conservativism." Rutgers University 2nd Annual Workshop "The Evaluation of EPA 10X Safety Factors in Health Risk Assessment," Nutley, NJ.

9/96 – "The Quantitative Use of Information on Susceptibility in Risk Assessment: Where is it Working or Not Working? How Can We Make It Better?" Third Annual NHEERL Symposium on Susceptibility and Risk Assessment, Raleigh, NC.

9/96 – "Principles of Toxicology." Harvard Center for Risk Analysis Course "Analyzing Risk: Assessment and Management," Boston, MA.

8/96 – "The Role of Risk Assessments in Superfund." American Bar Association, Orlando, FL.

12/95 – "Use of Monte Carlo Arsenic (As) Model to Predict Distributions of Urine Arsenic at a Mining and Milling Site." Society for Risk Analysis, Honolulu, HI.

10/95 – "Use of Information on Variations in Susceptibility – Ozone." ILSI Risk Science Institute Workshop on Human Variability, Washington, DC.

10/95 – "Evaluation of Health Effects Resulting from Accidental Exposures." Michigan Society for Risk Analysis, Dearborn, MI.

9/95 – "Principles of Toxicology." Harvard Center for Risk Analysis Course on "Analyzing Risk: Assessment and Management," Boston, MA.

6/95 – "Validation of an Arsenic Exposure Model at a Mining and Milling Site through Urinalysis." "Use of an Arsenic Exposure Model at a Gold Mining and Milling Site." Second International Conference on Arsenic Exposure and Health Effects, San Diego, CA.

7/94 – "A Review of Scientific Issues Pertaining to Arsenic." Society for Environmental Geochemistry and Health Conference on Lead and Arsenic Exposure in the Rocky Mountains, Salt Lake City, UT.

5/94 – "Use of Lead Exposure Assessment in the Regulatory Process." International Lead Zinc Research Organization Lead Exposure Assessment Workshop, Research Triangle Park, NC.

3/94 – "Non-linearities in Arsenic Risk Assessment." Boston Risk Assessment Group, Cambridge, MA.

3/93 – "Basic Risk Assessment: Current Developments." Continuing Education Course, Society of Toxicology, New Orleans, LA.

3/92 – "A Review of the Bioavailability of Petroleum Constituents." West Coast Soils and Groundwater Conference, Long Beach, CA.

3/92 – "Bioavailability of Metals and Organics." Workshop on Human Health and Ecological Risk Assessments for Contaminated Sites, Toronto, Canada.

2/92 – "Improvements in Quantitative Noncancer Risk Assessment." Chair of Symposium of Society of Toxicology Meeting, Seattle, WA.

2/92 – "Perspectives on the Development of Soil Cleanup Levels at Mining Sites." Colorado Bar Association, Denver, CO.

11/91 – "Environmental Law Update: Toxic Torts and How Clean is Clean?" Squire, Sanders & Dempsey, Cincinnati, OH.

10/91 – "Risk Assessment for Indoor Air: Evaluating Risks to Susceptible Populations." NATO/CCMS-COST 613 Joint Workshop, Kloster Banz, Bavaria, Germany.

2/91 – "An Update on Exposure and Risks of Lead." Chair of Symposium at Society of Toxicology Meeting.

2/90 – "Inhalation Risk Assessment." Chair of Symposium at Society of Toxicology Meeting.

1/90 – "The Use of Structure Activity Relationships for Alkyl Phenol Risk Assessment." New England Society for Risk Analysis, Boston, MA; RJR/Nabisco, Winston-Salem, NC.

1/90 – "The Use of Structure Activity Relationships in Risk Assessment." Harvard School of Public Health (now Harvard T.H. Chan School of Public Health), Boston, MA; Northeastern University, Boston, MA.

11/89 – "How Protection Levels are Developed and What They Mean." Course on Risk Assessment and Epidemiology for Lawyers, Harvard School of Public Health (now Harvard T.H. Chan School of Public Health), Boston, MA.

9/89 – "An Environmental Health Case Study." Tufts Medical School, Boston, MA.

3/89 – "Impact of Lead Derived from Mining Sources on Blood Lead." Boston Risk Assessment Group, Boston, MA.

2/89 – "Ecological and Health Risk Assessment for Arsenic in Soil." Society of Toxicology, Atlanta, GA.

12/88, 1/89, 9/89, 10/89, and 4/90 – "Risk Assessment for Hazardous Waste Sites, Including a Perspective on Toxic Torts." Executive Enterprises, Inc., Washington, DC, Chicago, IL, Philadelphia, PA, and Orlando, FL.

10/88 – "Ozone Toxicology and Risk Assessment." Harvard School of Public Health (now Harvard T.H. Chan School of Public Health), Boston, MA.

10/88 – "Risk Assessment for Arsenic in Soil." University of Massachusetts, Amherst, MA.

9/88 – "The Use of Animal Bioassays to Assess Lun30 Toxicity." NESCAUM, Princeton, NJ.

6/88 – "Review of Epidemiological and Toxicological Studies on Mining Derived Lead." US EPA, Philadelphia, PA.

3/88 – "Assessment of Impact on Blood Lead of Lead from Mining Sources. " US EPA, Washington, DC.

2/88 – "Regulatory Toxicology." Tufts University School of Medicine, Boston, MA.

12/87 – "Risk Assessment for Soil." Harvard School of Public Health (now Harvard T.H. Chan School of Public Health), Boston, MA.

12/87 – "Health Effects of Ozone and the Clean Air Act." New England Chapter for Society for Risk Analysis, Cambridge, MA.

11/87 – "Health Effects of Ozone." Harvard School of Public Health (now Harvard T.H. Chan School of Public Health), Boston, MA.

9/87 – "Health Risk Assessment for Soil." University of Massachusetts, Amherst, MA.

4/87 – "Key Issues in Addressing Adverse Effects of Ozone." University of Massachusetts, Amherst, MA.

1/87 – "Risk Assessment for Dioxin in Soil." MIT, Cambridge, MA.

10/86 – "Pulmonary Toxicology." Harvard School of Public Health (now Harvard T.H. Chan School of Public Health), Boston, MA.

10/86 – "Risk Assessment." University of Massachusetts, Amherst, MA.

10/86 – "Regulatory Toxicology." Tufts University School of Medicine, Boston, MA.

7/86 – "Health Effects of Indoor Air Pollutants." Region I US EPA, Lexington, MA.

6/86 – "Health Effects of Radon." Society of Women Engineers, Hartford, CT.

6/86 – "Contacting the Health and the Medical Community About the Adverse Effects of Ozone." US EPA, Washington, DC.

6/86 – "Animal Toxicology." US EPA Region I, Boston, MA.

4/86 – "Health Effects of Ozone." NESCAUM meeting, Newport, RI.

2/86 – "Pulmonary Toxicology." US EPA Region I, Boston, MA.

12/85 – "Toxicology of Dioxin." US EPA Dioxin Workshop, Lexington, MA.

11/85 – "Animal Bioassays." Harvard School of Public Health (now Harvard T.H. Chan School of Public Health), Boston, MA.

11/85 – "Pulmonary Toxicology." Harvard School of Public Health (now Harvard T.H. Chan School of Public Health), Boston, MA.

10/85 – "Indoor Air Pollution." Air Pollution Control Association Meeting, Enfield, CT.

1/85 – "Indoor Air Pollution." NESCAUM Workshop, Northampton, MA.

Editor

2010 to Present. Associate Editor. *Toxicology and Applied Pharmacology*.

2006 to 2010. Specialty Editor. *Toxicology and Applied Pharmacology*.

1995 to Present. *Human and Experimental Toxicology* (Editorial Board).

Beck, BD. 1992. *Trace Substances in Environmental Health - XXV, Proceedings of a Conference Held in Columbia, Missouri, USA, 20-23 May, 1991 [25th Annual Conference]*. Science Reviews, Ltd., Northwood, England. Prepared for University of Missouri, Environmental Trace Substances Research Center; Society for Environmental Geochemistry and Health; US EPA; Southern California Edison, 311p. Supplement to Vol. 14 (1992) of *Environmental Geochemistry and Health*.

Beck, BD. 1987. "Overview: Assessing Health Risks from Contaminated Soils." *Comments Toxicol.* 1(3-4):171-175.

Reviewer

Annals of Internal Medicine; Cancer Research; Environmental Health Perspectives; Environmental Research; Fundamental and Applied Toxicology; Human and Ecological Risk Assessment; Human and Experimental Toxicology; Journal of Society of Environmental Geochemistry and Health; Regulatory Toxicology and Pharmacology; Toxicological Sciences

Continuing Education Courses

- Toxicogenomics Meets Regulatory Decision-making: How to Get Past Heat Maps, Network/Pathway Diagrams, and "Favorite" Genes, Society of Toxicology, 2015.
- Current Trends in Genetic Toxicology Testing, Society of Toxicology, 2014.
- Understanding Toxic Neuropathy in Drug Development: Both Clinical and Nonclinical Perspectives, Society of Toxicology, 2013.
- Cutaneous Toxicity: *In Vitro* Methods for Toxicity and Safety Evaluation, Society of Toxicology, 2012.
- Epigenetics in Toxicology: Introduction, Mechanistic Understanding, and Applications in Safety Assessment, Society of Toxicology, 2011.
- Technologies and Tools for Toxicity Testing in the 21st Century, Society of Toxicology, 2010.
- Nanotoxicology: The Science of Developing a Safe Technology, Society of Toxicology, 2008.
- Dose-Response Modeling for Occupational and Environmental Risk Assessment, Society of Toxicology, 2008.
- Toxicology and Molecular Biology of Tissue Repair, Society of Toxicology, 2007.
- Use of Genome Databases for Toxicology, Society of Toxicology, 2006.

- Neuropathology for the Toxicologist, Society of Toxicology, 2006.
- Fundamentals of Nanotechnology: Chemistry, Exposure, Environmental/Health Assessments and Societal Impacts, Society of Toxicology, 2005.
- Integrating Toxicologic Pathology into Compound Evaluation and Risk Assessment, Society of Toxicology, 2002.
- Rodent Toxicity and Nongenotoxic Carcinogenesis: Knowledge-Based Human Risk Assessment from Molecular Mechanisms, Society of Toxicology, 2000.
- An Overview of the Tier 1 Screening Battery Proposed by EDSTAC, Society of Toxicology, 1999.
- Benchmark Dose, Society of Toxicology, 1997.
- Principles of Metal Toxicology, Society of Toxicology, 1997.
- Epidemiology for Toxicologists, Society of Toxicology, 1996.
- International Harmonization: Update on Scientific and Regulatory Issues. Part II: Toxic Substances and Environmental Issues, Society of Toxicology, 1994.
- Case Studies in Risk Assessment: Emphasis on Exposure, Society of Toxicology, 1992.
- Environmental Toxicology, Society of Toxicology, 1991.
- Target Organ Toxicity: Advanced Hepatotoxicity, Society of Toxicology, 1990.
- Toxicity of Agents: Pesticides, Society of Toxicology, 1990.
- Neurotoxicology, Society of Toxicology, 1989.
- Respiratory Tract Toxicology by Classes of Agents, Society of Toxicology, 1988.
- Mid-America Course in Toxicology, 1988.
- Pulmonary Pathophysiology, University of Vermont Medical School, 1979.