

# FACT SHEET

## **HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENT OF SEEP AREA, FORESHORE DOWN SLOPE OF THE EAST IMPOUNDING BASIN, CHEVRON BURNABY REFINERY, BURNABY, BC**

### **INTRODUCTION AND BACKGROUND**

This fact sheet describes the Human Health and Ecological Risk Assessment (HHERA) report completed as part of the human health and ecological risk assessment activities undertaken in response to seepages of oil found in April 2010 on the north, downward slope of the Chevron refinery towards Burrard Inlet. The seepages were immediately reported to the Provincial Emergency Program (PEP) and were addressed on an interim basis using soaker pads and booms. This study is part of the larger overall process being conducted at the site in which the end-objective is the final remediation of the foreshore in the area of the seeps.

### **HOW WAS THE STUDY CONDUCTED?**

The methods used to conduct this HHERA study were based on risk assessment procedures recommended by the BC Ministry of Environment and consistent with methods used by regulatory agencies across Canada and the United States.

### **WHAT IS A HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENT?**

In general, a human health and ecological risk assessment is a scientifically defensible standard way of evaluating the likelihood that adverse health or ecological effects may occur, or are occurring, as a result of being exposed to one or more things that cause stress (stressors such as chemicals). This risk assessment focuses on the potential for the chemicals released in the oil seeps to affect the health of people, plants, animals and fisheries that may come into contact with them.

### **What Is Included In a Human Health and Ecological Risk Assessment Study?**

The study is broken into two parts - the problem formulation and the risk assessment. For there to be any possibility of a risk to human or ecological health, people or plants or animals must actually be exposed to a chemical. This question is addressed systematically in the Problem Formulation by specifically identifying the potential chemicals of concern (PCOCs), the people who might be exposed to the PCOCs, and the specific pathways through which the people might actually be exposed. The information is summarized in a conceptual site model to determine the appropriate scope for further risk assessment activities, as appropriate. The receptor-PCOC combinations identified for human receptors arising from complete exposure pathways and cumulative media exposure in the described exposure scenarios are carried forward for risk assessment. The next steps are calculation of how much people are exposed to the chemical and the toxicity of the chemical and then, based on those two

# FACT SHEET

factors, a calculation of risk compared to the BC MOE human health risk based standards for cancer and non-cancer risks and ecological guidance.

## **WHAT WERE THE OVERALL FINDINGS OF THE HUMAN HEALTH RISK ASSESSMENT?**

The HHRA demonstrated that nobody is being exposed to chemicals from the seeps in ways that could lead to adverse health effects and unacceptable health risks under current site conditions and human activities.

### **What groups of people were identified in the HHRA?**

Several groups of people were identified that might be exposed to chemicals from the seeps based on their activities. These include the general public and First Nation members who may use the foreshore area to:

- Beach comb/walk
- Swim
- Scuba dive
- Boat
- Kayak/canoe
- Harvest shellfish, seaweeds and other marine organisms such as sea cucumber;
- Fish from the shoreline or from boats.

In addition, maintenance workers could also be exposed to these chemicals as a result of the activities that they perform in the area. Maintenance workers complete monitoring of the foreshore area on a routine basis including, for example, collecting groundwater and surface water samples and maintaining the absorbent and containment booms currently in place.

### **How can the identified groups of people come into contact with the chemicals of potential concern?**

People can come into contact with the chemicals of potential concern when conducting the activities listed above by:

- inadvertent ingestion of sediment
- skin contact with sediment
- inadvertent ingestion of surface water
- skin contact with surface water or pore water (e.g. when digging for clams)
- eating fish and shellfish obtained from the foreshore
- breathing air in the vicinity of the seepage.

Routine consumption of contaminated water from the area is not a realistic exposure pathway as the water is saline and not suitable for human consumption.

# FACT SHEET

## **What compounds have been retained as stressors?**

The chemicals released in the oil seeps are the chemicals of potential concern at this site. Sediment, surface water, pore water (the water contained in the sediment) and air were analyzed for components of oil, including one or more of the following compounds: light extractable petroleum hydrocarbons (LEPH), heavy extractable petroleum hydrocarbons (HEPH), volatile petroleum hydrocarbons (VPH), polycyclic aromatic hydrocarbons (PAHs), benzene, toluene, ethylbenzene, and xylenes (BTEX), methyl tertiary butyl ether (MTBE), phenols and select metals.

The maximum measured concentration of each of these compounds was compared to environmental standards and criteria defined by BC MOE, in order to eliminate those chemicals present at concentrations that are below levels of concern for human health. This comparison demonstrated that all chemicals were detected in surface water at levels that were below levels of concern.

There were two potential contaminants of concern identified for pore water (the water in the sediment): benzo(a)pyrene, and zinc.

There were two compounds identified in sediment: LEPH, VPH.

There was one compound identified in air: benzene

## **Are there any health concerns for people resulting from the ingestion of seafood or fish?**

No. Eating seafood caught in the area of the seeps is unlikely to present a health concern. The estimated potential health risks associated with the consumption of seafood were below levels of concern, as stipulated by BC Ministry of Environment.

## **What were the risk estimates for human receptors?**

The risk estimates for human receptors were less than MOE standards for both cancer and non-cancer risks.

## **WHAT WERE THE OVERALL FINDINGS OF THE ECOLOGICAL RISK ASSESSMENT?**

The ERA showed that potential adverse effects to ecological receptors were low to negligible.

The ERA showed that all compounds analyzed in surface water were present in concentrations below the applicable benchmarks for environmental health, and the likelihood of adverse effects to ecological receptors from direct contact with surface water is negligible.

The ERA showed that the potential adverse effects to wildlife species consuming prey items (potentially containing benzo(a)pyrene and zinc in their tissue) was negligible. The risk was calculated for wildlife foraging in the foreshore area using a food chain model. The food chain model used conservative assumptions such as the fact that the wildlife species would only eat prey items from the foreshore area impacted by the seeps and this for their entire life (this area is in fact approximately 40 m long).

# FACT SHEET

## **What species were identified as receptors and how?**

Numerous databases and reports were consulted to identify the ecological receptors potentially present in the foreshore area. In addition, site visits were completed by biologists and environmental scientists in order to gather information on plants and animals and their habitat. This information was used to compile a list of the species potentially present at the site. It is standard practice in completing ecological risk assessment to select a subset of representative plants and animal species (surrogate receptors) to evaluate a reasonable number of receptors. Provincial (BC MOE) and federal (CCME) agencies provide criteria to assist in the selection of surrogate receptors. These criteria were used to compile the final list of species for the Problem Formulation portion of the study.

The following species and categories were selected. Some species were selected to represent different food chains which are why the main component of their diet is provided in brackets.

- Aquatic plants
- Benthic invertebrates
- Black Oystercatcher (bird, eats small invertebrates, crabs, molluscs and barnacles).
- Great Blue Heron (bird, eats invertebrates and small fish)
- Double-crested Cormorant (bird, eats fish).
- Harbour seal (marine mammal, eats fish)
- Coastal dwelling mink (terrestrial mammals using the foreshore to forage for prey).
- Fish

## **How can the ecological receptors come into contact with the stressors?**

Ecological receptors can come into contact with the stressors by:

- Direct contact with contaminated environmental media (e.g., sediment, surface water);
- Ingestion (eating) of sediment and water; and,
- Ingestion of contaminated prey items.

## **Which compounds have been retained as stressors?**

The chemicals released in the oil seeps are the chemicals of potential concern at this site. Sediment, surface water and pore water (the water contained in the sediment) were analyzed for indicators and components of petroleum hydrocarbons, including one or more of the following compounds: light extractable petroleum hydrocarbons (LEPH), heavy extractable petroleum hydrocarbons (HEPH), volatile petroleum hydrocarbons (VPH), polycyclic aromatic hydrocarbons (PAHs), benzene, toluene, ethylbenzene, and xylenes (BTEX), methyl tertiary-butyl ether (MTBE), phenols and select metals.

The maximum measured concentration of each of these compounds was compared to environmental standards and criteria to eliminate those chemicals that are not present in concentrations exceeding prescribed benchmarks for the protection of environmental health.

# FACT SHEET

This comparison demonstrated that all chemicals were detected in sediment and surface water at levels that were below levels of concern.

This comparison resulted in the identification of three potential contaminants of concern in pore water: LEPH, benzo(a)pyrene, zinc

## **What were the risk estimates for ecological receptors?**

The ERA showed that potential adverse effects to benthic invertebrates from direct contact with pore water containing LEPH, benzo(a)pyrene were negligible , and potential adverse effects to zinc were low (based on low risk estimate and small areal extent) .

Accumulation of contaminants in the tissues of aquatic invertebrates or fish has the potential to adversely affect aquatic receptors or wildlife species that feed on these organisms. For this reason a food chain model was used to estimate the concentrations in tissues of aquatic invertebrates and fish. The model results indicated that benzo(a)pyrene and zinc risks to fish and wildlife foraging in the Seep Area are unlikely (i.e., negligible).

## **HOW CERTAIN ARE THE FINDINGS?**

This study is based on standard methods that are well-established in the scientific literature and among regulatory agencies. A conservative approach was used in selecting the parameters, assumptions and methodologies used in this study, which tends to overestimate exposures and risks. It is thus considered unlikely that the likelihood of adverse effects has been underestimated in this study.

## **HOW WERE THE RISK ASSESSMENT FINDINGS USED IN THE REMEDIATION PROGRAM?**

The risk assessment, based on site-specific data from the foreshore, was used to develop risk-based management targets (RBMT) for the foreshore remediation program. A RBMT is the concentration of a contaminant of concern that will be used to determine the success of remediation activities.