Ontario 153/04 Risk Assessments for Federal Contaminated Sites

Ruwan Jayasinghe\(^1\), Tereza Dan\(^1\), Jane Yaraskavitch\(^1\), Tanya Lalvani\(^1\), Brad Simpson\(^2\), and Randi Hay\(^3\)

\(^1\) Neegan Naynowan Stantec LP
\(^2\) Public Works and Government Services Canada
\(^3\) Department of Fisheries and Oceans

2014 RPIC Federal Contaminated Sites National Workshop, April 15, 2014
Ottawa, Ontario
Agenda

1. Objectives
2. Site History
3. Deviations from O.Reg. 153/04 Process
4. Risk Assessment Results
5. Risk Management & Recommendations
1 Objectives

Determine if contaminants of concern in environmental media within the property boundaries pose potential risks to human or ecological receptors.
Objectives

• Neegan Naynowan Stantec LP (NNS) was retained by Public Works and Government Services Canada (PWGSC), on behalf of the Department of Fisheries and Oceans (DFO), to conduct a due diligence site-specific human health and ecological risk assessment (HHERA) for an “environmentally sensitive” property, Michipicoten Harbour Lightstation (the “Site”), located on Gros Point Peninsula, Lake Superior, Ontario.
Objectives

• The risk assessment included an assessment of the potential health risks to human and ecological receptors from identified contaminants of concern in soil and surface water at the Site assuming a future recreational land use.

• The assessment was completed in accordance with Ontario Regulation 153/04 but with deviations from the regulatory process.
Site History
Site History

• Land owned by the First Nation of Michipicoten Cultural Association

• Operated for 70 years as an attended lightstation by Canadian Coast Guard

• Site is now uninhabited

• Currently houses an automated marine navigational light and fog horn
Site History

- Site consists of exposed granite-based bedrock and sparse vegetation (grasses and low shrubs)
- Surrounded by a dense mixed-forest to the north and Lake Superior surrounds the Site on the south, east and west sides of the Peninsula
Site History

• Environmental investigations were first initiated in 1997 to verify the presence of potential soil and surface water impacts associated with historical contaminating activities

  – Dumping of waste into several landfills, leaking oil/gasoline storage tanks, flaking metal-based paints, improper demolition of buildings, etc.
Site History

- COCs identified in soil at concentrations greater than applicable Ontario Ministry of the Environment (MOE) generic site condition standards for a residential/parkland property.
  - toluene, xylenes, petroleum hydrocarbons, polycyclic aromatic hydrocarbons, and metals
3 DEVIATIONS FROM O.REG. 153/04 PROCESS

In order to address limitations of the Site and meet the needs of the DFO, several deviations were taken from the regulated MOE process as a Record of Site Condition filing was not planned.
DEVIATIONS FROM O.REG.153/04 PROCESS

1. Characterization of risks from site data
   i. Maximum CoC concentrations
   ii. 95% upper confidence limit of the mean (UCLM) concentrations
      i. Risks quantified from only the UCLM concentrations were used for the development of risk management measures.
DEVIATIONS FROM O.REG.153/04 PROCESS

2. Calculation of Site-specific Target Levels
   
   i. Derivation of SSTLs is considered part of the federal risk assessment process in accordance with federal guidance documents, and is not considered an approved method in accordance with O.Reg. 153/04 (as amended).
DEVIATIONS FROM O.REG.153/04 PROCESS

3. Additional exposure pathways addressed
   i. Consumption of wild game
   ii. Consumption of traditional vegetation

4. NCSCS Score
   i. Score = 55, Category 2 (i.e., medium priority for action)
DEVIATIONS FROM O.REG.153/04 PROCESS

5. MOE Administrative Tasks
   i. Modified section headings
   ii. No pre-submission form
   iii. Record of Site Condition not filed

6. MOE Regulatory Requirements
   i. Environmental assessment reports do no necessarily comply with MOE regulatory requirements that came into effect on July 1, 2011
   ii. Analytical protocols used in previous reports may not satisfy the latest requirements of the amended regulation.
7. “Environmentally sensitive” site due to acidic pH conditions

   i. Acidic pH has the potential to increase the mobility of metals in soils, and may also result in an increase bioavailability of metals through the ingestion pathways.

   i. All metals that exceeded the O.Reg.153/04 Table 1 SCS were carried forward for quantitative evaluation of human health risks.

   ii. Relative absorption factor for metal CoC was adjusted to 1, to ensure potential risks were not underestimated.

   iii. A secondary screening of CoC to ecological criteria components was not completed; instead all CoC were quantitatively evaluated for the ecological risk assessment.
Overall, the risk assessment shows that potentially adverse health impacts exist to human and ecological receptors as a result of historical contamination.
Risk Assessment Results

• Human Receptor Exposure Summary
  – Direct Soil Contact
    • Maintenance Worker, Recreational Visitor
  – Ingestion of Wild Game
    • Recreational Visitor
  – Ingestion of Vegetation
    • Recreational Visitor
Risk Assessment Results

SOURCE

- Affected Solids
  - Wind Erosion
  - Volatilization
  - Leaching
  - Affected Groundwater
  - Affected Surface Water

Transport Mechanisms

- Vegetation Uptake
- Atmospheric Dispersion
- Enclosed Space Accumulation
- Groundwater Transport

Exposure Pathway

- Ingestion
- Ingestion of Vegetation
- Soil/Dust Dermal Contact and Ingestion
- Air Inhalation of Particulates
- Air Immersion / Inhalation of Vapours
- Groundwater Potable Water Ingestion
- Groundwater Dermal Contact
- Surface Water Dermal Contact

Receptors

- On-site
  - Toddler Recreational Visitor
  - Lifetime Recreational Visitor
- Off-site
  - NA

Legend:

- **Bold**: Complete Pathway
- **Not Bold**: Incomplete Pathway
- **Not bold**: Unknown Pathway
- **NA**: Not Applicable
Risk Assessment Results

• HHRA Risk Characterization
  – Maintenance Worker
    • Direct Soil Contact Risk – Arsenic, Lead
  – Recreational Visitor (Toddler)
    • Direct Soil Contact & Ingestion of Wild Game and Vegetation Risks
      – Antimony, Arsenic, Cadmium, Copper, Lead, Mercury, Molybdenum, Selenium, and Zinc
  – Recreational Visitor (Lifetime Receptor)
    • Direct Soil Contact & Ingestion of Wild Game and Vegetation Risks
      – Arsenic, B(A)P

• Calculated PPS considered protective of on-site receptors with associated RMM
Risk Assessment Results

• Ecological Receptor Exposure Summary
  – Plant and soil invertebrate contact with soil;
  – Ingestion of soil and vegetation by the meadow vole and red-winged blackbird;
  – Ingestion of soil and invertebrates by the short-tailed shrew, domestic sheep and American woodcock;
  – Ingestion of soil and terrestrial mammals by the red fox, red-tailed hawk; and,
  – Contact of aquatic plants, benthic invertebrates and fish with surface water from Michipicoten Bay, which is an off-site surface water body.
Risk Assessment Results

• ERA Risk Characterization

• **Phytotoxicity and soil invertebrates**: potential risk from exists from exposure to PHC F2, PHC F3, indeno(1,2,3-cd)pyrene and metals in soil.

• **Short-tailed shrew**: potential risk from exists from exposure to metals (arsenic, cadmium, copper, lead, mercury and zinc) in soil.

• **Meadow Vole, Domestic Sheep, Red Fox**: potential risk exists from exposure to arsenic in soil.

• **Red-winged blackbird and American Woodcock**: potential risk exists from exposure to PHC F3 and metals in soil.

• Calculated PPS considered protective of on-site receptors with associated RMM
5 Risk Management & Recommendations

Risk management measures, typical of an O.Reg.153/04 risk assessment, were not considered feasible for the Site.
## Risk Management & Recommendations

**Typical O.Reg. 153/04 RMM Options**

<table>
<thead>
<tr>
<th>Risk Management Measures</th>
<th>Exposure Pathways Addressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance worker health and safety requirements</td>
<td>Soil direct contact</td>
</tr>
<tr>
<td><strong>Surface cover (Fill Cap/Hard Cap)</strong></td>
<td>Soil direct contact</td>
</tr>
<tr>
<td>Land use restriction – no full time residential or commercial land use</td>
<td>All pathways for these receptors*</td>
</tr>
<tr>
<td>Land use restriction – groundwater not to be used as a source of drinking water</td>
<td>Ingestion of potable groundwater*</td>
</tr>
</tbody>
</table>
Risk Management & Recommendations

• Given the remote location of the Site, the types of contaminants present and impacted media (soil), the most appropriate remedial option is excavation and landfill disposal

• Recommended RMM Options
  1a. Removal of Impacted Soil – Table 1 SCS
  1b. Removal of Impacted Soil – SSTLs
Risk Management & Recommendations

• Prior to conducting any excavation activities, NNS recommends the following:
  • Additional site investigation
  • Background soil sampling program
  • Biologist Site Visit
Risk Management & Recommendations

• Benefits of using modified O.Reg. 153/04 Approach
  
  • DFO met obligations of determining and disclosing the condition of the property and federal liability

  • Completed assessment in one fiscal year

  • Saved on costs and time related to preparing documents need to support filing of a RSC
Risk Management & Recommendations

• Overall, NNS believes the use of a modified approach to Ontario risk assessments can be applied to other federally leased or owned lands in Ontario in order to satisfy the needs of federal custodians and provincial land owners with a risk assessment that is scientifically comparable to risk assessments prepared under O.Reg.153/04.
Questions