A Simple Solution to Product Recovery

CN Yard in Smithers, British Columbia

Prepared by:
CANADIAN NATIONAL RAILWAY COMPANY
KEYSTONE ENVIRONMENTAL LTD.
Introduction

- Section 1 - Background
- Section 2 - Site Description
- Section 3 - 1997 to 2000 Product Recovery
- Section 4 - 2001 to 2003 Recovery Approach
- Section 5 - Benefits
Background

Steam Era (1913-1959)

- Area HQ for GTP
- Bunker C fueling of steam locomotives
- 12 stall roundhouse for locomotive servicing
Fueling Stand (1996)
Background

Dieselization (1955 - Present)

- Diesel fueling without containment until 1990.
- Fueling facility removed 1997
- Product plume of Bunker C and Diesel composition
- Area of plume 9000m²
Air Photograph (1974)

- Tanks
- Fueling Stand
Free product Plume
Site Description

Geology:

Three Distinct layers:
1. Upper sand and gravel fill
2. Middle clay confining layer
   - varies in thickness and elevation
   - undulating clay layer
3. Lower sand unit
   - confined by upper clay layer
   - artesian type aquifer
Site Description

Product Migration:

- Transported from surface through breaks within clay.
- Occurred during seasonal groundwater fluctuations.
- Forced upwards hydraulically by artesian aquifer.
Cross Section (Visual)

- Fill
- Peat
- Clay
- Sand
- Visible Product
Site Cross Section (Schematic)
1997 to 2000 Product Recovery

Liquid Recovery System:

- Hydrocarbon skimmers installed in each well (19).
- Low vacuum induced on eductor to draw in product and groundwater from skimmers.
- Fluid sent through holding tank, transfer box, oil water separator
- Oil recovered for off site recycling
- Groundwater discharge to drainage ditches
1997 to 2000 Product Recovery

Liquid Recovery System:

- Eductor
- Wastewater Holding Tank
- Incoming wells
1997 to 2000 Product Recovery

System Deficiencies:

- Extreme heating of main product recovery system
- Formation of emulsions
  - elevated hydrocarbon concentration (TEH) in effluent.
- Low product recovery rates
1997 to 2000 Product Recovery

1999 Upgrades:

- Recycle line from holding tank to eductor tank
  - increase volume of water recirculated
  - reduce overall water temperature

- Oil skimmer installed in wastewater holding tank

- Cycle timer on pump to reduce introduction of air.

- Two new recovery wells
# Eductor Product Recovery Rates

<table>
<thead>
<tr>
<th>Year</th>
<th>(Litres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1997</td>
<td>2650</td>
</tr>
<tr>
<td>1998</td>
<td>3295</td>
</tr>
<tr>
<td>1999</td>
<td>523</td>
</tr>
<tr>
<td>2000</td>
<td>3295</td>
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</tbody>
</table>
2001 to 2003 Recovery Approach

Objectives:

- Reduce the operation and maintenance costs
- Increase the product recovery
- Simplify operation and maintenance for operators
2001 to 2003 Recovery Approach

New Product Recovery System:

- Recovery well (100 mm)
- Product recovery skimmer
- Transfer pump
- Hydrocarbon tank
- Enclosure
2001 to 2003 Recovery Approach

- Belt Skimmer
- Belt scraped by blades
- Product collected in AST
- Water returned to well
Recovery Well Layout
2001 Results

- 1500 Litres of product collected.
- Few mechanical difficulties.
- Low product migration into some wells.
2002 Results

- 7900 Litres of product collected
- Recovery well RW-25 - 3096 L
- Recovery well RW-28 - 2830 L
- Two infiltration trenches constructed
  - product recovery systems installed within the collection trenches
Rope Skimmer Product Recovery Rates

<table>
<thead>
<tr>
<th></th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Product Recovery</td>
<td>1550</td>
<td>7900</td>
<td>10000*</td>
</tr>
<tr>
<td>(Litres)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Average Product Recovery</td>
<td>0.5</td>
<td>2.7</td>
<td>3.1</td>
</tr>
<tr>
<td>Rate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Litres per operating</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>hour)</td>
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* Projected annual recovery
System Winterization
## Cost Comparison

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<thead>
<tr>
<th>Eductor Recovery System</th>
<th>Rope Skimmer System</th>
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</table>
# Average Product Recovery Rate

<table>
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<tr>
<th></th>
<th>Eductor Recovery System</th>
<th>Rope Skimmer System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Product Recovery (Litres)</td>
<td>2150&lt;sup&gt;1&lt;/sup&gt;</td>
<td>10000&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
<td>Average Product Recovery Rate (Litres per operating hour)</td>
<td>1.4</td>
<td>2.1</td>
</tr>
</tbody>
</table>

<sup>1</sup> Assuming emulsified oil contains 50% water content  
<sup>2</sup> Average results include projected annual recovery for 2003
Conclusions

Benefits of the “Simple” Solution:

- No emulsification and no discharge.
- Reduces potential impact on fish and fish habitat.
- Low maintenance, simple operation.
- Minimal local expertise required.
- Year round operation.
Acknowledgements

- Jack Stroet (CN operator) for his commitment and dedication in monitoring the system
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