Thermal Desorption Remediation In Relation to Landfill Disposal At Isolated Sites in Northern Alberta

ESAA Remediation Technology Conference
Banff, Alberta  October 21, 2005

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Presentation Outline

- ATCO Remediation Project Introduction
- Thermal Desorption (TD) - process description
- Quality control and quality assurance
- Steen River TD Project – two TD remediated sites
- TD Contracting – performance payment / tonne (T)
- Production rates and on-stream utilization
- % cost breakdown/T - fuel, labour, capital, peripherals
- Cost comparison - TD vs Dig and Dump (DD) in $2004
- TD advantages - mobility, contaminant destruction, groundwater treatment, and winter remediation
- TD limitations – salts, metals, fuel and water cost sensitivity and time onsite
- Fox Lake Staged TD Remediation and Aboriginal employment
ATCO Remediation Project

- ATCO identified 103 isolated generating sites
- 77 of these sites are to be remediated and/or reclaimed
- Alberta Environment (AENV) 2001 guidelines
  Alberta Soil & Water Quality Guidelines for Hydrocarbons at Upstream Oil and Gas Facilities
- Remediation criteria depends on site - location, zoning and end land use
Site Contamination

- Contamination - mainly through the loading, storage and dispensing of diesel fuel
- Diesel releases - offloading diesel, fuel filter, hose, piping and joint failures, and aboveground or underground storage tank releases
- Petroleum lubricants, polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), glycols, and metals generated limited contamination
TD Operating Steps

Soil preparation at TD
TD Soil Treatment

- Thermal desorption - rotary kiln
- Treated soil discharge and quenching
TD Operating Steps

- Contaminant off gas and dust treatment – baghouse
- Contaminant destruction and exhaust - afterburner/oxidation
Quality Control and Quality Assurance

- TD test burns (200 T stockpiles) determine operating parameters – temperature and residency time
- TD production 1,000 T stockpiles
- Stockpile testing
  - four headspace vapour tests; highest two samples
  - two PetroFlag immunoassay field tests; highest one
  - laboratory chemical analysis
Steen River 2004
TD Project

- TD Feasibility Study – TD comparable to DD at $47/T, 150 km & 4,000 T
- TD remediation of 29,000 T of diesel contaminated soil
- Two sites - Steen River Microwave and Steen River Community
- 150 km north of High Level, Alberta
- High grade paved highway
- Productivity in fine and coarse-grained soils
- TD winter operations - direct, indirect and total project costs
- Compared with similar 2004 DD sites
## Steen River Microwave

**21,900 T of clay-silt soil**

- **Excavation Volume**: 11,100 m³
- **Truck haul**: 560 truck loads - 17 km to TD
- **Soil Volume**: 21,900 T soil in 45 days
- **Soil Cost/T**: $47/T, $1,029,300 treatment
- **Average Productivity**: 486 T/day (fine-grained)
- **Total Project Cost**: $1,572,000
- **Project Cost**: $141/m³

$147,000 trucking PHC to TD and backhauling treated soil to SRM

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<table>
<thead>
<tr>
<th>Steen River Microwave TD</th>
<th>Wabasca DD</th>
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</thead>
<tbody>
<tr>
<td>Excavation Volume</td>
<td>11,110 m³</td>
</tr>
<tr>
<td>Truck haul</td>
<td>490 trucks, 146 km</td>
</tr>
<tr>
<td>Soil Volume</td>
<td>15,400 T in 29 days</td>
</tr>
<tr>
<td>Soil Cost/T</td>
<td>$20/T, $384,000 tipping</td>
</tr>
<tr>
<td>Average Productivity</td>
<td>530 T/day</td>
</tr>
<tr>
<td>Total Project Cost</td>
<td>$1,540,000</td>
</tr>
<tr>
<td>Project Cost</td>
<td>$139/m³</td>
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</tbody>
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**SRM excavation on Sept. 18, 2004. Facing South.**
Steen River Community Power Plant
6,500 T sand and gravel

Steen River Community TD
- Total Excavation: 5,900 m³ in 34 days
- Truck Haul: 159 trucks – 2 km to TD
- TD Soil Processing: 6,500 T soil in 12 days*
  *= Operational days – not including weather delays for Foggy Mountain DD
- Average Productivity: 540 T/day (coarse-grained)
- TD Soil Processing: $47/T = $305,500
- Total Project Cost: $780,000
- Project Cost: $132/m³

Foggy Mountain DD
- Total Excavation: 5,225 m³ in 35 days
- Truck Haul: 260 trucks – 160 km
- TD Soil Processing: 6,927 T in 29 days*
  *= Operational days – not including weather delays for Foggy Mountain DD
- Average Productivity: 237 T/day
- TD Soil Processing: 19 $/T = $131,500
- Total Project Cost: $844,000
- Project Cost: $152/m³
Steen River Project
Total Project Cost (%)

- NER TD Soil Processing Cost at 47 $/T 55%
- NER Peripheral Costs 26%
  - site preparation, excavation, trucking, backfill, compaction site reclamation, rentals and water supply
- Other ATCO Costs 19%
  - project administration, consultation and chemical analysis
- Total % Project 100%
NER Steen River Project
Soil Processing Cost (%)

Soil processing $47/T

- 20-30% fuel
- 40% labour
- 20% plant and equipment
- 10% peripherals - soil handling, tank rentals

TD Variable Costs and Requirements

1. Fuel is the largest variable cost factor
   TD fuels; diesel, natural gas, propane, heating oil and recycled oil cost depend on local cost and availability
   - Fuel consumption - soil moisture content and grain size, fuel type and energy yield

2. Water Supply – quantity, quality and rate is second most important TD process requirement
   - TD requires 200 L water/T or ~ 100 m$^3$ water/day
   - At Steen - water permit for the Hay River, however used onsite dugout
DD versus TD Considerations

Key considerations when comparing TD and DD

- Landfill distance, availability, fees and available backfill
- Available time frame for site remediation
- Trucking costs and availability
- Fuel costs and availability
- Water - TD requires ~ 100 m³/day
- Road permitting, access, and maintenance costs
TD ADVANTAGES

- TD - locate where highway trucks have road access - gravel, ice roads and bridges
- TD – once present, nearby (satellite) site remediation costs improve, DD economics remain unchanged
- TD less dependent on trucking – TD shorter hauls, fewer trucks
- Cost Exposure – Trucking invoiced hourly, paid based on tonnage – weather (road maintenance), truck delays increase cost
- Remediate contaminated groundwater using the TD quench system
- TD year-round operation – clean, unfrozen fill for winter compaction, DD requires alternate suitable, unfrozen backfill source
- TD less weather-dependent than DD trucking
TD CONSTRAINTS

- Ineffective remediation of salts and metals
- Excavate and truck faster than excavate and TD can process soil
- Fuel – TD is more cost-sensitive due to greater fuel consumption relative to DD sites
- Requires 100 m$^3$/day of suitable water
Fox Lake Staged Remediation

Remediation February 21 – March 21 2005 - 18,000 m³ (46,000 T)
1,150 m Ice Bridge – 1.5 m thick – 105 T rating – 40 days to build
Truck max. speed on ice bridge, loaded or empty – 5 km
1,100 truckloads – 22 km, 24 hrs/day, 2.25 hr cycle time/truck
Site preparation/complete demolition $67,000
Excavation $373,000
1,100 trucks hauling PHC soil to TD for processing $730,000
2,600 trucks hauling free backfill to excavation $300,000
Sub-total $1,470,000
TD Soil Processing – 46,000 T at 55 $/T (3 months) $2,555,000
Fox Lake Aboriginal Content

- Aboriginal content – Little Red River Cree Nation
- Little Red River Forestry – supplied 40 person camp
- Aboriginal Liaisons - Wayne Erasmus and Alex McGillivray facilitated Band Council Resolutions for site access, backfill sources, 24 hour site activities and community traffic controls
- During Excavation - Nelson employed 14 aboriginal equipment operators, truck drivers and general labourers
- During TD – Nelson employed 8 aboriginal equipment operators, truck drivers and general labourers
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