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

ESAA Remediation Technology Conference
Banff, Alberta October 21, 2005

ATCO Electric Ltd.

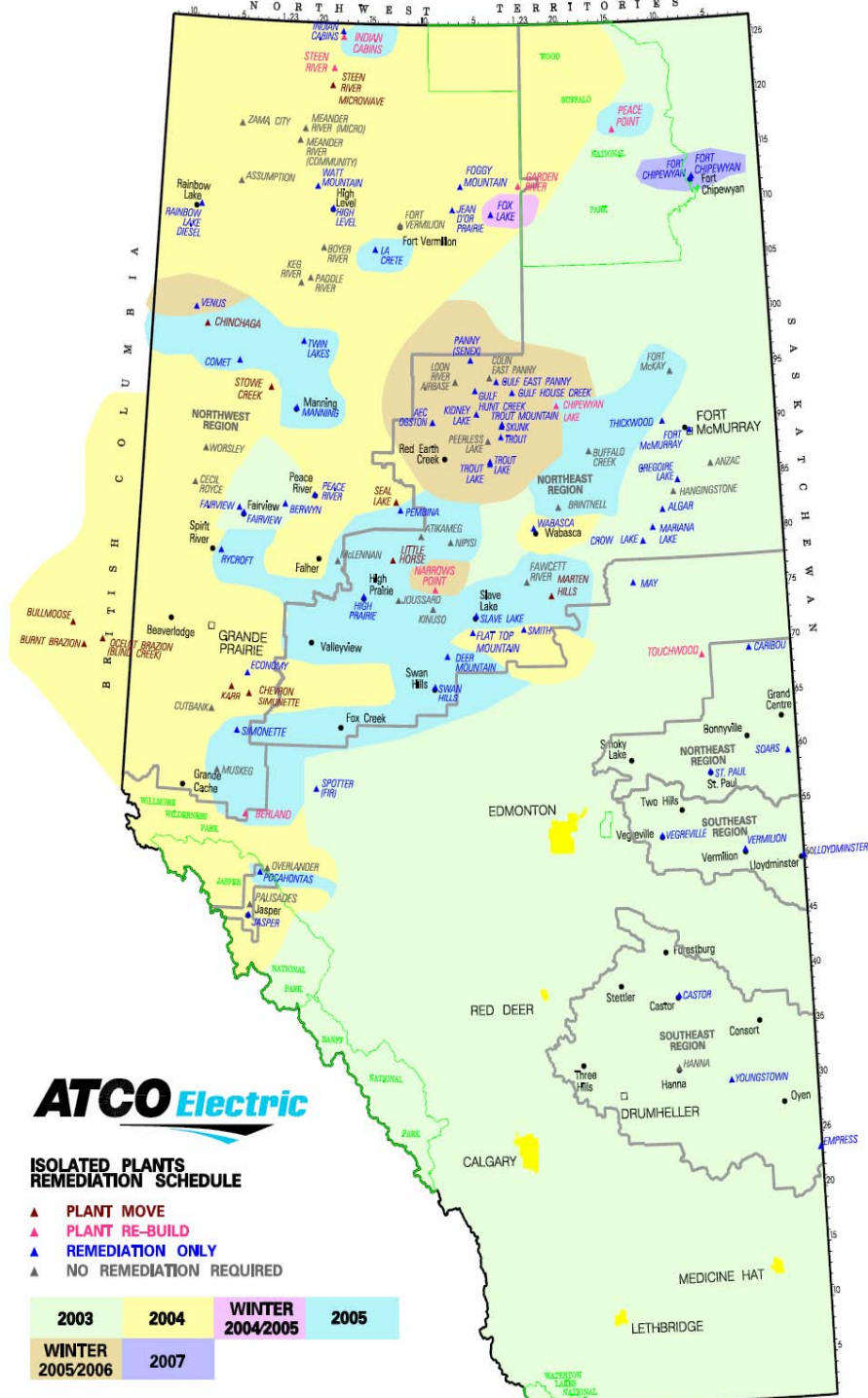
Greg Walker, Michael Henze

Nelson Environmental Remediation Ltd.

Darryl Nelson

Thurber Engineering Ltd.

Brian MacKinnon, Neal Fernuik

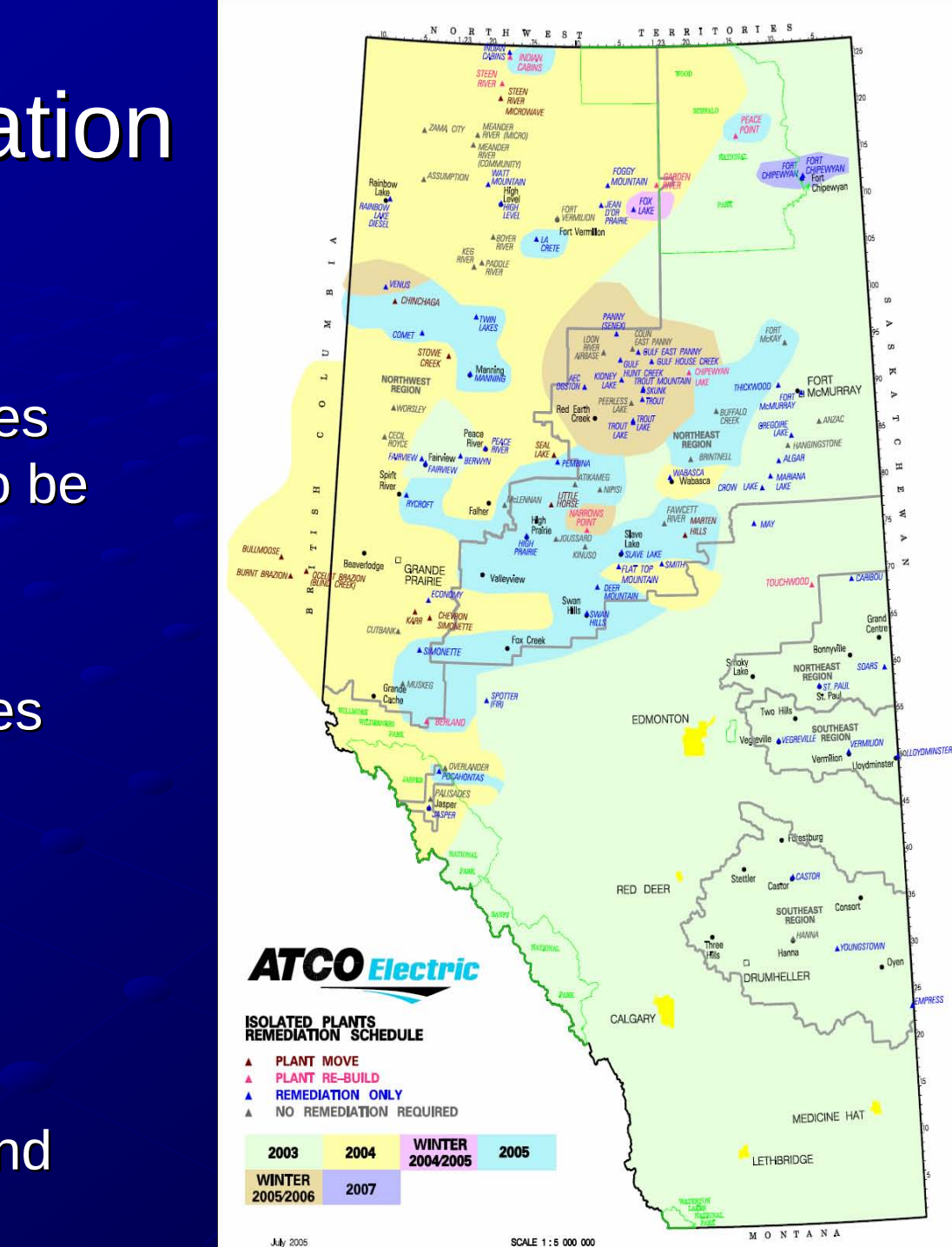


Presentation Outline

- 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

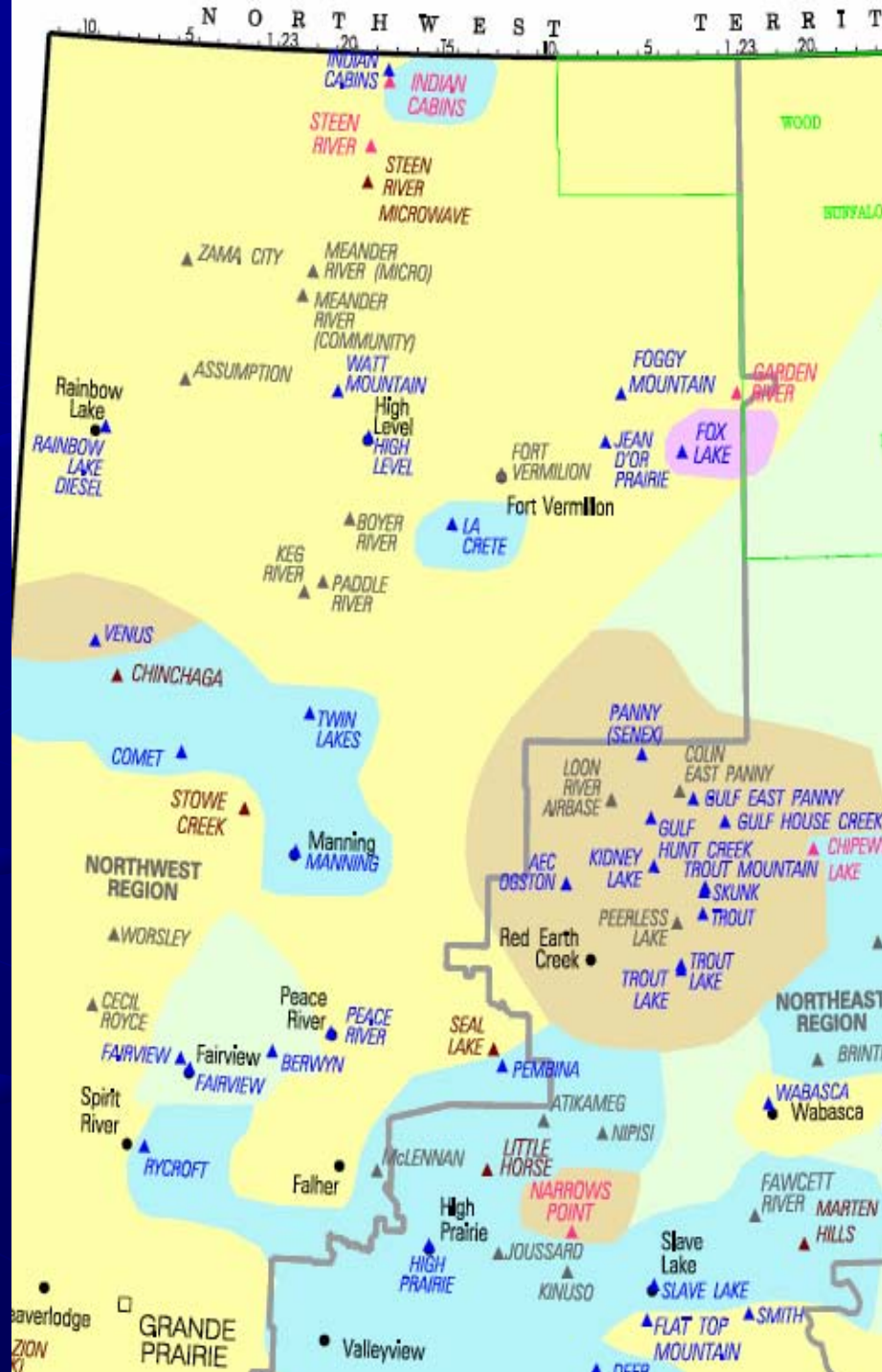
- Contaminant off gas and dust treatment – baghouse
- Contaminant destruction and exhaust - afterburner/oxidation

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

	Steen River Microwave TD		Wabasca DD
Excavation Volume	11,100 m^3		11,110 m^3
Truck haul	560 truck loads - 17 km to TD		490 trucks – 146 km
Soil Volume	21,900 T soil in 45 days		15,400 T in 29 days
Soil Cost/T	$47/T	$1,029,300 treatment	$20/T $384,000 tipping
Average Productivity	486 T/day (fine-grained)		530 T/day
Total Project Cost	$1,572,000		$1,540,000
Project Cost	$141/m3		$139/$m^3$

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

Steen River Community Power Plant
6,500 T sand and gravel

	Steen River Community TD	Foggy Mountain DD
Total Excavation	5,900 m^3 in 34 days	5,225 m^3 in 35 days
Truck Haul	159 trucks – 2 km to TD	260 trucks – 160 km
TD Soil Processing	6,500 T soil in 12 days*	6,927 T in 29 days*

*= Operational days – not including weather delays for Foggy Mountain DD

Average Productivity	540 T/day (coarse-grained)	237 T/day
TD Soil Processing	$47/T = $305,500	19 $/T = $131,500
Total Project Cost	$780,000	$844,000
Project Cost	$132/m3	$152/$m^3$

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
  - project administration, consultation and chemical analysis 19%
- 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 m^3/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 m^3 (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

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

ESAA Remediation Technology Conference Banff, Alberta

October 21, 2005

ATCO Electric Ltd.

Greg Walker, Michael Henze

Nelson Environmental Remediation Ltd.

Darryl Nelson

Thurber Engineering Ltd.

Brian MacKinnon, Neal Fernuik