

Challenges of Conducting Environmental Investigations in the Canadian Arctic

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Remediation Technologies Symposium 2009



Introduction



- 2009 Federal Budget*
 - \$80M to accelerate the management and assessment of contaminated sites
 - \$165M to accelerate the remediation of contaminated sites
- Over 25 sites are in various phases of remediation in the NWT**
- Total Number of Contaminated Sites***
 - NWT – 1,094
 - Nunavut - 645
 - Yukon - 147
 - Canada – 19,885

Sources: *Public Works and Government Services Canada

**Indian and Northern Affairs Canada

***Treasury Board of Canada



Who is Responsible for Contaminated Sites in the Arctic?



- Military
 - Former DEW Line Sites
 - Current NWS and FOL
- Industry
 - Oil and Gas Exploration
 - Mining Exploration
 - Former and Current Mine Sites
- Federal Government
 - Weather Stations
 - Defunct Industrial Operations
 - INAC/PWGSC/PC/EC/TC
- Territorial Governments
 - Electrical Power Production Sites
 - Municipal Infrastructure



Contaminants of Concern

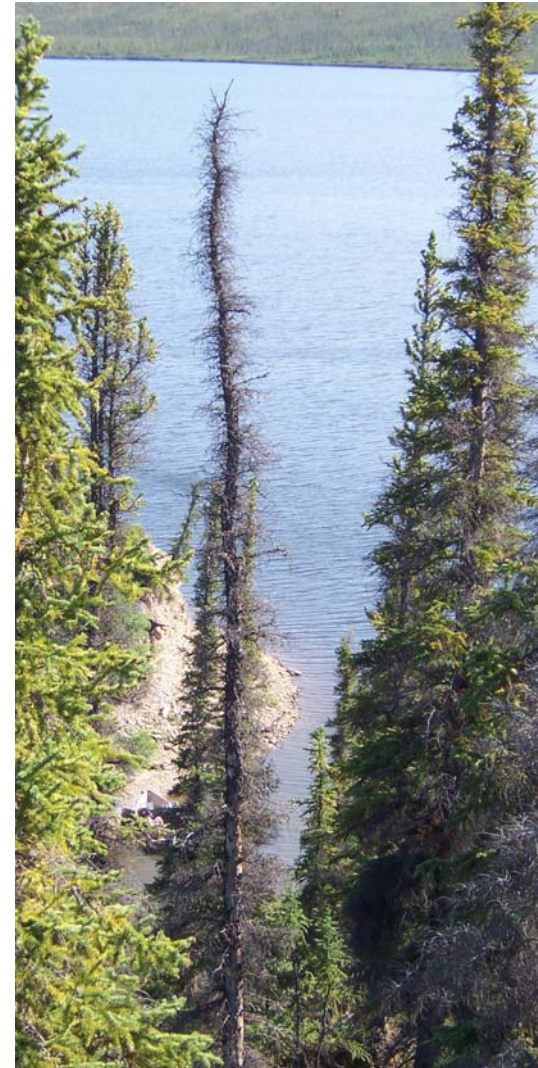


- Petroleum Hydrocarbons (PHC)
 - Diesel/Heating Fuel
 - Aviation Fuels
 - Gasoline
- Metals
- PCBs
- Soil is the Primary Medium

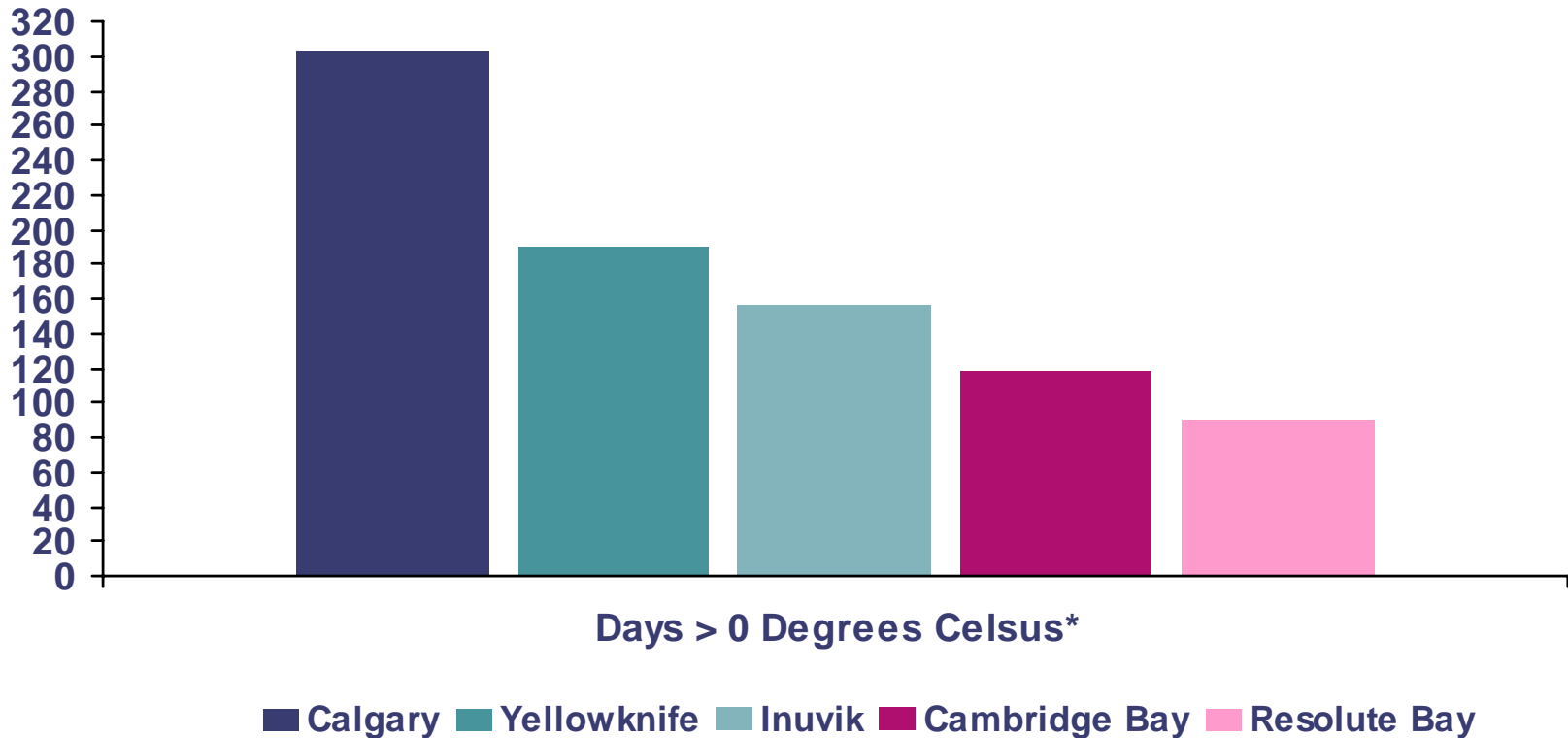


Overview – Challenges

- Length of Field Season
- Logistics
- Resource Availability
- Regulatory Regime
- Limited Number of Previous Studies
- Multi-Year Programs
- Regulatory Guidelines
- Permafrost Conditions
- Project Cost



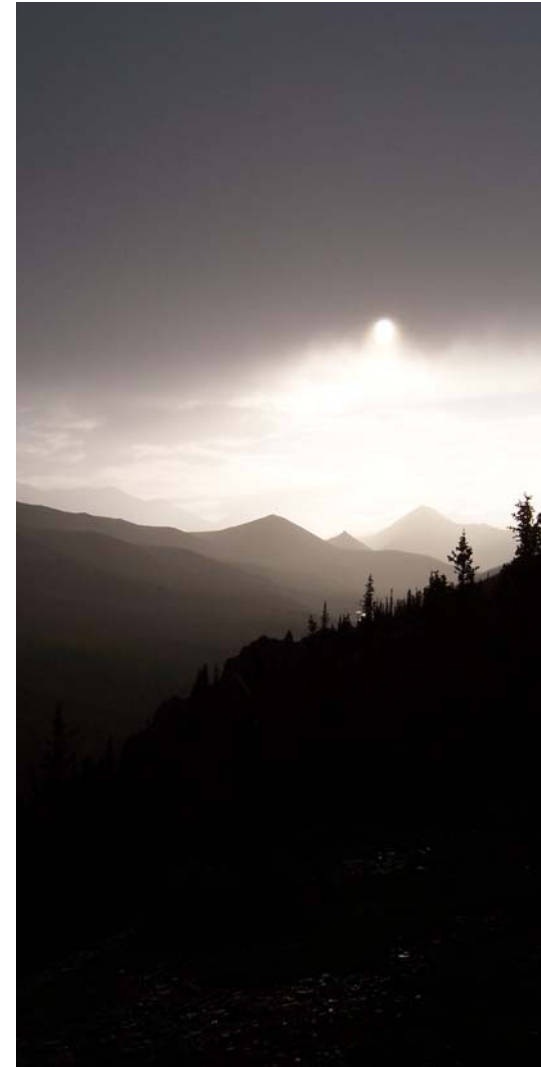
Challenges – Field Season Length



*Source: Environment Canada

Challenges – Field Season Length

- July – September Field Season
- Maximum Ground Thaw (Active Layer) After mid August
- Most Precipitation Occurs in August
- BUGS!!
- Twenty-Four Sunlight
- Winter Work Impacted by Darkness



- Travel Time
 - Can range from a few hours to days
 - Can be a combination of scheduled and/or chartered aircraft
 - Usually involves lots of time spent waiting in Airports, which may or may not have traveler services
- Example: A one day field program in Sachs Harbour consists of:
 - 6 hour flight from Calgary to Inuvik (Monday)
 - Overnight in Inuvik
 - 2 hour flight to Sachs Hr. (Tuesday)
 - Field Program (Wednesday)
 - 2 hour flight to Inuvik (Thursday)
 - Overnight in Inuvik
 - 6 hour flight to Calgary



- Site Access
 - Limited road access
- Four Access Options
 - Aircraft
 - Sealift
 - Winter/Ice Road
 - Winter “Cat” Train
- Aircraft
 - Depending on location either fixed wing or rotary wing
 - Twin Otter – off strip capability, ~3500 Lbs payload, up to 19 passengers
 - Helicopter – can land anywhere, but limited by payload, space, and fuel consumption



Challenges - Logistics

- Sealift
 - Tug boat and barge used in the Mackenzie River system and Western Arctic
 - Large payload
 - Do not need existing dock infrastructure
 - Very expensive
 - Scheduling conflicts (ice conditions)
 - Short operating season (July to October)
- Winter/Ice Road
 - Roads constructed on lakes and rivers
 - Can move greater volumes of equipment/supplies
 - Dependant on ice/snow conditions
 - Short operating season (January to April)
 - Very expensive (~ \$3000/km, Mackenzie Delta 2009)
- Cat Train



- Weather
 - Variable
 - Extreme Seasonal Differences
 - Affects Scheduling
 - Majority of Precipitation in Late Summer – Polar Desert
 - Short “Growing” Season
 - Fog
 - Ice Conditions
- Limited Forecasts
- Changing Climate Conditions



Challenges - Logistics



- Planning/Scheduling
- Equipment/Supply Orders
- Laboratory Hold Times
- Limited Commercial Shipping Options
- Weather Delays
- Dangerous Good Shipments
- Logistics Can Make up 10 – 15% of a Major Program's Budget



Challenges - Resources

- Equipment
 - Availability
 - Condition
 - Cost
 - Mobilization/Demobilization
 - Certified Operators
- Workers
 - Availability
 - Certified/Trained
- Subcontractors
 - Availability
 - Certified/Trained
 - Cost



Challenges – Regulatory Regime

- Numerous Regulatory Bodies
- Aboriginal Land Claims
- Community Consultation
- Example: Phase II ESA in Mackenzie Delta
 - CWS – KIBS
 - INAC – LUP
 - ARI
 - EISC
 - Additional Water License Required for Remediation
- Approximately 3 month turn around ~ \$10-\$15K to complete regulatory approvals



Challenges – Limited Number of Previous Studies

- Previously Completed Studies
- Lost or Misplaced Data
- Destroyed Data
- Record Keeping Changes
- Former Employees
- Aerial Photographs



Challenges – Multiyear Programs

- Site Assessments
 - Dependant on size and scope
- Remediation
 - Depends on location, size, and scope
- Monitoring
 - Post remediation monitoring
 - Erosion
 - Settling
 - Landfill Monitoring



Challenges – Regulatory Guidelines

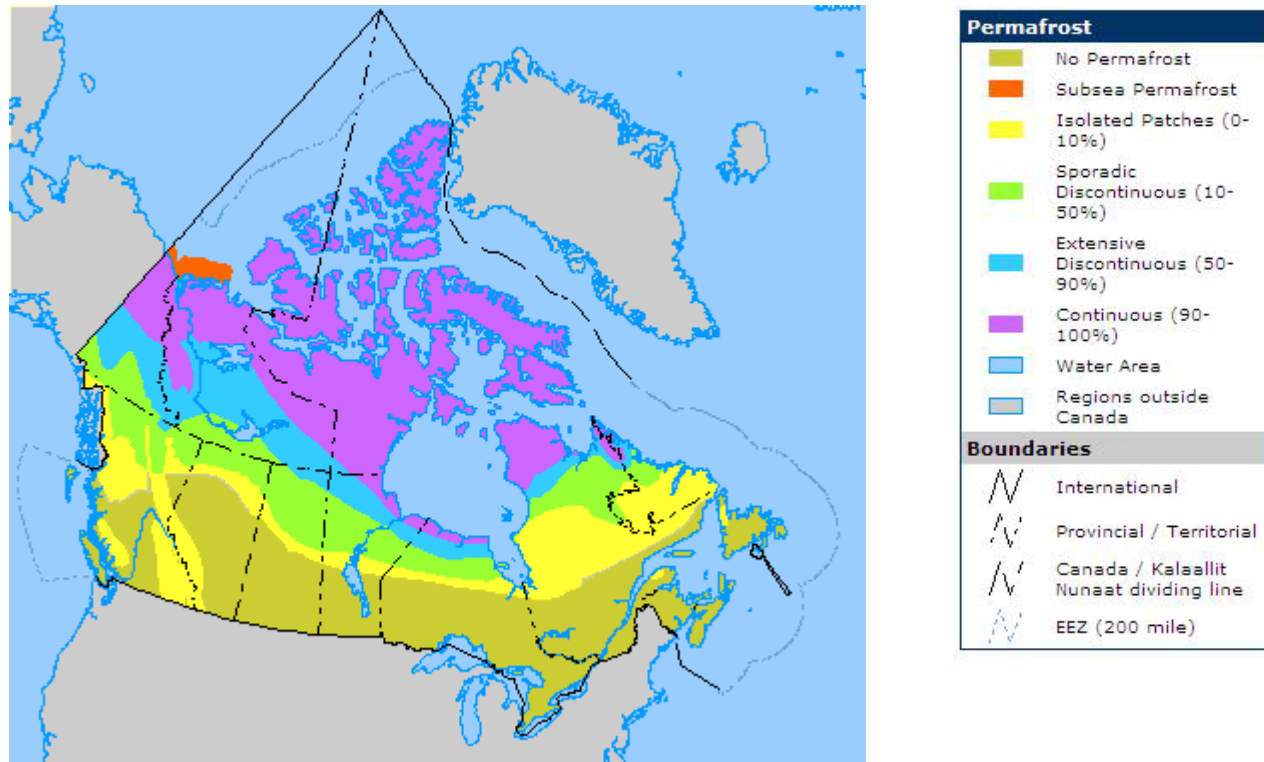


- National Guidelines are Applied to Northern Sites
- Site Specific/Risk Based Criteria
- Multiple Regulators
- Changes to Guidelines



Challenges – Permafrost

Permafrost occurs when the ground remains at or below a temperature of 0°C for a minimum period of two years.



Source: NRCan

Challenges – Permafrost

- Geophysical Investigations
- Active Layer Thickness
- Drilling
- Stability
- Drainage
- Monitoring Well Installation
- Sampling
- Soil Excavation
 - Dewatering
 - Water Treatment
 - Water Storage
- Beneficial uses



Challenges - Cost

- The cost of doing business in the north is much higher than in the south
- Key items that add to cost
 - Mobilization/Demobilization
 - Accommodations
 - Transportation
 - Shipping
 - Labour
 - Office Space
 - Delays
 - Unforeseen Circumstances



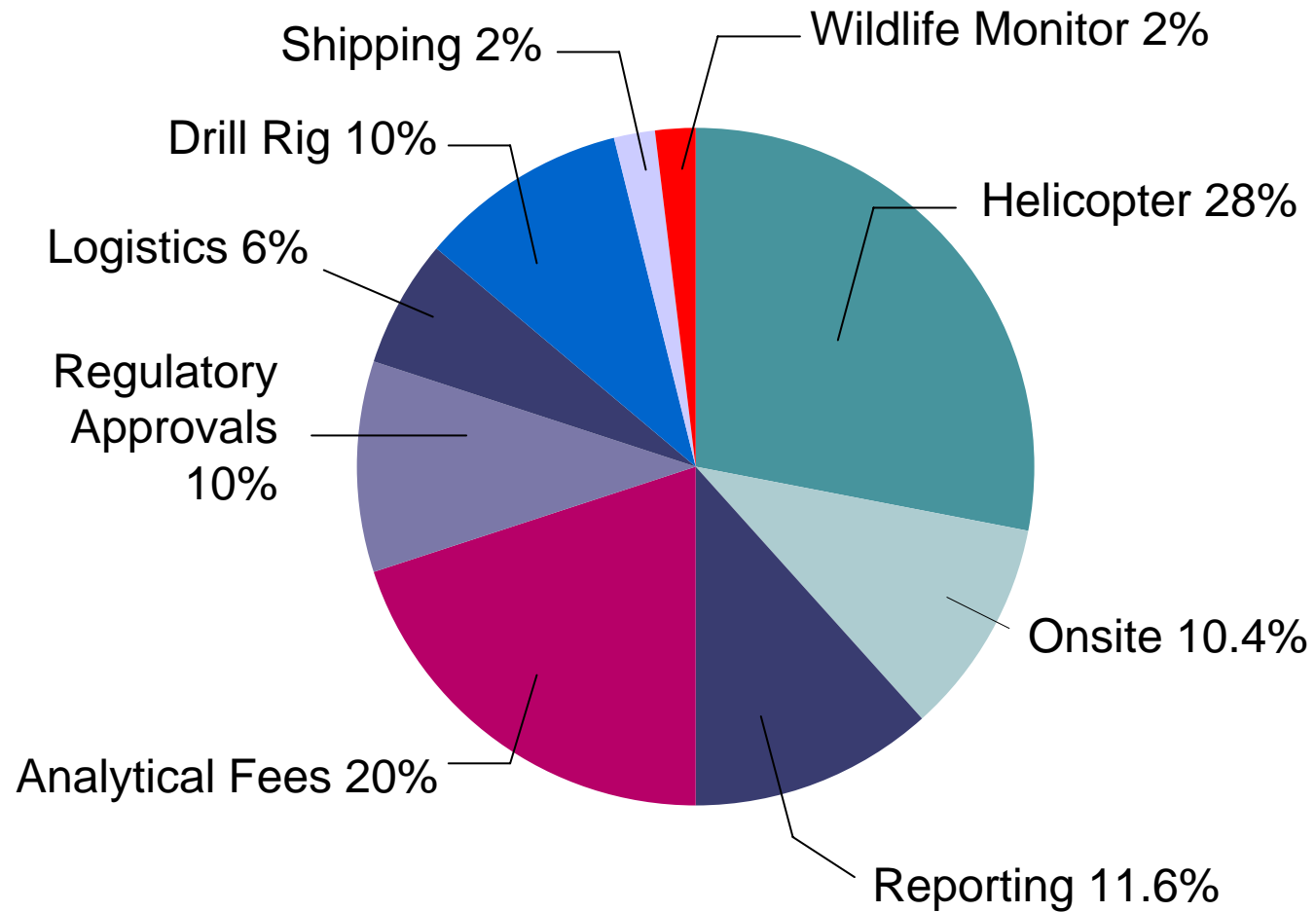
Case Study – Phase II ESA



- Budget - ~\$250 K
- Exploration Wellsite
- Unknown Sump(s) Location (conflicting geophysical investigations)
- Remote Access
- Ninety Boreholes
- Ten Monitoring Wells
- Three Thermistors
- Surface Water and Vegetation Sampling
- Site Survey
- Conducted Early September



Phase II ESA – Cost Allocation



- January – Scope of Work and Contract Execution
- March – Complete Project Description & Community Consultation
- April – Regulatory Submittals
- July – Receive Regulatory Approvals/Submit Sampling/Work Plan
- August – Logistics (drill rig, equipment rental, helicopter booking, etc)
- September – Field Program (10 days)
- November – Draft Report Submitted
- December – Final Report Submitted
- January/February – Remedial Action Plan Submitted

Conclusions

- Planning
- Logistics
- Work Plan
- Very Rewarding Environment to Work
- Questions?

