

Mark Pickering Alberta Environment and Sustainable Resource Development

# RemTech 2012







- EMS Data base-April 11, 2002 to present day, over 24 000 spills reported to AEW.
- Of those over 22 000 impacted surface water, shoreline or land.
- Alberta contains about 100,000 km2 of wetlands/muskegs, representing 16.3% of Alberta's land base.
- It is estimated that up to 64%\* of Alberta's wetlands has already been lost.

\* Institute of Wetlands and Waterfowl Research



- Currently there are over 377,000 km of pipeline throughout the province. Out of this total more than 120,000 km of line transmits oil, oil and produced brine mixtures and straight produced brine.
- The 2011 Field Surveillance & Operations Branch Provincial Summary reported a failure rate of 1.6 per 1000 km's of pipeline. A total of 1174 liquid releases were reported.
- The resulting contamination is often addressed via excavation and land filling or other forms of large scale soil disturbance; however, the results can be highly destructive to these sensitive ecosystems.
- Recently identified that better education with stakeholders & regulators regarding what is defined as a "water body" was needed.







- By using innovative, minimal disturbance spill containment and recovery techniques, the regulators desire for maximum ecological recovery in a minimum time frame can be achieved.
- > This presentation:
  - ✓ Will clarify the definition of a "water body"
  - Highlight innovative, minimal impact spill containment and recovery techniques
  - Touch on examples of positive ecological outcomes following application of these techniques



# Water Body





When dealing with a spill or release, the Environmental Protection and Enhancement Act and the Water Act are the applicable legislation within Alberta. The *Water Act* Section 1(1)(ggg) definition of "water body" applies:

"water body" means any location where water flows or is present, whether or not the flow or the presence of water is continuous, intermittent or occurs only during a flood, and includes but not limited to wetlands and aquifers.



The "water body" definition includes reference to "wetlands". Wetlands as further noted in the provincial wetland restoration guide (<u>http://environment.alberta.ca/01126.html</u>) include muskeg systems which include bogs, fens, marsh and shallow water. The definition of a "wetland" is:

"Wetland" is land saturated with water long enough to promote formation of water altered soils, growth of water tolerant vegetation and various kinds of biological activity that are adapted to wet environment."



# Environment & Sustainable Resource<sub>(drop the S)</sub> Development's Role





### **The Environmental Protection and Enhancement Act**

### **Purpose of Act**

- 2 The purpose of this Act is to **support and promote the protection**, enhancement and wise use of the environment while recognizing the following:
- (a) the **protection of the environment is essential to the integrity of ecosystems** and human health and to the well-being of society;"

#### Duty to take remedial measures

- **112(1)** Where a substance that may cause, is causing or has caused an adverse effect is released into the environment, the person responsible for the substance shall, as soon as that person becomes aware of or ought to have become aware of the release,
  - (a) take all reasonable measures to
    - (i) repair, remedy and confine the effects of the substance, an
    - (ii) remediate, manage, remove or otherwise dispose of the substance in such a manner as to prevent an adverse effect or further adverse effect, and

(b) restore the environment to a condition satisfactory to the Director.



### Water for Life Strategy

"We need to ensure reliable water resources, **promote the health and integrity of our aquatic ecosystems**, and Safeguard Albertans from risks associated with Water quality and quantity."

"Monitor, report, and adjust, where necessary, to ensure the health of aquatic ecosystems are maintained or improved"



# **Release Containment**





### **Considerations**

- Access
- Site characteristics
- Equipment
- Collateral damage





### Natural Features

- ✓ Surface topography (surface flow & containment, damming)
- Containment (beaver dams)
- ✓ Surface flow (flushing & dilution\*)

### Pipeline Right Away

- ✓ Roach berms
- Disturbance
- ✓ Settlement





#### Lease Berms (if present!)

- ✓ Containment
- ✓ Fluid recovery
- Lease Roads
  - ✓ Fluid recovery (ditches)
  - Surface flow diversion & Subsurface containment (act as barrier due to settlement within the muskeg





- Absorbents
- Booms
- Turner Valley gates
- Inverted weirs
- Water Gates



















# Preferred Remediation Techniques





- Rapid response and placement of containment measures essential.
- Movement is usually slow in these types of receptors. Dependent on several factors including temperature, surface topography & characteristics, saturation of organic medium and precipitation.
- Encouragement of utilization of site topography & characteristics for remedial works. ie "natural" flushing of the impacted areas to low lying areas (bell holes)
- Best for the environment "Lesser of Two Evils"



Old Way

- ➢ "Dig & Dump".
- Little consideration for overall impacts to sensitive ecosystems.
- Dewatering and excavation were the main remedial techniques utilized for emulsion and crude oil releases into muskeg and wetland receptors, however these are the most destructive.



New Way:

- Non Intrusive and minimal disturbance containment & remedial actions encouraged.
- Remediation actions plans reviewed by ESRD staff especially if surface water, muskeg or wetlands are impacted.
- Monitoring by ESRD during initial response and remedial activities.



Draw Back – Produced Water in Wetland/Peatland receptors

- Excavation at failure location (Source removal).
- Utilize pump to dewater excavation and draw fluids back to source location.
- Requires little to no flushing activity.
- Minimizes use of fresh water and surface disturbance.









Fresh Water Flushing - Produced Water in Wetland/Peatland receptors

- Utilizes trenching and bell holes for surface flow diversion & fluid recovery.
- Locations based on initial delineation work and surface flow features.
- Utilize pumps and/or vacuum trucks to recovery impacted fluids.
- Usually requires aggressive fresh water flushing to recover salinity impacts.
- Greater amount of surface disturbance and time consuming.







### Oil in Wetland/Peatland receptors

- 1) Utilize vacuum trucks or skimmers to recover free product from surface and vegetation.
  - ✓ Minimal disturbance working in/out
- 2) Removal of impacted debris and vegetation.
  - ✓ Hand work. Minimal disturbance working in/out
  - Root zone not disturbed
- 3) Dewatering & Surface Scraping.
  - ✓ Treatment and return of recovered fluids.
  - ✓ Remove residual surface soil impacts.
  - ✓ Peat amendment work.































### Peat Amendments

Peat Moss.

- Kiln dried peat moss. Compressed and bagged (Inexpensive)
  - Mineral & Organic Soils
    - Draws residual product from mineral soils and allows for more rapid break down.
    - Minimal disturbance to rooting zones.
  - Surface Water
    - Absorbs floating free product as well as dissolved phase and allows for easy recovery (Leaf blowers)
    - Collected and recovered prior to saturation to prevent sinking.













# **Bio-Remediation and Surfactants**

- Microbes are native to all ecosystems but specific to particular regions.
- Enhanced microbial activity with the correct microbes for the product to be consumed can take 1-6 months
- Surfactants may be required to help break up the hydrocarbons which speeds up the bioremediation by increasing bacterial access to the oil
- The converted hydrocarbon turns to water and carbon dioxide.
- Product may spread unless contained



| Parameters                                      | Before         | After         |
|---|----------------|---------------|
|   | Bio-Reclaim    | Bio-Reclaim   |
|   | Application    | application   |
|   | March 16, 2009 | July 23, 2009 |
| Light Extractable Petroleum Hydrocarbons (C10 – |                |               |
| C19)  | 69000          | 1.6           |
| Heavy Extractable Petroleum Hydrocarbons (C20-  | 50400          |               |
|   | 50100          | 5.4           |
| Acenaphthene                                    | 0.51           | <0.00001      |
| Athracene                                       | <0.003         | <0.00001      |
| Chrysene  | 2.62           | <0.00001      |
| Fluorene  | 3.88           | 0.00047       |
| Naphthalene                                     | 9.34           | 0.00021       |
| Phenanthrene                                    | 9.4            | 0.00264       |
| Benzo   | 0.36           | <0.00001      |
| Benzo(a)pyrene                                  | 0.12           | <0.00001      |
| Benzene   | 15.4           | 0.0015        |
| Toluene   | 60.5           | 0.0015        |
| Ethylbenzene                                    | 11.0           | <0.0005       |
| Xylenes   | 72.7           | 0.0011        |
| Styrene   | <0.05          | <0.0005       |



# **Questions / Comments**

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