Waste in Our World, an Oil and Gas Perspective

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Outline

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Oilfield waste shipments must be documented, tracked, and reported in accordance with provincial and federal regulatory requirements.
- Federal or provincial waste manifest must be used for hazardous waste.
- All shipping documents must be retained for two years.
In Alberta, the AER distinguishes 111 different oil & gas industry waste types via use of waste codes.
Generators are liable for all waste from “cradle to grave”; must track how and where the waste is generated, how it is transported, and how and where it is disposed/treated.
Waste handling is subject to regulatory audit.
- Regulator may request info on waste origin and properties, shipping documents, regulatory approvals for disposal facilities, waste classification and characterization documentation.
Waste Tracking – Disposal Facilities

- In 2015 Canadian Natural made use of over 128 third party waste disposal facilities (>60,000 shipment records):
  - **Class II Landfills**
    - contaminated soils, drill cuttings, lime sludge
  - **Oilfield Waste Processing Facilities and Disposal Wells**
    - production fluids, hydrocarbon fluids and sludge’s
  - **Recycling Facilities / Transfer Stations**
    - used lubricating oil, filters, batteries, rags & absorbents, empty containers, scrap metal, plastics, miscellaneous debris

- Canadian Natural also owns/operates internal waste disposal facilities:
  - **Waste Caverns**
    - produced sand and water, evaporator blowdown water, lime sludge
  - **Landfills**
    - contaminated soils and camps waste
  - **Disposal Wells**
    - produced water and some waste fluids
Volumes/Types of Waste

• O&G Companies deal with significant volumes that we must manage in an environmentally responsible manner.

• Produced Sand
  – Production of materials can often lead to large volumes of sand as well.
    • Some companies produce, from one field, enough volume to fill a 500,000 tonne landfill cell a year.
  – Produced sand is often benign.
    • Management options are limited though due to sheer volume, land application is not an option.
Volumes/Types of Waste

- Lime Sludge
  - Thermal Operations often have water softening requirements.
  - The produced water used is often hard and requires lime treatment to soften.
  - This creates large volumes of lime sludge that must be dried and placed in a Class II landfill.
    - Upwards of 80K m3 of dried lime a year from some operators.
    - Often costly to dry via centrifugation.
Volumes/Types of Waste

- Produced Water
  - Although not technically defined as a waste in Alberta, huge volumes are generated - cost effective management a must.
  - Flowback vs Produced Water.
    - Defining the difference can enable a wider range of disposal options.
  - Deep Well Disposal (Class Ib vs Class II).
Volumes/Types of Waste

• Remediation Project Waste (Dirty Dirt)
  – Inheriting legacy sites adds up.
  – Often, sites are inherited from old companies that are no longer in business.
  • When these sites are evaluated it is often determined the soil needs to be removed to meet Tier I (or equivalent).
  • Volumes of one project can reach over 100K Tonnes, difficult logistics for both sides.
    – Moving large volumes of soil also requires significant back fill and additional equipment.
Volumes/Types of Waste

• Camp Waste
  – As you can imagine, O&G has a need to house people in large camps.
  – To facilitate production and expansion, some operations can have 10,000+ people to accommodate at one time.
  – These camps generate the same amount of waste a comparable sized town would.
  – A camp this size will generate approx. 250 tonnes a week.

• Due to the remoteness, disposal is not often cheap, or easy.
Volumes/Types of Waste

• Camp Waste cont’d
  – Sewage is also a large consideration for camps.
  – If you feed people, they have a tendency to need a washroom!
  – Permanent camps are a little easier to manage as they install water treatment plants.
  – The bio-solids generated at the septic plants must be landfilled and is a big cost.

• Where feasible, we are looking at composting operations.
  – Difficulty is wildlife concerns.
Volumes/Types of Waste

• Drilling Waste
  – This is actually is the coolest part of what I do.
  – When drilling a well, it is a general rule that we will generate 2 ½ or 3 times the hole volume in waste.
  • A typical heavy oil well will generate 200ish cubes of waste (total waste = solids and liquids).
  • We try to Landspray all of the waste that we can.
  • Landspraying is a very environmentally responsible way to dispose of drill mud and cuttings.
Management options: Land Application

• LWD of Drilling Waste
Drilling Waste

• Pros of conventional DWD
  – Reduced facility disposal.
  – Greatly reduced carbon footprint.
  – Generally, this option is easier to carry out logistically, at a reduced cost.
    • Vacuum trucks are needed on a drilling rig regardless of disposal option.
  – Landowners often prefer this disposal option, particularly in a dry year.
    • Add moisture and micro nutrients to the soil.
Drilling Waste

• Cons of land application of drilling waste
  – Diligence is very important.
    • We must ensure that the products we are drilling with are benign and environmentally responsible.
    • There are a number of significant testing parameters that we must carry out prior to LWD or mixing on site.
  – Often ROP is sacrificed for the ability to carry out conventional disposal.
    • Invert mud is much faster to drill with, but both the fluid and solids must be managed at an appropriate facility, this makes it a costly option.
Management options: Caverns

- Caverns
  - A great alternative for the management of large volumes of waste is deposition into salt caverns.
  - In some projects, the volume of sand could fill a 500K tonne cell every year.
  - Salt caverns can be developed to accommodate 500K m3.

- In the US, there are caverns more than a 1M cubic metres in size.
Caverns
Caverns
Caverns

• Pros of using caverns
  – They are permanent disposal solutions with no migration potential.
  – Caverns act as a separation vessel of sorts.
    • With the heat and pressure from the formation, HC will be separated from the solids and can be returned to surface for treatment to sales quality.
    • This is HC that would remain within the solids when disposed of at a landfill.
  – High volumes can be disposed of per day with little man power.
Caverns

• Cons of using caverns
  – There are limited areas you can put them.
    • You need the geology to be available and have the thickness of salt to make the site economical.
    • Basically, the NE corner of Alberta and NW corner of Sask are the two viable areas that meet the criteria.
  – Significant time to develop a cavern.
    • From drilling to operationally capable to accept waste would be approx. 2-3 years. ROI is strained.
    • Capital required for the supporting surface infrastructure.
Management Options

- **Landfills**
  - Class I vs Class II.
    - O&G companies do not generate much waste that requires a Class I landfill disposal option.

- **TRD**
  - Fluid management.
    - Often used to recycle materials as well.
  - Disposal Wells (class Ib, Class II).
    - Defining difference between Brine equivalent and Frac water key.
Recycling

• O&G have tried many technologies to allow for efficient recycling.
  – Drilling Fluid (Mud) recycling has been carried out for years. It reduces the amount of HC that is on drilling cuttings substantially.
  – Reduces need for more invert to be brought into a site.
• Similar tech has been tried on production sand.
  – Results have been promising but still end up with 1000’s m3 of clean sand. What do we do with it?
Trucking

• Trucking is probably the largest single consideration for an O&G company when it comes to managing waste.
  – This could be waste fluids, solids or a combination of both.

• A large oil and gas company can typically spend 70%-80% of its WM budget in trucking material to appropriate disposal.
  – In 2014, CNRL spent $60M in disposal, but almost $220M in trucking the waste to facility.
Trucking

• Proximity to a facility is a big consideration when we are determining the best management plan for our wastes.
  – Remote Operations: Some disposals have had to be shipped for 24 hours in order to reach the nearest facility.

• Often line-ups at facilities.
  – Because of the limited number of facilities, we incur costs for trucks while they are waiting to off load (36 hours in wait times is not unheard off).
  – As a result, standby costs can result in an exponential increase in our disposal costs above what was budgeted.
Trucking

• Sheer volume of waste often creates a trucking shortage.
  – With large volume areas, there is often a shortage of trucks, driving up costs.
  – A few years ago, CNRL used over 534 different trucking companies just to go to three of the bigger disposal companies.

• Safety is one of our core values and of paramount importance to us, we would love to reduce the distance and number of trucks we use.
Questions