

# MONTHLY UPDATE REPORT PRIMROSE OIL SANDS FLOW TO SURFACE LOCATIONS

NOVEMBER 29, 2013

## 1 Introduction

Canadian Natural Resources Limited Primrose/Wolf Lake Oil Sands Project is a thermal in situ operation located on the Cold Lake Air Weapons Range approximately 65 km north-northeast of Bonnyville, Alberta. Bitumen production from this project employs cyclic steam stimulation (CSS) technology whereby steam is injected into the oil sands formation (at approx. 500 metres depth) through wells to reduce the viscosity of the bitumen. After steaming, bitumen then flows through the same wells and is processed at project facilities.

In May and June of 2013, Canadian Natural discovered four sites in the Primrose project area where bitumen emulsion had flowed to surface (FTS). Measures were immediately taken to address the incidents in order to clean up, investigate, remediate and address the causes of the events.

The legal descriptions of the four FTS sites are:

- 02-22-067-03 W4M (2-22)
- 10-01-067-03 W4M (10-1)
- 10-02-067-03 W4M (10-2)
- 09-21-067-04 W4M (9-21)

Canadian Natural has made good progress in cleaning up the sites, is continuing to investigate the causes, and will increasingly focus on sub-surface monitoring and remediation and eventual surface reclamation. We have worked closely with regulators and stakeholders throughout this process. In response to the incident, Alberta Environment and Sustainable Resource Development (ESRD) formalized their direction to Canadian Natural as follows:

- *On Oct 21, 2013, Canadian Natural was served by ESRD with an Environmental Enforcement Order (EO) which required that:*

*As a result of the FTS situation and pursuant to section 12 of the Alberta Environmental Protection and Enhancement Act, Canadian Natural will take all reasonable measures to:*

- *Repair, remedy, and confine the effects of the substance*
  - *Remediate, manage, remove or otherwise dispose of the substance in such a manner as to prevent an adverse effect or further adverse effect*
  - *Restore the environment to a condition satisfactory to AESRD Director*
- *On September 24, 2013, ESRD issued an Environmental Protection Order (EPO-2013-33/NR) specific to the (9-21) site as the FTS incident at this site was beneath a water body and required a unique and more diverse response that was enabled by the EPO*

Canadian Natural's response to the four FTS sites is by way of a Comprehensive Plan. The plan consists of eight separate plans requiring ESRD and Alberta Energy Regulator (AER) approval prior to any earthworks or drilling activity. Canadian Natural is working diligently with ESRD and AER. Investigative drilling has commenced and will continue throughout the winter season.

## **2 Summary of Activities to Date**

### **2.1. Surface Site Containment, Delineation and Remediation Plan**

This plan covers site containment, delineation and remediation plans for the incident sites. Status at each site:

#### **2.1.1 2-22 (Terrestrial Site)**

##### Containment

- Impacted area is .31 hectares
- Identified fissures are contained by clay berms isolating the fissure from surface water inflow and to allow collection of continued bitumen emulsion seepage

##### Delineation

- Continue to recover and remove bitumen seepage

##### Remediation

- Evacuation of all impacted material is complete
- Material was disposed of at a class 2 landfill

#### **2.1.2 10-1 (Terrestrial Site)**

##### Containment

- Impacted area is .55 hectares
- Identified fissures are contained by clay berms isolating the fissure from surface water inflow and to allow collection of continued bitumen emulsion seepage

##### Delineation

- Continue to recover and remove bitumen seepage

##### Remediation

- Evacuation of all impacted material is complete
- Material was disposed of at a class 2 landfill

#### **2.1.3 10-2 (Terrestrial Site)**

##### Containment

- Impacted area is .57 hectares
- Identified fissures are contained by clay berms isolating the fissure from surface water inflow and to allow collection of continued bitumen emulsion seepage

##### Delineation

- Continue to recover and remove bitumen seepage

##### Remediation

- Evacuation of all impacted material is complete
- Material was disposed of at a class 2 landfill

#### **2.1.4 9-21 (Water Body Site)**

##### Overview

- Impacted area is 5.95 hectares
- Water body is not fish bearing
- Does not interact of flow with other water bodies
- Multiple containment curtains and booms were deployed around the perimeter of the source and scaffolding and netting was deployed above the source as a deterrent to birds
- Bitumen continues to be removed from the fissure area
- Surface water and sediment samples were collected daily and analyzed to monitor the water quality during the bitumen recovery period
- Fencing and wildlife deterrents are in place and a team of biologists worked to minimize the effect to wildlife and waterfowl
- A contingent of international Oil Spill Experts that were onsite to capture and rehabilitate affected birds and animals
- 3 beavers, 49 birds, 1,828 frogs and 70 small mammals were captured and removed from the 9-21 site
- 2 beavers, 43 birds, 103 frogs and 36 small mammals were impacted by the bitumen release

##### Dewatering

- Dewatering has been completed
- Pumping began on September 27th and ended on October 22nd
- Water samples were collected every two hours during pumping
- Surface water from the water body and Downstream Fen was sampled daily
- Shallow groundwater was sampled weekly to monitor groundwater infiltration
- Staff gauges to monitor water levels were read once daily

#### **2.2. Geology and Regional Ground Water Delineation, Monitoring and Remediation Plan**

This plan covers ground water delineation, monitoring and remediation in and around the FTS sites.

- No identified groundwater discharge areas
- Aquifer impact expected to be minimal
- Work is being carried out by team of professionals including hydrogeological consultants
- Over 100 groundwater monitoring wells currently exist in the area
- Lakes, streams and water-bodies will not be affected by impacted groundwater
- Drinking water-wells will not be affected by impacted groundwater; closest water wells are over 10 kms away
- Impacted groundwater not expected to migrate far from FTS sites
- A multi stage groundwater drilling investigation is planned for all 4 sites

### **2.3. Source/Flow Pathways Investigation Plan**

This plan outlines the investigation activities that will be undertaken at and around the four FTS sites and may be adapted depending on the outcome of the investigation activities.

The 3 main objectives of the plan are:

1. To locate and delineate the FTS flow path from its source in the Clearwater, through the Grand Rapids strata, the Colorado Group capping shales, and the Quaternary strata to the FTS sites
2. Where possible, intercept the ongoing flow to surface through the conversion of investigation wells to relief wells. Such relief wells are expected to reduce or stop the ongoing impact of continued flow to surface
3. To collect additional subsurface data for use in identifying the root cause(s) of FTS and report these results to the ESRD and the AER

Next steps:

- Several investigation wells will be drilled in and around each FTS area in an effort to locate the source and flow pathway of the FTS
- The sizing of the areas encompasses what is required to execute the investigative/possible relief drilling including area for rig placement, soil storage, topography (cut/fill and back sloping), borrow requirements and snow removal
- To minimize environmental impact associated with land access, we will complete the activities on pre disturbed areas where possible and only disturb what is required
- The drill program(s) will delineate the impact in the Quaternary (groundwater), provide probable bedrock relief wells, provide insight into mechanisms involved and provide the option to monitor environmental risks that are found.
- Canadian Natural will execute the Surface/Flow Pathway Investigation Plan in a timely manner
- Assessment/mitigation of the subsurface environmental risks is a very high priority for Canadian Natural and limiting the possible risks of further contamination of the Quaternary and surface is very desirable.
- Canadian Natural's investigation plans are subject to change, as the understanding of FTS is developed and results are analyzed

### **2.4. Surface Water Management and Monitoring Plan**

This plan covers site surface water management and monitoring plans for the FTS sites.

In general, surface water was managed and monitored at the FTS sites through the following measures:

- In areas that are well drained (the west side of 10-2 and the FTS at 2-22), no berms or only short sections of berms were built around the work area to control surface water entering the FTS areas
- In wet areas (10-1, east side of 10-2 and west area of 2-22), a clay berm was placed around the FTS to divert surface water from the FTS and to contain water that may have been in contact with bitumen emulsion from leaving the FTS
- Water from within the bermed area was removed with the bitumen emulsion and largely trucked for disposal offsite

- Water from up gradient of the areas was pumped from culverts (10-1 and 10-2) and disposed onto the ground surface away from the FTS sites
- Grab samples were collected to characterize water within the FTS working areas and any water that may have originated onsite
- Surface water sampling following rainfall events was revised based on sample results and, with agreement from ESRD, were only conducted after major 20 mm rainfall events.
- All samples are taken to an accredited and certified laboratory for analysis
- Results are compared to the Alberta Tier 1 Soil and Ground Water Remediation guidelines and the Alberta tier 2 Soil and Ground Water Remediation guidelines

## **2.5. Wildlife Management Plan**

This plan addresses wildlife deterrents, capture and treatment of impacted wildlife and rehabilitation/release options.

- A wildlife fence consisting of silt fencing, snow fencing and a top rope (with flagging tape ribbons) was erected around the site perimeter to prevent wildlife from entering the impacted area
- Additional mitigation such as Zon cannons and deterrents (e.g., effigies, scary eyes, mylar tape, osprey kites) are in place to discourage wildlife use near the impacted area.
- Perimeter fences are visited daily to ensure intactness
- Canadian Natural will comply with all federal and provincial legislation that apply to the conservation and management of wildlife

## **2.6. Waste Management Plan**

This plan outlines the waste management activities that will be undertaken by Canadian Natural at the four FTS sites. The Waste Management activities may be adapted as the needs of the investigation and clean-up change, which will be shared with ESRD and AER.

It is Canadian Natural's goal to manage the waste resulting from this bitumen release in a manner that will mitigate environmental impact, minimize waste volumes and utilize recycling opportunities where possible.

- Canadian Natural expects the waste streams resulting from these releases to consist of waste solids, free fluids, emulsion, vegetation, oily absorbents, contaminated liners and delineation well drilling waste
- Impacted material will be excavated and transported by rock trucks to lined and bermed containment cells
- The material will be dried out, tested and transported to an approved Class 11 landfill
- Drilling waste from investigation drilling will be managed using remote sumps in accordance with Directive 50

## **2.7. Reclamation Plan**

While the final reclamation plan will not be submitted to ESRD/AER until June 2014 (in accordance with Enforcement Order EO-2013/05-NR), the initial plan covers Pre-Disturbance Assessments (PDA) and Conservation and Reclamation (C&R) plan.

The purpose of the PDA and C&R plan is to identify:

- Final development plans
- Sensitive environmental conditions and mitigation measures

- Areas where detailed C&R might be developed for site-specific terrain, soil or vegetation
- reclamation activities that, at the end of FTS, will achieve equivalent land capability in terms of soil conditions, topography and vegetation establishment and growth
- A written Conservation and Reclamation Plan will be submitted to ESRD by June 30, 2014
- Annual reclamation procedures and progress reporting will begin November 1, 2014 and continue annually until advised otherwise by ESRD

## **2.8. Communications Plan**

This plan summarizes our planned weekly and monthly communication with stakeholders, regulators, Government officials and the general public.

- Canadian Natural's website information on the incident will be updated on a regular basis
- We will continue to address government and media and public inquiries through our Investor Relations or Public Affairs Departments
- We will meet with affected stakeholders as needed to provide updates

## **3 Summary**

Significant progress on the surface clean-up has been made at all four sites. While the surface clean-up can mitigate the environmental impact of these events, there are also issues that need to be investigated in the subsurface.

Canadian Natural's efforts to investigate and mitigate these events in the subsurface require access to suitable surface locations. To minimize the environmental impact associated with the investigation, Canadian Natural intends to complete activities on existing leases and previously disturbed lands wherever possible.

## **4 Future Action**

1. Locate and delineate the FTS event subsurface flow paths
2. Where possible, intercept any ongoing flow to surface through the conversion of investigation wells to relief wells
3. Collect additional subsurface data for use in identifying the root cause(s) of these events and report these results to ESRD and AER
4. Continue to monitor the surface and subsurface to fully understand the effects of the FTS events and remediate any effects on groundwater as necessary
5. Review the integrity of legacy wells in the Primrose area to identify potential issues and repair any wells that pose a risk of future events
6. Reclaim all surface areas affected by the FTS events including any new disturbances required for investigative activities according to a Conservation and Reclamation Plan.