Cold Lake, Hot Bitumen:

CNRL'S BITUMEN BLOWOUT

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Sometime this spring the boreal forest north of Cold Lake erupted, not with the calls of songbirds, but instead with toxic, hot, pressurized liquefied bitumen. Over 1.6 million litres of bitumen has bubbled to the surface at four different sites over 10 kilometres apart at Canadian Natural Resources Limited's (CNRL's) Primrose oil sands operation. This serious incident confirms AWA's conviction that risks to ground water, the land, and wildlife from *in situ* (underground drilling) tar sands projects are not being properly assessed and managed.

The Primrose operation is about 350 kilometres northeast of Edmonton, on the Cold Lake Air Weapons Range. It is in the 'bitumen alley' portion of the Range that Alberta leases to oil sands companies. In what was roadless, intact boreal forest only 20 years ago, multiple *in situ* oil sands leases now fragment these forests and wetlands. Webs of seismic lines, pipelines, roads, well sites and steam plants cover the landscape. These webs of human disturbance are the major threat to the survival of the Cold Lake caribou population. According to Environment Canada, 72 percent of its range had been "disturbed" in this way by 2011. With loss of intact habitat has come increased caribou predation and essentially no recent calf survival.

When bitumen is too deep to mine *in situ* (meaning 'in place') extraction methods are used. Multiple wells are drilled and injected with enough high pressure steam to make the bitumen flow. *In situ* oil sands projects currently account for about half of Alberta's oil sands production, with the other half coming from mines. But *in situ* production is the future of oil sands exploitation. *In situ* methods could eventually be used to access 80 percent of the oil sands resource. At Primrose, CNRL was permitted to use High Pressure Cyclic Steam Stimulation (HPCSS). HPCSS applies high enough pressure to spur higher flow rates by fracturing the bitumen reservoir. Using this technique depends on having one or more strong caprock layers in which to contain the high pressures. These four spills sites are evidence that the pressurized bitumen somehow breached the caprock layer and rose up to surface from the bitumen-bearing formation 500 metres below. The bitumen migrated up through an unprotected freshwater aquifer 75 to 100 metres below ground and emerged at ground level in long fissures.

Flowing bitumen, with its hydrocarbons and heavy metals, is a toxic stew to life. It has contaminated peat soils at three sites; at a fourth site, a fissure was opened up at the bottom of a small lake and contaminated its water. Early leaked photos of a spill site showed snow still on the ground and also showed that the bitumen had sprayed two feet up a tree trunk and gives you some idea of the initial force of the eruption. The spill has killed wildlife. As of September 19, 2013 at least 105 amphibians, 49 birds, two beavers, and 49 small mammals had been claimed by this industrial accident. As required by regulators, CNRL is removing contaminated soils, vegetation and bitumen.

At the small lake, clean up has been considerably more difficult. CNRL used booms to contain and skim the contaminated water and set up wildlife deterrents to reduce mortalities. As the bitumen continued to flow into the lake, CNRL sought and was granted permission September 24 to take the unusual step of dewatering about 2/3 of the lake's water by mid-October. Alberta Environment and Sustainable Resource Development (ESRD) issued an environmental protection order directing CNRL to contain the water in a pit and in part of the original lake. The company will then recover the bitumen from the fissure site, and try to prevent and remedy further surface and groundwater contamination. If there's a silver lining here it rests in the fact that, because of the emergency protection order, there may be more transparency and ENGO/First Nations involvement on the clean up and impacts at this site. But more transparency is needed with respect to the other sites and on the broader causes and impacts.

Public disclosure around the spills has been poor. Though the Alberta Energy Regulator (AER) states that CNRL informed it on May 20 of two spills, on June 6 of a third spill, and on June 24 of the fourth spill into the lake, the public was first informed via an AER news release June 27 – more than one month after the first spill was noticed. After receiving widespread criticism for its secretive handling of the incidents, CNRL didn't issue its first press release until late July. The company organized a media tour on August 8 of two of the Primrose spill sites which I attended as a writer for *Wild Lands Advocate*.

On the Primrose site tour, I learned that CNRL discovered the first leaks by chance from a seismic crew that was in the area, not from any systematic regular ground inspection. There was no detectable pressure drop in the operation of the facility. After the first discoveries, CNRL conducted a thorough grid search and found the other two spills. A company spokesperson stated that, judging from the way vegetation was affected on site, the first spills may have been happening for several months before they were discovered in May.

We were bussed to the third spill site, a 159 metre long fissure according to company officials. The emphasis throughout the tour was on clean-up procedures. Two months after the spills, much of the contaminated soils and vegetation had been removed from the third site, leaving the fissure with oozing bitumen. In one part of the fissure, CNRL let the bitumen accumulate so we could see that about 100 litres settled in that section over approximately a two week period. We were also taken to the fourth site, the small lake. There we stood on the shore opposite to where the bitumen fissure was, serenaded by bird deterrent cannons. The fissure there site was estimated to be 30 metres long. We were not taken to the first two spill sites, which were very close to the site of a January 2009 spill to surface at the Primrose East operation.

No company investigative experts joined us on the tour. Two senior executives came with us and deferred any questions we posed to them until a 10 minute ques-

CNRL official talking to media August 8, beside a map of the small lake on the Primrose South operation. CNRL will drain 2/3 of the lake to excavate the fissure where hot bitumen continues to flow up from underground.

PHOTO: © C. CAMPBELL

Spilling through a 159-metre long fissure, hot pressurized bitumen comes up to surface. A CNRL official points to a day's accumulation of bitumen at this section where top soil has been scraped away.

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tion and answer scrum at the end. Then CNRL President Steve Laut answered questions. Colin Woods, AER Team Leader from the Bonnyville Field Office, answered the questions I posed to him throughout the tour. After CNRL's Laut departed, Woods also participated in a media scrum for about 15 minutes, after which we re-boarded the buses and left the Primrose site. From Woods, I learned that steaming restrictions have been applied for one kilometre around the spill sites. They've judged this distance to be sufficient until they determine the cause of the spills. The AER doesn't know if CNRL exceeded prescribed pressures, doesn't know the extent of fresh groundwater contamination, and doesn't know when the bitumen flow to the surface will stop. There is no known method to stop the bitumen from surfacing aside from waiting until it depressurizes, cools, and reverts to its natural viscous, non-flowing, state.

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On January 3, 2009, during early steaming of Primrose East operations, CNRL and the boreal forest also suffered a bitumen surface spill. In that case, the bitumen spilled up to, then flowed out, a well pad identified as Pad 74. AWA learned of this spill through an anonymous tip January 26, and in subsequent days issued a news release outlining its concerns about '*in situ*' risks illustrated by the spill. CNRL didn't release any information about the causes of the spill or its groundwater impacts to AWA. In a spectacularly dramatic illustration of poor government disclosure, the energy regulator at the time (the Energy Resources Conservation Board) only released its report on CNRL's 2009 spill in January 2013. There the regulator resembled bitumen in its natural state – very hard to move.

The ERCB's 2009 spill report noted that on January 3, CNRL immediately stopped steam injection, initiated a procedure to depressurize the formation, notified the regulator and agreed steaming would not resume without ERCB approval. By contrast, an AER document dated June 14, 2013 (which was leaked to the Toronto Star) orders CNRL to stop steaming operations in a township area at Primrose East where the first three spills were discovered, over 3 weeks after CNRL first discovered and reported the 2013 spills. This delay and change in procedure has not been explained and there doesn't appear to have been any urgency in taking precautionary measures; the delay in ordering the steam injection shut in is particularly troubling given that the first two reported spill sites are very close to Pad 74.

In 2009, bitumen flowed into the fresh groundwater Bonnyville aquifer. Higher than usual pressure as well as bitumen were detected at four Bonnyville aquifer monitoring wells. "There remains uncertainty about how the bitumen emulsion will break down over time with heat from further steam injection and about what constituents may be released into the Bonnyville Aquifer," the regulator admitted. This aquifer is the source of some water wells further south and it ultimately drains into Cold Lake. CNRL has prepared a plan to "further understand the effect of heating from steam injection on the movement of bitumen contamination within the Bonnyville Aquifer." These findings should be made public.

In 2009, CNRL was injecting steam at significantly higher pressures than had occurred previously in its Primrose and Wolf Lake operations, because the well spacing had been reduced. The regulator concluded that "this likely contributed to the bitumen emulsion surface release." CNRL was then limited in the steam injection volumes it could inject per cycle.

The ERCB found that the pressurized bitumen's path through the caprock Colorado Group was likely either from a wellbore "or a series of pre-existing faults." One of the most serious concerns about the Primrose project found in the 2009 ERCB report is that the project lies in an area of geological weakness. One hundred metres below the bitumen-bearing Clearwater formation in the Primrose East area are Devonian salt formations that are dissolving and subsiding. These features make it likely, according to the ERCB, that fractures and faults could develop in upper layers, including the caprock. While CNRL didn't identify fractures or faults in the caprock, the ERCB believes that could be because the tools used cannot detect them. They may be evading detection given our current technological capabilities

Another possible pathway through the caprock was from a wellbore with failed cementing or casing that allowed the bitumen to travel

Hot pressurized bitumen spills to surface through soil and vegetation at the same spill site on CNRL's Primrose oil sands project, August 8.

Fencing deters wildlife from entering a section with a leakage amount of about 100 litres that CNRL left to accumulate over a period of two weeks, to compare to the leakage of one day.

PHOTO: © C. CAMPBELL

up the bore. Old well bore locations are not always easily detected (as in the case of the Total *in situ* explosion to surface in 2006) and the integrity can be lost over time due to repeated exposure to high pressures.

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In response to the 2009 CNRL release, the ERCB said that it would review and assess its requirements for both caprock and wellbore integrity issues with respect to steam injection operations. The ERCB issued a draft directive in 2012 dealing with wellbore integrity issues but has not implemented those proposed rules. Given the existing uncertainties and risks of the Primrose operation, the AER should not have allowed production to resume there.

On August 13, 2013, AWA joined over 20 organizations in calling on the AER to undertake a broader inquiry into CSS and SAGD steam injection operations. They asked the AER to reassess *in situ* tar sands technology and regulations in light of the ongoing CNRL spill incidents since these latest incidents reflect unresolved risks from the 2009 spill. An Environment Canada spokesperson stated in early September that the department is investigating the CNRL spill sites with respect to federal environmental and wildlife laws. In mid-September scientists Kevin Timoney and Peter Lee released a report criticizing the corporate and regulatory management of the risks posed by these spills. They recommended all HPCSS operations should be suspended until the major knowledge gaps are addressed.

CNRL's Primrose project should never restart because of possible pre-existing faults in the caprock, because of the difficulty of ensuring well bore integrity, and also because of unacceptable impacts to caribou and other sensitive wildlife such as old-growth or wetlands-dependent migratory birds. At a minimum, Primrose should not restart until the following problems, and solutions to them, are documented publicly with third party review: groundwater contamination; reclamation of wetlands and uplands; wildlife mortality; the causes of the blowouts; a much stronger approach to preventing future blowouts; and finally, a much stronger approach to detecting and reducing impacts of any future blowouts

There are many other unanswered questions about risks to northern Alberta waters and lands arising from *in situ* oil sands projects. Hopefully, these spills will produce an impetus for the provincial and federal governments to substantially reduce these risks.

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Hot pressurized bitumen leaks into the bottom of a small lake through a 30-metre long fissure. Wildlife deterrents, including "bitu-men," have been set up to try to prevent migrating birds from landing.