NATURAL RESOURCES DEFENSE COUNCIL

TAR SANDS PIPELINE SAFETY BACKGROUNDER

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Tar Sands Pipelines: Presenting Unaddressed Hazards to Public Safety

Tar sands crude oil pipeline companies may be putting the American public's safety at risk by using conventional pipeline technology to transport a highly corrosive, acidic and potentially unstable blend of thick raw bitumen and volatile natural gas liquid condensate called DilBit. Bitumen is the raw material that is strip mined or drilled from under Canada's Boreal forest in Alberta. It is eventually upgraded into synthetic crude oil and then primarily refined into transportation fuels. DilBit is the primary product being transported through the new TransCanada Keystone and the new Enbridge Alberta Clipper pipelines from the Alberta tar sands to the U.S. Midwest. The transportation of DilBit is also the primary purpose of TransCanada's proposed Keystone XL pipeline, which would run 2000 miles from the Alberta tar sands through sensitive lands and aquifers to refineries on the U.S. Gulf Coast.

Until recently, DilBit exports to the United States (as opposed to the total amount of tar sands derived oil) have been relatively small.[1] Historically, the United States has imported the majority of crude from the tar sands region in the form of synthetic crude oil, a substance similar to conventional crude oil that has already gone through an initial refining process called "upgrading," which removes impurities and makes the oil lighter and less corrosive. Over the last ten years, DilBit exports to the United States have increased almost fivefold to 550,000 barrels per day (bpd) in 2010 – over half of the approximately 900,000 bpd of tar sands oil that currently flows into the United States.[2] By 2019, Canadian tar sands producers plan to export as much as 1.5 million bpd of DilBit.[3]

There are many indications that DilBit is significantly more corrosive to pipeline systems than conventional crude. Bitumen blends are highly acidic,[4] sulfuric, viscous[5] and abrasive[6] relative to

[1] Canadian Association of Petroleum Producers, Oil Sands Statistics 2000-2007; http://membernet.capp.ca/raw.asp?x=1&dt=NTV&e=PDF&dn=34093.

[2] National Energy Board, Estimated Canadian Crude Oil Exports by Type and Destination, 2010 Q1, http://www.neb-one.gc.ca/clf-nsi/rnrgynfmtn/sttstc/crdlndptrlmprdct/2010/stmtdcndncrdlxprttpdstnt2010_q1.xls, (the United States imported 550,000 bpd of blended bitumen (DilBit, SynBit, and DilSynBit) in the 1st quarter of 2010; this does not include synthetic crude oil); Energy Resources Conservation Board, 2009, http://www.ercb.ca/docs/products/STs/st98_current.pdf, (the ERCB estimates that in 2009, Alberta exported 500,000 bpd of SCO (79,600 m^3, pg. 2-34); 140,000 bpd (pg 2-33) to refineries in Canada and the United States)

[3] ERCB, http://www.ercb.ca/docs/products/STs/st98_current.pdf, (ERCB estimates that nonupgraded bitumen removals will increase from 555,000 bpd in 2009 (88,200 m^3) to 1.5 million in 2019 (243,000 m^3). (pg 2-34) Refineries in Western and Eastern Canada can only process a negligible amount of DilBit. (pg 2-32-33) Additionally, in 2019 ERCB estimates Canada will produce 1.5 million bpd mined bitumen (or 236,000 m^3; pg. 2-20-21), 1.7 million bpd in situ bitumen (or 271,000 m^3, pg. 2-23), for a total production of 3.2 million bpd. ERCB estimates a capacity for 1.35 million bpd of synthetic crude (or 215,000 m^3, pg 2-25)).

[4] Gareth Crandall, Non-Conventional Oil Market Outlook, Presentation to IEA, 2002, pg. 4, http://www.iea.org/work/2002/calgary/Crandall.pdf.

[5] Crude Oil Quality Association, Canadian Crude Quick Reference Guide, Nov. 2009, http://www.coqa-inc.org/102209CanadianCrudeReferenceGuide.pdf.

conventional crudes.[7] The Alberta hazardous liquid pipeline system has a relatively high rate of pipeline failure posing an early indication of the risks DilBit poses to pipeline integrity. The U.S. Pipeline and Hazardous Materials Safety Administration (PHMSA) does not distinguish between conventional crude and DilBit when setting minimum standards for hazardous liquid pipelines.

DilBit poses an elevated risk to public safety not only due to higher risks of a spill or rupture, but also because DilBit spills pose increased hazards to the environment and public safety. The natural gas liquid component of DilBit increases the risk of conflagration and the clean-up of a spill presents greater challenges than a conventional oil spill. In addition, tar sands related Material Safety Data Sheets list hydrogen sulfide as a potential hazard associated with a DilBit release and as one of several toxic products of a DilBit conflagration.[8] During the Enbridge Kalamazoo DilBit spill, the company identified hydrogen sulfide as a risk for its field personnel.[9]

The State Department, as the agency responsible for assessing the environmental impacts of the transboundary Keystone XL tar sands pipeline, has not considered the unique risks DilBit poses to public safety in its Draft Environmental Impact Statement (DEIS).[10] The Keystone XL pipeline is intended to carry up to 900,000[11] bdp of petroleum product through the heartland of the United States. TransCanada bases its temperature effects study on the assumption that 80 percent of that product will be DilBit. [12]

Tar Sands Oil Pipelines Transporting DilBit Pose Greater Spill Risks than Conventional Oil Pipelines

DilBit pipelines, which require high operating pressures, appear to pose new and significant risks of leak or rupture due to internal corrosion and pressure anomalies. DilBit is more corrosive than conventional crude. It contains fifteen to twenty times higher acid concentrations than conventional benchmark crudes[13] and five to ten times as much sulfur as benchmark crudes,[14] which can lead to the weakening or

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[6] 2008 National Petrochemical and Refiners Association Q&A and Technology Forum Answer Book, 2008, Question 50, http://www.npra.org/forms/uploadFiles/17C4900000055.filename.2008_QA_Answer_Book.pdf

[7] Environmental Science & Technology Centre (ESTC), Canadian Government, http://www.etc-cte.ec.gc.ca/databases/OilProperties/pdf/WEB_West_Texas_Intermediate.pdf.

[8] Imperial Oil, Material Safety Data Sheet for Cold Lake Blend DilBit, Oilhttp://www.msdsxchange.com/english/show_msds.cfm?paramid1=2479752 (combustion of DilBit produces carbon monoxide, hydrogen sulfide, and sulfur dioxide).

[9] Enbridge Line 6B 608 Pipeline Release, Marshall, Michigan, Health and Safety Plan, Aug. 2, 2010, 2.02, http://www.epa.gov/enbridgespill/pdfs/finalworkplanpdfs/enbridge_final_healthsafety_20100819.pdf.

[10] State Department, Draft EIS for Keystone XL, 3.13-33 (http://www.keystonepipeline-xl.state.gov/clientsite/keystonexl.nsf?Open) (treating synthetic crude oil and DilBit as "similar enough to be treated as one," despite significant differences material to the pipeline's impact to public safety)

[11] State Department Draft EIS, Project Description, pg. 2-1, http://www.keystonepipeline-xl.state.gov/clientsite/keystonexl.nsf?Open, (The Keystone XL pipeline would carry Western Canadian Blend (WCB), a SynDilBit).

[12] State Department, Draft EIS for Keystone XL, Appendix L, L-1 (http://www.keystonepipeline-xl.state.gov/clientsite/keystonexl.nsf?Open), (The temperature analysis for the Keystone XL assumes it will carry 80% DilBit and 20% Synthetic crude).

[13] Crude Oil Quality Association, pg. 11; http://www.coqa-inc.org/20091022_Sutton.pdf.

[14] Environmental Science and Technology Centre, Oil Properties Database, WTI (http://www.etc-cte.ec.gc.ca/databases/OilProperties/pdf/WEB_West_Texas_Intermediate.pdf) (West Texas Intermediate crude, a benchmark conventional oil, has a sulfur content of 0.34%-0.57%); Crude Oil Quality Association, Canadian Crude

embrittlement of pipelines. Refiners also have found tar sands derived crude to contain significantly higher quantities of abrasive quartz sand particles than conventional crude.[15] These are risks that can be mitigated by the pipeline operator, however there are no requirements for such mitigation in federal pipeline regulations.

The risks of corrosion and the abrasive nature of DilBit are exacerbated by the relatively high heat and pressure at which these pipelines are operated. Industry defines a high pressure pipeline as one that operates over 600 pounds per square inch (psi).[16] Due to the high viscosity of DilBit, pipelines such as Keystone XL operate at pressures up to 1440 psi[17] and at temperatures up to 160 degrees Fahrenheit.[18] Higher temperatures reduce the viscosity and increases the efficiency of moving the oil, but it also increases the risk of internal and external corrosion.

At high pressure and temperature, the potential instability of raw bitumen and diluent components could render DilBit pipelines particularly susceptible to ruptures caused by pressure spikes.[19] These factors may explain why the hazardous liquid pipeline system in Alberta is recorded as having over four times more incidents of failure per mile than the entire U.S pipeline system,[20] despite the fact that the U.S. system overall includes older pipelines.

Quick Reference Guide (http://www.coqa-inc.org/102209CanadianCrudeReferenceGuide.pdf) (Bitumen blends have sulfur contents between 2.53%-4.59%).

[15] 2008 National Petrochemical and Refiners Association Q&A and Technology Forum Answer Book, 2008, Question 50, http://www.npra.org/forms/uploadFiles/17C4900000055.filename.2008_QA_Answer_Book.pdf.

[16] Shell Oil Company, Terminology, http://www.shell.us/home/content/usa/products_services/solutions_for_businesses/pipeline/pipeline_america/terminology/.

[17] http://www.hydrocarbons-technology.com/projects/keystone_pipeline/

[18] State Department, Draft Environmental Impact Statement for Keystone XL, Appendix L, Pipeline Temperature Effects Study, http://www.keystonepipeline-xl.state.gov/clientsite/keystonexl.nsf?Open.

[19] Challenges Inherent in the Development of Predictive Deposition Tools for Asphaltene Containing Hydrocarbon Fluids, John M. Shaw and Xiang-Yang Zou, Petroleum Science and Technology, http://www.uofaweb.ualberta.ca/jmshaw/pdfs/2004Challenges_Inherent_in_Development.pdf.

[20] Alberta Energy and Utilities Board, Pipeline Performance in Alberta, 1990-2005, April 2007, http://www.ercb.ca/docs/documents/reports/r2007-a.pdf, (Hazardous liquid pipelines include multiphase, crude oil and other product pipelines (excluding natural gas, sour gas and water pipelines). Alberta's hazardous liquid pipeline system included 81,917 km of operating pipelines as of December 31, 2005 (38,536 km multiphase, 28,479 km other products and 14,902 km crude oil, pg. 9). During the time between 1990 and 2005 there were 5333 reported hazardous liquid incidents (multiphase pipelines had 4726, (pg. 28), crude oil pipelines had 411 (pg. 30), other product had 196 (pg. 38). This was 356 incidents per year in a 81,917 km system, which is a rate of 699 incidents per 100,000 miles of pipeline. It should be noted that this analysis understates the case, as the Alberta pipeline system was smaller than 81,917 km during most of this time. The United States onshore hazardous liquid system had 3,763 reported incidents during that period (PHMSA Pipeline Mileage and Incidents Reports, http://primis.phmsa.dot.gov/comm/reports/safety/AllPSI.html?nocache=5046#_liquid). This is a rate of 139 incidents per year per 100,000 miles in a 180,000 mile system (Congressional Research Service, Pipeline Security: Overview of Federal Activities and Current Policy Issues, 2004 , CRS-2 (http://www.fas.org/sgp/crs/RL31990.pdf) (At a rate of 699 incidents per 100,000 miles, Alberta's system had a incident rate greater than four times of that of the United States at 139 incidents per 100,000 miles).

Alberta Pipeline System Provides Indications of DilBit Risks

In the United States, where the majority of hazardous liquid pipelines are over forty years old,[21] age is considered to be one of the primary risk factor for pipeline failure.[22] In contrast, the majority of the Alberta pipeline system is less than twenty years old.[23] As tar sands production increased between 1990 and 2005, the Alberta hazardous liquid pipeline system doubled from 49,597 km to 100,641 km.[24]

Despite its relatively recent construction [25] Alberta's hazardous liquid system, which carries a high proportion of diluted bitumen, had over four times as many reportable incidents[26] per mile as the older U.S. system between 1990 and 2005.[27] Notably, internal corrosion accounted for 49% of reported pipeline incidents in the Alberta hazardous liquid pipeline system, causing over twenty five times as many leaks and ruptures per mile of pipeline than in the U. S. system.[28]

As Alberta exports increasing volumes of DilBit to the United States, the risks of pipeline spills are becoming apparent. In July 2010, Enbridge spilled over one million gallons of diluted bitumen into

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[21] Christian Science Monitor, "Oil spills hit on land too: Aging pipelines imperil Midwest", Sept. 14, 2010, http://www.csmonitor.com/USA/2010/0914/Oil-spills-hit-on-land-too-Aging-pipelines-imperil-Midwest (quoting Pipeline Safety Trust stating that majority of liquid pipelines were installed before 1970).

[22] Seattle Pi, "With aging lines and lax regulation, potential for accidents is high", 1999, http://www.seattlepi.com/pipelines/old10.shtml.

[23] Alberta's pipeline system increased from 49,597 km in 1990 to 100,641 km in 2005 (Alberta Energy and Utilities Board, Pipeline Performance in Alberta, 1990-2005, April 2007, pg. 7, http://www.ercb.ca/docs/documents/reports/r2007-a.pdf).

[24] Alberta Energy and Utilities Board, Pipeline Performance in Alberta, 1990-2005, April 2007, pg. 7, http://www.ercb.ca/docs/documents/reports/r2007-a.pdf.

[25] In 1990, Alberta's hazardous liquid pipeline system was 49,597 km (10,284 km of crude, 25,552 km of multiphase, and 13,761 of other product);by 2005 the system had doubled to 100,641 km (18,019 km crude, 50,977 km multiphase, and 31,645 km other product) (Alberta Energy and Utilities Board, Pipeline Performance in Alberta, 1990-2005, April 2007, pg. 7, http://www.ercb.ca/docs/documents/reports/r2007-a.pdf); over 50% of the US pipelines system is over 40 years old (Phil Hopkins, The Structural Integrity of Oil and Gas Transmission Pipelines, May 2002, pg. 16, http://www.penspen.com/Downloads/Papers/Documents/TheStructuralIntegrityofOilandGasTransmissionPipelines.pdf).

[26] Alberta Energy and Utilities Board, Pipeline Performance in Alberta, 1990-2005, April 2007, pg. 19, http://www.ercb.ca/docs/documents/reports/r2007-a.pdf, (Of these incidents, 94.9% were leaks or ruptures that resulted in a product release).

[27] The United States system had 139 incidents per 100,000 miles during 1990-2005, compared to Alberta's rate of 699 incidents per 100,000 miles.

[28] Internal corrosion caused 8.5% of the significant incidents on the United States onshore hazardous liquid pipeline system between 1990 and 2010. (PHMSA, Significant Pipeline Incidents by Cause, National Hazardous Liquid Onshore: Significant Incident Details: 1990-2009, http://primis.phmsa.dot.gov/comm/reports/safety/SigPSIDet_1990_2009_US.html?nocache=973#_liquidon) (Internal corrosion caused 2633 of the 5333 reported incidents on the Alberta hazardous pipeline system (including 2521 incidents for multiphase (pg, 28), 102 incidents for crude oil pipelines (pg. 30), and 8 other products (pg. 38) (Alberta Energy and Utilities Board, Pipeline Performance in Alberta, 1990-2005, April 2007, pg. 19, http://www.ercb.ca/docs/documents/reports/r2007-a.pdf). Of 699 incidents per 100,000 miles of Alberta pipelines, 49%, or 343 incidents per 100,000 miles, were caused by internal corrosion. This can be compared to the United States system, where 8.5% of 139 incidents per 100,000 miles, or 12 incidents, were caused by internal corrosion. Alberta's 343 incidents is 28.6 times the 12 incident rate of internal corrosion failure in the US system.

Michigan's Kalamazoo River.[29] Preliminary reports regarding this spill show that corrosion may be responsible for the spill.[30]

Pipeline Spills of DilBit Present Greater Risks than Conventional Crude

A DilBit pipeline rupture presents greater risks of explosion and conflagration than conventional crude. Natural gas condensate is highly flammable and can form an ignitable and explosive mixture in the air at temperatures above 0 degrees Fahrenheit.[31] This mixture can be ignited by heat, spark, static charge or flame.[32] While raw bitumen is not volatile at ambient temperatures, ignition of the natural gas liquid condensate component of DilBit could ignite the raw bitumen. [33] Its Material Safety Data Sheet indicates that the combustion of DilBit may result in a number of toxic byproducts including hydrogen sulfide.[34]

In addition, unlike conventional crude oils, Athabasca bitumen, having an API gravity of 7.7-9, is heavier than water. Bitumen spills in river and wetland environments can sink into the water column and coat the underlying surfaces, posing higher impacts to marine life than conventional crude spills, which float above the water surface. This can also create challenges to cleanup efforts. Raw bitumen also contains significantly higher concentrations of mercury, lead, vanadium, nickel, arsenic and other heavy metals than conventional crude.[35] These heavy metals have a variety of toxic effects, are not biodegradable and can accumulate in biological systems to become significant health hazards.

Elevated Risks of DilBit Pipelines Should be Considered and Mitigated in State Department's Draft Environmental Impact Statement

The Draft Environmental Impact Statement (DEIS)[36] for the proposed Keystone XL pipeline issued by the State Department on April 16, 2010 does not adequately address the risks associated with a DilBit

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[29] The Michigan Messenger, "Pipeline spill underlines fears of new tar sands development", 8/10/10, http://michiganmessenger.com/40744/pipeline-spill-underlines-fears-of-new-tar-sands-development (In a conference call, the CEO of Enbridge acknowledged that the Kalamazoo spill involved Cold Lake DilBit, a blend of 1/3 diluent, 2/3 bitumen); Enbridge Health and Safety Plan, Aug. 2, 2010, http://www.epa.gov/enbridgespill/pdfs/finalworkplanpdfs/enbridge_final_healthsafety_20100819.pdf (identifying the source of the crude as Christina Lake / Foster Creek, in situ sources currently transported as Cold Lake DilBit)

[30] Christian Science Monitor, "Oil spills hit on land too: Aging pipelines imperil Midwest", Sept. 14, 2010, http://www.csmonitor.com/USA/2010/0914/Oil-spills-hit-on-land-too-Aging-pipelines-imperil-Midwest.

[31] Imperial Oil, Material Safety Data Sheet for Natural Gas Condensates, September 27, 2002, http://www.msdsxchange.com/english/show_msds.cfm?paramid1=2480179.

[32]ONEOK, Inc., Material Safety Data Sheet for Natural Gas Condensates, July, 2009, http://www.oneokpartners.com/en/CorporateResponsibility/~/media/ONEOK/SafetyDocs/Natural%20Gas%20Condensate%20Petroleum.ashx.

[33] Imperial Oil, Material Safety Data Sheet for Bitumen, June 7 2001, http://www.msdsxchange.com/english/show_msds.cfm?paramid1=2480144.

[34]Imperial Oil, Material Safety Data Sheet for Cold Lake Blend DilBit, Oilhttp://www.msdsxchange.com/english/show_msds.cfm?paramid1=2479752 (combustion of DilBit produces carbon monoxide, hydrogen sulfide, and sulfur dioxide).

[35]Emergencies Science Division of Environment Canada, http://www.etc-cte.ec.gc.ca/databases/OilProperties/pdf/WEB_Athabasca_Bitumen.pdf; South Dakota Sierra Club, http://southdakota.sierraclub.org/LivingRiver/tarsands.htm (last visited Dec. 1, 2010) evidence of these heavy metals can be found throughout academic literature and refinery reports.

[36] State Department, Draft Environmental Impact Statement for Keystone XL, http://www.keystonepipeline-xl.state.gov/clientsite/keystonexl.nsf?Open.

pipeline. The DEIS uses measures that substantially underestimate the risk of spills from the Keystone XL pipeline, the volume of potential DilBit spills, the potential impacts of DilBit to the environment and water quality, and the unique challenges posed in cleaning up these spills. DilBit may be distinguished from conventional crude by its greater corrosivity, acidity, viscosity, volatility, instability and toxicity. These factors present the risk of substantial environmental impacts which are not considered in the original State Department DEIS for the Keystone XL pipeline. This lack of consideration of the specific risks of a DilBit pipeline are one reason that the State Department should prepare a Supplemental Environmental Impact Statement (SEIS) that will allow for public review and full incorporation of these critical issues in the deliberations about whether to permit the proposed Keystone XL pipeline. The State Department should consider the following in an SEIS:

1. The DEIS pipeline incident frequency assessment for Keystone XL is based on data which significantly underestimates the risk of spills from the pipeline. The DEIS bases its baseline spill risk assessment on historical data from the U. S. hazardous liquid pipeline system.[37] The majority of the U. S. hazardous liquid pipeline system transports conventional crude. Pipelines, such as the proposed Keystone XL, that transport highly corrosive DilBit, have a higher risk of internal corrosion and over-pressure By basing the risk of spills on the existing U. S. system, the DEIS significantly underestimates the potential spill frequency of the Keystone XL pipeline.

2. The DEIS reduces the baseline spill frequency of Keystone XL by a factor of 0.1-1 to account for the Keystone XL's age relative to the United State pipeline system.[38] While pipeline age is an important parameter of spill risk in the United States, pipeline incident data from Alberta suggests that the chemical properties of the petroleum product are a more important indicator. Despite being on average at least twenty years younger, the Alberta pipeline system, which has a higher percentage of DilBit pipelines similar to the proposed Keystone XL, also has four times as many pipeline incidents per mile as the U. S. system. The DEIS should have increased the baseline spill frequency of Keystone XL to account for the greater frequency of spills in Alberta's newer system.

3. The DEIS uses hazardous liquid pipeline data from the Pipeline and Hazardous Materials Safety Administration (PHMSA) to estimate risk of corrosion.[39] It then attributes a disproportionate frequency of corrosion-related incidents to pre-1950 pipelines. Because the rate of internal corrosion in the Alberta system, the majority of which was constructed after 1990, is twenty-five times greater than the older U. S. system, this significantly underreports the risk of pipeline corrosion related failure for the Keystone XL pipeline.

4. The DEIS assumes that Keystone's Supervisory Control and Data Acquisition (SCADA) computer monitoring system[40] will alert operators to abnormal operating conditions, including spills or leaks.[41] The DEIS does not account for the tendency of DilBit pipelines to give false positives making interpretation SCADA data and discovery of leaks difficult. For example, pipeline

[37] State Department, Draft Environmental Impact Statement for Keystone XL, .3.13-7 - 3.13-14.
[38] State Department, Draft Environmental Impact Statement for Keystone XL, 3.13-13.
[39] State Department, Draft Environmental Impact Statement for Keystone XL, 3-13-11.
[40] SCADA is an acronym for Supervisory Control and Data Acquisition, a computer system used to monitor pipeline system. A SCADA system gathers information and transfers it to a central site where it can be interpreted.
[41] State Department, Draft Environmental Impact Statement for Keystone XL, 3-13.27.

experts[42] have attributed the twelve hour detection lag during the spill from a tar sands pipeline into the Kalamazoo River in Michigan to the difficulty of interpreting the SCADA data from the system that Enbridge had in place. The DEIS does not contain sufficient information regarding Keystone XL's leak detection system to instill confidence that the SCADA can reliably identify pipeline ruptures like the one which occurred in Marshall, Michigan.

5. The DEIS does not assess the environmental impacts of a DilBit crude oil spill. While the DEIS notes the importance of specific gravity, viscosity, pour point, volatility, toxicity, solubility and persistence in the environment in determining the impacts of crude oil spills,[43] it avoided analyzing these attributes for DilBit by considering it similar enough to be treated as one with more conventional synthetic crude oil.[44] DilBit differs significantly from conventional crude in these attributes. It is significantly more corrosive and twenty to thirty times more viscous than conventional crude. Its condensate components are more volatile than conventional crude while its bitumen component is heavier. Because Keystone XL is a dedicated DilBit pipeline, the attributes of DilBit must be specifically considered to assess the project's environmental impact.

6. The DEIS assumes that the water quality effects of most spills on larger lakes would be eliminated once the oil slick is removed.[45] Its impact analysis is based on numerous studies of conventional crude oil spills and therefore do not address DilBits distinguishing properties.[46] The bitumen component of DilBit would be expected to sink into the water column and accumulate on the underwater lake bed, where cleanup will be difficult. The Keystone XL countermeasures to contain and remove DilBit released in a water resource call for sorbent booms, socks, and or pads.[47] These measures are typically used for spills of conventional crudes that are less dense than water. They do not address heavy bitumen that would sink below the water's surface.[48]

7. The DEIS underestimates the effect of a DilBit spill on freshwater fish, macro-invertebrates, and other aquatic organisms.[49] By equating DilBit to conventional crude, the DEIS assumes that even

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[42] Richard Kuprewicz, quoted in the Michigan Messanger, "Pipeline spill underlies fears of new tar sands development," Aug. 10, 2010, http://michiganmessenger.com/40744/pipeline-spill-underlines-fears-of-new-tar-sands-development (saying that the viscosity of tar sands and the use of diluents create frequent pressure warnings in pipeline monitoring systems, false positives that can make it more difficult to detect a real pressure problem in the pipe which can indicate a leak).

[43] State Department, Draft Environmental Impact Statement for Keystone XL, 3-13.19.

[44] State Department, Draft Environmental Impact Statement for Keystone XL, 3-13.19.

[45] State Department, Draft Environmental Impact Statement for Keystone XL, 3-13-41.

[46] State Department, Draft Environmental Impact Statement for Keystone XL, 3-13-46.

[47] State Department, Draft Environmental Impact Statement for Keystone XL, Appendix C, Section 4. Spill Control and Countermeasures.

[48] Athabasca bitumen has an API gravity of 7.7-9, which makes it heavier than fresh water, with an API gravity of 10. Also see Cekirge et al., 1997, Orimulsion spill modeling in marine environments, http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6V0V-3SNVJ0R-18&_user=10&_coverDate=06%2F30%2F1997&_rdoc=1&_fmt=high&_orig=search&_origin=search&_sort=d&_docanchor=&view=c&_searchStrId=1544637083&_rerunOrigin=google&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=7d81371f9c02094a85effded80b3ff22&searchtype=a (modeling a blend of bitumen and emulsified water in a marine environment. In fresh water, the bitumen sinks, though energy in the water can remix bitumen particles into the water column).

[49] State Department, Draft Environmental Impact Statement for Keystone XL, 3.13-46.

a large spill would result in low concentrations of oil in the water column. This is true with conventional crude, as it is less dense than water and floats. In DilBit, the bitumen component is denser than water and would be expected to sink[50] in the water column. This could have significant impacts on fish and plankton[51] in the water column as well as all organisms associated with river and creek beds.[52]

The new and legitimate safety concerns associated with DilBit pipelines create risk of substantial environmental impacts which were not considered in the DEIS for the Keystone XL pipeline. A Supplemental EIS for the Keystone XL is necessary to consider alternatives to avoid or mitigate the impacts to the communities and the environment it transverses.

[50] Athabasca bitumen has an API gravity of 7.7-9, which makes it heavier than fresh water, with an API gravity of 10. Also see Cekirge et al., 1997, Orimulsion spill modeling in marine environments, http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6V0V-3SNVJ0R-18&_user=10&_coverDate=06%2F30%2F1997&_rdoc=1&_fmt=high&_orig=search&_origin=search&_sort=d&_docanchor=&view=c&_searchStrId=1544637083&_rerunOrigin=google&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=7d81371f9c02094a85effded80b3ff22&searchtype=a (modeling a blend of bitumen and emulsified water in a marine environment. In fresh water, the bitumen sinks, though energy in the water can remix bitumen particles into the water column).

[51] Jerry Neff, An Oil Spill in an Illinois Lake: Ecological and Human Health Assessment, 1991, pg. 7, http://www.iosc.org/papers/01477.pdf (noting the relationship between oil concentration in the water column and toxicity to marine plants and animals).

[52] Jerry Neff, An Oil Spill in an Illinois Lake: Ecological and Human Health Assessment, 1991, pg. 6, http://www.iosc.org/papers/01477.pdf (noting the initial effect of a spill on fish spawning and nursery habitat).