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Oil Sands Extraction: Lessons From Alberta Can, and Should, Inform American Policies

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Introduction

Tar sands are not the only energy source that exploits water but they do pose substantial dangers to both water quality and human health; Alberta's tar sands extraction offers a warning for others who want to develop their own tar sands (including recent endeavours in Utah). There is an increasing problem of the water and energy nexus (Maisonet-Guzman, 2011). The water and energy nexus is the Catch-22 that production of energy consumes vast amounts of water while provision of water also consumes energy (Glassman, Wucker, Isaacman, & Champilou, 2011). Global demand for energy is expected to increase by 30% by 2030 (Maisonet-Guzman, 2011), and it is important to assess the methods of energy provision for social, environmental, and economic sustainability. Tar sands extraction is for the sake of energy but consumes vast amounts of both energy and water which far surpass the output its energy can provide (negative net energy balance). "The competition between water and energy needs represents a critical business, security, and environmental issue, but has not yet received the attention that it merits" (Glassman, Wucker, Isaacman, & Champilou, 2011). Western legal traditions enshrined in the constitutions of Canada and the United States evolved within a "market-oriented paradigm". Market values have dominated both legal development and politics. In principle, this limits government intervention, government conservation initiatives, and environmental law which are vulnerable to market-oriented initiatives based (Matsui, 2012). However, while oil extraction

from the tar sands has been justified on energy security and economic grounds, even market principles should warn against the dangers of oil extraction from tar sands.

America has newly entered the oil sands extraction frontier. The Obama administration has opened "nearly 462,000 acres of land in Colorado, Utah and Wyoming for the research and development of oil" through non-conventional methods (Malewitz, 2012). The rise of crude oil prices have made commercial tar sands use in Utah attractive (2012 Oil Shale & Tar Sands Programmatic EIS Information Center). In fact, in October 2012, despite the links to water contamination with current practices, the Utah Water Quality Board (UWQB) approved the first tar sands mine on American soil. They deemed there was no risk of groundwater contamination from prospective tar sands mining. Meanwhile, the Associated Press has indicated that the proposed project will contaminate a Utah-based offshoot of the Colorado River (Horn, 2012). The Colorado River is under compact with seven states in Western America (Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming) (New Mexico Water Resources Institute), and if contaminated, this affects an immense population of the United States—nearly 25 million people are, at least in part, served by Colorado River water (Colorado River Water Users Association, 2007). Interestingly, three of the seven states are served by the Colorado River (Utah, Colorado, and Wyoming) are the ones opened for exploration. Moreover, public hearings in Utah were allowed, but no input was permitted from the public at these hearings (Horn, 2012) which severely limits the ability of non-business or non-governmental agencies to play any role in the process. There are arguments for increasing the domestic energy supply in America, including national security. "The United States, as the world's largest oil consumer at 20–23 million barrels a day, has encouraged the growth of oil sands development in neighboring Canada" (Worldwatch Institute). Being the largest consumer in the world means

consistent supply can be a concern. Since tar sands extraction is already underway in Alberta, supported by American companies, it provides a case study for the benefits and dangers posed by the method. Many lessons are offered by Alberta's experience that must be taken with heed by American policymakers before hastily jumping into this oil extraction process. These are the focus of this paper and must be a focus of national and Utah politicians before moving forward with commercialized production.

Tar Sands

Perhaps the most contentious method for oil extraction is from oil/tar sands (these terms are interchangeable). Tar sands are an amalgamation of clay, water, sand, and bitumen. Oil rich bitumen is extracted and later refined into oil (2012 Oil Shale & Tar Sands Programmatic EIS Information Center). Tar sands oil is a "heavy sour" crude that contains more metals, sulfur, and nitrogen (including mercury, lead, nickel, and arsenic) than conventional crudes (Bruno, Baizel, Casey-Lefkowitz, Shope, & Colarulli, 2010). Oil from tar sands is refined into both gasoline and diesel (Bruno, Baizel, Casey-Lefkowitz, Shope, & Colarulli, 2010) so it provides two separate energy sources. This process is costly, with insurmountable impacts on the environment and human health.

Oil sands refinement requires both extraction and separation systems. Tar sands deposits are mined through strip mining, open pit mining, or underground heating and additional upgrading. Strip mining is similar to coal extraction in that the strips of the tar sands are removed and taken for processing. Open pit mining "systems use large hydraulic and electrically powered shovels to dig up tar sands and load them into enormous trucks that can carry up to 320 tons of tar sands per load" (2012 Oil Shale & Tar Sands Programmatic EIS Information Center).

Underground heating uses heat emission to bring the bitumen to the surface for easier extraction of deeper deposits. Additional upgrading can be used for primary processing on extraction sites. From there, the tar sands are brought to extraction plants which use a hot water process to separate bitumen from sand, water, and minerals. With hot water and agitation air bubbles attach to bitumen droplets and they float to the top where they can be skimmed off. Further processing removes excess residual, then, this needs to be further refined into synthetic crude oil (2012 Oil Shale & Tar Sands Programmatic EIS Information Center). Less than 20% of tar sands oil can be extracted through open pit mining (Bruno, Baizel, Casey-Lefkowitz, Shope, & Colarulli, 2010). The vast majority of bitumen deposits are deeper.

For oil that is too deep to be economically efficient to extract, there are several "in situ" (in place) methods as they are called in the field: steam injection, solvent injection, and firefloods. Firefloods inject oxygen and part of the resource is burned to provide heat. Steam injection is the favoured in situ method (2012 Oil Shale & Tar Sands Programmatic EIS Information Center). These processes are akin to hydraulic fracturing and offer many of the same challenges. "[H]ydraulic fracturing has come under scrutiny over concerns about contamination of drinking water, the use of chemicals, wastewater management, and the potential for causing earthquakes" (Loris, 2012). However, water contamination of tar sands extraction (in situ or not) leads to many adverse effects which must be grasped and are outlined below, including extensive energy and water use along with air and water pollution.

Large inputs are required for small outputs. For one barrel of oil about two tons of tar sands are required (2012 Oil Shale & Tar Sands Programmatic EIS Information Center). "The water-based extraction process uses enormous water inputs, requiring between two and four

barrels of water for each barrel of oil produced" (Worldwatch Institute). The tar sands industry also uses hefty amounts of energy and creates substantial amounts of waste water (tailings) (Worldwatch Institute). Al Gore said: "[f]or every barrel of oil they extract there, they have to use enough natural gas to heat a family's home for four days. And they have to tear up four tons of landscape, all for one barrel of oil. It is truly nuts" (Worldwatch Institute). Is this really something that should be forced upon American territory and people that will bear the burden of health care and degradation?

Canadian Tar Sands Energy Politics

Canada is ranked third for proven reserves in the world, after only Saudi Arabia and Venezuela. The oil sands account for a reserve of 169.2 billion barrels while traditional methods offer only 1.5 billion barrels of oil reserves (Alberta Department of Energy, 2010). Clearly, the vast majority of reserves are in the tar sands, and these are what make Canada a major oil economy, not conventional oil. Oil sands extraction has only been underway in Canada for the past decade but has already caused massive degradation. Only in 2003 did Albertan oil sands get officially recognized as economically viable (Worldwatch Institute) but they have since led to major pollution and environmental degradation. Rapid development of extraction made Alberta the single fastest growing source of greenhouse gas (GHGs) emissions in Canada (Worldwatch Institute). In fact, tar sands extraction produces three times the amount of GHGs as conventional oil pumping (Bruno, Baizel, Casey-Lefkowitz, Shope, & Colarulli, 2010). Emissions include nitrogen oxides, volatile organic compounds, sulfur dioxides, and particulate matter. They pollute the air and are known to have negative impacts on human and animal health (Bruno, Baizel, Casey-Lefkowitz, Shope, & Colarulli, 2010). For a country that wants to promote clean

and sustainable energy (U.S. Department of the Interior Bureau of Land Management, 2012) this is certainly inconsistent.

Aboriginals have been disproportionately affected by the degradation caused through oil extraction. A former chief of Alberta's Mikisew Cree nation, George Poitras, is concerned about the effects of increased oil development in a region his people have inhabited for some 12,000 years. Tribal elders have seen changes in the local environment such as worsening water quality, recession along the Athabasca River, shifting bird and caribou migrations patterns, and many fish showing deformities and blisters (Worldwatch Institute). However, these tribal elders are not alone in their concerns. Many doctors and ecologists also saw environmental degradation, shifting migration patterns, fish deformities, and human health effects.

Western Canadian Geography of Oil Extraction

Tarry bitumen lies under the Boreal forest in Alberta and Saskatchewan (International Boreal Conservation Campaign). The oil industry strip mines and drills the Boreal forests and wetlands for the bitumen lying under the trees (Bruno, Baizel, Casey-Lefkowitz, Shope, & Colarulli, 2010). If unchecked, oil extraction from the tar sands will turn an area the size of Florida into wasteland (Bruno, Baizel, Casey-Lefkowitz, Shope, & Colarulli, 2010). The Boreal forest is one of the world's largest carbon reducers and is at risk with tar sands extraction (Bruno, Baizel, Casey-Lefkowitz, Shope, & Colarulli, 2010). Canada's Boreal forest is 11% of the world's remaining intact terrestrial carbon storehouses (Bruno, Baizel, Casey-Lefkowitz, Shope, & Colarulli, 2010). Water for oil sands extraction comes from the Athabasca River (flowing almost 930 miles past the tar sand mines) (Bruno, Baizel, Casey-Lefkowitz, Shope, & Colarulli, 2010). "As of 2009, the Alberta government had granted permits allowing oil companies to

divert 21 billion cubic feet of water each year for their operations, an amount that is about six times what is needed by a city of one million people for one year" (Bruno, Baizel, Casey-Lefkowitz, Shope, & Colarulli, 2010). Such water extractions threaten the sustainability of waterfowl nesting grounds and fish populations by both diminishing the water bodies and also pollution deteriorating the quality of the remaining water source (Bruno, Baizel, Casey-Lefkowitz, Shope, & Colarulli, 2010). While most water from in situ methods can be recycled some remains underground (Bruno, Baizel, Casey-Lefkowitz, Shope, & Colarulli, 2010). Canada holds 20% of the world's fresh water but this is at risk (Matsui, 2012). Continuous pumping of water lowers table water and is shrinking lakes and wetlands (Bruno, Baizel, Casey-Lefkowitz, Shope, & Colarulli, 2010). However, if salt water is used, an additional step to remove the salt is required (Bruno, Baizel, Casey-Lefkowitz, Shope, & Colarulli, 2010).

Water Use and Contamination

Petroleum extraction from Canadian tar sands uses 20 times more water than traditional drilling (Maisonet-Guzman, 2011). However, this figure is actually an underestimation because it does not include the water used in steam injection extraction (Glassman, Wucker, Isaacman, & Champilou, 2011). The project consumes and contaminates massive amounts of fresh water, up to four gallons of water for each gallon of crude oil produced (Bruno, Baizel, Casey-Lefkowitz, Shope, & Colarulli, 2010). For the most part, a water source found solely within a territory or province falls within their jurisdiction alone (Environment Canada, 2012). However, this neglects the flow cycles of water sources and the relationship between a water source and ground water that certainly impacts other provinces and territories.

Huge amounts of contamination are in tailings from tar sands including naphthenic acids, polycyclic aromatic hydrocarbons, ammonia, phenolic compounds, mercury, and other trace metals (Bruno, Baizel, Casey-Lefkowitz, Shope, & Colarulli, 2010). These tailing ponds are acutely toxic to aquatic organisms and mammals (Bruno, Baizel, Casey-Lefkowitz, Shope, & Colarulli, 2010). These pollutants make "people sick, causing lung and respiratory problems such as bronchitis, asthma, respiratory infections, and decreased lung function" (Bruno, Baizel, Casey-Lefkowitz, Shope, & Colarulli, 2010). Many of the metals contained, like mercury, are neurotoxic and some volatile organic compounds emitted are carcinogenic (Bruno, Baizel, Casey-Lefkowitz, Shope, & Colarulli, 2010). The Environmental Protection Agency (EPA) deemed polycyclic aromatic hydrocarbons to be "definite, possible, or probable" cancer causing agents for humans (Bruno, Baizel, Casey-Lefkowitz, Shope, & Colarulli, 2010). Because of this, the tailings water is not released back to the Athabasca River; it is stored behind holding dams (Bruno, Baizel, Casey-Lefkowitz, Shope, & Colarulli, 2010). Essentially, this means that toxic water is being stored and can still impact wildlife and leech into the soil and groundwater.

Tailing ponds cover approximately 50 square miles, leaking into ground water, and estimates suggest that 4 million litres leak each year (Bruno, Baizel, Casey-Lefkowitz, Shope, & Colarulli, 2010). "Every day Syncrude – the largest producer of tar sands oil – dumps 250,000 tons of liquid toxic waste into its man-made tailings ponds" (International Boreal Conservation Campaign). In fact, their tailings pond is the second largest dam on the planet only to China's Three Gorges Dam (International Boreal Conservation Campaign). Sixteen hundred migrating ducks were killed in the spring of 2008 when they landed on one of Syncrude's tailings ponds (Bruno, Baizel, Casey-Lefkowitz, Shope, & Colarulli, 2010). Many fish deformities in the Athabasca River, alongside tar sands operations, are observed (including cysts, lesions, and

tumors) due to tailings seepage (Dolha, 2010). Even more petrifying, the oil industry actually has no reclamation approach to successfully manage toxic waste of tailing ponds (Bruno, Baizel, Casey-Lefkowitz, Shope, & Colarulli, 2010).

There is an attempted tailings mitigation method being used. However, this does not entirely remove the danger posed. Tailings Seepage Recapturing and Monitoring Systems use a curtain wall, or outer recovery trench, for an interceptor recovery well with seepage monitoring checking at different depths to see how much is being lost and divert the rest back to the seepage collection ditch (Alberta Government). Thus, the industry is trying to mitigate environmental damage in some ways. However, as previous statistics indicated, ground water and waterways are still contaminated through seepage, leading to adverse human, animal, and territorial health.

Aboriginal Peoples Resist

In Canada, indigenous peoples are by far the worst impacted by the tar sands operations (aside from the environment) simply based on proximity to operations and through treaty rights being neglected. "Tar sands operations harm the health of communities that depend on local waters and wildlife, and violate the legal rights of Canadian indigenous peoples" (Bruno, Baizel, Casey-Lefkowitz, Shope, & Colarulli, 2010). Many indigenous leaders have denounced the tar sands because they destroy forests and limit their ability to fish and hunt in traditional territories (Bruno, Baizel, Casey-Lefkowitz, Shope, & Colarulli, 2010). "The First Nations also report that they were not adequately consulted – as required by their constitutional treaty rights – before these mammoth operations were launched" (Bruno, Baizel, Casey-Lefkowitz, Shope, & Colarulli, 2010). The Canadian Environmental Assessment Act (1992) includes a provision to require that environmental assessments consider traditional knowledge of local and Indigenous

peoples (Matsui, 2012). The required consultation simply did not occur. "Programs and services for the provision of potable water on reserves are provided through First Nation Band Councils, Health Canada, and Indian and Northern Affairs Canada (INAC)" (National Aboriginal Health Organization (NAHO), 2002). Health Canada collaborates with provinces and territories for the Guidelines for Canadian Drinking Water Quality to ensure water quality monitoring and surveillance programming is in place for First Nations communities (National Aboriginal Health Organization (NAHO), 2002). However, these communities are experiencing water contamination and destruction of habitat which was used for daily life and subsistence. Under section 36 of the Constitution Act 1982, the government is obligated to provide "essential public services of reasonable quality to all Canadians" (Boyd). This can certainly be seen as a failing in the context of insecurity of water and food supplies experienced by First Nations in Canada. There is really no mandate for attaining consultation due to a free entry system. Expansion of oil sands extraction is likely to persist without consultation.

> "Postexploration and predevelopment activities are subject to varying levels of review by local First Nations, territorial, and federal agencies, yet petroleum seismic exploration activities are routinely permitted, while little or no consultation of those Aboriginal peoples who live near the exploration activity." (Caine & Krogman, 2010)

Canada has a free entry system to explore for mineral development opportunities, which is generally allowed without an agreement from First Nations (Caine & Krogman, 2010).

Tar sands exploitation has not been without repercussion; there has been First Nations backlash against the project. The Athabasca Chipewyan and Mikisew Cree called for a moratorium on developing tar sands in 2008. The Beaver Lake Cree filed suit against Canada and Alberta for violating their treaty rights with severe pollution of their territory in the same

year. A coalition of 30 First Nations from British Columbia, whose lives and livelihoods are threatened by a proposed pipeline to the Pacific coast declared, in 2010, that "tankers carrying crude oil from the Alberta Tar Sands will not be allowed to transit our lands and waters" (Bruno, Baizel, Casey-Lefkowitz, Shope, & Colarulli, 2010). Moreover, there is a recent "Idle No More" campaign in Canada with peaceful protests being staged across the country on environmental issues. A "Stop Tar Sands Profiteers" week of action has been called for March 16-23, 2013 to block expansion of the XL Keystone pipeline (Tar Sands Blockade, 2013). No such opposition has been raised for Utah as of yet short of environmental groups. However, in Portland Oregon and Washington D.C. there have been protests staged. In Portland, Climate Justice Activists got together to protest an oil sands profiteer (ESCO Corps.). In Washington D.C. 48 people were arrested at the fence for protesting the Keystone XL pipeline (Tar Sands Blockade, 2013). There had already been an opposition movement to tar sands before they began extraction in the United States which prompts the need for thorough assessment of the proposed project.

Health Outcomes

Tar sands extraction impacts indigenous peoples' health. "For Canada's Aboriginal communities, contaminated water is repeatedly identified as a major source of concern and a perennial cause of illness" (National Aboriginal Health Organization (NAHO), 2002). Human health patterns in these regions are indicators as to the direct impacts of contaminants in food and water linked to the oil sands industry. Anthroprogenic activities have led to environmental contaminants entering the traditional food systems where consumption of traditional foods is often an economic necessity (Richmond & Ross, 2009). Not only does water contamination impact aboriginal health but animals are carriers of the toxins which also contaminates their

food. Having one segment of the population so disproportionately affected by the health impacts of tar sands extraction further indicates their isolation from venues of governance.

As of 2010, 49 First Nations communities have high-risk drinking water systems and over 100 First Nations face ongoing boil water advisories (one sixth of the First Nations in Canada). Common factors cited as causal "to bacteriological contamination include wastewater contamination of drinking water supplies, contamination of surface water from animal waste, or where watersheds are insufficiently protected from industrial waste" (Isfeld, 2009). Industrial waste from the tar sands is what is concerning for human health outcomes. Health Canada estimates 90 deaths and 90,000 illnesses each year are caused by contaminated drinking water (Isfeld, 2009). Unfortunately, there is no statistic subdividing illness and death numbers related to tar sands extractions.

American Oil Sands Energy Politics

America is the leading consumer of oil, currently consuming a quarter of the world's oil (Bruno, Baizel, Casey-Lefkowitz, Shope, & Colarulli, 2010) making America a quarter of the demand side for oil markets. That means America is highly integrated into oil markets and is a cause for their promotion of tar sands extraction in Canada. American dependence on oil is a concern for national security (CNA Analysis & Solutions, 2012) since they are heavily reliant on a consistent and fairly priced supply of oil. Energy policies and national security have been intertwined, and the Democratic Party's platform, for the recent election win, posits the desire to attain American energy independence (Democratic National Committee, 2012). The Republican Party's platform also indicated the desire for energy self-sufficiency (GOP, 2012) so this was an

actually on which both parties actually agreed. Potential for oil sands extraction could be an opportunity for America to attain energy independence.

There is a single company involved in current operation for the Utah tar sands. U.S. Oil Sands has 100% interest of bitumen leases across 32,005 acres of Utah land and is engaged in the exploration and development of oil sands properties (U.S. Oil Sands). The company asserts that their technology for oil extraction is better than what is used in Alberta. They have a proprietary extraction process using a bio-solvent where they claim that no tailings ponds are required and 95% of water is recycled with a low energy input (U.S. Oil Sands). How exactly they plan to avoid tailings ponds with 5% of water not being recycled is not specified. Moreover, American tar sands are different than Canadian tar sands and require additional treatment for the conglomerate material so it is questionable, at the very least, to assert a lower energy input. American tar sands extraction through open pit mining and strip mining are starkly reminiscent of Appalachian coal mining (Miller, 2012). A large amount of environmental degradation and massive impacts on human and animal health are the cost.

American Tar Sands

As mentioned above, there are tar sands in Utah, Wyoming, and Colorado. Geography of each deposit is important to compare the potential effects of extraction. Utah's Uinta Basin have had mine operations opened (Oil Sands Inc., 2012). Like Canada, there is a free entry system to explore for mineral development opportunities (Bureau of Land Management (BLM)). "The Bureau of Land Management (BLM) is considering allocating up to 2.5 million acres of public lands in Utah, Wyoming and Colorado for new commercial leases to develop oil shale and tar sands" (National Parks Conservation Agency (NPCA)). This is a large amount of territory.

Western American parklands are a source of both recreation and of jobs which are both economic drivers. In fact, 65,000 recreation economy supported jobs are supported in Utah alone (National Parks Conservation Agency (NPCA)). National park visitation in 2010 generated $612 million in local spending in Utah, $300 million in Colorado, and $610 million in Wyoming (National Parks Conservation Agency (NPCA)) . These are substantial figures and important sources of revenue for these states.

American tar sands are not a direct replica of Canadian tar sands, they need to be independently understood. "Jim Bartis from RAND stated, "[t]he Utah [bitumen] resources are overall of lower quality in seam thickness and yield per ton as compared to the Canadian resources. So in the absence of government subsidy, I would be surprised to find investors interested in U.S. sands so long as investment opportunities are available in Alberta" (Miller, 2012). U.S. tar sands tend to have sand cemented to minerals, and are lean. Lessons from the experience in Alberta are beneficial but modifications to technologies may be required to produce synthetic oil from U.S. tar sands in a cost effective manner (United States Department of Energy (DOE)). Unfortunately, American tar sands extraction is already seen as a viable market option in Utah at the moment. However, American tar sands require a more complicated process. "The infrastructure needed for tar sands in the United States requires a network of pipelines and refineries crisscrossing the Northern Plains and Midwest that will affect farmers, ranchers, Native Americans, and the residents of industrial areas" (Bruno, Baizel, Casey-Lefkowitz, Shope, & Colarulli, 2010). The process is more complicated and poses many risks similar to those mentioned above but more expansive in nature due to the adjacent water source.

There has been a Draft Programmatic Environmental Impact Statement put out by the Bureau of Land Management (BLM) about tar sands extraction in the United States. BLM lands in Utah, Colorado, and Wyoming are under consideration for land use amendments for oil sands extraction (Bureau of Land Management (BLM), 2012). U.S. oil sands are hydrocarbon wet while the ones in Canada are water wet which implies a different processing method is required (Bureau of Land Management (BLM), 2012) . Utah's deposits are estimated to be between 12-30 billion barrels and are the largest of all American tar sands deposits (Miller, 2012) which are substantially smaller than Alberta's deposits but are still a commercial opportunity. The bulk of Utah reserves are on BLM or other public land (Miller, 2012) so the government would have to offer leases to commercial extraction companies.

Water Use and Contamination Potential

There is a major potential for water contamination spanning across many states, whether or not they are home to tar sands. In Alberta, two to four barrels of water and enough natural gas to heat a family's home for four days are used for each individual barrel of oil. Western America has limited water supplies shared across an expanse of states. It has been made clear that a more complicated separation process is required which could use more water than the Canadian method. There are already four endangered fish in the Colorado River and the Mexican spotted owl is threatened. They would be impacted by proposed tar sands extraction (National Parks Conservation Agency (NPCA)). The Canadian experience has shown death of birds and fish with deformities, skin lesions, cysts, and tumors as an outcome.

U.S. Oil Sands' compound was derived from orange peels called citrus oil, or d-Limonene, which "unsticks" the tar. However, while this compound is found in several

consumer products and has been used in oil spills cleanups, it has not been used in commercial oil production ever. Hot water agitation is still needed, and the tar is passed through separation towers, to isolate crude oil (Miller, 2012). However, if the compound only allows for recycling of 95% of water the remaining 5% is still left for tailing ponds. The firm does not state where they plan to store this waste water but do claim their process requires no tailings ponds, but the water has to go somewhere and it is ridden with toxins. Akin to Canada, there is a required energy-intensive refining step to remove impurities like sulfur and heavy metals to make the oil useful (Miller, 2012). These are the same components of tailings water that leave neurotoxins in that seep into ground water in Canada. Hence, despite the claimed improved method for separation, contamination remains. The method does use less water than Albertan tar sands extraction, but there are also increased risks imposed by D-Limonene as it too releases polycylic aromatic hydrocarbons which are known carcinogenic substances (Miller, 2012). Therefore, the risk of tar sands extraction is not actually mitigated with the new process being proposed despite claims otherwise.

Many people could be affected by tar sands extraction in Utah. However, those groups that would be the most disadvantaged are the ones that are already struggling with access to adequate safe drinking water. In America and Canada, indigenous peoples are more likely to have poor access to, and contaminated sources of, water supplies. "Some 13% of Native American households have no access to safe water and/or wastewater disposal, compared with 0.6% in non-native households" (The Millennium Project, 2011). It is plausible that they would be disproportionately impacted by tar sands extraction in Utah (or Colorado/Wyoming). Bruno et al have found these groups would certainly be impacted by oil sands extraction.

These three states are in compact with four others for a shared water source proximate to the Utah proposed extraction, which renders the possibility of contamination even more alarming. Water pollution from tar sands leads to major health impacts. Some volatile organic compounds and polycylic aromatic hydrocarbons emitted are carcinogenic. Many metals like mercury are actually neurotoxic (Bruno, Baizel, Casey-Lefkowitz, Shope, & Colarulli, 2010). These are dangers for all seven states. Air pollution from oil sands extraction is linked to lung and respiratory problems such as asthma, bronchitis, respiratory infections, and decreased lung function (Bruno, Baizel, Casey-Lefkowitz, Shope, & Colarulli, 2010). Such health risks, in combination with risks to the environment, should be major concerns—especially because of the nature of the shared Colorado River water supply. "[D]eer, elk, and black bear roam the undulating plateau. But increased traffic from energy development could fragment their habitat, as well as that of several threatened species, including the greater sage grouse and Mexican spotted owl" (Miller, 2012). There are many environmental and human health impacts that must be assessed prior to moving forward with the project. Social ramifications of adversely impacting one area of the United States for energy consumption across the whole country would also need assessment. In short, the fast tracked project in Utah has a great deal that should be ascertained prior to commencing extraction.

Conclusion

The water energy nexus has solutions. A holistic understanding to the water and energy nexus is in regional documents like the Organization of American States' "Declaration of Santa Cruz '10" (Maisonet-Guzman, 2011). It incorporates the dynamics of the water and energy nexus into water usage strategies with the notion of needing to be sustainable in both energy and water (Maisonet-Guzman, 2011). Such documents need to be assessed in relation to the tar

sands extraction. Moreover, Albertan experiences must be taken as a cautionary tale to ban, or at least restrict, extracting from oil sands in America. Tar sands have degraded the Boreal Forest, contaminated the Athabasca River, and polluted air. It has led to negative health outcomes for humans and animals alike; birds have died en masse; fish have been deformed with lesions, tumors, and cysts. Humans have gotten asthma, bronchitis, respiratory infections, and decreased lung capacity. Massive areas of land are destroyed. Ground water and related waterways are horribly contaminated. Neurotoxins are emitted. Utah extraction could lead to horrible outcomes for the Colorado River and all states compacted the share this resource. U.S. Oil Sands claims that their method is better for the environment, but D-Limonene can actually lead to an increase in polycylic aromatic hydrocarbons despite the reduction of water use. Meanwhile, the claim to not using tailing ponds is not backed up by the 5% of water unaccounted for that is not recycled. American politicians need to be extremely weary and cautious before allowing tar sands extraction to ruin water and air quality and pose major health risks. Must the public pay for this filthy oil's healthcare burden?

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