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CRITICAL REVIEW DISCUSSION SUPPLEMENT

Oil Sands Research Bibliography

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ABSTRACT

The 2019 Critical Review by Brook et al. (2019) summarized much work by Environment and Climate Change Canada (ECCC), but discussants in Altshuler et al. (2019) found it lacking in terms of the publications and reports examined and referenced. A more complete bibliography of relevant work is compiled here with a brief guide to resources that might facilitate future efforts to critically examine oil sand extraction processes, emissions, control measures, and effects on local, regional, and global environments.

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Introduction

This supplement to the 2019 Critical Review documents more than 850 printed resources related to oil sands extraction processes, emissions to air/land/water, emission control measures, transport and transformation, and potential adverse effects. Most of the citations were identified by searches on Web of Science, GoogleScholar, and SCOPUS data bases. ERA (2019) has compiled a large number of grey-literature reports available for download, most of which are not referenced here. WBEA (2019) has also posted annual reports on air quality trends as well as additional research reports. A large number of Environmental Impact Assessments (EIA's) have been prepared for different projects, but only a few are included here.

Most of the citations are specific to the oil sands region (OSR) of northern Alberta, Canada, although there are also references from other parts of the world with similar resources, such as China, Malaysia, Nigeria, and Russia..

Several prior reviews provide initial gateways to the literature on various topics. Percy (2012) has compiled a series of overview articles on emissions, processes, and ecosystem effects. Kapadia et al. (2015), Masliyah et al. (2004), Rao and Liu (2013) Upreti et al. (2007) and Vittoratos and Kovscek (2019) review several aspects of the oil sands extraction and upgrading processes. Dhar et al (2018), Foster et al. (2019), Lima and Wrona (2019) and Tolton et al. (2012) summarize information related to different OSR ecosystems. Harner et al. (2018) provide a comprehensive assessment for polycyclic aromatic compounds (PAC) from their emissions to ecosystem effects. Liu et al. (2019) take a broader view of worldwide oil sand resources and their exploitation potential, while Zou et al. (2015) focus on similar resources in China. Garibaldi (2009), Mantyka-Pringle et al. (2015), Usher (2000), and Wanvik and Caine (2017) address important aspects of Traditional Ecological Knowledge (TEK) and how this is relevant to today's environmental issues.

It is recognized that any bibliographic listing of this type will be incomplete and possibly outdated within a few years, but it is hoped that its documentation here can be of use to future reviewers on various aspects of this important energy resource.

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References

Abella, J.P. and Bergerson, J.A. 2012. Model to investigate energy and greenhouse gas emissions implications of

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refining petroleum: Impacts of crude quality and refinery configuration. *Environ. Sci. Technol.*, 46:13037-13047.

ABMI 2015. Alberta Biodiversity Monitoring Institute. http://www.abmi.ca/home.html (Accessed August 15, 2019)

Abolfazlzadehdoshanbehbazari, M., Birks, S.J., Moncur, M.C. and Ulrich, A.C. 2013. Fate and transport of oil sand process-affected water into the underlying clay till: A field study. *Journal of Contaminant Hydrology*, 151:83-92.

Abram, M. and Cain, G. 2014. Particle-Size Analysis for the Pike 1 Project, McMurray Formation. *Journal of Canadian Petroleum Technology*, 53:339-354.

Addison, P.A. and Puckett, K.J. 1980. Deposition of atmospheric pollutants as measured by lichen element content in the Athabasca oil sands area. *Canadian Journal of Botany*, 58:2323-2334.

Adebiyi, F.M. and Thoss, V. 2015. Spectroscopic characterization of asphaltene fraction of Nigerian bitumen. *Petroleum Science and Technology*, 33:245-255.

AEMERA 2015. Alberta Environmental Moitoring, Evaluation, and Reporting Agency. AEMERA, Edmonton, AB, Canada. http://www.aemera.org/ (Accessed August 15, 2019)

Afzal, A., Drzewicz, P., Perez-Estrada, L.A., Chen, Y., Martin, J.W. and El-Din, M.G. 2012. Effect of molecular structure on the relative reactivity of naphthenic acids in the UV/H2O2 advanced oxidation process. *Environ. Sci. Technol.*, 46:10727-10734.

Ahad, J.M.E., Pakdel, H., Savard, M.M., Simard, M.C. and Smirnoff, A. 2012. Extraction, separation, and intramolecular carbon isotope characterization of Athabasca oil sands acids in environmental samples. *Anal. Chem*, 84:10419-10425.

Ahad, J.M.E., Pakdel, H., Savard, M.M., Calderhead, A.I., Gammon, P.R., Rivera, A., Peru, K.M. and Headley, J.V. 2013. Characterization and quantification of mining-related "Naphthenic Acids" in groundwater near a major oil sands tailings pond. *Environ. Sci. Technol.*, 47:5023-5030.

Ahad, J.M.E., Gammon, P.R., Gobeil, C., Jautzy, J., Krupa, S., Savard, M.M. and Studabaker, W.B. 2014. Evaporative emissions from tailings ponds are not likely an important source of airborne PAHs in the Athabasca oil sands region. *Proceedings of the National Academy of Sciences of the United States of America*, 111:E2439-E2439.

Ahad, J.M.E., Jautzy, J.J., Cumming, B.F., Das, B., Laird, K.R. and Sanei, H. 2015. Sources of polycyclic aromatic hydrocarbons (PAHs) to northwestern Saskatchewan lakes east of the Athabasca oil sands. *Organic Geochemistry*, 80:35-45. 10.1016/j.orggeochem.2015.01.001.

Aherne, J. and Shaw, D.P. 2010. Impacts of sulphur and nitrogen deposition in western Canada. *J. Limnol*, 69:1-3.

Ajaero, C., Peru, K.M., Simair, M., Friesen, V., O'Sullivan, G., Hughes, S.A., McMartin, D.W. and Headley, J.V. 2018. Fate and behavior of oil sands naphthenic acids in a pilot-scale treatment wetland as characterized by negative-ion electrospray ionization Orbitrap mass spectrometry. *Sci. Total Environ*, 631-632:829-839. 10.1016/j.scitotenv.2018.03.079.

Ajaero, C., Peru, K.M., Hughes, S.A., Chen, H., McKenna, A.M., Corilo, Y.E., McMartin, D.W. and Headley, J. 2019. Atmospheric pressure photoionization Fourier transform ion cyclotron resonance mass spectrometry characterization of oil sand process-affected water in constructed wetland treatment. *Energy & Fuels*, 33:4420-4431. 10.1021/acs.energyfuels.9b00469.

Akingunola, A., Makar, P.A., Zhang, J.H., Darlington, A., Li, S.M., Gordon, M., Moran, M.D. and Zheng, Q. 2018. A chemical transport model study of plume-rise and particle size distribution for the Athabasca oil sands. *Atmos. Chem. Phys*, 18:8667-8688. 10.5194/acp-18-8667-2018.

Akre, C.J., Headley, J.V., Conly, F.M., Peru, K.M. and Dickson, L.C. 2004. Spatial patterns of natural polycyclic aromatic hydrocarbons in sediment in the lower Athabasca River. *Journal of Environmental Science and Health Part A-Toxic/Hazardous Substances & Environmental Engineering*, 39:1163-1176.

AlbertaGovernment 2017. Oil sands: Facts and Stats. Alberta Government, Edmondton, AB, Canada. https://open.alberta.ca/publications/oil-sands-facts-and-stats (Accessed August 15, 2019)

AlbertaGovernment 2019. Ambient air quality objectives. Alberta Government, Edmondton, AB, Canada. https://www.alberta.ca/ambient-air-quality-objectives.aspx (Accessed August 15, 2019)

Alekandre, P., Kyser, K., Polito, P. and Thomas, D. 2005. Alteration mineralogy and stable isotope geochemistry of paleoproterozoic basement hosted unconformity-type uranium deposits in the Athabasca Basin, Canada. *Economic Geology*, 100:1547-1563.

Alexander, A.C. and Chambers, P.A. 2016. Assessment of seven Canadian rivers in relation to stages in oil sands industrial development, 1972-2010. *Environmental Reviews*, 24:484-494. 10.1139/er-2016-0033.

Alexander, A.C., Chambers, P.A. and Jeffries, D.S. 2017. Episodic acidification of 5 rivers in Canada's oil sands during snowmelt: A 25-year record. *Sci. Total Environ*, 599:739-749. 10.1016/j.scitotenv.2017.04.207.

Alexandre, P. and Kyser, T.K. 2006. Geochemistry of uraniferous bitumen in the southwest Athabasca basin, Saskatchewan, Canada. *Economic Geology*, 101:1605-1612.

Alharbi, H.A., Morandi, G.D., Jones, P.D., Wisemanl, S.B. and Giesy, J.P. 2019. Comparison of the effects of extraction techniques on mass spectrometry profiles of dissolved organic compounds in oil sand process-affected water. *Energy & Fuels*, 33:7001-7008. 10.1021/acs.energyfuels.9b00813.

Allen, E.W. 2008. Process water treatment in Canada's oil sands industry: II. A review of emerging technologies. *Journal of Environmental Engineering and Science*, 7:499-524. 10.1139/s08-020.

Allen, E.W. 2008. Process water treatment in Canada's oil sands industry: I. Target pollutants and treatment objectives. *Journal of Environmental Engineering and Science*, 7:123-138. 10.1139/s07-038.

Almao, P.P. 2012. In situ upgrading of bitumen and heavy oils via nanocatalysis. *Canadian Journal of Chemical*

Engineering, 90:320-329.

Altshuler, S.L., Ahad, J.M.E., Chow, J.C., Duane, C., Dube, M., Legge, A.H., Percy, K.E., Stevenson, E.D. and Watson, J.G. 2019. Critical review discussion: Advances in science and applications in air pollution monitoring: A case study on oil sands monitoring targeting ecosystem protection. *J. Air Waste Manage. Assoc.*, 69:online. 10.1080/10962247.2019.1659192.

Altshuler, S.L. and Stevenson, E.D. 2019. Critical review introduction: Advances in science and applications of air pollution monitoring: A case study on oil sands monitoring targeting ecosystem protection. *J. Air Waste Manage. Assoc.*, 69:659-660. 10.1080/10962247.2019.1607690.

Alvarado, V. and Manrique, E. 2010. Enhanced oil recovery: An update review. *Energies*, 3:1529-1575.

Alvarez-Majmutov, A., Gieleciak, R. and Chen, J.W. 2019. Modeling the molecular composition of vacuum residue from oil sand bitumen. *Fuel*, 241:744-752. 10.1016/j.fuel.2018.12.096.

A-MAPS 2015. Oil sands air quality monitoring. A-MAPS Environmental Inc., Ottawa, ON, Canada. http://amapsenv.com/AlbertaAQ.aspx (Accessed August 15, 2019)

Amiri, N., Ghahremaninezhad, R., Rempillo, O., Tokarek, T.W., Odame-Ankrah, C.A., Osthoff, H.D. and Norman, A.L. 2018. Stable sulfur isotope measurements to trace the fate of SO2 in the Athabasca oil sands region. *Atmos. Chem. Phys*, 18:7757-7780. 10.5194/acp-18-7757-2018.

Anderson, J., Wiseman, S.B., Moustafa, A., El-Din, M.G., Liber, K. and Giesy, J.P. 2012. Effects of exposure to oil sands process-affected water from experimental reclamation ponds on Chironomus dilutus. *Water Research*, 46:1662-1672.

Anderson, J.C., Wiseman, S.B., Wang, N., Moustafa, A., Perez-Estrada, L., El-Din, M.C., Martin, J.W., Liber, K. and Giesy, J.P. 2012. Effectiveness of ozonation treatment in eliminating toxicity of oil sands process-affected water to Chironomus dilutus. *Environ. Sci. Technol.*, 46:486-493.

Angle, C.W. and Gharib, S. 2017. Effects of sand and flocculation on dewaterability of kaolin slurries aimed at treating mature oil sands tailings. *Chemical Engineering Research & Design*, 125:306-318. 10.1016/j.cherd.2017.07.014.

Anochie-Boateng, J.K. and Tutumluer, E. 2014. Advanced testing and characterization of shear modulus and deformation characteristics of oil sand materials. *Journal of Testing and Evaluation*, 42:1228-1239.

Anon 2010. IHS CERA: Oil sands GHG emissions lower than perceived. *Oil & Gas Journal*, 108:40-41.

Anon 2012. Canadian oil sands producers form environmental alliance. *Oil & Gas Journal*, 110:25-26.

Anon 2015. The oil sand moose. *Oil & Gas Journal*, 113:20-20.

Anon 2019. Oil sands 101: Process overview. *Oil Sands Magazine*, online.

ARA 2016. 2015 annual report for services agreement AS103-15: Laboratory analysis of mass, ions, and trace elments on PM2.5 and PM10 filters. Atmospheric Research & Analysis, Inc., Cary, NC. (Accessed August 15, 2019)

Arciszewski, T.J., Munkittrick, K.R., Kilgour, B.W., Keith, H.M., Linehan, J.E. and McMaster, M.E. 2017. Increased size and relative abundance of migratory fishes observed near the Athabasca oil sands. *Facets*, 2:833-858. 10.1139/facets-2017-0028.

Arciszewski, T.J., Munkittrick, K.R., Scrimgeour, G.J., Dube, M.G., Wrona, F.J. and Hazewinkel, R.R. 2017. Using adaptive processes and adverse outcome pathways to develop meaningful, robust, and actionable environmental monitoring programs. *Integrated Environmental Assessment and Management*, 13:877-891. 10.1002/ieam.1938.

Arciszewski, T.J., Hazewinkel, R.R., Munkittrick, K.R. and Kilgour, B.W. 2018. Developing and applying control charts to detect changes in water chemistry parameters measured in the Athabasca River near the oil sands: A tool for surveillance monitoring. *Environmental Toxicology and Chemistry*, 37:2296-2311. 10.1002/etc.4168.

Arens, C.J., Arens, J.C., Hogan, N.S., Kavanagh, R.J., Berrue, F., Van der Kraak, G.J. and van den Heuvel, M.R. 2017. Population impacts in White Sucker (Catostomus Commersonii) exposed to oil sands-derived contaminants in the Athabasca River. *Environmental Toxicology and Chemistry*, 36:2058-2067. 10.1002/etc.3735.

Associates, G. 2005. Estimating contributions to ambient concentrations in Fort McKay. Golder Associates, Inc., Ft McMurray, AB, Canada. http://www.cemaonline.ca/content/view/26/73/ (Accessed August 15, 2019)

Asubiojo, O.I. and Adebiyi, F.M. 2014. The impact of bitumen deposits on groundwater quality. *Energy Sources Part A-Recovery Utilization and Environmental Effects*, 36:445-456.

Azad, A. and Chalaturnyk, R.J. 2012. An improved SAGD analytical simulator: Circular steam chamber geometry. *Journal of Petroleum Science and Engineering*, 82-83:27-37.

Baker, L.F., Ciborowski, J.J.H. and MacKinnon, M.D. 2012. Petroleum coke and soft tailings sediment in constructed wetlands may contribute to the uptake of trace metals by algae and aquatic invertebrates. *Sci. Total Environ*, 414:177-186.

Baray, S., Darlington, A., Gordon, M., Hayden, K.L., Leithead, A., Li, S.M., Liu, P.S.K., Mittermeier, R.L., Moussa, S.G., O'Brien, J., Staebler, R., Wolde, M., Worthy, D. and McLaren, R. 2018. Quantification of methane sources in the Athabasca Oil Sands Region of Alberta by aircraft mass balance. *Atmos. Chem. Phys*, 18:7361-7378. 10.5194/acp-18-7361-2018.

Bari, M.A., Kindzierski, W.B. and Cho, S. 2014. A wintertime investigation of atmospheric deposition of metals and polycyclic aromatic hydrocarbons in the Athabasca Oil Sands Region, Canada. *Sci. Total Environ*, 485:180-192.

Bari, M. and Kindzierski, W.B. 2015. Fifteen-year trends in criteria air pollutants in oil sands communities of Alberta, Canada. *Environ. Intl.*, 74:200-208.

Bari, M.A. and Kindzierski, W.B. 2017. Ambient fine particulate matter (PM2.5) in Canadian oil sands communities: Levels, sources and potential human health risk. *Sci. Total Environ*, 595:828-838. 10.1016/j.scitotenv.2017.04.023.

Bari, M.A. and Kindzierski, W.B. 2018. Ambient volatile organic compounds (VOCs) in communities of the Athabasca oil sands region: Sources and screening health risk assessment. *Environ. Pollut.*, 235:602-614. 10.1016/j.envpol.2017.12.065.

Barrow, M.P., Peru, K.M. and Headley, J.V. 2014. An Added Dimension: GC Atmospheric Pressure Chemical Ionization FTICR MS and the Athabasca Oil Sands. *Anal. Chem.*, 86:8281-8288. 10.1021/ac501710y.

Barrow, M.P., Peru, K.M., Fahlman, B., Hewitt, L.M., Frank, R.A. and Headley, J.V. 2015. Beyond Nahthenic aids: Environmental sreening of water from natural sources and the Athabasca oil sands industry using atmospheric pressure photoionization Fourier transform ion cyclotron resonance mass spectrometry. *Journal of the American Society for Mass Spectrometry*, 26:1508-1521. 10.1007/s13361-015-1188-9.

Basu, S., Nandakumar, K. and Masliyah, J.H. 1997. On bitumen liberation from oil sands. *Canadian Journal of Chemical Engineering*, 75:476-479.

Bata, T., Parnell, J., Samaila, N.K., Abubakar, M.B. and Maigari, A.S. 2015. Geochemical evidence for a Cretaceous oil sand (Bima oil sand) in the Chad Basin, Nigeria. *Journal of African Earth Sciences*, 111:148-155. 10.1016/j.jafrearsci.2015.07.026.

Bauer, A.E., Hewitt, L.M., Parrott, J.L., Bartlett, A.J., Gillis, P.L., Deeth, L.E., Rudy, M.D., Vanderveen, R., Brown, L., Campbell, S.D., Rodrigues, M.R., Farwell, A.J., Dixon, D.G. and Frank, R.A. 2019. The toxicity of organic fractions from aged oil sands process-affected water to aquatic species. *Sci. Total Environ*, 669:702-710. 10.1016/j.scitotenv.2019.03.107.

Bawden, A.J., Linton, H.C., Burn, D.H. and Prowse, T.D. 2014. A spatiotemporal analysis of hydrological trends and variability in the Athabasca River region, Canada. *Journal of Hydrology*, 509:333-342.

Beasse, M.L., Quideau, S.A. and Oh, S.W. 2015. Soil microbial communities identify organic amendments for use during oil sands reclamation. *Ecological Engineering*, 75:199-207. 10.1016/j.ecoleng.2014.11.042.

Beckingham, J.D. and Archibald, J.H. 1996. Field guide to ecosites of northern Alberta. Natural Resources Canada, Ottawa, ON. http://www.publications.gc.ca/site/eng/57727/publication.html (Accessed August 15, 2019)

Beddow, J., Johnson, R.J., Lawson, T., Breckels, M.N., Webster, R.J., Smith, B.E., Rowland, S.J. and Whitby, C. 2016. The effect of oil sands process -affected water and model naphthenic acids on photosynthesis and growth in Emiliania huxleyi and Chlorella vulgaris. *Chemosphere*, 145:416-423. 10.1016/j.chemosphere.2015.11.046.

Bell, R.J., Davey, N.G., Martinsen, M., Collin-Hansen, C., Krogh, E.T. and Gill, C.G. 2015. A field-portable membrane introduction mass spectrometer for real-time quantitation and spatial mapping of atmospheric and aqueous contaminants. *Journal of the American Society for Mass Spectrometry*, 26:212-223. 10.1007/s13361-014-1028-3.

Beltaos, S. 2014. Comparing the impacts of regulation and climate on ice-jam flooding of the Peace-Athabasca Delta. *Cold Regions Science and Technology*, 108:49-58. 10.1016/j.coldregions.2014.08.006.

Beltaos, S. 2018. Erosion potential of dynamic ice breakup in Lower Athabasca River. Part II: Field data analysis and interpretation. *Cold Regions Science and Technology*, 148:77-87. 10.1016/j.coldregions.2018.01.012.

Beltaos, S. 2018. Frequency of ice-jam flooding of Peace-Athabasca Delta. *Canadian Journal of Civil Engineering*, 45:71-75. 10.1139/cjce-2017-0434.

Beltaos, S., Carter, T., Rowsell, R. and DePalma, S.G.S. 2018. Erosion potential of dynamic ice breakup in Lower Athabasca River. Part I: Field measurements and initial quantification. *Cold Regions Science and Technology*, 149:16-28. 10.1016/j.coldregions.2018.01.013.

Bensebaa, F., Kotlyar, L.S., Sparks, B.D. and Chung, K.H. 2000. Organic coated solids in athabasca bitumen: Characterization and process implications. *Canadian Journal of Chemical Engineering*, 78:610-616.

Benyon, C., Leier, A., Leckie, D.A., Webb, A., Hubbard, S.M. and Gehrels, G. 2014. Provenance of the Cretaceous Athabasca Oil Sands, Canada: Implications for continental-scale sediment transport. *Journal of Sedimentary Research*, 84:136-143. 10.2110/jsr.2014.16.

Berbesi, L.A., di Primio, R., Anka, Z., Horsfield, B. and Higley, D.K. 2012. Source rock contributions to the Lower Cretaceous heavy oil accumulations in Alberta: A basin modeling study. *Aapg Bulletin*, 96:1211-1234.

Berger, R.G., Aslund, M.W., Sanders, G., Charlebois, M., Knopper, L.D. and Bresee, K.E. 2016. A multiple lines of evidence approach for the ecological risk assessment of an accidental bitumen release from a steam assisted gravity drainage (SAGD) well in the Athabasca oil sands region. *Sci. Total Environ*, 542:495-504. 10.1016/j.scitotenv.2015.10.050.

Bergerson, J.A., Kofoworola, O., Charpentier, A.D., Sleep, S. and MacLean, H.L. 2012. Life cycle greenhouse gas emissions of current oil sands technologies: Surface mining and in situ applications. *Environ. Sci. Technol.*, 46:7865-7874.

Berkowitz, N. and Speight, J.G. 1975. The oil sands of Alberta. *Fuel*, 54:138-149. 10.1016/0016-2361(75)90001-0.

Berryman, S.B., Geiser, L. and Brenner, G. 2004. Depositional gradients of atmospheric pollutants in the Athabasca oil sands region, Canada: an analysis of lichen tissue and lichen communities. Lichen Indicator Pilot Program 2002-2003. Wood Buffalo Environmental Association, Fort McMurray, AB, Canada. (Accessed August 15, 2019)

Betancourt-Torcat, A., Gutierrez, G., Elkamel, A. and Ricardez-Sandoval, L. 2011. Integrated energy optimization model for oil sands operations. *Industrial & Engineering Chemistry Research*, 50:12641-12663.

Bhatti, J.S., Foster, N.W., Oja, T., Moayeri, M.H. and Arp, P.A. 1998. Modeling potentially sustainable biomass productivity in jack pine forest stands. *Canadian Journal of Soil Science*, 78:105-113. 10.4141/S97-041.

Bicalho, B., Grant-Weaver, I., Sinn, C., Donner, M.W., Woodland, S., Pearson, G., Larter, S., Duke, J. and Shotyk, W. 2017. Determination of ultratrace (< 0.1 mg/kg) elements in Athabasca bituminous sands mineral and bitumen fractions using inductively coupled plasma sector field mass spectrometry (ICP-SFMS). *Fuel*, 206:248-257. 10.1016/j.fuel.2017.05.095.

Bichard, J.A. 1987. *Oil Sands Composition and Behaviour Research*. Edmonton, Canada: Alberta Oil Sands Technology & Research Authority.

Bilodeau, J.C., Villagomez, J.M.G., Kimpe, L.E., Thomas, P.J., Pauli, B.D., Trudeau, V.L. and Blais, J.M. 2019. Toxicokinetics and bioaccumulation of polycyclic aromatic compounds in wood frog tadpoles (Lithobates sylvaticus) exposed to Athabasca oil sands sediment. *Aquatic Toxicology*, 207:217-225. 10.1016/j.aquatox.2018.11.006.

Birks, S.J., Cho, S., Taylor, E., Yi, Y. and Gibson, J.J. 2017. Characterizing the PAHs in surface waters and snow in the Athabasca region: Implications for identifying hydrological pathways of atmospheric deposition. *Sci. Total Environ*, 603:570-583. 10.1016/j.scitotenv.2017.06.051.

Blais, J.M. and Donahue, W.F. 2015. Comment on "Sphagnum mosses from 21 ombrotrophic bogs in the Athabasca bituminous sands region show no significant atmospheric contamination of 'heavy metals'". *Environ. Sci. Technol.*, 49:6352-6353. 10.1021/acs.est.5b00475.

Blum, J.D., Johnson, M.W., Gleason, J.D., Demers, J.D., Landis, M.S. and Krupa, S. 2012. Mercury concentration and isotopic composition of epiphytic tree lichens in the Athabasca Oil Sands Region, Percy, K.E. (Ed.) *Alberta Oil Sands: Energy, Industry, and the Environment,* Amsterdam, The Netherlands: Elsevier. 373-390. http://www.sciencedirect.com/science/article/pii/B9780080977607000160

Bordenave, S., Kostenko, V., Dutkoski, M., Grigoryan, A., Martinuzzi, R.J. and Voordouw, G. 2010. Relation between the activity of anaerobic microbial populations in oil sands tailings ponds and the sedimentation of tailings. *Chemosphere*, 81:663-668. 10.1016/j.chemosphere.2010.07.058.

Boret, S.E.B. and Marin, O.R. 2019. Development of surrogate models for CSI probabilistic production forecast of a heavy oil field. *Mathematics and Computers in Simulation*, 164:63-77. 10.1016/j.matcom.2018.11.023.

Botha, L. and Soares, J.B.P. 2015. The influence of tailings composition on flocculation. *Canadian Journal of Chemical Engineering*, 93:1514-1523. 10.1002/cjce.22241.

Botis, S., Pan, Y.M., Bonli, T., Xu, Y.K., Zhang, A.M., Nokhrin, S. and Sopuck, V. 2006. Natural radiation-induced damage in quartz. II. Distribution and implications for uranium mineralization in the Athabasca basin, Saskatchewan, Canada. *Canadian Mineralogist*, 44:1387-1402.

Boutilier, R.G. and Black, L. 2013. Legitimizing industry and multi-sectoral regulation of cumulative impacts: A comparison of mining and energy development in Athabasca, Canada and the Hunter Valley, Australia. *Resources Policy*, 38:696-703.

Boutin, S., Boyce, M.S., Hebblewhite, M., Hervieux, D., Knopff, K.H., Latham, M.C., Latham, A.D.M., Nagy, J., Seip, D. and Serrouya, R. 2012. Why are caribou declining in the oil sands? *Frontiers in Ecology and the Environment*, 10:65-67.

Boutin, C. and Carpenter, D.J. 2017. Assessment of wetland/upland vegetation communities and evaluation of soil-plant contamination by polycyclic aromatic hydrocarbons and trace metals in regions near oil sands mining in Alberta. *Sci Total Environ*, 576:829-839.

Bradley, M.J. 2008. Evaluation of vehicle emissions reduction options for the oil sands mine fleet. Manchester, NH. (Accessed August 15, 2019)

Brandt, A.R. 2012. Variability and uncertainty in life cycle assessment models for greenhouse gas emissions from Canadian oil sands production. *Environ. Sci. Technol.*, 46:1253-1261.

Brandt, A.R. 2012. Response to comment on "Variability and uncertainty in life cycle assessment models for greenhouse gas emissions from Canadian oil sands prodluction". *Environ. Sci. Technol.*, 46:4254-4254.

Brandt, A.R. 2018. OPGEE: The Oil Production Greenhouse gas Emissions Estimator. Stanford School of Earth, Energy & Environmental Sciences, Palo Alto, CA. https://eao.stanford.edu/research-areas/opgee (Accessed August 15, 2019)

Brook, J.R., Cober, S.G., Freemark, M., Harner, T., Li, S.M., Liggio, J., Makar, P. and Pauli, B. 2019. Critical review discussion rebuttal: Advances in science and applications of air pollution monitoring: A case study on oil sands monitoring targeting ecosystem protection. *J. Air Waste Manage. Assoc.*, 69:S1-S3.

Brooks, P.W., Fowler, M.G. and Macqueen, R.W. 1988. Biological marker and conventional organic geochemistry of oil sands/heavy oils, Western Canada basin. *Organic Geochemistry*, 12:519-538. doi: 10.1016/0146-6380(88)90144-1.

Brown, D.M., Reuter, G.W. and Flesch, T.K. 2011. Temperature, precipitation, and lightning modification in the vicinity of the Athabasca oil sands. *Earth Interactions*, 15:

Brown, D. and Reuter, G. 2018. WRF model simulations of the influence of the Athabasca oil sands development on convective storms. *Earth Interactions*, 22:1-25. 10.1175/ei-d-17-0013.1.

Burkus, Z. 2014. GHG emissions from ol sands tailings ponds: Overview and modelling based on fermentable substrates-Part II: Modelling of GHG emissions from tailings ponds based on fermentable substrates. Alberta Environment, Edmonton, AB, Canada. https://era.library.ualberta.ca/downloads/5x21tg04h (Accessed August 15, 2019)

Burkus, Z., Wheler, J. and Pletcher, S. 2014. GHG emissions

from ol sands tailings ponds: Overview and modelling based on fermentable substrates-Part I: Review of the tailings ponds facts and practices. Alberta Environment, Edmonton, AB, Canada. https://era.library.ualberta.ca/downloads/5x21tg04h (Accessed August 15, 2019)

Bytnerowicz, A., Fraczek, W., Schilling, S. and Alexander, D. 2010. Spatial and temporal distribution of ambient nitric acid and ammonia in the Athabasca Oil Sands Region, Alberta. *J. Limnol*, 69:11-21.

Bytnerowicz, A., Hsu, Y.M., Percy, K.E., Legge, A., Fenn, M.E., Schilling, S., Frączek, W. and Alexander, D. 2016. Ground-level air pollution changes during a boreal wildland mega-fire. *Sci. Total Environ*, 572:755-769. https://doi.org/10.1016/j.scitotenv.2016.07.052.

Cai, H., Brandt, A.R., Yeh, S., Englander, J.G., Han, J., Elgowainy, A. and Wang, M.Q. 2015. Well-to-wheels greenhouse gas emissions of Canadian oil sands products: Implications for US petroleum fuels. *Environ. Sci. Technol.*, 49:8219-8227.

Campos-Ruiz, R., Parisien, M.A. and Flannigan, M.D. 2018. Temporal patterns of wildfire activity in areas of contrasting human influence in the Canadian boreal forest. *Forests*, 9:10.3390/f9040159.

CAPP 2012. Canadian Association of Petroleum Producers. Canadian Association of Petroleum Producers (CAPP), Calgary, AB, Canada. (Accessed August 15, 2019)

CAPP 2018. Oil sands history and milestones. Canada's Oil & Natural Gas Producers, Calgary, AB, Canada. https://www.canadasoilsands.ca/en/what-are-the-oil-sands/oil-sands-history-and-milestones (Accessed August 15, 2019)

Carl, C., Vonpechmann, E., Hohndorf, A. and Ruhrmann, G. 1992. Mineralogy and U/Pb, Pb/Pb, and Sm/Nd geochronology of the Key Lake uranium deposit, Athabasca Basin, Saskatchewan, Canada. *Canadian Journal of Earth Sciences*, 29:879-895.

Caruso, J.A., Zhang, K.Z., Schroeck, N.J., McCoy, B. and McElmurry, S.P. 2015. Petroleum coke in the urban environment: A review of potential health effects. *International Journal of Environmental Research and Public Health*, 12:6218-6231. 10.3390/ijerph120606218.

Casey-Lefkowitz, S. 2011. Oil sands and the environment. *Physics Today*, 64:9-9.

Cathcart, H., Aherne, J., Jeffries, D.S. and Scott, K.A. 2016. Critical loads of acidity for 90,000 lakes in northern Saskatchewan: A novel approach for mapping regional sensitivity to acidic deposition. *Atmos. Environ.*, 146:290-299. 10.1016/j.atmosenv.2016.08.048.

CEAA 2008. Canadian Environmental Assessment Registry: Alberta. Canadian Environmental Assessment Agency (CEAA), Ottawa, ON, Canada. http://www.ceaa.gc.ca/050/mapSearch_e.cfm?ProvinceID=11 (Accessed August 15, 2019)

CEMA 2006. Ozone management framework for the regional municipality of Wood Buffalo area. Cumulative Environmental Management Association, Fort McMurray, AB, Canada. http://www.cemaonline.ca/content/view/24/70/ (Accessed August 15, 2019)

CEMA 2008. Cumulative Environmental Management Association. Cumulative Environmental Management Association, Ft McMurray, AB, Canada. http://www.cemaonline.ca/ (Accessed August 15, 2019)

Chalaturnyk, R.J., Scott, J.D. and Ozum, B. 2002. Management of oil sands tailings. *Petroleum Science and Technology*, 20:1025-1046.

Chalmers, H. and Gibbins, J. 2010. Carbon capture and storage: More energy or less carbon? *Journal of Renewable and Sustainable Energy*, 2:031006-031001-031006-031010.

Charpentier, A.D., Bergerson, J.A. and MacLean, H.L. 2009. Understanding the Canadian oil sands industry's greenhouse gas emissions. *Environmental Research Letters*, 4:1-11.

Charpentier, A.D., Kofoworola, O., Bergerson, J.A. and MacLean, H.L. 2011. Life cycle greenhouse gas emissions of current oil sands technologies: GHOST model development and illustrative application. *Environ. Sci. Technol.*, 45:9393-9404.

Chasmer, L., Baker, T., Carey, S.K., Straker, J., Strilesky, S. and Petrone, R. 2018. Monitoring ecosystem reclamation recovery using optical remote sensing: Comparison with field measurements and eddy covariance. *Sci. Total Environ*, 642:436-446. 10.1016/j.scitotenv.2018.06.039.

Chavez-Rodriguez, M.F. and Nebra, S.A. 2010. Assessing GHG emissions, ecological footprint, and water linkage for different fuels. *Environ. Sci. Technol.*, 44:9252-9257.

Chen, M., Walshe, G., Fru, E.C., Ciborowski, J.J.H. and Weisener, C.G. 2013. Microcosm assessment of the biogeochemical development of sulfur and oxygen in oil sands fluid fine tailings. *Applied Geochemistry*, 37:1-11. 10.1016/j.apgeochem.2013.06.007.

Chen, X.L., Chen, Z.X., Moore, R.G., Mehta, S.A., Ursenbach, M.G. and Harding, T.G. 2015. Kinetic modelling of the in-situ combustion process for Athabasca oil sands. *Journal of Canadian Petroleum Technology*, 54:12-14.

Cheng, L., Peake, E. and Davis, A. 1987. The rate of SO_2 sulfate particle formation in an air parcel from an oil sands extraction plant plume. *J. Air Pollut. Control Assoc.*, 37:163-167.

Cheng, L., Angle, R.P., Peake, E. and Sandhu, H.S. 1995. Effective acidity modelling to establish acidic deposition objectives and manage emissions. *Atmos. Environ.*, 29:383-392.

Cheng, I., Wen, D.Y., Zhang, L.M., Wu, Z.Y., Qiu, X., Yang, F.Q. and Harner, T. 2018. Deposition mapping of polycyclic aromatic compounds in the oil sands region of Alberta, Canada and linkages to ecosystem impacts. *Environ. Sci. Technol.*, 52:12456-12464. 10.1021/acs.est.8b02486.

Cheng, Y., Li, S.M., Gordon, M. and Liu, P. 2018. Size distribution and coating thickness of black carbon from the Canadian oil sands operations. *Atmos. Chem. Phys*, 18:2653-2667. 10.5194/acp-18-2653-2018.

Chhetri, A.B. and Islam, M.R. 2008. A critical review of electromagnetic heating for enhanced oil recovery.

Petroleum Science and Technology, 26:1619-1631.

Chibwe, L., Manzano, C.A., Muir, D., Atkinson, B., Kirk, J.L., Marvin, C.H., Wang, X.W., Teixeira, C., Shang, D.Y., Harner, T. and De Silva, A.O. 2019. Deposition and source identification of nitrogen heterocyclic polycyclic aromatic compounds in snow, sediment, and air samples from the Athabasca oil sands region. *Environ. Sci. Technol.*, 53:2981-2989. 10.1021/acs.est.8b06175.

Chindo, M. 2015. Environmental risks associated with developing oil sands in southwestern Nigeria. *Singapore Journal of Tropical Geography*, 36:3-22. 10.1111/sjtg.12091.

Cho, S., McEachern, P., Morris, R., Shah, T., Johnson, J. and Nopmongcol, U. 2012. Emission sources sensitivity study for ground-level ozone and PM2.5 due to oil sands development using air quality modeling system: Part I-model evaluation for current year base case simulation. *Atmos. Environ.*, 55:533-541.

Cho, S., Morris, R., McEachern, P., Shah, T., Johnson, J. and Nopmongcol, U. 2012. Emission sources sensitivity study for ground-level ozone and PM2.5 due to oil sands development using air quality modelling system: Part II-Source apportionment modelling. *Atmos. Environ.*, 55:542-556.

Cho, S., Sharma, K., Brassard, B.W. and Hazewinkel, R. 2014. Polycyclic aromatic hydrocarbon deposition in the snowpack of the Athabasca Oil Sands Region of Alberta, Canada. *Water Air and Soil Pollution*, 225:

Cho, S., Vijayaraghavan, K., Spink, D., Cosic, B., Davies, M. and Jung, J. 2017. Assessing the effects of oil sands related ozone precursor emissions on ambient ozone levels in the Alberta oil sands region, Canada. *Atmos. Environ.*, 168:62-74. 10.1016/j.atmosenv.2017.08.062.

Cho, S., Vijayaraghavan, K., Spink, D., Jung, J., Morris, R. and Pauls, R. 2017. Assessment of regional acidifying pollutants in the Athabasca oil sands area under different emission scenarios. *Atmos. Environ.*, 156:160-168. 10.1016/j.atmosenv.2017.02.038.

Cho, S., Dinwoodie, G., Fu, Y.Y., Abboud, S. and Turchenek, L. 2019. An assessment of long-term soil acidification trends in Alberta, Canada. *Ecological Indicators*, 98:712-722. 10.1016/j.ecolind.2018.11.020.

Choquette-Levy, N., MacLean, H.L. and Bergerson, J.A. 2013. Should Alberta upgrade oil sands bitumen? An integrated life cycle framework to evaluate energy systems investment tradeoffs. *Energy Policy*, 61:78-87. 10.1016/j.enpol.2013.04.051.

Chow, J.C., Wang, X.L., Kohl, S.D., Gronstal, S.B. and Watson, J.G. 2010. Heavy-duty diesel emissions in the Athabasca Oil Sands Region, Tropp, R.J. and Legge, A.H. (Eds.), *Proceedings, 103rd Annual Meeting of the Air & Waste Management Association,* Pittsburgh, PA: Air & Waste Management Association. 1-5.

Chung, T., Bae, W., Lee, J., Lee, W. and Jung, B. 2012. A review of practical experience and management of the SAGD process for oil sands development. *Energy Sources Part A-Recovery Utilization and Environmental Effects*, 34:219-226.

Ciu, Z., Liu, Q., Etsell, T.H., Oxenford, J. and Coward, J. 2003. Heavy minerals in the Athabasca oil sands tailings - Potential and recovery processes. *Canadian Metallurgical Quarterly*, 42:383-392.

Clair, T.A. and Percy, K.E. 2015. Assessing forest health in the Athabasca oil sands region. Fort McMurray, Alberta, Canada. https://wbea.org/wp-content/uploads/2018/03/assessing_forest_health_in_the_athabasca_oil_sands_region_forest_health_report_2015.pdf (Accessed August 15, 2019)

Clark, M.G., Humphreys, E. and Carey, S.K. 2019. The initial three years of carbon dioxide exchange between the atmosphere and a reclaimed oil sand wetland. *Ecological Engineering*, 135:116-126. 10.1016/j.ecoleng.2019.05.016.

Clearstone and Golder 2003. A priority ranking of air emissions in the oilsands region. Clearstone Engineering, Ltd., Calgary, AB, Canada. (Accessed August 15, 2019)

Clearstone 2006. An inventory of GHGs, CACs and H2S emissions by the Canadian bitumen industry: 1990 to 2003- Volume 3, Methodology and compendium of factors. Clearstone Engineering Ltd., Calgary, AB, Canada. (Accessed August 15, 2019)

Clearstone 2007. 2002 Inventory of CAC emissions from the oil sands region of Alberta. Clearstone Engineering Ltd., Calgary, AB, Canada. (Accessed August 15, 2019)

Clemente, J.S. and Fedorak, P.M. 2005. A review of the occurrence, analyses, toxicity, and biodegradation of naphthenic acids. *Chemosphere*, 60:585-600. 10.1016/j.chemosphere.2005.02.065.

Clingenpeel, A.C., Robbins, W.K., Corilo, Y.E. and Rodgers, R.P. 2015. Effect of the water content on silica gel for the isolation of interfacial material from Athabasca bitumen. *Energy & Fuels*, 29:7150-7155. 10.1021/acs.energyfuels.5b01936.

Colavecchia, M.V., Backus, S.M., Hodson, P.V. and Parrott, J.L. 2004. Toxicity of oil sands to early life stages of fathead minnows (Pimephales promelas). *Environmental Toxicology and Chemistry*, 23:1709-1718. 10.1897/03-412.

Colavecchia, M.V., Hodson, P.V. and Parrott, J.L. 2006. CYP1A induction and blue sac disease in early life stages of white suckers (Catostomus commersoni) exposed to oil sands. *Journal of Toxicology and Environmental Health-Part a-Current Issues*, 69:967-994. 10.1080/15287390500362154.

Connor, S.J., Alexander-Trusiak, A.C. and Baird, D.J. 2018. Vulnerability of diatom communities in the Peace-Athabasca Delta to environmental change. *Peerj*, 6:10.7717/peerj.5447.

Cooke, C.A., Kirk, J.L., Muir, D.C.G., Wiklund, J.A., Wang, X.W., Gleason, A. and Evans, M.S. 2017. Spatial and temporal patterns in trace element deposition to lakes in the Athabasca oil sands region (Alberta, Canada). *Environmental Research Letters*, 12:10.1088/1748-9326/aa9505.

COSIA 2019. Canada's Oil Sands Innovation Alliance (COSIA). Canada's Oil Sands Innovation Alliance (COSIA), Calgary, AB Canada. http://www.cosia.ca/ (Accessed August 15, 2019)

Cowie, B.R., James, B., Nightingale, M. and Mayer, B. 2014. Determination of the stable isotope composition and total dissolved solids of Athabasca oil sands reservoir porewater: Part 2. Characterization of McMurray Formation waters in the Suncor-Firebag field. *Aapg Bulletin*, 98:2143-2160. 10.1306/05051413193.

Cowie, B.R., James, B., Nightingale, M. and Mayer, B. 2014. Determination of the stable isotope composition and total dissolved solids of Athabasca oil sands reservoir porewater: Part 1. A new tool for aqueous fluid characterization in oil sands reservoirs. *Aapg Bulletin*, 98:2131-2141. 10.1306/05051413192.

Cowie, B.R., James, B. and Mayer, B. 2015. Distribution of total dissolved solids in McMurray Formation water in the Athabasca oil sands region, Alberta, Canada: Implications for regional hydrogeology and resource development. *Aapg Bulletin*, 99:77-90. 10.1306/07081413202.

Cronmiller, J.G. and Noble, B.F. 2018. The discontinuity of environmental effects monitoring in the Lower Athabasca region of Alberta, Canada: institutional challenges to long-term monitoring and cumulative effects management. *Environmental Reviews*, 26:169-180. 10.1139/er-2017-0083.

Cronmiller, J.G. and Noble, B.F. 2018. Integrating environmental monitoring with cumulative effects management and decision making. *Integrated Environmental Assessment and Management*, 14:407-417. 10.1002/ieam.4034.

Crump, D., Williams, K.L., Chiu, S., Zhang, Y.F. and Martin, J.W. 2017. Athabasca oil sands petcoke extract elicits biochemical and transcriptomic effects in Avian Hepatocytes. *Environ. Sci. Technol.*, 51:5783-5792. 10.1021/acs.est.7b00767.

Cruz-Martinez, L., Fernie, K.J., Soos, C., Harner, T., Getachew, F. and Smits, J.E.G. 2015. Detoxification, endocrine, and immune responses of tree swallow nestlings naturally exposed to air contaminants from the Alberta oil sands. *Sci. Total Environ*, 502:8-15. 10.1016/j.scitotenv.2014.09.008.

Culp, J.M., Glozier, N.E., Baird, D.J., Wrona, F.J., Brua, R.B., Ritcey, A.L., Peters, D.L., R., C., Choung, C.B., Curry, C.J., Halliwell, D., Keet, E., Kilgour, B., Kirk, J.L., Lento, J., Luiker, E. and Suzanne, C. 2018. Assessing ecosystem health in benthic macroinvertebrate assemblages of the Athabasca River main stem, tributaries and Peace-Athabasca delta. Edmonton, Alberta, Canada. https://open.alberta.ca/dataset/9781460140314#summary (Accessed August 15, 2019)

Curtis, C.J., Flower, R., Rose, N., Shilland, J., Simpson, G.L., Turner, S., Yang, H.D. and Pla, S. 2010. Palaeolimnological assessment of lake acidification and environmental change in the Athabasca Oil Sands Region, Alberta. *J. Limnol*, 69:92-104.

Czarnecki, J., Radoev, B., Schramm, L.L. and Slavchev, R. 2005. On the nature of Athabasca oil sands. *Advances in Colloid and Interface Science*, 114:53-60.

Date, V., Nwaishi, F.C., Price, J.S. and Andersen, R. 2018. Short-term exposure to oil sand process-Affected water does not reduce microbial potential activity in three contrasting peatland types. *Wetlands*, 38:769-778. 10.1007/s13157-018-1026-5.

Davidson, C. and Spink, D. 2018. Alternate approaches for assessing impacts of oil sands development on air quality: A case study using the First Nation Community of Fort McKay. *J. Air Waste Manage. Assoc.*, 68:308-328. 10.1080/10962247.2017.1377648.

Davies, M.J.E. 2012. Air quality modeling in the Athabasca Oil Sands Region, Percy, K.E. (Ed.) *Alberta Oil Sands: Energy, Industry, and the Environment,* Amsterdam, The Netherlands: Elsevier. 267-309. http://www.sciencedirect.com/science/article/pii/B9780080977607000123

Debenest, T., Turcotte, P., Gagne, F., Gagnon, C. and Blaise, C. 2012. Ecotoxicological impacts of effluents generated by oil sands bitumen extraction and oil sands lixiviation on Pseudokirchneriella subcapitata. *Aquatic Toxicology*, 112:83-91.

Demoz, A. and Mikula, R.J. 2012. Role of mixing energy in the flocculation of mature fine tailings. *Journal of Environmental Engineering-Asce*, 138:129-136.

Demoz, A. 2015. Scaling inline static mixers for flocculation of oil sand mature fine tailings. *Aiche Journal*, 61:4402-4411. 10.1002/aic.14958.

Desando, M.A., Lahajnar, G., Ripmeester, J.A. and Zupancic, I. 1999. The low temperature oxidation of Athabasca oil sand asphaltene observed from C-13, F-19, and pulsed field gradient spin-echo proton n.m.r. spectra. *Fuel*, 78:31-45.

Desando, M.A. and Ripmeester, J.A. 2002. Chemical derivatization of Athabasca oil sand asphaltene for analysis of hydroxyl and carboxyl groups via nuclear magnetic. *Fuel*, 81:1305-1319.

Desmarais, D., Gignac, L.D. and Bailleux, E.M. 1994. A comparative analysis of 3 methods for determining the elemental composition of bryophytes (in French). *Acta Botanica Gallica*, 141:27-41.

Dettman, H., Inman, A., Salmon, S., Scott, K. and Fuhr, B. 2005. Chemical characterization of GPC fractions of Athabasca bitumen asphaltenes isolated before and after thermal treatment. *Energy & Fuels*, 19:1399-1404.

Dew, W.A., Hontela, A., Rood, S.B. and Pyle, G.G. 2015. Biological effects and toxicity of diluted bitumen and its constituents in freshwater systems. *Journal of Applied Toxicology*, 35:1219-1227. 10.1002/jat.3196.

Deygout, F. 2011. Volatile emissions from hot bitumen storage tanks. *Environmental Progress & Sustainable Energy*, 30:102-112. 10.1002/ep.10444.

Dhar, A., Comeau, P.G., Karst, J., Pinno, B.D., Chang, S.X., Naeth, A.M., Vassov, R. and Bampfylde, C. 2018. Plant community development following reclamation of oil sands mine sites in the boreal forest: a review. *Environmental Reviews*, 26:286-298. 10.1139/er-2017-0091.

Dibike, Y., Eum, H.I. and Prowse, T. 2018. Modelling the Athabasca watershed snow response to a changing climate. *Journal of Hydrology-Regional Studies*, 15:134-148. 10.1016/j.ejrh.2018.01.003.

Dibike, Y., Shakibaeinia, A., Eum, H.I., Prowse, T. and

Droppo, I. 2018. Effects of projected climate on the hydrodynamic and sediment transport regime of the lower Athabasca River in Alberta, Canada. *River Research and Applications*, 34:417-429. 10.1002/rra.3273.

Dibike, Y.B., Shakibaeinia, A., Droppo, I.G. and Caron, E. 2018. Modelling the potential effects of oil-sands tailings pond breach on the water and sediment quality of the Lower Athabasca River. *Sci. Total Environ*, 642:1263-1281. 10.1016/j.scitotenv.2018.06.163.

Dickie, M., Serrouya, R., DeMars, C., Cranston, J. and Boutin, S. 2017. Evaluating functional recovery of habitat for threatened woodland caribou. *Ecosphere*, 8:10.1002/ecs2.1936.

Dickie, M., Serrouya, R., McNay, R.S. and Boutin, S. 2017. Faster and farther: Wolf movement on linear features and implications for hunting behaviour. *Journal of Applied Ecology*, 54:253-263. 10.1111/1365-2664.12732.

Dietrich, S.T. and MacKenzie, M.D. 2018. Biochar affects aspen seedling growth and reclaimed soil properties in the Athabasca oil sands region. *Canadian Journal of Soil Science*, 98:519-530. 10.1139/cjss-2017-0113.

Dinis, L., Savard, M.M., Gammon, P., Begin, C. and Vaive, J. 2016. Influence of climatic conditions and industrial emissions on spruce tree-ring Pb isotopes analyzed at ppb concentrations in the Athabasca oil sands region. *Dendrochronologia*, 37:96-106. 10.1016/j.dendro.2015.12.011.

Dinis, L., Gammon, P., Savard, M.M., Begin, C., Girard, I. and Vaive, J. 2018. Puzzling Zn isotopes in spruce tree-ring series. *Chemical Geology*, 476:171-179. 10.1016/j.chemgeo.2017.11.015.

Doan, D.H., Delage, P., Nauroy, J.F., Tang, A.M. and Youssef, S. 2012. Microstructural characterization of a Canadian oil sand. *Canadian Geotechnical Journal*, 49:1212-1220.

Dolgova, S., Popp, B.N., Courtoreille, K., Espie, R.H.M., Maclean, B., McMaster, M., Straka, J.R., Tetreault, G.R., Wilkie, S. and Hebert, C.E. 2018. Spatial trends in a biomagnifying contaminant: Application of amino acid compound-specific stable nitrogen isotope analysis to the interpretation of bird mercury levels. *Environmental Toxicology and Chemistry*, 37:1466-1475. 10.1002/etc.4113.

Doluweera, G.H., Jordaan, S.M., Moore, M.C., Keith, D.W. and Bergerson, J.A. 2011. Evaluating the role of cogeneration for carbon management in Alberta. *Energy Policy*, 39:7963-7974.

Donkor, K.K., Kratochvil, B. and Thompson, G.R. 1995. Analysis of Athabasca oil sand by near infrared diffuse reflectance spectroscopy. *Analyst*, 120:2713-2717.

Donkor, K.K., Kratochvil, B. and Duke, M.J.M. 1996. Estimation of the fines content of Athabasca oil sands using instrumental neutron activation analysis. *Canadian Journal of Chemistry-Revue Canadienne de Chimie*, 74:583-590.

Donner, M.W., Javed, M.B., Shotyk, W., Francesconi, K.A. and Siddique, T. 2017. Arsenic speciation in the lower Athabasca River watershed: A geochemical investigation of the dissolved and particulate phases. *Environ Pollut*, 224:265-274.

Donner, M.W., Bicalho, B., Sinn, C. and Shotyk, W. 2018. Selenium and sulphur in Athabasca bituminous sands mineral and bitumen fractions. *Fuel*, 224:718-725. 10.1016/j.fuel.2018.03.093.

Donner, M.W., Cuss, C.W., Poesch, M., Sinnatamby, R.N., Shotyk, W. and Siddique, T. 2018. Selenium in surface waters of the lower Athabasca River watershed: Chemical speciation and implications for aquatic life. *Environ. Pollut.*, 243:1343-1351. 10.1016/j.envpol.2018.09.067.

Dougan, P.D. 1989. Near-infrared reflectance analysis: Its potential application in oil sand processing. *AOSTRA J. Res*, 5:203-210.

Dowdeswell, L., Dillon, P., Ghoshal, S., Miall, A., Rasmussen, J. and Smol, J.P. 2010. A foundation for the future: Building an environmental monitoring system for the oil sands. Canadian Ministry of the Environment, Ottawa, ON, Canada. http://www.ec.gc.ca/pollution/E9ABC93B-A2F4-4D4B-A06D-BF5E0315C7A8/1359_Oilsands_Advisory_Panel_report_09.pdf (Accessed August 15, 2019)

Droppo, I.G., di Cenzo, P., Power, J., Jaskot, C., Chambers, P.A., Alexander, A.C., Kirk, J. and Muir, D. 2018. Temporal and spatial trends in riverine suspended sediment and associated polycyclic aromatic compounds (PAC) within the Athabasca oil sands region. *Sci. Total Environ*, 626:1382-1393. 10.1016/j.scitotenv.2018.01.105.

Du, X.Z., Shrestha, N.K. and Wang, J.N. 2019. Integrating organic chemical simulation module into SWAT model with application for PAHs simulation in Athabasca oil sands region, Western Canada. *Environmental Modelling & Software*, 111:432-443. 10.1016/j.envsoft.2018.10.011.

Duan, M. and Chang, S.X. 2015. Responses of lodgepole pine (Pinus contorta) and white spruce (Picea glauca) to fertilization in some reconstructed boreal forest soils in the oil sands region. *Ecological Engineering*, 84:354-361. 10.1016/j.ecoleng.2015.09.046.

Duan, M., House, J. and Chang, S.X. 2015. Limiting factors for lodgepole pine (Pinus contorta) and white spruce (Picea glauca) growth differ in some reconstructed sites in the Athabasca oil sands region. *Ecological Engineering*, 75:323-331. 10.1016/j.ecoleng.2014.12.010.

Dubé, M., Cash, K., Wrona, F., Enei, G., Cronmiller, J., Abel, R., Andreeff, W., Berrade, D., Davidson, C., Dawson, J., Dersch, A., Dertien, K., Donald, G., Evans, M., Fayant, K., Gladue, B., Gosselin, J., Ilesanmi, Y., Ladouceur, B., Lawrence, L., Lee-Johnson, E., MacDermid, F., MacLean, B., New, B., Schaldemose, L., Scoville, D., Starr, C., Tomlinson, G., Wells, C. and Zhira, M. 2018. Oil sands monitoring program letter of agreement and operational framework. Alberta Environment and Parks, Edmonton, AB. https://open.alberta.ca/publications/9781460142363 (Accessed August 15, 2019)

Duflin, L., Wang, X.M. and Stoesz, J. 2017. Detection of volatile organic compounds in froth multiphase systems from oil sands operations using a headspace GC-MS method. *Energy & Fuels*, 31:11925-11931.

10.1021/acs.energyfuels.7b02286.

Durand, E., Clemancey, M., Lancelin, J.M., Verstraete, J., Espinat, D. and Quoineaud, A.A. 2010. Effect of chemical composition on asphaltenes aggregation. *Energy & Fuels*, 24:1051-1062.

ECCC 2017. Backgrounder: Joint Canada-Alberta oil sands monitoring data portal. Environment and Climate Change Canada, Ottawa, ON, Canada. https://www.ec.gc.ca/default.asp?lang=En&n=757CF272-1&news=F88B8904-4245-4538-8587-3FB3ADEF88DF (Accessed August 15, 2019)

Edge, K., Barona, B., Young, R.F., Fedorak, P.M. and Wismer, W.V. 2010. Odor detection thresholds of naphthenic acids from commercial sources and oil sands process-affected water. *Chemosphere*, 81:932-939.

Edgerton, E.S., Fort, J.M., Baumann, K., Graney, J.R., Landis, M.S., Berryman, S. and Krupa, S. 2012. Method for extraction and multielement analysis of Hypogymnia physodes samples from the Athabasca Oil Sands Region, Percy, K.E. (Ed.) *Alberta Oil Sands: Energy, Industry, and the Environment,* Amsterdam, The Netherlands: Elsevier. 315-342. http://www.sciencedirect.com/science/article/pii/B9780080977607000147

El-Din, M.G., Fu, H.J., Wang, N., Chelme-Ayala, P., Perez-Estrada, L., Drzewicz, P., Martin, J.W., Zubot, W. and Smith, D.W. 2011. Naphthenic acids speciation and removal during petroleum-coke adsorption and ozonation of oil sands process-affected water. *Sci. Total Environ*, 409:5119-5125.

Ellis, J. and Jasechko, S. 2018. Formation waters discharge to rivers near oil sands projects. *Hydrological Processes*, 32:533-549. 10.1002/hyp.11435.

Elmes, M.C., Wiklund, J.A., Van Opstal, S.R., Wolfe, B.B. and Hall, R.I. 2016. Characterizing baseline concentrations, proportions, and processes controlling deposition of river-transported bitumen-associated polycyclic aromatic compounds at a floodplain lake (Slave River Delta, Northwest Territories, Canada). *Environmental Monitoring and Assessment*, 188:10.1007/s10661-016-5277-4.

EMCLA 2015. Ecological Monitoring Committee for the Lower Athabasca. http://www.emcla.ca/ (Accessed August 15, 2019)

Emmerton, C.A., Cooke, C.A., Wentworth, G.R., Graydon, J.A., Ryjkov, A. and Dastoor, A. 2018. Total mercury and methylmercury in lake water of Canada's oil sands region. *Environ. Sci. Technol.*, 52:10946-10955. 10.1021/acs.est.8b01680.

Englander, J.G., Bharadwaj, S. and Brandt, A.R. 2013. Historical trends in greenhouse gas emissions of the Alberta oil sands (1970-2010). *Environmental Research Letters*, 8:10.1088/1748-9326/8/4/044036.

Englander, J.G. and Brandt, A.R. 2014. Oil sands energy intensity analysis for GREET model update. Stanford University, Palo Alto, CA. https://greet.es.anl.gov/files/lca-update-oil-sands (Accessed August 15, 2019)

EnvironmentCanada 2011. 2009 detailed substance report for mercury (and its compounds) reported by Syncrude Canada Ltd. - Mildred Lake Plant Site. Environment Canada, Ottawa, ON, Canada. http://www.ec.gc.ca/pdb/websol/querysite/substance_details_e.cfm?opt_npri_id=0000002274&opt_cas_number=NA%20-%2010&opt_report_year=2009 (Accessed August 15, 2019)

EnvironmentCanada 2019. 2019 Air Pollutant Emissions for Alberta. Air Pollutant Emission Inventory Search, National Pollutant Release Inventory. Environment Canada, Ottawa, Ontario. https://pollution-waste.canada.ca/air-emission-inventory/ (Accessed August 15, 2019)

ERA 2019. Oil Sands Research and Information Network (OSRIN). University of Alberta, Edmonton, AB. https://era.library.ualberta.ca/communities/e4fdd15f-c21d-4612-a2f7-bfec3fdfc1de (Accessed August 15, 2019)

ERCB 1994. Syncurde continued improvement and development project Mildred Lake oil sands plant. Energy Resources Conservation Board, Calgary, AB. https://archive.org/details/syncrudecontinue00albe (Accessed August 15, 2019)

Eslahpazir, R., Kupsta, M., Liu, Q. and Ivey, D.G. 2011. Sample preparation method for characterization of fine solids in Athabasca oil sands by electron microscopy. *Energy & Fuels*, 25:5158-5164.

Eslahpazir, R., Liu, Q. and Ivey, D.G. 2012. Characterization of iron-bearing particles in Athabasca oil sands. *Energy & Fuels*, 26:5036-5047.

Eum, H.I., Yonas, D. and Prowse, T. 2014. Uncertainty in modelling the hydrologic responses of a large watershed: a case study of the Athabasca River basin, Canada. *Hydrological Processes*, 28:4272-4293.

Eum, H.I., Dibike, Y. and Prowse, T. 2017. Climate-induced alteration of hydrologic indicators in the Athabasca River Basin, Alberta, Canada. *Journal of Hydrology*, 544:327-342. 10.1016/j.jhydrol.2016.11.034.

Evans, M.S. and Talbot, A. 2012. Investigations of mercury concentrations in walleye and other fish in the Athabasca River ecosystem with increasing oil sands developments. *Journal of Environmental Monitoring*, 14:1989-2003.

Ezeuko, C.C., Wang, J., Kallos, M.S. and Gates, I.D. 2015. Towards the development of bitumen carbonates: An integrated analysis of Grosmont steam pilots. *Oil & Gas Science and Technology-Revue D Ifp Energies Nouvelles*, 70:983-1005. 10.2516/ogst/2013111.

Fairley, P. 2011. Alberta's oil sands heat up. *Technology Review*, 114:52-59.

Fan, Q. and Bai, G. 2015. The evaluation of oil sand bitumen produced from Inner Mongolia. *Petroleum Science and Technology*, 33:437-442.

Fan, R.X., Xing, L.X., Pan, J., Shan, X.L., You, J.F., Li, C. and Zhong, W.J. 2019. Study of the relationship between the oil content of oil sands and spectral reflectance based on spectral derivatives. *Journal of the Indian Society of Remote Sensing*, 47:931-940. 10.1007/s12524-018-0931-7.

Faradonbeh, M.R., Dong, M.Z., Harding, T.G. and Abedi, J.

2013. Experimental and modeling study of residual liquid recovery from spent sand in bitumen extraction processes from oil sands. *Environ. Sci. Technol.*, 47:2109-2116.

Farkish, A. and Fall, M. 2014. Consolidation and hydraulic conductivity of oil sand mature fine tailings dewatered by using super absorbent polymer. *Journal of Geotechnical and Geoenvironmental Engineering*, 140:

Fedorak, P.M., Coy, D.L., Dudas, M.J., Simpson, M.J., Renneberg, A.J. and MacKinnon, M.D. 2003. Microbially-mediated fugitive gas production from oil sands tailings and increased tailings densification rates. *Journal of Environmental Engineering and Science*, 2:199-211. 10.1139/s03.022.

Fenn, M.E., Bytnerowicz, A., Schilling, S.L. and Ross, C.S. 2015. Atmospheric deposition of nitrogen, sulfur and base cations in jack pine stands in the Athabasca Oil Sands Region, Alberta, Canada. *Environ. Pollut.*, 196:497-510. http://dx.doi.org/10.1016/j.envpol.2014.08.023.

Fennell, J. and Arciszewski, T.J. 2019. Current knowledge of seepage from oil sands tailings ponds and its environmental influence in northeastern Alberta. *Sci. Total Environ*, 686:968-985. 10.1016/j.scitotenv.2019.05.407.

Ferguson, G.P., Rudolph, D.L. and Barker, J.F. 2009. Hydrodynamics of a large oil sand tailings impoundment and related environmental implications. *Canadian Geotechnical Journal*, 46:1446-1460.

Fernie, K., Marteinson, S.C., Soos, C., Chen, D., Cruz-Martinez, L. and Smits, J.E.G. 2018. Reproductive and developmental changes in tree swallows (Tachycineta bicolor) are influenced by multiple stressors, including polycyclic aromatic compounds, in the Athabasca Oil Sands. *Environ. Pollut.*, 238:931-941. 10.1016/j.envpol.2018.03.074.

Fernie, K.J., Marteinson, S.C., Chen, D., Eng, A., Harner, T., Smits, J.E.G. and Soos, C. 2018. Elevated exposure, uptake and accumulation of polycyclic aromatic hydrocarbons by nestling tree swallows (&ITTachycineta bicolor&IT) through multiple exposure routes in active mining-related areas of the Athabasca oil sands region. *Sci. Total Environ*, 624:250-261. 10.1016/j.scitotenv.2017.12.123.

Fernie, K.J., Marteinson, S.C., Chen, D., Palace, V., Peters, L., Soos, C. and Smits, J.E.G. 2019. Changes in thyroid function of nestling tree swallows (Tachycineta bicolor) in relation to polycyclic aromatic compounds and other environmental stressors in the Athabasca Oil Sands Region. *Environmental Research*, 169:464-475. 10.1016/j.envres.2018.11.031.

Finan, A.E. and Kadak, A.C. 2010. Integration of nuclear energy into oil sands projects. *Journal of Engineering for Gas Turbines and Power-Transactions of the Asme*, 132:

Finlay, A.J., Selby, D. and Osborne, M.J. 2012. Petroleum source rock identification of United Kingdom Atlantic Margin oil fields and the Western Canadian Oil Sands using Platinum, Palladium, Osmium and Rhenium: Implications for global petroleum systems. *Earth and Planetary Science Letters*, 313:95-104.

Fioletov, V.E., McLinden, C.A., Cede, A., Davies, J., Mihele, C., Netcheva, S., Li, S.M. and O'Brien, J. 2016. Sulfur dioxide (SO2) vertical column density measurements by Pandora spectrometer over the Canadian oil sands. *Atmos. Meas. Tech.*, 9:2961-2976. 10.5194/amt-9-2961-2016.

Fisher, J.T. and Burton, A.C. 2018. Wildlife winners and losers in an oil sands landscape. *Frontiers in Ecology and the Environment*, 16:323-328. 10.1002/fee.1807.

Flego, C., Carati, C., Del Gaudio, L. and Zannoni, C. 2013. Direct mass spectrometry of tar sands: A new approach to bitumen identification. *Fuel*, 111:357-366.

Foote, L. 2012. Threshold considerations and wetland reclamation in Alberta's mineable oil sands. *Ecology and Society*, 17:

Forman, G.S., Hahn, T.E. and Jensen, S.D. 2011. Greenhouse gas emission evaluation of the GTL pathway. *Environ. Sci. Technol.*, 45:9084-9092.

Foster, K.R., McDonald, K. and Eastlick, K. 2001. Development and application of critical, target and monitoring loads for the management of acid deposition in Alberta, Canada. *Water, Air & Soil Pollution*, 1:135-151.

Foster, K.R., Davidson, C., Tanna, R.N.N. and Spink, D. 2019. Introduction to the virtual special issue monitoring ecological responses to air quality and atmospheric deposition in the Athabasca Oil Sands region the wood Buffalo environmental Association's Forest health monitoring program. *Sci. Total Environ*, 686:345-359.

Fowler, M.G., Stasiuk, L.D., Hearn, M. and Obermajer, M. 2001. Devonian hydrocarbon source rocks and their derived oils in the Western Canada Sedimentary Basin. *Bulletin of Canadian Petroleum Geology*, 49:117-148.

Frakman, Z., Ignasiak, T.M., Lown, E.M. and Strausz, O.P. 1990. Oxygen compounds in Athabasca asphaltene. *Energy & Fuels*, 4:263-270.

Frank, R.A., Fischer, K., Kavanagh, R., Burnison, B.K., Arsenault, G., Headley, J.V., Peru, K.M., Van der Kraak, G. and Solomon, K.R. 2009. Effect of carboxylic acid content on the acute toxicity of oil sands naphthenic acids. *Environ. Sci. Technol.*, 43:266-271.

Frank, R.A., Roy, J.W., Bickerton, G., Rowland, S.J., Headley, J.V., Scarlett, A.G., West, C.E., Peru, K.M., Parrott, J.L., Conly, F.M. and Hewitt, L.M. 2014. Profiling oil sands mixtures from industrial developments and natural groundwaters for source identification. *Environ. Sci. Technol.*, 48:2660-2670.

Frank, R.A., Roy, J.W., Bickerton, G., Rowland, S.J., Headley, J.V., Scarlett, A.G., West, C.E., Peru, K.M., Parrott, J.L., Conly, F.M. and Hewitt, L.M. 2014. Response to comment on "Profiling oil sands mixtures from industrial developments and natural groundwaters for source identification". *Environ. Sci. Technol.*, 48:11015-11016.

Frey, C. and Mcclain, K. 2011. Oil sands producer benefits from VISTA's TruckLogic (TM) training system. *E&Mj-Engineering and Mining Journal*, 212:85-88.

Fu, L., Huda, Q., Yang, Z., Zhang, L. and Hashisho, Z. 2017. Autonomous mobile platform for monitoring air emissions from industrial and municipal wastewater ponds. *J. Air Waste Manage. Assoc.*, 67:1205-1212. 10.1080/10962247.2017.1285832.

Fustic, M., Hubbard, S.M., Spencer, R., Smith, D.G., Leckie,

D.A., Bennett, B. and Larter, S. 2012. Recognition of down-valley translation in tidally influenced meandering fluvial deposits, Athabasca Oil Sands (Cretaceous), Alberta, Canada. *Marine and Petroleum Geology*, 29:219-232.

Gaboreau, S., Cuney, M., Quirt, D., Beayfort, D., Patrier, P. and Mathieu, R. 2007. Significance of aluminum phosphate-sulfate minerals associated with U unconformity-type deposits: The Athabasca basin, Canada. *American Mineralogist*, 92:267-280.

Gagne, F., Andre, C., Douville, M., Talbot, A., Parrott, J., McMaster, M. and Hewitt, M. 2011. An examination of the toxic properties of water extracts in the vicinity of an oil sand extraction site. *Journal of Environmental Monitoring*, 13:3075-3086.

Gagne, F., Douville, M., Andre, C., Debenest, T., Talbot, A., Sherry, J., Hewitt, L.M., Frank, R.A., McMaster, M.E., Parrott, J. and Bickerton, G. 2012. Differential changes in gene expression in rainbow trout hepatocytes exposed to extracts of oil sands process-affected water and the Athabasca River. *Comparative Biochemistry and Physiology C-Toxicology & Pharmacology*, 155:551-559.

Gagne, F., Bruneau, A., Turcotte, P., Gagnon, C. and Lacaze, E. 2017. An investigation of the immunotoxicity of oil sands processed water and leachates in trout leukocytes. *Ecotoxicology and Environmental Safety*, 141:43-51. 10.1016/j.ecoenv.2017.03.012.

Galarneau, E., Hollebone, B.P., Yang, Z.Y. and Schuster, J. 2014. Preliminary measurement-based estimates of PAH emissions from oil sands tailings ponds. *Atmos. Environ.*, 97:332-335.

Gao, Y.F., Chen, M., Lin, B.T. and Jin, Y. 2019. An analytical model of hydraulic dilation area for Karamay oil sand reservoir under water injection in SAGD wells. *Journal of Petroleum Science and Engineering*, 179:1090-1101. 10.1016/j.petrol.2019.05.008.

Garcia-Garcia, E., Ge, J.Q., Oladiran, A., Montgomery, B., El-Din, M.G., Perez-Estrada, L.C., Stafford, J.L., Martin, J.W. and Belosevic, M. 2011. Ozone treatment ameliorates oil sands process water toxicity to the mammalian immune system. *Water Research*, 45:5849-5857.

Garibaldi, A. 2009. Moving from model to application: Cultural keystone species and reclamation in Fort McKay, Alberta. *Journal of Ethnobiology*, 29:323-338. 10.2993/0278-0771-29.2.323.

Gates, I.D. and Larter, S.R. 2014. Energy efficiency and emissions intensity of SAGD. *Fuel*, 115:706-713.

Gehrke, H., Ruthardt, K., Mathiak, J. and Roosen, C. 2011. Hydrogen: A small molecule with large impact. *Oil Gas-European Magazine*, 37:29-33.

Gentes, M.L., Waldner, C., Papp, Z. and Smits, J.E.G. 2006. Effects of oil sands tailings compounds and harsh weather on mortality rates, growth and detoxification efforts in nestling tree swallows (Tachycineta bicolor). *Environ. Poll*, 142:24-33.

Gentes, M.L., McNabb, A., Waldner, C. and Smits, J.E.G. 2007. Increased thyroid hormone levels in tree swallows (Tachycineta bicolor) on reclaimed wetlands of the Athabasca oil sands. *Archives of Environmental Contamination and Toxicology*, 53:287-292. 10.1007/s00244-006-0070-y.

Gerken, M., Gerken, M. and Hazendonk, P. 2015. Solid-state H-1 and C-13 nuclear magnetic resonance spectroscopy of Athabasca Oil Sands asphaltenes: Evidence for interlocking pi-stacked nanoaggregates with intercalated alkyl side chains. *Energy & Fuels*, 29:2790-2800. 10.1021/ef5020499.

Gerner, N.V., Kone, M., Ross, M.S., Pereira, A., Ulrich, A.C., Martin, J.W. and Liess, M. 2017. Stream invertebrate community structure at Canadian oil sands development is linked to concentration of bitumen-derived contaminants. *Sci. Total Environ*, 575:1005-1013. 10.1016/j.scitotenv.2016.09.169.

Giacchetta, G., Leporini, M. and Marchetti, B. 2015. Economic and environmental analysis of a Steam Assisted Gravity Drainage (SAGD) facility for oil recovery from Canadian oil sands. *Applied Energy*, 142:1-9.

Gibson, J.J., Birks, S.J., Jeffries, D.S., Kumar, S., Scott, K.A., Aherne, J. and Shaw, D.P. 2010. Site-specific estimates of water yield applied in regional acid sensitivity surveys across western Canada. *J. Limnol*, 69:67-76.

Gibson, J.J., Birks, S.J., Kumar, S., McEachern, P.M. and Hazewinkel, R. 2010. Inter-annual variations in water yield to lakes in northeastern Alberta: Implications for estimating critical loads of acidity. *J. Limnol*, 69:126-134.

Gibson, J.J., Fennell, J., Birks, S.J., Yi, Y., Moncur, M.C., Hansen, B. and Jasechko, S. 2013. Evidence of discharging saline formation water to the Athabasca River in the oil sands mining region, northern Alberta. *Canadian Journal of Earth Sciences*, 50:1244-1257.

Gibson, J.F., Shokralla, S., Curry, C., Baird, D.J., Monk, W.A., King, I. and Hajibabaei, M. 2015. Large-scale biomonitoring of remote and threatened ecosystems via high-throughput sequencing. *Plos One*, 10:10.1371/journal.pone.0138432.

Gingras-Hill, T., Nwaishi, F.C., Macrae, M.L., Price, J.S. and Petrone, R.M. 2018. Ecohydrological functioning of an upland undergoing reclamation on post-mining landscape of the Athabasca oil sands region, Canada. *Ecohydrology*, 11:10.1002/eco.1941.

GOA 2011. Alberta oil sands industry quarterly update, winter 2011. Government of Alberta (GOA), Edmonton, AB, Canada. http://albertacanada.com/AOSID_QuarterlyUpdate_Winter2011.pdf (Accessed August 15, 2019)

Goddio, M.F. and Lopez, G.D. 2018. Enhanced settling of mature fine tailings (MFT) by paramagnetic nanofluids based on nanoiron. *Materia-Rio De Janeiro*, 23:10.1590/s1517-707620180002.0481.

Godwin, C.M., Barclay, R.M.R. and Smits, J.E.G. 2019. Tree swallow (Tachycineta bicolor) nest success and nestling growth near oil sands mining operations in northeastern Alberta, Canada. *Canadian Journal of Zoology*, 97:547-557. 10.1139/cjz-2018-0247.

Goff, K.L., Peru, K., Wilson, K.E. and Headley, J.V. 2014. Evaluation of biologically mediated changes in oil sands naphthenic acid composition by Chlamydomonas Reinhardtii using negative-ion electrospray orbitrap mass

spectrometry. *J Phycol*, 50:727-735. 10.1111/jpy.12202.

Golby, S., Ceri, H., Gieg, L.M., Chatterjee, I., Marques, L.L.R. and Turner, R.J. 2012. Evaluation of microbial biofilm communities from an Alberta oil sands tailings pond. *Fems Microbiology Ecology*, 79:240-250.

Golby, S., Ceri, H., Marques, L.L.R. and Turner, R.J. 2014. Mixed-species biofilms cultured from an oil sand tailings pond can biomineralize metals. *Microbial Ecology*, 68:70-80.

GolderAssociates 1998. Technical reference for the meteorology, emissions, and ambient air quality in the Athabasca oil sands region. Golder Associates, Inc., Calgary, AB. https://era.library.ualberta.ca/items/2f3407d5-193a-4a9e-b2cb-633ffd7c8a3f/view/abe6dcac-e75e-4f50-880a-21fb1db972e7/2A-1_-_Meteorology__Emissions_and_Ambient_Air_Quality_in_the_Athabasca_Oil_Sands_Region.pdf (Accessed August 15, 2019)

Gorakhki, M.H. and Bareither, C.A. 2017. Sustainable reuse of mine tailings and waste rock as water-balance covers. *Minerals*, 7:10.3390/min7070128.

Gordon, M., Li, S.M., Staebler, R., Darlington, A., Hayden, K., O'Brien, J. and Wolde, M. 2015. Determining air pollutant emission rates based on mass balance using airborne measurement data over the Alberta oil sands operations. *Atmos. Meas. Tech.*, 8:3745-3765. 10.5194/amt-8-3745-2015.

Gordon, M., Makar, P.A., Staebler, R.M., Zhang, J.H., Akingunola, A., Gong, W.M. and Li, S.M. 2018. A comparison of plume rise algorithms to stack plume measurements in the Athabasca oil sands. *Atmos. Chem. Phys*, 18:14695-14714. 10.5194/acp-18-14695-2018.

Gosselin, P., Hrudey, S.E., Naeth, M.A., Plourde, A., Therrien, R., Van der Kraak, G.J. and Xu, Z.H. 2010. *Environmental and Health Impacts of Canada's Oil Sands Industry*. Ottawa, Ontario, Canada: The Royal Society of Canada.

Graney, J.R., Landis, M.S. and Krupa, S. 2012. Coupling lead isotopes and element concentrations in epiphytic lichens to track sources of air emissions in the Athabasca Oil Sands Region, Percy, K.E. (Ed.) *Alberta Oil Sands: Energy, Industry, and the Environment,* Amsterdam, The Netherlands: Elsevier. 343-372.

Graney, J.R., Landis, M.S., Puckett, K.J., Studabaker, W.B., Edgerton, E.S., Legge, A.H. and Percy, K.E. 2017. Differential accumulation of PAHs, elements, and Pb isotopes by five lichen species from the Athabasca Oil Sands Region in Alberta, Canada. *Chemosphere*, 184:700-710. 10.1016/j.chemosphere.2017.06.036.

Graney, J.R., Edgerton, E.S. and Landis, M.S. 2019. Using Pb isotope ratios of particulate matter and epiphytic lichens from the Athabasca Oil Sands Region in Alberta, Canada to quantify local, regional, and global Pb source contributions. *Sci. Total Environ*, 654:1293-1304. 10.1016/j.scitotenv.2018.11.047.

Gray, M., Xu, Z.H. and Masliyah, J. 2009. Physics in the oil sands of Alberta. *Physics Today*, 62:31-35.

Gray, M.R., Xu, Z.H. and Masliyah, J.H. 2009. Efficiency and environmental effects in the oil sands of Alberta Reply. *Physics Today*, 62:8-9.

Gray, M.R., Masliyah, J.H. and Xu, Z.H. 2011. Oil sands and the environment reply. *Physics Today*, 64:9-9.

Greco, R. 2012. Comment on "Variability and Uncertainty in Life Cycle Assessment Models for Greenhouse Gas Emissions from Canadian Oil Sands Production". *Environ. Sci. Technol.*, 46:4253-4253.

Gue, A.E., Mayer, B. and Grasby, S.E. 2015. Origin and geochemistry of saline spring waters in the Athabasca oil sands region, Alberta, Canada. *Applied Geochemistry*, 61:132-145. 10.1016/j.apgeochem.2015.05.015.

Gueguen, C., Clarisse, O., Perroud, A. and McDonald, A. 2011. Chemical speciation and partitioning of trace metals (Cd, Co, Cu, Ni, Pb) in the lower Athabasca river and its tributaries (Alberta, Canada). *Journal of Environmental Monitoring*, 13:2865-2872.

Gueguen, C., Burns, D.C., McDonald, A. and Ring, B. 2012. Structural and optical characterization of dissolved organic matter from the lower Athabasca River, Canada. *Chemosphere*, 87:932-937.

Gueguen, C., Cuss, C.W. and Cho, S. 2016. Snowpack deposition of trace elements in the Athabasca oil sands region, Canada. *Chemosphere*, 153:447-454.

Gutierrez, L. and Pawlik, M. 2014. Influence of humic acids on oil sand processing. Part I: Detection and quantification of humic acids in oil sand ores and their effect on bitumen wettability. *International Journal of Mineral Processing*, 126:117-125.

Gutierrez, L. and Pawlik, M. 2014. Influence of humic acids on oil sand processing. Part II: Relationship between bitumen extraction, humic acids concentration and power draw measurements on oil sand slurries. *International Journal of Mineral Processing*, 126:126-135.

Hall, R.I., Wolfe, B.B., Wiklund, J.A., Edwards, T.W.D., Farwell, A.J. and Dixon, D.G. 2012. Has Alberta oil sands development altered delivery of polycyclic aromatic compounds to the Peace-Athabasca delta? *Plos One*, 7:e46089. 10.1371/journal.pone.0046089.

Han, D.Y., Yu, W.Q., Luo, K.Y. and Cao, Z.B. Study on the process of oil recovery from oil sludge and tailing oil sands by blending extraction. *Petroleum Science and Technology*, 10.1080/10916466.2019.1633347.

Han, X.M., MacKinnon, M.D. and Martin, J.W. 2009. Estimating the in situ biodegradation of naphthenic acids in oil sands process waters by HPLC/HRMS. *Chemosphere*, 76:63-70. 10.1016/j.chemosphere.2009.02.026.

Han, D.Y., Yu, W.Q., Luo, K.Y. and Cao, Z.B. 2019. Study on the process of oil recovery from oil sludge and tailing oil sands by blending extraction. *Petroleum Science and Technology*, 10.1080/10916466.2019.1633347.

Harjai, S.K., Flury, C., Masliyah, J., Drelich, J. and Xu, Z.H. 2012. Robust aqueous-nonaqueous hybrid process for bitumen extraction from mineable Athabasca oil sands. *Energy & Fuels*, 26:2920-2927.

Harms, N.J., Fairhurst, G.D., Bortolotti, G.R. and Smits, J.E.G. 2010. Variation in immune function, body condition, and feather corticosterone in nestling Tree

Swallows (Tachycineta bicolor) on reclaimed wetlands in the Athabasca oil sands, Alberta, Canada. *Environ. Pollut.*, 158:841-848. 10.1016/j.envpol.2009.09.025.

Harner, T., Su, K., Genualdi, S., Karpowicz, J., Ahrens, L., Mihele, C., Schuster, J., Charland, J.P. and Narayan, J. 2013. Calibration and application of PUF disk passive air samplers for tracking polycyclic aromatic compounds (PACs). *Atmos. Environ.*, 75:123-128.

Harner, T., Rauert, C., Muir, D., Schuster, J., Hsu, Y.M., Zhang, L.M., Marson, G., Watson, J.G., Ahad, J., Cho, S., Jariyasopit, N., Kirk, J.L., Korosi, J.B., Landis, M., Martin, J., Zhang, Y.F., Fernie, K.J., Wentworth, G.R., Wnorowsi, A., Dabek, E., Charland, J.P., Pauli, B., Wania, F., Galarneau, E., Cheng, I., Makar, P., Whaley, C., Chow, J.C. and Wang, X.L. 2018. Air synthesis review on polycyclic aromatic compounds in the Athabasca oil sands region. *Environmental Reviews*, 26:430-468. 10.1139/er-2018-0039.

Hart, J.F., de Araujo, F., Thomas, B.R. and Mansfield, S.D. 2013. Wood quality and growth characterization across intra- and inter-specific hybrid aspen clones. *Forests*, 4:786-807.

Hazewinkel, R.R.O., Wolfe, A.P., Pla, S., Curtis, C. and Hadley, K. 2008. Have atmospheric emissions from the Athabasca Oil Sands impacted lakes in northeastern Alberta, Canada? *Canadian Journal of Fisheries and Aquatic Sciences*, 65:1554-1567.

He, Y.H., Wiseman, S.B., Hecker, M., Zhang, X.W., Wang, N., Perez, L.A., Jones, P.D., El-Din, M.G., Martin, J.W. and Giesy, J.P. 2011. Effect of ozonation on the estrogenicity and androgenicity of oil sands process-affected water. *Environ. Sci. Technol.*, 45:6268-6274.

He, Y.H., Patterson, S., Wang, N., Hecker, M., Martin, J.W., El-Din, M.G., Giesy, J.P. and Wiseman, S.B. 2012. Toxicity of untreated and ozone-treated oil sands process-affected water (OSPW) to early life stages of the fathead minnow (Pimephales promelas). *Water Research*, 46:6359-6368.

He, Y.H., Wiseman, S.B., Wang, N., Perez-Estrada, L.A., Gamal El-Din, M., Martin, J.W. and Giesy, J.P. 2012. Transcriptional responses of the brain-gonad-liver axis of Fathead Minnows exposed to untreated and ozone-treated oil sands process-affected water. *Environ. Sci. Technol.*, 46:9701-9708.

He, L., Lin, F., Li, X.G., Xu, Z.H. and Sui, H. 2015. Effect of solvent addition on bitumen-air bubble attachment in process water. *Chemical Engineering Science*, 137:31-39. 10.1016/j.ces.2015.05.062.

Headley, J.V., Akre, C., Conly, F.M., Peru, K.M. and Dickson, L.C. 2001. Preliminary characterization and source assessment of PAHs in tributary sediments of the Athabasca River, Canada. *Environmental Forensics*, 2:335-345.

Headley, J.V., Marsh, P., Akre, C.J., Peru, K.M. and Lesack, L. 2002. Origin of polycyclic aromatic hydrocarbons in lake sediments of the Mackenzie Delta. *Journal of Environmental Science and Health Part A-Toxic/Hazardous Substances & Environmental Engineering*, 37:1159-1180.

Headley, J.V., Crosley, B., Conly, F.M. and Quagraine, E.K. 2005. The characterization and distribution of inorganic chemicals in tributary waters of the lower Athabasca River, oilsands region, Canada. *Journal of Environmental Science and Health Part A-Toxic/Hazardous Substances & Environmental Engineering*, 40:1-27.

Headley, J.V. and Peru, K.M. 2007. Characterization of naphthenic acids from Athabasca oil sands using electrospray ionization: The significant influence of solvents. *Anal. Chem*, 79:6222-6229.

Headley, J.V., Armstrong, S.A., Peru, K.M., Mikula, R.J., Germida, J.J., Mapolelo, M.M., Rodgers, R.P. and Marshall, A.G. 2010. Ultrahigh-resolution mass spectrometry of simulated runoff from treated oil sands mature fine tailings. *Rapid Communications in Mass Spectrometry*, 24:2400-2406. 10.1002/rcm.4658.

Headley, J.V., Peru, K.M., Mishra, S., Meda, V., Dalai, A.K., Mcmartin, D.W., Mapolelo, M.M., Rodgers, R.P. and Marshall, A.G. 2010. Characterization of oil sands naphthenic acids treated with ultraviolet and microwave radiation by negative ion electrospray Fourier transform ion cyclotron resonance mass spectrometry. *Rapid Communications In Mass Spectrometry*, 24:3121-3126.

Headley, J.V., Barrow, M.P., Peru, K.M., Fahlman, B., Frank, R.A., Bickerton, G., McMaster, M.E., Parrott, J. and Hewitt, L.M. 2011. Preliminary fingerprinting of Athabasca oil sands polar organics in environmental samples using electrospray ionization Fourier transform ion cyclotron resonance mass spectrometry. *Rapid Communications In Mass Spectrometry*, 25:1899-1909.

Headley, J.V., Peru, K.M., Mohamed, M.H., Frank, R.A., Martin, J.W., Hazewinkel, R.R.O., Humphries, D., Gurprasad, N.P., Hewitt, L.M., Muir, D.C.G., Lindeman, D., Strub, R., Young, R.F., Grewer, D.M., Whittal, R.M., Fedorak, P.M., Birkholz, D.A., Hindle, R., Reisdorph, R., Wang, X., Kasperski, K.L., Hamilton, C., Woudneh, M., Wang, G., Loescher, B., Farwell, A., Dixon, D.G., Ross, M., Pereira, A.D., King, E., Barrow, M.P., Fahlman, B., Bailey, J., Mcmartin, D.W., Borchers, C.H., Ryan, C.H., Toor, N.S., Gillis, H.M., Zuin, L., Bickerton, G., McMaster, M., Sverko, E., Shang, D., Wilson, L.D. and Wrona, F.J. 2013. Chemical fingerprinting of naphthenic acids and oil sands process watersA review of analytical methods for environmental samples. *Journal of Environmental Science and Health Part A-Toxic/Hazardous Substances & Environmental Engineering*, 48:1145-1163.

Headley, J.V., Kumar, P., Dalai, A., Peru, K.M., Bailey, J., McMartin, D.W., Rowland, S.M., Rodgers, R.P. and Marshall, A.G. 2015. Fourier transform ion cyclotron resonance mass spectrometry characterization of treated Athabasca oil sands processed waters. *Energy & Fuels*, 29:2768-2773. 10.1021/ef502007b.

Hebert, C., Nordstrom, W. and Shutt, L. 2010. Colonial waterbirds nesting on Egg Island, Lake Athabasca, 2009. *Canadian Field-Naturalist*, 124:49-53. 10.22621/cfn.v124i1.1029.

Hebert, C.E., Weseloh, C., MacMillan, S., Campbell, D. and Nordstrom, W. 2011. Metals and polycyclic aromatic

hydrocarbons in colonial waterbird egs from Lake Athabasca and the Peace Athabasca delta, Canada. *Environmental Toxicology and Chemistry*, 30:1178-1183. 10.1002/etc.489.

Hebert, C.E., Campbell, D., Kindopp, R., MacMillan, S., Martin, P., Neugebauer, E., Patterson, L. and Shatford, J. 2013. Mercury trends in colonial waterbird eggs downstream of the oil sands region of Alberta, Canada. *Environ. Sci. Technol.*, 47:11785-11792. 10.1021/es402542w.

Hebert, C.E. 2019. The river runs through it: The Athabasca River delivers mercury to aquatic birds breeding far downstream. *Plos One*, 14:10.1371/journal.pone.0206192.

Hebert, C.E. 2019. The river runs through it: The Athabasca River delivers mercury to aquatic birds breeding far downstream. *Plos One*, 14:e0206192. 10.1371/journal.pone.0206192.

Hein, F.J. 2000. Historical overview of the Fort McMurray area and oil sands industry in northern Alberta. Alberta Energy and Utilities Board, Edmonton, AB, Canada. http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=21&cad=rja&uact=8&ved=0ahUKEwjpyIetoIPcAhWSJDQIHaCbBS0QFgigATAU&url=http%3A%2F%2Fags.aer.ca%2Fdocument%2FESR%2FESR_2000_05.pdf&usg=AOvVaw3UkZCePbIoWoUCl8dMCmS2 (Accessed August 15, 2019)

Hemsley, T.L., MacKenzie, M.D. and Quideau, S.A. 2019. Ecophysiological response of aspen (Populus tremuloides) and jack pine (Pinus banksiana) to atmospheric nitrogen deposition on reconstructed boreal forest soils in the Athabasca Oil Sands Region. *Sci. Total Environ*,

Hoberg, G. and Phillips, J. 2011. Playing defence: Early responses to conflict expansion in the oil sands policy subsystem. *Canadian Journal of Political Science-Revue Canadienne de Science Politique*, 44:507-527.

Hodson, P.V. 2013. History of environmental contamination by oil sands extraction. *Proc. Natl. Acad. Sci. USA*, 110:1569-1570.

Holowenko, F.M., MacKinnon, M.D. and Fedorak, P.M. 2000. Methanogens and sulfate-reducing bacteria in oil sands fine tailings waste. *Canadian Journal of Microbiology*, 46:927-937.

Holowenko, F.M., MacKinnon, M.D. and Fedorak, P.M. 2002. Characterization of naphthenic acids in oil sands wastewaters by gas chromatography-mass spectrometry. *Water Research*, 36:2843-2855. 10.1016/s0043-1354(01)00492-4.

Hooshiar, A., Uhlik, P., Ivey, D.G., Liu, Q. and Etsell, T.H. 2012. Clay minerals in nonaqueous extraction of bitumen from Alberta oil sands Part 2. Characterization of clay minerals. *Fuel Processing Technology*, 96:183-194.

Hossini, A., Mostafavi, V. and Bresee, D. 2018. Investigation of post-abandonment surface subsidence in Steam-Assisted-Gravity-Drainage operations. *Spe Reservoir Evaluation & Engineering*, 21:772-788. 10.2118/180717-pa.

Howell, S.G., Clarke, A.D., Freitag, S., McNaughton, C.S., Kapustin, V., Brekovskikh, V., Jimenez, J.L. and Cubison, M.J. 2014. An airborne assessment of atmospheric particulate emissions from the processing of Athabasca oil sands. *Atmos. Chem. Phys*, 14:5073-5087.

Hrudey, S.E. 2011. Oil sands contaminants. *Environ. Health Perspect*, 119:A330-A330.

Hrudey, S.E., Naeth, M.A., Therrien, R., Van der Kraak, G., Gosselin, P., Plourde, A. and Xu, Z.H. 2012. Response to Timoney critique of Royal Society of Canada Expert Panel on Oil Sands. *Environ. Sci. Technol.*, 46:4257-4258.

Hsu, Y.M. 2013. Trends in passively-measured ozone, nitrogen dioxide and sulfur dioxide concentrations in the Athabasca Oil Sands Region of Alberta, Canada. *Aerosol Air Qual. Res.*, 13:1448-1463.

Hsu, Y.M. and Clair, T.A. 2015. Measurement of fine particulate matter water-soluble inorganic species and precursor gases in the Alberta Oil Sands Region using an improved semicontinuous monitor. *J. Air Waste Manage. Assoc.*, 65:423-435.

Hsu, Y.M., Harner, T., Li, H. and Fellin, P. 2015. PAH measurements in air in the Athabasca oil sands region. *Environ. Sci. Technol.*, 49:5584-5592.

Hsu, Y.M., Bytnerowicz, A., Fenn, M.E. and Percy, K.E. 2016. Atmospheric dry deposition of sulfur and nitrogen in the Athabasca Oil Sands Region, Alberta, Canada. *Sci. Total Environ*, 568:285-295. https://doi.org/10.1016/j.scitotenv.2016.05.205.

Hsu, Y.M., Wang, X.L., Chow, J.C., Watson, J.G. and Percy, K.E. 2016. Collocated comparisons of continuous and filter-based $PM_{2.5}$ measurements at Fort McMurray, Alberta, Canada. *J. Air Waste Manage. Assoc.*, 66:329-339.

Huang, R.F., McPhedran, K.N. and El-Din, M.G. 2015. Ultra performance liquid chromatography ion mobility time-of-flight mass spectrometry characterization of naphthenic acids species from oil sands process-affected water. *Environ. Sci. Technol.*, 49:11737-11745. 10.1021/acs.est.5b03178.

Huang, R.F., McPhedran, K.N., Yang, L.L. and Gamal El-Din, M. 2016. Characterization and distribution of metal and nonmetal elements in the Alberta oil sands region of Canada. *Chemosphere*, 147:218-229. https://doi.org/10.1016/j.chemosphere.2015.12.099.

Huang, S.J., Xia, Y., Xiong, H., Liu, H. and Chen, X. 2018. A three-dimensional approach to model steam chamber expansion and production performance of SAGD process. *International Journal of Heat and Mass Transfer*, 127:29-38. 10.1016/j.ijheatmasstransfer.2018.06.136.

Huang, S.J., Yang, L.J., Xia, Y., Du, M.G. and Yang, Y.W. 2019. An experimental and numerical study of a steam chamber and production characteristics of SAGD considering multiple barrier layers. *Journal of Petroleum Science and Engineering*, 180:716-726. 10.1016/j.petrol.2019.05.062.

Hubbard, S.M., Pemberton, S.G. and Howard, E.A. 1999. Regional geology and sedimentology of the basal Cretaceous Peace River oil sands deposit, north-central Alberta. *Bulletin of Canadian Petroleum Geology*, 47:270-297.

Hubert, C.R.J., Oldenburg, T.B.P., Fustic, M., Gray, N.D., Larter, S.R., Penn, K., Rowan, A.K., Seshadri, R., Sherry,

A., Swainsbury, R., Voordouw, G., Voordouw, J.K. and Head, I.M. 2012. Massive dominance of Epsilonproteobacteria in formation waters from a Canadian oil sands reservoir containing severely biodegraded oil. *Environmental Microbiology*, 14:387-404.

Hugenholtz, C.H. and Wolfe, S.A. 2010. Rates and environmental controls of aeolian dust accumulation, Athabasca River Valley, Canadian Rocky Mountains. *Geomorphology*, 121:274-282. 10.1016/j.geomorph.2010.04.024.

Hughes, S.A., Mahaffey, A., Shore, B., Baker, J., Kilgour, B., Brown, C., Peru, K.M., Headley, J.V. and Bailey, H.C. 2017. Using ultrahigh-resolution mass spectrometry and toxicity identification techniques to characterize the toxicity of oil sands process-affected water: The case for classical naphthenic acids. *Environmental Toxicology and Chemistry*, 36:3148-3157. 10.1002/etc.3892.

Hurtado, J.L.A., Chodakowski, M., Long, B.W. and Shaw, J.M. 2011. Characterization of physically and chemically separated Athabasca asphaltenes using small-angle x-ray scattering. *Energy & Fuels*, 25:5100-5112.

Ibanez, M., Wijdeveld, A. and Chassagne, C. 2014. The role of mono- and divalent ions in the stability of kaolinite suspensions and fine tailings. *Clays and Clay Minerals*, 62:374-385.

IHS 2012. Oil sands, greenhouse gases, and US oil suppl: Getting the numbers right—2012 update. IHS Cambridge Energy Research Associates. https://cdn.ihs.com/ihs/cera/Oil-Sands-Greenhouses-Gases-and-US-Oil-Supply.pdf (Accessed August 15, 2019)

Inc., C.I.S. 2007. Forecast of criteria air contaminants in Alberta (2002 to 2020). Markham, ON, Canada. (Accessed August 15, 2019)

Irvine, G., Doyle, J.R., White, P.A. and Blais, J.M. 2014. Soil ingestion rate determination in a rural population of Alberta, Canada practicing a wilderness lifestyle. *Sci. Total Environ*, 470:138-146. 10.1016/j.scitotenv.2013.09.037.

Irvine, G.M., Blais, J.M., Doyle, J.R., Kimpe, L.E. and White, P.A. 2014. Cancer risk to First Nations ' people from exposure to polycyclic aromatic hydrocarbons near in-situ bitumen extraction in Cold Lake, Alberta. *Environmental Health*, 13:

Islam, S. and Shang, J.Q. 2019. Coagulation enhanced electrokinetic settling of mature fine oil sands tailings. *International Journal of Mining Science and Technology*, 29:199-208. 10.1016/j.ijmst.2018.04.012.

Israelson, D. 2008. How the oil sands got to the Great Lakes Basin: Pipelines, revineries and emissions to air and water. Munk Centre for International Studies, University of Toronto, Toronto, ON, Canada. (Accessed August 15, 2019)

Jacobs, F.S. and Filby, R.H. 1982. Trace element composition of Athabasca tar sands and extracted bitumens, Filby, R.H., Carpenter, B.S. and Ragaini, R. (Eds.), *Atomic and Nuclear Methods in Fossil Energy Research,* New York, NY: Springer. 49-59.

Jaques, D.R. and Legge, A.H. 2012. Ecological analogues for biomonitoring industrial sulfur emissions in the Athabasca Oil Sands Region, Alberta, Canada, E.Percy, K. (Ed.) *Alberta Oil Sands: Energy, Industry, and the Environment,* Amsterdam, The Netherlands: Elsevier. 219-241. http://www.sciencedirect.com/science/article/pii/B9780080977607000010X

Jariyasopit, N., Harner, T., Wu, D.M., Williams, A., Halappanavar, S. and Su, K. 2016. Mapping indicators of toxicity for polycyclic aromatic compounds in the atmosphere of the Athabasca Oil Sands Region. *Environ. Sci. Technol.*, 50:11282-11291. 10.1021/acs.est.6b02058.

Jariyasopit, N., Zhang, Y.F., Martine, J.W. and Harner, T. 2018. Comparison of polycyclic aromatic compounds in air measured by conventional passive air samplers and passive dry deposition samplers and contributions from petcoke and oil sands ore. *Atmos. Chem. Phys*, 18:9161-9171. 10.5194/acp-18-9161-2018.

Jautzy, J., Ahad, J.M.E., Gobeil, C. and Savard, M.M. 2013. Century-long source apportionment of PAHs in Athabasca Oil Sands Region lakes using diagnostic ratios and compound-specific carbon isotope signatures. *Environ. Sci. Technol.*, 47:6155-6163.

Jautzy, J.J., Ahad, J.M.E., Gobeil, C., Smirnoff, A., Barst, B.D. and Savard, M.M. 2015. Isotopic evidence for oil sands petroleum coke in the Peace-Athabasca delta. *Environ. Sci. Technol.*, 49:12062-12070. 10.1021/acs.est.5b03232.

Jautzy, J.J., Ahad, J.M.E., Hall, R.I., Wiklund, J.A., Wolfe, B.B., Gobeil, C. and Savard, M.M. 2015. Source apportionment of background PAHs in the Peace-Athabasca delta (Alberta, Canada) using molecular level radiocarbon analysis. *Environ. Sci. Technol.*, 49:9056-9063. 10.1021/acs.est.5b01490.

Javadli, R. and de Klerk, A. 2012. Desulfurization of heavy oil-oxidative desulfurization (ODS) as potential upgrading pathway for oil sands derived bitumen. *Energy & Fuels*, 26:594-602.

Javed, M.B. and Siddique, T. 2016. Thermally released arsenic in porewater from sediments in the Cold Lake area of Alberta, Canada. *Environ. Sci. Technol.*, 50:2191-2199. 10.1021/acs.est.5b04555.

Javed, M.B., Cuss, C.W., Grant-Weaver, I. and Shotyk, W. 2017. Size-resolved Pb distribution in the Athabasca River shows snowmelt in the bituminous sands region an insignificant source of dissolved Pb. *Scientific Reports*, 7:10.1038/srep43622.

Javed, M.B. and Shotyk, W. 2018. Estimating bioaccessibility of trace elements in particles suspended in the Athabasca River using sequential extraction. *Environ. Pollut.*, 240:466-474. 10.1016/j.envpol.2018.04.131.

Jeffries, D.S., Semkin, R.G., Gibson, J.J. and Wong, I. 2010. Recently surveyed lakes in northern Manitoba and Saskatchewan, Canada: characteristics and critical loads of acidity. *J. Limnol*, 69:45-55.

Jervis, R.E., Ho, K.L.R. and Tiefenbach, B. 1982. Trace Impurities in Canadian oil sands, coals and petroleum products and their fate during extraction, upgrading and

combustion. *Journal of Radioanalytical Chemistry*, 71:225-241.

Jia, N., Moore, R.G., Mehta, S.A., Van Fraassen, K., Ursenbach, M.G. and Zalewski, E. 2005. Compositional changes for Athabasca bitumen in the presence of oxygen under low temperature conditions. *Journal of Canadian Petroleum Technology*, 44:51-57.

Jia, N., Moore, G., Mehta, S.A., Zalewski, E. and Ursenbach, M. 2007. Compositional changes and rheological properties of athabasca bitumen under CO2/O-2 mixtures associated with carbon dioxide flooding/sequestration process. *Industrial & Engineering Chemistry Research*, 46:365-368.

Jia, C.X., Wang, Q., Ge, J.X. and Xu, X.F. 2014. Pyrolysis and combustion model of oil sands from non-isothermal thermogravimetric analysis data. *Journal of Thermal Analysis and Calorimetry*, 116:1073-1081.

Jiang, T.M., Hirasaki, G., Miller, C., Moran, K. and Fleury, M. 2007. Diluted bitumen water-in-oil emulsion stability and characterization by nuclear magnetic resonance (NMR) measurements. *Energy & Fuels*, 21:1325-1336.

Johnson, M.R., Kostiuk, L.W. and Spangelo, J.L. 2001. A characterization of solution gas flaring in Alberta. *J. Air Waste Manage. Assoc.*, 51:1167-1177.

Johnson, E.A. and Miyanishi, K. 2008. Creating new landscapes and ecosystems - The Alberta oil sands. *Year in Ecology and Conservation Biology 2008*, 1134:120-145.

Johnson, M.R. and Coderre, A.R. 2011. An analysis of flaring and venting activity in the Alberta upstream oil and gas industry. *J. Air Waste Manage. Assoc.*, 61:190-200.

Johnson, M.R., Crosland, B.M., McEwen, J.D., Hager, D.B., Armitage, J.R., Karimi-Golpayegani, M. and Picard, D.J. 2016. Estimating fugitive methane emissions from oil sands mining using extractive core samples. *Atmos. Environ.*, 144:111-123. 10.1016/j.atmosenv.2016.08.073.

Johnston, D.C., Turetsky, M.R., Benscoter, B.W. and Wotton, B.M. 2015. Fuel load, structure, and potential fire behaviour in black spruce bogs. *Can J Forest Res*, 45:888-899. 10.1139/cjfr-2014-0334.

Jokuty, P.L. and Gray, M.R. 1991. Resistant nitrogen compounds in hydrotreated gas oil from Athabasca bitumen. *Energy & Fuels*, 5:791-795.

Joly, T.L., Longley, H., Wells, C. and Gerbrandt, J. 2018. Ethnographic refusal in traditional land use mapping: Consultation, impact assessment, and sovereignty in the Athabasca oil sands region. *Extractive Industries and Society-an International Journal*, 5:335-343. 10.1016/j.exis.2018.03.002.

Jones, D., Scarlett, A.G., West, C.E. and Rowland, S.J. 2011. Toxicity of individual naphthenic acids to vibrio fischeri. *Environ. Sci. Technol.*, 45:9776-9782.

Jordaan, S.M., Keith, D.W. and Stelfox, B. 2009. Quantifying land use of oil sands production:A life cycle perspective. *Environmental Research Letters*, 4:

Jordaan, S.M. 2012. Land and water impacts of oil sands production in Alberta. *Environ. Sci. Technol.*, 46:3611-3617.

JOSM 2016. Joint oil sands monitoring program emissions inventory compilation. Environment and Climate Change Canada, Downsview, ON. http://aep.alberta.ca/air/reports-data/documents/JOSM-EmissionsInventoryReport-Jun2016.pdf (Accessed August 15, 2019)

JOSM 2017. Canada-Alberta oil sands environmental monitoring Joint Oil Sands Monitoring, Ottawa, ON, Canada. https://www.canada.ca/en/environment-climate-change/services/oil-sands-monitoring.html (Accessed August 15, 2019)

Jung, K.H., Ok, Y.S. and Chang, S.X. 2011. Sulfate adsorption properties of acid-sensitive soils in the Athabasca oil sands region in Alberta, Canada. *Chemosphere*, 84:457-463.

Jung, K. and Chang, S.X. 2012. Four years of simulated N and S depositions did not cause N saturation in a mixedwood boreal forest ecosystem in the oil sands region in northern Alberta, Canada. *Forest Ecology and Management*, 280:62-70.

Jung, K.H. and Chang, S.X. 2013. Soil and tree chemistry reflected the cumulative impact of acid deposition in Pinus banksiana and Populus tremuloides stands in the Athabasca oil sands region in western Canada. *Ecological Indicators*, 25:35-44. https://doi.org/10.1016/j.ecolind.2012.09.008.

Jung, K.H., Chang, S.X., Ok, Y.S. and Arshad, M.A. 2013. Critical loads and H+ budgets of forest soils affected by air pollution from oil sands mining in Alberta, Canada. *Atmos. Environ.*, 69:56-64.

Jung, K., Duan, M., House, J. and Chang, S.X. 2014. Textural interfaces affected the distribution of roots, water, and nutrients in some reconstructed forest soils in the Athabasca oil sands region. *Ecological Engineering*, 64:240-249.

Kabwe, L.K., Scott, J.D., Beier, N.A., Wilson, G.W. and Jeeravipoolvarn, S. 2019. Environmental implications of end pit lakes at oil sand mines in Alberta, Canada. *Environmental Geotechnics*, 6:67-74. 10.1680/jenge.17.00110.

Kaminsky, H.A.W., Etsell, T.H., Ivey, D.G. and Omotoso, O. 2008. Characterization of heavy minerals in the Athabasca oil sands. *Minerals Engineering*, 21:264-271.

Kannel, P.R. and Gan, T.Y. 2012. Naphthenic acids degradation and toxicity mitigation in tailings wastewater systems and aquatic environments: A review. *Journal of Environmental Science and Health Part A-Toxic/Hazardous Substances & Environmental Engineering*, 47:1-21.

Kapadia, P.R., Kallos, M.S. and Gates, I.D. 2015. A review of pyrolysis, aquathermolysis, and oxidation of Athabasca bitumen. *Fuel Processing Technology*, 131:270-289.

Karras, G. 2010. Combustion emissions from refining lower quality oil: What is the global warming potential? *Environ. Sci. Technol.*, 44:9584-9589.

Kasperski, K.L. and Mikula, R.J. 2011. Waste streams of mined oil sands: Characteristics and remediation. *Elements*, 7:387-392.

Kassem, M., Soliman, A. and El Naggar, H. 2018. Sustainable approach for recycling treated oil sand waste in concrete: Engineering properties and potential applications. *Journal of Cleaner Production*, 204:50-59.

10.1016/j.jclepro.2018.08.349.

Kavanagh, R.J., Burnison, B.K., Frank, R.A., Solomon, K.R. and Van Der Kraak, G. 2009. Detecting oil sands process-affected waters in the Alberta oil sands region using synchronous fluorescence spectroscopy. *Chemosphere*, 76:120-126. 10.1016/j.chemosphere.2009.02.007.

Kavanagh, R.J., Frank, R.A., Oakes, K.D., Servos, M.R., Young, R.F., Fedorak, P.M., MacKinnon, M.D., Solomon, K.R., Dixon, D. and Van Der Kraak, G. 2011. Fathead minnow (Pimephales promelas) reproduction is impaired in aged oil sands process-affected waters. *Aquatic Toxicology*, 101:214-220. 10.1016/j.aquatox.2010.09.021.

Keesom, W., Unnasch, S. and Moretta, J. 2009. Life cycle assessment comparison of North American and imported crudes. Alberta Energy Research Institute, Edmonton, AB. http://eipa.alberta.ca/media/39640/life%20cycle%20analysis%20jacobs%20final%20report.pdf (Accessed August 15, 2019)

Kelly, E.N., Short, J.W., Schindler, D.E., Hodson, P.V., Ma, M.S., Kwan, A.K. and Fortin, B.L. 2009. Oil sands development contributes polycyclic aromatic compounds to the Athabasca River and its tributaries. *Proc. Natl. Acad. Sci. USA*, 106:22346-22351.

Kelly, E.N., Schindler, D.E., Hodson, P.V., Short, J.W., Radmanovich, R. and Nielsen, C.C. 2010. Oil sands development contributes elements toxic at low concentrations to the Athabasca River and its tributaries. *Proc. Natl. Acad. Sci. USA*, 107:16178-16183.

Kelly, K.E., Wilkey, J.E., Spinti, J.P., Ring, T.A. and Pershing, D.W. 2014. Oxyfiring with CO2 capture to meet low-carbon fuel standards for unconventional fuels from Utah. *International Journal of Greenhouse Gas Control*, 22:189-199.

Kenefick, S.L., Brownlee, B.G., Perley, T.R. and Hrudey, S.E. 1995. A chemical and sensory study of odor compounds in the Athabasca River, Alberta, Canada. *Water Science and Technology*, 31:15-21.

Kerkhoven, E. and Gan, T.Y. 2013. Differences in the potential hydrologic impact of climate change to the Athabasca and Fraser River nasins of Canada with and without considering shifts in vegetation patterns induced by climate change. *Journal of Hydrometeorology*, 14:963-976. 10.1175/jhm-d-12-011.1.

Khadka, B., Munir, T.M. and Strack, M. 2015. Effect of environmental factors on production and bioavailability of dissolved organic carbon from substrates available in a constructed and reference fens in the Athabasca oil sands development region. *Ecological Engineering*, 84:596-606. 10.1016/j.ecoleng.2015.09.061.

Khammar, M., Zhu, Y.Y. and Xu, Y.M. 2019. Centrifugal recovery of solvent-diluted bitumen from oil sands. *Minerals Engineering*, 136:8-17. 10.1016/j.mineng.2019.03.005.

Khulbe, K.C., Mann, R.S., Lamarche, G. and Lamarche, A.M. 1992. Electron spin resonance study of the thermal decomposition of solvent extracted Athabasca tar sand bitumen. *Fuel Processing Technology*, 31:91-103.

Khulbe, K.C., Mann, R.S., Lamarche, A.M., Lamarche, G. and MacPhee, J.A. 1993. Thermal decomposition of Athabasca tar sand and bitumen. *Fuel Processing Technology*, 35:303-316.

Khuluse-Makhanya, S., Stein, A., Breytenbach, A., Gxumisa, A., Dudeni-Tlhone, N. and Debba, P. 2017. Ensemble classification for identifying neighbourhood sources of fugitive dust and associations with observed PM10. *Atmos. Environ.*, 166:151-165.

Kindzierski, W.B. and Mueller, B. 2005. Indoor/outdoor PM10 levels in a community adjacent to oil sand facilities in northern Alberta, *Proceedings, 98th Annual Meeting of the Air & Waste Management Association,* Pittsburgh, PA: Air & Waste Management Association.

Kindzierski, W.B. and Ranganathan, H.K.S. 2006. Indoor and outdoor SO2 in a community near oil sand extraction and production facilities in northern Alberta. *Journal of Environmental Engineering and Science*, 5:S121-S129.

Kirk, J.L., Muir, D.C.G., Gleason, A., Wang, X.W., Lawson, G., Frank, R.A., Lehnherr, I. and Wrona, F. 2014. Atmospheric deposition of mercury and methylmercury to landscapes and waterbodies of the Athabasca oil sands region. *Environ. Sci. Technol.*, 48:7374-7383.

Kister, P., Laverret, E., Quirt, D., Cuney, M., Mas, P.P., Beaufort, D. and Bruneton, P. 2006. Mineralogy and geochemistry of the host-rock alterations associated with the Shea Creek unconformity-type uranium deposits (Athabasca Basin, Saskatchewan, Canada). Part 2. Regional-scale spatial distribution of the Athabasca group sandstone matrix minerals. *Clays and Clay Minerals*, 54:295-313.

Klein, C., Harbottle, D., Alagha, L. and Xu, Z.H. 2013. Impact of fugitive bitumen on polymer-based flocculation of mature fine tailings. *Canadian Journal of Chemical Engineering*, 91:1427-1432.

Kompanizare, M., Petrone, R.M., Shafii, M., Robinson, D.T. and Rooney, R.C. 2018. Effect of climate change and mining on hydrological connectivity of surficial layers in the Athabasca Oil Sands Region. *Hydrological Processes*, 32:3698-3716. 10.1002/hyp.13292.

Kondoh, H., Tanaka, K., Nakasaka, Y., Tago, T. and Masuda, T. 2016. Catalytic cracking of heavy oil over TiO2-ZrO2 catalysts under superheated steam conditions. *Fuel*, 167:288-294. 10.1016/j.fuel.2015.11.075.

Korosi, J.B., Irvine, G., Skierszkan, E.K., Doyle, J.R., Kimpe, L.E., Janvier, J. and Blais, J.M. 2013. Localized enrichment of polycyclic aromatic hydrocarbons in soil, spruce needles, and lake sediments linked to in-situ bitumen extraction near Cold Lake, Alberta. *Environ. Pollut.*, 182:307-315. 10.1016/j.envpol.2013.07.012.

Korosi, J.B., Cooke, C.A., Eickmeyer, D.C., Kimpe, L.E. and Blais, J.M. 2016. In-situ bitumen extraction associated with increased petrogenic polycyclic aromatic compounds in lake sediments from the Cold Lake heavy oil fields (Alberta, Canada). *Environ. Pollut.*, 218:915-922.

Kotlyar, L.S., Morat, C. and Ripmeester, J.A. 1991. Structural analysis of Athabasca maltenes fractions using Distortionless Enhancement by Polarization Transfer (DEPT) related C-13 NMR sequences. *Fuel*, 70:90-94.

Kotzer, T.G., Kyser, T.K. and Irving, E. 1992. Paleomagnetism and the evolution of fluids in the

Proterozoic Athabasca Basin, Northern Saskatchewan, Canada. *Canadian Journal of Earth Sciences*, 29:1474-1491.

Kraemer, D., Bajpayee, A., Muto, A., Berube, V. and Chiesa, M. 2009. Solar assisted method for recovery of bitumen from oil sand. *Applied Energy*, 86:1437-1441.

Krupa, S. 2012. WBEA receptor modeling study in the Athabasca Oil Sands: An introduction, Percy, K.E. (Ed.) *Alberta Oil Sands: Energy, Industry, and the Environment,* Amsterdam, The Netherlands: Elsevier. 311-314. http://www.sciencedirect.com/science/article/pii/B9780080977607000135

Kunzig, R. 2009. The Canadian oil boom: Scraping bottom. *National Geographic*, 215:34-59.

Kurek, J., Kirk, J.L., Muir, D.C.G., Wang, X.W., Evans, M.S. and Smol, J.P. 2013. Legacy of a half century of Athabasca oil sands development recorded by lake ecosystems. *Proc. Natl. Acad. Sci. USA*, 110:1761-1766.

Kurian, V., Mahapatra, N., Wang, B., Alipour, M., Martens, F. and Gupta, R. 2015. Analysis of Soot Formed during the Pyrolysis of Athabasca Oil Sand Asphaltenes. *Energy & Fuels*, 29:6823-6831. 10.1021/acs.energyfuels.5b01716.

Kuznetsov, O., Agrawal, D., Suresh, R., Feng, X.H., Behles, J. and Khabashesku, V. 2019. Experimental evaluation of colloidal nanosilica for improving bitumen recovery from mined oil sand ore. *Spe Reservoir Evaluation & Engineering*, 22:50-60. 10.2118/179567-pa.

Kwak, J.H., Chang, S.X., Naeth, M.A. and Schaaf, W. 2015. Coarse woody debris extract decreases nitrogen availability in two reclaimed oil sands soils in Canada. *Ecological Engineering*, 84:13-21. 10.1016/j.ecoleng.2015.07.012.

Kwak, J.H., Chang, S.X. and Naeth, M.A. 2018. Eleven years of simulated deposition of nitrogen but not sulfur changed species composition and diversity in the herb stratum in a boreal forest in western Canada. *Forest Ecology and Management*, 412:1-8. 10.1016/j.foreco.2018.01.049.

Lacaze, E., Devaux, A., Bruneau, A., Bony, S., Sherry, J. and Gagne, F. 2014. Genotoxic potential of several naphthenic acids and a synthetic oil sands process-affected water in rainbow trout (Oncorhynchus mykiss). *Aquatic Toxicology*, 152:291-299.

Laird, K.R., Das, B., Kingsbury, M., Moos, M.T., Pla-Rabes, S., Ahad, J.M.E., Wiltse, B. and Cumming, B.F. 2013. Paleolimnological assessment of limnological change in 10 lakes from northwest Saskatchewan downwind of the Athabasca oils sands based on analysis of siliceous algae and trace metals in sediment cores. *Hydrobiologia*, 720:55-73.

Laird, K.R., Das, B., Hesjedal, B., Leavitt, P.R., Mushet, G.R., Scott, K.A., Simpson, G.L., Wissel, B., Wolfe, J. and Cumming, B.F. 2017. Paleolimnological assessment of nutrient enrichment on diatom assemblages in a priori defined nitrogen- and phosphorus-limited lakes downwind of the Athabasca Oil Sands, Canada. *Journal of Limnology*, 76:488-502. 10.4081/jlimnol.2017.1598.

Landis, M.S., Pancras, J.P., Graney, J.R., Stevens, R.K., Percy, K.E. and Krupa, S. 2012. Receptor modeling of epiphytic lichens to elucidate the sources and spatial distribution of inorganic air pollution in the Athabasca Oil Sands Region, Percy, K.E. (Ed.) *Alberta Oil Sands: Energy, Industry, and the Environment,* Amsterdam, The Netherlands: Elsevier. 427-467.

Landis, M.S., Pancras, J.P., Graney, J.R., White, E.M., Edgerton, E.S., Legge, A. and Percy, K.E. 2017. Source apportionment of ambient fine and coarse particulate matter at the Fort McKay community site, in the Athabasca Oil Sands Region, Alberta, Canada. *Sci. Total Environ*, 584:105-117. 10.1016/j.scitotenv.2017.01.110.

Landis, M.S., Edgerton, E.S., White, E.M., Wentworth, G.R., Sullivan, A.P. and Dillner, A.M. 2018. The impact of the 2016 Fort McMurray Horse River Wildfire on ambient air pollution levels in the Athabasca Oil Sands Region, Alberta, Canada. *Sci. Total Environ*, 618:1665-1676. 10.1016/j.scitotenv.2017.10.008.

Landis, M.S., Berryman, S.D., White, E.M., Graney, J.R., Edgerton, E.S. and Studabaker, W.B. 2019. Use of an epiphytic lichen and a novel geostatistical approach to evaluate spatial and temporal changes in atmospheric deposition in the Athabasca Oil Sands Region, Alberta, Canada. *Sci. Total Environ*, 692:1005-1021.

Landis, M.S., Studabaker, W.B., Pancras, J.P., Graney, J.R., Puckett, K., White, E.M. and Edgerton, E.S. 2019. Source apportionment of an epiphytic lichen biomonitor to elucidate the sources and spatial distribution of polycyclic aromatic hydrocarbons in the Athabasca Oil Sands Region, Alberta, Canada. *Sci. Total Environ*, 654:1241-1257. 10.1016/j.scitotenv.2018.11.131.

Landis, M.S., Studabaker, W.B., Pancras, J.P., Graney, J.R., White, E.M. and Edgerton, E.S. 2019. Source apportionment of ambient fine and coarse particulate matter polycyclic aromatic hydrocarbons at the Bertha Canter-Fort McKay community site in the Oil Sands Region of Alberta, Canada. *Sci. Total Environ*, 666:540-558. 10.1016/j.scitotenv.2019.02.126.

Lari, E., Steinkey, D. and Pyle, G.G. 2018. Effects of seasonal changes on the toxic impacts of oil sands process-affected water on Daphnia magna. *Archives of Environmental Contamination and Toxicology*, 74:408-413. 10.1007/s00244-017-0460-3.

Larsen, J.W. and Li, S. 1995. Determination of bitumen molecular-weight distributions using Cf-252 plasma desorption mass-spectrometry. *Energy & Fuels*, 9:760-764.

Larter, S.R. and Head, I.M. 2014. Oil sands and heavy oil: Origin and exploitation. *Elements*, 10:277-283.

Latham, A.D.M. and Boutin, S. 2008. Evidence of arboreal lichen use in peatlands by white-tailed deer, Odocoileus virginianus, in Northeastern Alberta. *Canadian Field-Naturalist*, 122:230-233. 10.22621/cfn.v122i3.604.

Latham, A.D.M., Latham, M.C., McCutchen, N.A. and Boutin, S. 2011. Invading white-tailed deer change wolf-caribou dynamics in northeastern Alberta. *Journal of Wildlife Management*, 75:204-212. 10.1002/jwmg.28.

Lathem, T.L., Beyersdorf, A.J., Thornhill, K.L., Winstead, E.L., Cubison, M.J., Hecobian, A., Jimenez, J.L., Weber, R.J., Anderson, B.E. and Nenes, A. 2013. Analysis of CCN

activity of Arctic aerosol and Canadian biomass burning during summer 2008. *Atmos. Chem. Phys*, 13:2735-2756.

Latifovic, R., Fytas, K., Chen, J. and Paraszczak, J. 2005. Assessing land cover change resulting from large surface mining development. *International Journal of Applied Earth Observation and Geoinformation*, 7:29-48.

Latifovic, R. and Pouliot, D. 2014. Monitoring cumulative long-term vegetation changes over the Athabasca oil sands region. *Ieee Journal of Selected Topics in Applied Earth Observations and Remote Sensing*, 7:3380-3392. 10.1109/Jstars.2014.2321058.

Laverret, E., Mas, P.P., Beaufort, D., Kister, P., Quirt, D., Bruneton, P. and Clauer, N. 2006. Mineralogy and geochemistry of the host-rock alterations associated with the Shea Creek unconformity-type uranium deposits (Athabasca Basin, Saskatchewan, Canada). Part 1. Spatial variation of illite properties. *Clays and Clay Minerals*, 54:275-294.

Laxton, D.L., Watmough, S.A., Aherne, J. and Straker, J. 2010. An assessment of nitrogen saturation in Pinus banksiana plots in the Athabasca Oil Sands Region, Alberta. *J. Limnol*, 69:171-180.

Laxton, D.L., Watmough, S.A. and Aherne, J. 2012. Nitrogen cycling in Pinus banksiana and Populus tremuloides stands in the Athabasca Oil Sands Region, Alberta, Canada. *Water Air and Soil Pollution*, 223:1-13.

Lazorko, H. and Van Rees, K.C.J. 2012. Root distributions of planted Boreal mixedwood species on reclaimed saline-sodic overburden. *Water Air and Soil Pollution*, 223:215-231.

Leatherdale, J., Chanasyk, D.S. and Quideau, S. 2012. Soil water regimes of reclaimed upland slopes in the oil sands region of Alberta. *Canadian Journal of Soil Science*, 92:117-129.

Leconte, R., Peters, D., Pietroniro, A. and Prowse, T. 2006. Modelling climate change impacts in the Peace and Athabasca catchment and delta: II - variations in flow and water levels with varying winter severity. *Hydrological Processes*, 20:4215-4230.

Leisen, M., Boiron, M.C., Richard, A. and Dubessy, J. 2012. Determination of Cl and Br concentrations in individual fluid inclusions by combining microthermometry and LA-ICPMS analysis: Implications for the origin of salinity in crustal fluids. *Chemical Geology*, 330:197-206.

Leong, D.N.S. and Donner, S.D. 2015. Climate change impacts on streamflow availability for the Athabasca Oil Sands. *Climatic Change*, 133:651-663. 10.1007/s10584-015-1479-y.

Leung, S.S., MacKinnon, M.D. and Smith, R.E.H. 2003. The ecological effects of naphthenic acids and salts on phytoplankton from the Athabasca oil sands region. *Aquatic Toxicology*, 62:11-26.

Li, Z.F., Kung, J., Tu, Y., Kotlyar, L.S. and Chung, K.H. 2004. Characterization of ultra fine solids(BS) in athabasca bitumen. *Chinese Journal of Structural Chemistry*, 23:751-754.

Li, X.G., Sun, W.J., Wu, G.Z., He, L., Li, H. and Sui, H. 2011. Ionic liquid enhanced solvent extraction for bitumen recovery from oil sands. *Energy & Fuels*, 25:5224-5231.

Li, C., Hsu, N.C., Sayer, A.M., Krotkov, N.A., Fu, J.S., Lamsal, L.N., Lee, J. and Tsay, S.C. 2016. Satellite observation of pollutant emissions from gas flaring activities near the Arctic. *Atmos. Environ.*, 133:1-11. 10.1016/j.atmosenv.2016.03.019.

Li, S.M., Leithead, A., Moussa, S.G., Liggio, J., Moran, M.D., Wang, D., Hayden, K., Darlington, A., Gordon, M., Staebler, R., Makar, P.A., Stroud, C.A., McLaren, R., Liu, P.S.K., O'Brien, J., Mittermeier, R.L., Zhang, J.H., Marson, G., Cober, S.G., Wolde, M. and Wentzell, J.J.B. 2017. Differences between measured and reported volatile organic compound emissions from oil sands facilities in Alberta, Canada. *Proceedings of the National Academy of Sciences*, 114: E3756–E3765. 10.1073/pnas.1617862114.

Li, K., Liggio, J., Lee, P., Han, C., Liu, Q.F. and Li, S.M. 2019. Secondary organic aerosol formation from alpha-pinene, alkanes, and oil-sands-related precursors in a new oxidation flow reactor. *Atmos. Chem. Phys*, 19:9715-9731. 10.5194/acp-19-9715-2019.

Liang, H. and Zou, C.J. 2019. Adsorption of naphthenic acids from oil sand process-affected water with water-insoluble poly(beta-cyclodextrin-citric acid). *Canadian Journal of Chemical Engineering*, 97:1894-1902. 10.1002/cjce.23452.

LICA 2019. Airshed. Lakeland Industry & Community Association, Bonnyville, AB. https://lica.ca/airshed/ (Accessed August 15, 2019)

Liggio, J., Li, S.M., Hayden, K., Taha, Y.M., Stroud, C., Darlington, A., Drollette, B.D., Gordon, M., Lee, P., Liu, P., Leithead, A., Moussa, S.G., Wang, D., O'Brien, J., Mittermeier, R.L., Brook, J.R., Lu, G., Staebler, R.M., Han, Y.M., Tokarek, T.W., Osthoff, H.D., Makar, P.A., Zhang, J.H., Plata, D.L. and Gentner, D.R. 2016. Oil sands operations as a large source of secondary organic aerosols. *Nature*, 534:91-+. 10.1038/nature17646.

Liggio, J., Stroud, C.A., Wentzell, J.J.B., Zhang, J.H., Sommers, J., Darlington, A., Liu, P.S.K., Moussa, S.G., Leithead, A., Hayden, K., Mittermeier, R.L., Staebler, R., Wolde, M. and Li, S.M. 2017. Quantifying the primary emissions and photochemical formation of isocyanic acid downwind of oil sands operations. *Environ. Sci. Technol.*, 51:14462-14471. 10.1021/acs.est.7b04346.

Liggio, J., Li, S.M., Staebler, R.M., Hayden, K., Darlington, A., Mittermeier, R.L., O'Brien, J., McLaren, R., Wolde, M., Worthy, D. and Vogel, F. 2019. Measured Canadian oil sands CO2 emissions are higher than estimates made using internationally recommended methods. *Nature Communications*, 10:10.1038/s41467-019-09714-9.

Lima, A.C. and Wrona, F.J. 2019. Multiple threats and stressors to the Athabasca River Basin: What do we know so far? *Sci. Total Environ*, 649:640-651. 10.1016/j.scitotenv.2018.08.285.

Lin, F., Xu, Y.M. and Nelson, R. 2018. Determination and understanding of solvent losses to tailings from a laboratory hybrid bitumen extraction process. *Energy & Fuels*, 32:9202-9210. 10.1021/acs.energyfuels.8b01978.

Liu, Q., Cui, Z. and Etsell, T.H. 2006. Pre-concentration and residual bitumen removal from Athabasca oilsands froth treatment tailings by a Falcon centrifugal concentrator.

International Journal of Mineral Processing, 78:220-230.

Liu, Q., Cui, Z. and Etsell, T.H. 2006. Characterization of Athabasca oil sands froth treatment tailings for heavy mineral recovery. *Fuel*, 85:807-814.

Liu, C.L., Che, C.B., Zhu, J. and Yang, H.L. 2010. China assesses unconventional land oil shale, oil sands, coal gas resources. *Oil & Gas Journal*, 108:36-39.

Liu, Z.D., Wang, H.J., Blackbourn, G., Ma, F., He, Z.J., Wen, Z.X., Wang, Z.M., Yang, Z., Luan, T.S. and Wu, Z.Z. 2019. Heavy oils and oil sands: Global distribution and resource assessment. *Acta Geologica Sinica-English Edition*, 93:199-212. 10.1111/1755-6724.13778.

Liu, Z.Y., Li, Y.H., Yu, F.H., Zhu, J. and Xu, L. 2019. Co-pyrolysis of oil sand bitumen with lignocellulosic biomass under hydrothermal conditions. *Chemical Engineering Science*, 199:417-425. 10.1016/j.ces.2018.12.052.

Lo, C.C., Brownlee, B.G. and Bunce, N.J. 2003. Electrospray-mass spectrometric analysis of reference carboxylic acids and Athabasca oil sands naphthenic acids. *Anal. Chem*, 75:6394-6400.

Lo, C.C., Brownlee, B.G. and Bunce, N.J. 2006. Mass spectrometric and toxicological assays of Athabasca oil sands naphthenic acids. *Water Research*, 40:655-664.

Long, C.M. and Pavelsky, T.M. 2013. Remote sensing of suspended sediment concentration and hydrologic connectivity in a complex wetland environment. *Remote Sensing of Environment*, 129:197-209.

Lowell, R.B., Culp, J.M. and Dube, M.G. 2000. A weight-of-evidence approach for Northern River risk assessment: Integrating the effects of multiple stressors. *Environmental Toxicology and Chemistry*, 19:1182-1190.

Lowey, M. 2012. Energy and environment: Toward achieving the balance in Alberta, Percy, K.E. (Ed.) *Alberta Oil Sands: Energy, Industry, and the Environment,* Amsterdam, The Netherlands: Elsevier. 35-45. http://www.sciencedirect.com/science/article/pii/B9780080977607000032

Lundin, J.I., Riffell, J.A. and Wasser, S.K. 2015. Polycyclic aromatic hydrocarbons in caribou, moose, and wolf scat samples from three areas of the Alberta oil sands. *Environ. Pollut.*, 206:527-534. 10.1016/j.envpol.2015.07.035.

Lynam, M.M., Dvonch, J.T., Barres, J.A., Morishita, M., Legge, A. and Percy, K. 2015. Oil sands development and its impact on atmospheric wet deposition of air pollutants to the Athabasca Oil Sands Region, Alberta, Canada. *Environ. Pollut.*, 206:469-478. 10.1016/j.envpol.2015.07.032.

Lynam, M., Dvonch, J.T., Barres, J. and Percy, K. 2018. Atmospheric wet deposition of mercury to the Athabasca Oil Sands Region, Alberta, Canada. *Air Quality Atmosphere and Health*, 11:83-93. 10.1007/s11869-017-0524-6.

Ma, Y. and Li, S.Y. 2012. The pyrolysis, extraction and kinetics of Buton oil sand bitumen. *Fuel Processing Technology*, 100:11-15.

MacDonald, L.A., Wiklund, J.A., Elmes, M.C., Wolfe, B.B. and Hall, R.I. 2016. Paleolimnological assessment of riverine and atmospheric pathways and sources of metal deposition at a floodplain lake (Slave River Delta, Northwest Territories, Canada). *Sci. Total Environ*, 544:811-823. 10.1016/j.scitotenv.2015.11.173.

MacEachern, C. 2010. The Wood Buffalo Environmental Association: Monitoring in the Athabasca oil sands region, *Proceedings, 103rd Annual Conference and Exhibition,* Pittsburgh, PA: Air & Waste Management Associaiton. 1-5.

MacKenzie, M.D. and Quideau, S.A. 2012. Laboratory-based nitrogen mineralization and biogeochemistry of two soils used in oil sands reclamation. *Canadian Journal of Soil Science*, 92:131-142.

Madill, R.E.A., Brownlee, B.G., Josephy, P.D. and Bunce, N.J. 1999. Comparison of the Ames Salmonella assay and Mutatox genotoxicity assay for assessing the mutagenicity of polycyclic aromatic compounds in porewater from Athabasca oil sands mature fine tailings. *Environ. Sci. Technol.*, 33:2510-2516.

Mahapatra, N., Kurian, V., Wang, B., Martens, F. and Gupta, R. 2015. Pyrolysis of asphaltenes in an atmospheric entrained flow reactor: A study on char characterization. *Fuel*, 152:29-37. 10.1016/j.fuel.2015.02.086.

Majid, A., Sparks, B.D. and Ripmeester, J.A. 1991. Characterization of solvent insoluble organic matter isolated from Alberta oil sands. *Fuel*, 70:78-83.

Majid, A., Sparks, B.D. and Ripmeester, J.A. 1992. Isolation and characterization of humic matter from Syncrude sludge pond tailings. *Fuel*, 71:165-168.

Majid, A., Argue, S., Kargina, I., Boyko, V., Pleizier, G. and Tunney, J. 2002. Isolation and characterization of amorphous solids from oil sands fine tailings. *Nanoporous Materials Iii*, 141:669-674.

Makar, P.A., Akingunola, A., Aherne, J., Cole, A.S., Aklilu, Y.A., Zhang, J.H., Wong, I., Hayden, K., Li, S.M., Kirk, J., Scott, K., Moran, M.D., Robichaud, A., Cathcart, H., Baratzedah, P., Pabla, B., Cheung, P., Zheng, Q. and Jeffries, D.S. 2018. Estimates of exceedances of critical loads for acidifying deposition in Alberta and Saskatchewan. *Atmos. Chem. Phys*, 18:9897-9927. 10.5194/acp-18-9897-2018.

Mannix, A.E., Adamowicz, W.L. and Dridi, C. 2014. Solutions to the high costs of future water restrictions for new oil sands industry along the Athabasca River. *Can Water Resour J*, 39:395-408. 10.1080/07011784.2014.965038.

Mantyka-Pringle, C.S., Westman, C.N., Kythreotis, A.P. and Schindler, D.W. 2015. Commentary: Honouring indigenous treaty rights for climate justice. *Nature Climate Change*, 5:798-801.

Manzano, C.A., Muir, D., Kirk, J., Teixeira, C., Siu, M., Wang, X.W., Charland, J.P., Schindler, D. and Kelly, E. 2016. Temporal variation in the deposition of polycyclic aromatic compounds in snow in the Athabasca Oil Sands area of Alberta. *Environmental Monitoring and Assessment*, 188:10.1007/s10661-016-5500-3.

Manzano, C.A., Marvin, C., Muir, D., Harner, T., Martin, J. and Zhang, Y.F. 2017. Heterocyclic aromatics in petroleum coke, snow, lake sediments, and air samples from the Athabasca oil sands region. *Environ. Sci. Technol.*, 51:5445-5453. 10.1021/acs.est.7b01345.

Marentette, J.R., Sarty, I., Cowie, A.M., Frank, R.A., Hewitt, L.M., Parrott, J.L. and Martyniuk, C.J. 2017. Molecular responses of Walleye (Sander vitreus) embryos to naphthenic acid fraction components extracted from fresh oil sands process-affected water. *Aquatic Toxicology*, 182:11-19. 10.1016/j.aquatox.2016.11.003d.

Marey, H.S., Hashisho, Z., Fu, L. and Gille, J. 2015. Spatial and temporal variation in CO over Alberta using measurements from satellites, aircraft, and ground stations. *Atmos. Chem. Phys*, 15:3893-3908. 10.5194/acp-15-3893-2015.

Margeson, J.L., Hornof, V. and Neale, G.H. 1989. Characterization of the humic-clay complex and its influence on bitumen displacement from Athabasca oil sand. *Journal of Canadian Petroleum Technology*, 28:57-62.

Marshall, G.M., Kingston, D.M., Moran, K. and Mercier, P.H.J. 2014. Multivariate factor analysis of heavy minerals concentrate from Athabasca oil sands tailings by X-ray photoelectron spectroscopy. *Surface and Interface Analysis*, 46:197-209.

Martin, J.W., Barri, T., Han, X.M., Fedorak, P.M., El-Din, M.G., Perez, L., Scott, A.C. and Jiang, J.T. 2010. Ozonation of oil sands process-affected water accelerates microbial bioremediation. *Environ. Sci. Technol.*, 44:8350-8356.

Masliyah, J. 2002. Processing of tailings in Canadian oil sands industry. *Transactions of Nonferrous Metals Society of China*, 12:524-528.

Masliyah, J., Zhou, Z.J., Xu, Z.H., Czarnecki, J. and Hamza, H. 2004. Understanding water-based bitumen extraction from Athabasca oil sands. *Canadian Journal of Chemical Engineering*, 82:628-654.

Masse, J., Prescott, C.E., Renaut, S., Terrat, Y. and Grayston, S.J. 2017. Plant community and nitrogen deposition as drivers of alpha and beta diversities of prokaryotes in reconstructed oil sand soils and natural boreal forest soils. *Applied and Environmental Microbiology*, 83:10.1128/aem.03319-16.

McIntyre, N., Warner, N.H., Gupta, S., Kim, J.R. and Muller, J.P. 2012. Hydraulic modeling of a distributary channel of Athabasca Valles, Mars, using a high-resolution digital terrain model. *Journal of Geophysical Research-Planets*, 117:

McKellar, J.M., Charpentier, A.D., Bergerson, J.A. and MacLean, H.L. 2009. A life cycle greenhouse gas emissions perspective on liquid fuels from unconventional Canadian and US fossil sources. *International Journal of Global Warming*, 1:160-178.

McKellar, J.M., Bergerson, J.A. and MacLean, H.L. 2010. Replacing natural gas in Alberta's oil sands: Trade-offs associated with alternative fossil fuels. *Energy & Fuels*, 24:1687-1695.

McKellar, J.M., Bergerson, J.A., Kettunen, J. and MacLean, H.L. 2013. Predicting project environmental performance under market uncertainties: Case study of oil sands coke. *Environ. Sci. Technol.*, 47:5979-5987.

McKenzie, N., Yue, S.Q., Liu, X.D., Ramsay, B.A. and Ramsay, J.A. 2014. Biodegradation of naphthenic acids in oils sands process waters in an immobilized soil/sediment bioreactor. *Chemosphere*, 109:164-172.

McLinden, C.A., Fioletov, V., Boersma, K.F., Krotkov, N., Sioris, C.E., Veefkind, J.P. and Yang, K. 2012. Air quality over the Canadian oil sands: A first assessment using satellite observations. *Geophysical Research Letters*, 39:

McLinden, C.A., Fioletov, V., Boersma, K.F., Kharol, S.K., Krotkov, N., Lamsal, L., Makar, P.A., Martin, R.V., Veefkind, J.P. and Yang, K. 2014. Improved satellite retrievals of NO2 and SO2 over the Canadian oil sands and comparisons with surface measurements. *Atmos. Chem. Phys*, 14:3637-3656.

McLinden, C.A., Fioletov, V., Krotkov, N.A., Li, C., Boersma, K.F. and Adams, C. 2016. A decade of change in NO2 and SO2 over the Canadian oil sands as seen from space. *Environ. Sci. Technol.*, 50:331-337. 10.1021/acs.est.5b04985.

McNaughton, C.S., Vandenberg, J. and Thiede, P. 2019. Reanalysis of aerial deposition of metals and polycyclic aromatic compounds to snow in the Athabasca Oil Sands Region of Alberta Canada. *Sci. Total Environ*, 682:692-708.

Mech, M. 2012. A comprehensive guide to the Alberta oil sands. http://www.greenparty.ca/sites/default/files/a_comprehensive_guide_to_the_alberta_oil_sands_-_may_2011_-_last_revised_march_2012.pdf (Accessed August 15, 2019)

Melvin, S.D. and Trudeau, V.L. 2012. Toxicity of naphthenic acids to wood frog tadpoles (Lithobates Sylvaticus). *Journal of Toxicology and Environmental Health-Part A-Current Issues*, 75:170-173.

Mercier, P.H.J., Le Page, Y., Tu, Y. and Kotlyar, L. 2008. Powder x-ray diffraction determination of phyllosilicate mass and area versus particle thickness distributions for clays from the Athabasca oil sands. *Petroleum Science and Technology*, 26:307-321.

Mercier, P.H.J., Patarachao, B., Kung, J., Kingston, D.M., Woods, J.R., Sparks, B.D., Kotlyar, L.S., Ng, S., Moran, K. and McCracken, T. 2008. X-ray diffraction (XRD)-derived processability markers for oil sands based on clay mineralogy and crystallite thickness distributions. *Energy & Fuels*, 22:3174-3193.

Miall, A.D. 2013. The Environmental Hydro-geology of the Oil Sands, Lower Athabasca Area, Alberta. *Geoscience Canada*, 40:

Middleton, R.S. and Brandt, A.R. 2013. Using infrastructure optimization to reduce greenhouse gas emissions from oil sands extraction and processing. *Environ. Sci. Technol.*, 47:1735-1744.

Mikula, R.J., Zrobok, R. and Omotoso, O. 2004. The potential for carbon dioxide sequestration in oil sands processing streams. *Journal of Canadian Petroleum Technology*, 43:48-52.

Miller, A.I. and Duffey, R.B. 2009. Sustainable supply of global energy needs and greenhouse gas reductions. *Transactions of the Canadian Society for Mechanical Engineering*, 33:1-9.

Miller, W.G., Scott, J.D. and Sego, D.C. 2009. Flume

deposition modeling of caustic and noncaustic oil sand tailings. *Canadian Geotechnical Journal*, 46:679-693.

Mohseni, P., Hahn, N.A., Frank, R.A., Hewitt, L.M., Hajibabaei, M. and Van Der Kraak, G. 2015. Naphthenic acid mixtures from oil sands process-Affected water enhance differentiation of mouse embryonic stem cells and affect development of the heart. *Environ. Sci. Technol.*, 49:10165-10172. 10.1021/acs.est.5b02267.

Mojelsky, T.W., Ignasiak, T.M., Frakman, Z., Mcintyre, D.D., Lown, E.M., Montgomery, D.S. and Strausz, O.P. 1992. Structural features of Alberta oil sand bitumen and heavy oil asphaltenes. *Energy & Fuels*, 6:83-96.

Mollard, F.P.O., Roy, M.C., Frederick, K. and Foote, L. 2012. Growth of the dominant macrophyte Carex aquatilis is inhibited in oil sands affected wetlands in Northern Alberta, Canada. *Ecological Engineering*, 38:11-19.

Moncur, M.C., Paktunc, D., Birks, S.J., Ptacek, C.J., Welsh, B. and Thibault, Y. 2015. Source and distribution of naturally occurring arsenic in groundwater from Alberta's Southern Oil Sands Regions. *Applied Geochemistry*, 62:171-185. 10.1016/j.apgeochem.2015.02.015.

Morimoto, M., Sugimoto, Y., Sato, S. and Takanohashi, T. 2014. Comparison of thermal cracking processes for Athabasca oil sand bitumen: Relationship between conversion and yield. *Energy & Fuels*, 28:6322-6325.

Morimoto, M., Sato, T., Araki, S., Tanaka, R., Yamamoto, H., Sato, S. and Takanohashi, T. 2015. Mapping the degree of asphaltene aggregation, determined using Rayleigh scattering measurements and Hansen solubility parameters. *Energy & Fuels*, 29:2808-2812. 10.1021/ef502053c.

Mullan-Boudreau, G., Belland, R., Devito, K., Noernberg, T., Pelletier, R. and Shotyk, W. 2017. Sphagnum moss as an indicator of contemporary rates of atmospheric dust deposition in the Athabasca bituminous sands region. *Environ. Sci. Technol.*, 51:7422-7431. 10.1021/acs.est.6b06195.

Mullan-Boudreau, G., Davies, L., Devito, K., Froese, D., Noernberg, T., Pelletier, R. and Shotyk, W. 2017. Reconstructing past rates of atmospheric dust Deposition in the Athabasca bituminous sands region using peat cores from bogs. *Land Degradation & Development*, 28:2468-2481. 10.1002/ldr.2782.

Mundy, L.J., Bilodeau, J.C., Schock, D.M., Thomas, P.J., Blais, J.M. and Pauli, B.D. 2019. Using wood frog (Lithobates sylvaticus) tadpoles and semipermeable membrane devices to monitor polycyclic aromatic compounds in boreal wetlands in the oil sands region of northern Alberta, Canada. *Chemosphere*, 214:148-157. 10.1016/j.chemosphere.2018.09.034.

Mundy, L.J., Williams, K.L., Chiu, S.H., Pauli, B.D. and Crump, D.R. 2019. Extracts of passive samplers deployed in variably contaminated wetlands in the Athabasca Oil Sands Region elicit biochemical and transcriptomic effects in avian hepatocytes. *Environ. Sci. Technol.*, 53:9192-9202. 10.1021/acs.est.9b02066.

Munkittrick, K.R. and Arciszewski, T.J. 2017. Using normal ranges for interpreting results of monitoring and tiering to guide future work: A case study of increasing polycyclic aromatic compounds in lake sediments from the Cold Lake oil sands (Alberta, Canada) described in Korosi et al. (2016). *Environ. Pollut.*, 231:1215-1222. 10.1016/j.envpol.2017.07.070.

Munkittrick, K.R. 2019. Relationshps between air pollutants and fores ecosystem health in the oil sands region, Alberta, Canada. *Sci. Total Environ*, Virtual Issue:

Murray, K.R., Barlow, N. and Strack, M. 2017. Methane emissions dynamics from a constructed fen and reference sites in the Athabasca Oil Sands Region, Alberta. *Sci. Total Environ*, 583:369-381. http://dx.doi.org/10.1016/j.scitotenv.2017.01.076.

Murugan, P., Mani, T., Mahinpey, N. and Dong, M.Z. 2012. Pyrolysis kinetics of Athabasca bitumen using a TGA under the influence of reservoir sand. *Canadian Journal of Chemical Engineering*, 90:315-319.

Mushet, G.R., Laird, K.R., Das, B., Hesjedal, B., Leavitt, P.R., Scott, K.A., Simpson, G.L., Wissel, B.R., Wolfe, J.D. and Cumming, B.F. 2017. Regional climate changes drive increased scaled-chrysophyte abundance in lakes downwind of Athabasca Oil Sands nitrogen emissions. *Journal of Paleolimnology*, 58:419-435. 10.1007/s10933-017-9987-6.

Naderi, K. and Babadagli, T. 2014. Experimental analysis of heavy-oil recovery by alternate injection of steam and solvent (Hydrocarbon/CO2) in unconsolidated sand reservoirs. *Journal of Canadian Petroleum Technology*, 53:263-274.

Nasab, F.M., Shahandeh, H. and Li, Z.K. 2018. Strategic planning of steam assisted gravity drainage reservoir development under reservoir production and oil price uncertainty. *Industrial & Engineering Chemistry Research*, 57:9513-9526. 10.1021/acs.iecr.8b00742.

Nassif, M., Finch, J.A. and Waters, K.E. 2014. Determining frother-like properties of process water in bitumen flotation. *Minerals Engineering*, 56:121-128. 10.1016/j.mineng.2013.10.024.

Nduagu, E.I. and Gates, I.D. 2015. Unconventional heavy oil growth and global greenhouse gas emissions. *Environ. Sci. Technol.*, 49:8824-8832.

Neil, E.J. and Si, B.C. 2018. Exposure to weathering reduces the water repellency of aggregated oil sand material from subsoils of the Athabasca region. *Canadian Journal of Soil Science*, 98:264-276. 10.1139/cjss-2017-0087.

Neil, E.J. and Si, B.C. 2019. Interstitial hydrocarbons reduce the infiltration rates of coarse textured reclamation materials from the Athabasca oil sands. *Catena*, 173:207-216. 10.1016/j.catena.2018.09.047.

Nesbitt, J.A. and Lindsay, M.B.J. 2017. Vanadium geochemistry of oil sands fluid petroleum coke. *Environ. Sci. Technol.*, 51:3102-3109. 10.1021/acs.est.6b05682.

Neville, L.A., Patterson, R.T., Gammon, P. and Macumber, A.L. 2014. Relationship between ecological indicators (Arcellacea), total mercury concentrations and grain size in lakes within the Athabasca oil sands region, Alberta. *Environmental Earth Sciences*, 72:577-588.

Ngnie, G., Baitan, D., Dedzo, G.K. and Detellier, C. 2018. Sedimentation of fine particles of kaolinite and polymer-coated kaolinite in cyclohexane: Implications for fines

removal from extracted bitumen in non-aqueous processes. *Fuel*, 234:218-224. 10.1016/j.fuel.2018.07.032.

Nguyen, Q.T. and Watkinson, A.P. 1993. Sulfur capture during gasification of oil sand cokes. *Canadian Journal of Chemical Engineering*, 71:401-410.

Nhieu, P., Liu, Q. and Gray, M.R. 2016. Role of water and fine solids in onset of coke formation during bitumen cracking. *Fuel*, 166:152-156. 10.1016/j.fuel.2015.10.100.

Nie, F., He, D.M., Guan, J., Li, X.Q., Hong, Y., Wang, L.F., Zheng, H.A. and Zhang, Q.M. 2018. Oil sand pyrolysis: Evolution of volatiles and contributions from mineral, bitumen, maltene, and SARA fractions. *Fuel*, 224:726-739. 10.1016/j.fuel.2018.03.069.

Nimana, B., Canter, C. and Kumar, A. 2015. Energy consumption and greenhouse gas emissions in the recovery and extraction of crude bitumen from Canada's oil sands. *Applied Energy*, 143:189-199. 10.1016/j.apenergy.2015.01.024.

Noah, M., Poetz, S., Vieth-Hillebrand, A. and Wilkes, H. 2015. Detection of residual oil-sand-derived organic material in developing soils of reclamation sites by ultra-high-resolution mass spectrometry. *Environ. Sci. Technol.*, 49:6466-6473.

Noble, B.F., Skwaruk, J.S. and Patrick, R.J. 2014. Toward cumulative effects assessment and management in the Athabasca watershed, Alberta, Canada. *Canadian Geographer-Geographe Canadien*, 58:315-328. 10.1111/cag.12063.

Norris, C.E., Dungait, J.A.J., Joynes, A. and Quideau, S.A. 2013. Biomarkers of novel ecosystem development in boreal forest soils. *Organic Geochemistry*, 64:9-18.

Nosal, M., Legge, A.H., Nosal, E.M. and Hansen, M.C. 2012. Development and application of statistical approaches for reducing uncertainty in ambient air quality data, Percy, K.E. (Ed.) *Alberta Oil Sands: Energy, Industry, and the Environment,* Amsterdam, The Netherlands: Elsevier. 93-111. http://www.sciencedirect.com/science/article/pii/B9780080977607000056

Nourozieh, H., Kariznovi, M. and Abedi, J. 2011. Physical properties and rxtraction measurements for the Athabasca bitumen plus light hydrocarbon system: Evaluation of the pressure effect, solvent-to-bitumen ratio, and solvent type. *Journal of Chemical and Engineering Data*, 56:4261-4267.

Nourozieh, H., Kariznovi, M. and Abedi, J. 2014. Measurement and prediction of density for the mixture of Athabasca bitumen and pentane at temperatures up to 200 degrees C. *Energy & Fuels*, 28:2874-2885.

Nourozieh, H., Kariznovi, M. and Abedi, J. 2015. Modeling and measurement of thermo-physical properties for Athabasca bitumen and n-heptane mixtures. *Fuel*, 157:73-81. 10.1016/j.fuel.2015.04.032.

Nwaishi, F., Petrone, R.M., Price, J.S., Ketcheson, S.J., Slawson, R. and Andersen, R. 2015. Impacts of donor-peat management practices on the functional characteristics of a constructed fen. *Ecological Engineering*, 81:471-480. 10.1016/j.ecoleng.2015.04.038.

Nwaishi, F., Petrone, R.M., Macrae, M.L., Price, J.S., Strack, M., Slawson, R. and Andersen, R. 2016. Above and below-ground nutrient cycling: a criteria for assessing the biogeochemical functioning of a constructed fen. *Applied Soil Ecology*, 98:177-194. 10.1016/j.apsoil.2015.10.015.

Nyakas, A., Han, J., Peru, K.M., Headley, J.V. and Borchers, C.H. 2013. Comprehensive analysis of oil sands processed water by direct-infusion Fourier-Transform Ion Cyclotron Resonance Mass Spectrometry with and without offline UHPLC sample prefractionation. *Environ. Sci. Technol.*, 47:4471-4479.

O'Brien, R.J., Percy, K.E. and Legge, A.H. 2012. Co-measurement of volatile organic and sulfur compounds in the Athabasca Oil Sands Region by dual detector pneumatic focusing gas chromatography, Percy, K.E. (Ed.) *Alberta Oil Sands: Energy, Industry, and the Environment,* Amsterdam, The Netherlands: Elsevier. 113-144. http://www.sciencedirect.com/science/article/pii/B9780080977607000068

Ofosuasiedu, K., Hughes, R., Price, D. and Rutherford, J.P. 1992. SEM Aia study of size distribution and mineral content of Athabasca oil sand and its coke residues. *Energy Sources*, 14:95-105.

Okawa, H., Akazawa, N., Kato, T. and Sugawara, K. 2019. Separation and desulfurization of bitumen from oil sand using oxidation combined with ultrasound. *Japanese Journal of Applied Physics*, 58:10.7567/1347-4065/ab0bb0.

Olabanji, S.O., Haque, A.M.I., Fazinic, S., Cherubini, R. and Moschini, G. 1994. PIGE-PIXE analysis of Nigerian tar sands. *Journal of Radioanalytical and Nuclear Chemistry-Articles*, 177:243-252.

Olateju, B. and Kumar, A. 2011. Hydrogen production from wind energy in Western Canada for upgrading bitumen from oil sands. *Energy*, 36:6326-6339.

Omotoso, O.E. and Mikula, R.J. 2004. High surface areas caused by smectitic interstratification of kaolinite and illite in Athabasca oil sands. *Applied Clay Science*, 25:37-47.

Orbach, R.L. 2012. Energy production: A global perspective, Percy, K.E. (Ed.) *Alberta Oil Sands: Energy, Industry, and the Environment,* Amsterdam, The Netherlands: Elsevier. 1-18. http://www.sciencedirect.com/science/article/pii/B9780080977607000019

Ordorica-Garcia, G., Croiset, E., Douglas, P., Elkamel, A. and Gupta, M. 2007. Modeling the energy demands and greenhouse gas emissions of the Canadian oil sands industry. *Energy & Fuels*, 21:2098-2111.

Ordorica-Garcia, G., Elkamel, A., Douglas, P.L., Croiset, E. and Gupta, M. 2008. Energy optimization model with CO2-emission constraints for the Canadian oil sands industry. *Energy & Fuels*, 22:2660-2670.

Osacky, M., Geramian, M., Dyar, M.D., Sklute, E.C., Valter, M., Ivey, D.G., Liu, Q. and Etsell, T.H. 2013. Characterisation of petrologic end members of oil sands from the athabasca region, Alberta, Canada. *Canadian Journal of Chemical Engineering*, 91:1402-1415.

Osacky, M., Geramian, M., Ivey, D.G., Liu, Q. and Etsell, T.H. 2013. Mineralogical and chemical composition of

petrologic end members of Alberta oil sands. *Fuel*, 113:148-157.

Oskouei, S.J.P., Moore, R.G., Maini, B. and Mehta, S.A. 2011. Feasibility of in-situ combustion in the SAGD chamber. *Journal of Canadian Petroleum Technology*, 50:31-44.

Pan, H.W., Jin, Y. and Gao, Y.F. 2019. Evaluation of elastic property changes in Karamay oil sand reservoir during thermal stimulation. *Energy Science & Engineering*, 7:1233-1253. 10.1002/ese3.342.

Parajulee, A. and Wania, F. 2014. Reply to Ahad et al.: Source apportionment of polycyclic aromatic hydrocarbons in the Athabasca oil sands region is still a work in progress. *Proceedings of the National Academy of Sciences of the United States of America*, 111:E2440-E2440.

Parajulee, A. and Wania, F. 2014. Evaluating officially reported polycyclic aromatic hydrocarbon emissions in the Athabasca oil sands region with a multimedia fate model. *Proceedings of the National Academy of Sciences of the United States of America*, 111:3344-3349.

Park, Y.C., Paek, J.Y., Bae, D.H. and Shun, D. 2009. Study of pyrolysis kinetics of Alberta oil sand by thermogravimetric analysis. *Korean Journal of Chemical Engineering*, 26:1608-1612.

Parks, N. 2010. Oil sands debate heats up in Alberta. *Frontiers in Ecology and the Environment*, 8:452-452.

Parrott, J.L., Marentette, J.R., Hewitt, L.M., McMaster, M.E., Gillis, P.L., Norwood, W.P., Kirk, J.L., Peru, K.M., Headley, J.V., Wang, Z., Yang, C. and Frank, R.A. 2018. Meltwater from snow contaminated by oil sands emissions is toxic to larval fish, but not spring river water. *Sci. Total Environ*, 625:264-274. 10.1016/j.scitotenv.2017.12.284.

Parsons, B.G., Watmough, S.A., Dillon, P.J. and Somers, K.M. 2010. A bioassessment of lakes in the Athabasca Oil Sands Region, Alberta, using benthic macroinvertebrates. *J. Limnol*, 69:105-117.

Parsons, B.G., Watmough, S.A., Dillon, P.J. and Somers, K.M. 2010. Relationships between lake water chemistry and benthic macroinvertebrates in the Athabasca Oil Sands Region, Alberta. *J. Limnol*, 69:118-125.

Pauls, R.W. 1999. Bison and the oil sands industry. *Cim Bulletin*, 92:91-94.

Payzant, J.D., Lown, E.M. and Strausz, O.P. 1991. Structural units of Athabasca asphaltene - the aromatics with a linear carbon framework. *Energy & Fuels*, 5:445-453.

Penner, T.J. and Foght, J.M. 2010. Mature fine tailings from oil sands processing harbour diverse methanogenic communities. *Canadian Journal of Microbiology*, 56:459-470.

Peramanu, S., Pruden, B.B. and Rahimi, P. 1999. Molecular weight and specific gravity distributions for athabasca and cold lake bitumens and their saturate, aromatic, resin, and asphaltene fractions. *Industrial & Engineering Chemistry Research*, 38:3121-3130.

Percy, K.E. 2010. The Athabasca Oil Sands Region: Effects-based environmental monitoring in a multistakeholder air quality management context, Chow, J.C., Watson, J.G. and Cao, J.J. (Eds.), *Proceedings, Leapfrogging Opportunities for Air Quality Improvement,* Pittsburgh, PA: Air & Waste Management Association. 543-543. http://www.dri.edu/conference-proceedings

Percy, K.E. 2012. *Alberta Oil Sands: Energy, Industry, and the Environment*. Amsterdam, The Netherlands: Elsevier Press.

Percy, K.E. 2012. Preface, Percy, K.E. (Ed.) *Alberta Oil Sands: Energy, Industry, and the Environment,* Amsterdam, The Netherlands: Elsevier. xxi-xxiii. http://www.sciencedirect.com/science/article/pii/B9780080977607099947

Percy, K.E. 2012. Introduction, Percy, K.E. (Ed.) *Alberta Oil Sands: Energy, Industry, and the Environment,* Amsterdam, The Netherlands: Elsevier. xxv-xxvi. http://www.sciencedirect.com/science/article/pii/B9780080977607099960

Percy, K.E. 2012. Alberta Oil Sands: Energy, Industry and the Environment. Oxford, UK: Elsevier.

Percy, K.E., Hansen, M.C. and Dann, T. 2012. Air quality in the Athabasca Oil Sands Region 2011, Percy, K.E. (Ed.) *Alberta Oil Sands: Energy, Industry, and the Environment,* Amsterdam, The Netherlands: Elsevier. 47-91. http://www.sciencedirect.com/science/article/pii/B9780080977607000044

Percy, K.E. and Krupa, S. 2012. Concluding remarks, Percy, K.E. (Ed.) *Alberta Oil Sands: Energy, Industry, and the Environment,* Amsterdam, The Netherlands: Elsevier. 469-483. http://www.sciencedirect.com/science/article/pii/B9780080977607000196

Percy, K.E., Maynard, D.G. and Legge, A.H. 2012. Applying the forest health approach to monitoring boreal ecosystems in the Athabasca Oil Sands Region, Percy, K.E. (Ed.) *Alberta Oil Sands: Energy, Industry, and the Environment,* Amsterdam, The Netherlands: Elsevier. 193-217. http://www.sciencedirect.com/science/article/pii/B9780080977607000093

Percy, K.E. 2013. Ambient air quality and linkage to ecosystems in the Athabasca Oil Sands, Alberta. *Geoscience Canada*, 40:182-201.

Pereira, A.N. and Trevisan, O.V. 2014. Thermoanalysis and reaction kinetics of heavy oil combustion. *Journal of the Brazilian Society of Mechanical Sciences and Engineering*, 36:393-401.

Perera, P., Hewage, K., Alam, M.S., Merida, W. and Sadiq, R. 2018. Scenario-based economic and environmental analysis of clean energy incentives for households in Canada: Multi criteria decision making approach. *Journal of Cleaner Production*, 198:170-186. 10.1016/j.jclepro.2018.07.014.

Pilote, M., Andre, C., Turcotte, P., Gagne, F. and Gagnon, C. 2018. Metal bioaccumulation and biomarkers of effects in caged mussels exposed in the Athabasca oil sands area. *Sci. Total Environ*, 610:377-390. 10.1016/j.scitotenv.2017.08.023.

Pinno, B.D., Landhausser, S.M., MacKenzie, M.D., Quideau, S.A. and Chow, P.S. 2012. Trembling aspen seedling

establishment, growth and response to fertilization on contrasting soils used in oil sands reclamation. *Canadian Journal of Soil Science*, 92:143-151.

Platt, U., Seitz, K., Buxmann, J. and Thimm, H.F. 2012. Air quality monitoring in the Canadian Oil Sands: Tests of new technology. *Oil Gas-European Magazine*, 38:220-224.

Pollet, I. and Bendell-Young, L.I. 2000. Amphibians as indicators of wetland quality in wetlands formed from oil sands effluent. *Environmental Toxicology and Chemistry*, 19:2589-2597. 10.1897/1551-5028(2000)019<2589:aaiowq>2.3.co;2.

Pouderoux, H.F., Pedersen, P.K. and Coderre, A.B. 2015. Fluvial reservoirs stacked in thin deltaic successions of the Lower Cretaceous Grand Rapids Formation, east-central Alberta, Canada. *Interpretation-J Sub*, 3:T207-T232. 10.1190/Int-2014-0100.1.

Powter, C., Chymko, N., Dinwoodie, G., Howat, D., Janz, A., Puhlmann, R., Richens, T., Watson, D., Sinton, H., Ball, K., Etmanski, A., Patterson, B., Brocke, L. and Dyer, R. 2012. Regulatory history of Alberta's industrial land conservation and reclamation program. *Canadian Journal of Soil Science*, 92:39-51.

Proemse, B., Mayer, B., Chow, J.C. and Watson, J.G. 2012. Isotopic characterization of nitrate, ammonium and sulfate emitted from the Athabasca oil sand operations, Alberta, Canada. *Atmos. Environ.*, 60:555-563.

Proemse, B.C. and Mayer, B. 2012. Tracing industrial nitrogen and sulfur emissions in the Athabasca Oil Sands Region using stable isotopes, Percy, K.E. (Ed.) *Alberta Oil Sands: Energy, Industry, and the Environment,* Amsterdam, The Netherlands: Elsevier. 243-266. http://www.sciencedirect.com/science/article/pii/B9780080977607000111

Proemse, B.C., Mayer, B. and Fenn, M.E. 2012. Tracing industrial sulfur contributions to atmospheric sulfate deposition in the Athabasca oil sands region, Alberta, Canada. *Applied Geochemistry*, 27:2425-2434. 10.1016/j.apgeochem.2012.08.006.

Proemse, B.C., Mayer, B., Fenn, M.E. and Ross, C.S. 2013. A multi-isotope approach for estimating industrial contributions to atmospheric nitrogen deposition in the Athabasca oil sands region in Alberta, Canada. *Environ. Poll*, 182:80-91.

Proemse, B.C., Maynard, D.G. and Mayer, B. 2016. Foliage chemistry of Pinus banksiana in the Athabasca Oil Sands Region, Alberta, Canada. *Forests*, 7:10.3390/f7120312.

Proskin, S., Sego, D. and Alostaz, M. 2010. Freeze-thaw and consolidation tests on Suncor mature fine tailings (MET). *Cold Regions Science and Technology*, 63:110-120.

Prowse, T.D., Beltaos, S., Gardner, J.T., Gibson, J.J., Granger, R.J., Leconte, R., Peters, D.L., Pietroniro, A., Romolo, L.A. and Toth, B. 2006. Climate change, flow regulation and land-use effects on the hydrology of the Peace-Athabasca-Slave system; Findings from the Northern Rivers Ecosystem Initiative. *Environmental Monitoring and Assessment*, 113:167-197. 10.1007/s10661-005-9080-x.

Puttaswamy, N. and Liber, K. 2011. Identifying the causes of oil sands coke leachate toxicity to aquatic invertebrates. *Environmental Toxicology and Chemistry*, 30:2576-2585.

Puttaswamy, N. and Liber, K. 2012. Influence of inorganic anions on metals release from oil sands coke and on toxicity of nickel and vanadium to Ceriodaphnia dubia. *Chemosphere*, 86:521-529.

Qiu, X., Cheng, I., Yang, F.Q., Horb, E., Zhang, L.M. and Harner, T. 2018. Emissions databases for polycyclic aromatic compounds in the Canadian Athabasca oil sands region - development using current knowledge and evaluation with passive sampling and air dispersion modelling data. *Atmos. Chem. Phys*, 18:3457-3467. 10.5194/acp-18-3457-2018.

Quagraine, E.K., Headley, J.V. and Peterson, H.G. 2005. Is biodegradation of bitumen a source of recalcitrant naphthenic acid mixtures in oil sands tailing pond waters? *Journal of Environmental Science and Health Part a-Toxic/Hazardous Substances & Environmental Engineering*, 40:671-684. 10.1081/ese-200046637.

Quagraine, E.K., Peterson, H.G. and Headley, J.V. 2005. In situ bioremediation of naphthenic acids contaminated tailing pond waters in the Athabasca oil sands region-demonstrated field studies and plausible options: A review. *Journal of Environmental Science and Health Part a-Toxic/Hazardous Substances & Environmental Engineering*, 40:685-722. 10.1081/ese-200046649.

Raab, D. and Bayley, S.E. 2012. A vegetation-based Index of Biotic Integrity to assess marsh reclamation success in the Alberta oil sands, Canada. *Ecological Indicators*, 15:43-51.

Rahman, M.M., Canter, C. and Kumar, A. 2014. Greenhouse gas emissions from recovery of various North American conventional crudes. *Energy*, 74:607-617. 10.1016/j.energy.2014.07.026.

Rahman, M.M., Canter, C. and Kumar, A. 2015. Well-to-wheel life cycle assessment of transportation fuels derived from different North American conventional crudes. *Applied Energy*, 156:159-173. 10.1016/j.apenergy.2015.07.004.

Raine, J.C., Turcotte, D., Romanowski, L. and Parrott, J.L. 2018. Oil sands tailings pond sediment toxicity to early life stages of northern pike (&ITEsox lucius&IT). *Sci. Total Environ*, 624:567-575. 10.1016/j.scitotenv.2017.12.163.

Rainville, A., Hawkins, R. and Bergerson, J. 2015. Building consensus in life cycle assessment: the potential for a Canadian product category rules standard to enhance credibility in greenhouse gas emissions estimates for Alberta's oil sands. *Journal of Cleaner Production*, 103:525-533. 10.1016/j.jclepro.2014.06.067.

Ram, S., Saraswat, D.K. and Narayan, K.A. 1990. Spectroscopic studies of Athabasca oil sands. *Fuel*, 69:512-515.

Ramcharan, T. and Hosein, R. 2019. Radio frequency heating combined with solvent extraction- A method for oil recovery from surface oil sands. *Journal of Petroleum Science and Engineering*, 179:328-336. 10.1016/j.petrol.2019.04.048.

Ramos-Padron, E., Bordenave, S., Lin, S.P., Bhaskar, I.M., Dong, X.L., Sensen, C.W., Fournier, J., Voordouw, G. and Gieg, L.M. 2011. Carbon and sulfur cycling by microbial

communities in a gypsum-treated oil sands tailings pond. *Environ. Sci. Technol.*, 45:439-446. 10.1021/es1028487.

RAMP 2015. Regional Aquatics Monitoring Program. Alberta Environment and Sustainable Resource Development, Edmonton, AL, CA. http://www.ramp-alberta.org/RAMP.aspx (Accessed August 15, 2019)

Rao, F. and Liu, Q. 2013. Froth treatment in Athabasca oil sands bitumen recovery process: A review. *Energy & Fuels*, 27:7199-7207.

Redman, A.D., Parkerton, T.F., Butler, J.D., Letinski, D.J., Frank, R.A., Hewitt, L.M., Bartlett, A.J., Gillis, P.L., Marentette, J.R., Parrott, J.L., Hughes, S.A., Guest, R., Bekele, A., Zhang, K., Morandi, G., Wiseman, S. and Giesy, J.P. 2018. Application of the rarget lipid model and passive samplers to characterize the toxicity of bioavailable organics in oil sands process-affected water. *Environ. Sci. Technol.*, 52:8039-8049. 10.1021/acs.est.8b00614.

Reid, M.L. and Warren, L.A. 2016. S reactivity of an oil sands composite tailings deposit undergoing reclamation wetland construction. *Journal of Environmental Management*, 166:321-329. 10.1016/j.jenvman.2015.10.014.

Ren, S.L., Dang-Vu, T., Zhao, H.Y., Long, J., Xu, Z.H. and Masliyah, J. 2009. Effect of weathering on surface characteristics of solids and bitumen from oil sands. *Energy & Fuels*, 23:334-341.

Ren, S.L., Zhao, H.Y., Dang-Vu, T., Xu, Z.H. and Masliyah, J.H. 2009. Effect of weathering on oil sands processability. *Canadian Journal of Chemical Engineering*, 87:879-886.

Rezanezhad, F., Andersen, R., Pouliot, R., Price, J.S., Rochefort, L. and Graf, M.D. 2012. How fen vegetation structure affects the transport of oil sands process-affected waters. *Wetlands*, 32:557-570.

Richardson, E. and Dacks, J.B. 2019. Microbial Eukaryotes in oil sands environments: Heterotrophs in the spotlight. *Microorganisms*, 7:10.3390/microorganisms7060178.

Risacher, F.F., Morris, P.K., Arriaga, D., Goad, C., Nelson, T.C., Slater, G.F. and Warren, L.A. 2018. The interplay of methane and ammonia as key oxygen consuming constituents in early stage development of Base Mine Lake, the first demonstration oil sands pit lake. *Applied Geochemistry*, 93:49-59. 10.1016/j.apgeochem.2018.03.013.

Robinson, M.P. and Ross, M.M. 1997. Traditional land use and occupancy studies and their impact on forest planning and management in Alberta. *Forestry Chronicle*, 73:596-605. 10.5558/tfc73596-5.

Rodriguez-Estival, J., North, M.A. and Smits, J.E.G. 2015. Sublethal health effects in laboratory rodents from environmentally relevant exposures to oil sands contaminants. *Environmental Toxicology and Chemistry*, 34:2884-2897. 10.1002/etc.3145.

Ronconi, R.A. 2006. Predicting bird oiling events at oil sands tailings ponds and assessing the importance of alternate waterbodies for waterfowl: A preliminary assessment. *Canadian Field-Naturalist*, 120:1-9.

Rood, S.B., Stupple, G.W. and Gill, K.M. 2015. Century-long records reveal slight, ecoregion-localized changes in Athabasca River flows. *Hydrological Processes*, 29:805-816. 10.1002/hyp.10194.

Rooney, R.C. and Bayley, S.E. 2012. Development and testing of an index of biotic integrity based on submersed and floating vegetation and its application to assess reclamation wetlands in Alberta's oil sands area, Canada. *Environ. Mon. Assess*, 184:749-761.

Rooney, R.C., Bayley, S.E. and Schindler, D.W. 2012. Oil sands mining and reclamation cause massive loss of peatland and stored carbon. *Proc. Natl. Acad. Sci. USA*, 109:4933-4937.

Rosenberg, P.E. and Foit, F.F. 2006. Magnesiofoitite from the uranium deposits of the Athabasca Basin, Saskatchewan, Canada. *Canadian Mineralogist*, 44:959-965.

Rosenfeld, J., Pont, J., Law, K., Hirshfeld, D. and Kolb.J. 2009. Comparison of North American and imported crude oil lifecycle GHG emissions. Alberta Energy Research Institute, Edmonton, AB. http://www.albertainnovates.ca/media/15753/life%20cycle%20analysis%20jacobs%20final%20report.pdf (Accessed August 15, 2019)

Roshani, A., Fall, M. and Kennedy, K. 2018. Microstructural, hydraulic conductivity and geochemical changes of drying mature fine oil sand tailings in column experiments. *International Journal of Mining Reclamation and Environment*, 32:239-253. 10.1080/17480930.2017.1278658.

Ross, M.S., Pereira, A.D., Fennell, J., Davies, M., Johnson, J., Sliva, L. and Martin, J.W. 2012. Quantitative and qualitative analysis of naphthenic acids in natural waters surrounding the Canadian oil sands industry. *Environ. Sci. Technol.*, 46:12796-12805.

Roth, E., Bank, T., Howard, B. and Granite, E. 2017. Rare earth elements in Alberta oil sand process streams. *Energy & Fuels*, 31:4714-4720. 10.1021/acs.energyfuels.6b03184.

Rowland, S.J., Scarlett, A.G., Jones, D., West, C.E. and Frank, R.A. 2011. Diamonds in the rough: Identification of individual naphthenic acids in oil sands process water. *Environ. Sci. Technol.*, 45:3154-3159.

Rowland, S.J., West, C.E., Jones, D., Scarlett, A.G., Frank, R.A. and Hewitt, L.M. 2011. Steroidal aromatic 'Naphthenic Acids' in oil sands process-affected water: Structural comparisons with environmental estrogens. *Environ. Sci. Technol.*, 45:9806-9815.

Rowland, S.J., West, C.E., Scarlett, A.G., Jones, D., Boberek, M., Pan, L., Ng, M., Kwong, L. and Tonkin, A. 2011. Monocyclic and monoaromatic naphthenic acids: synthesis and characterisation. *Environmental Chemistry Letters*, 9:525-533.

Rowland, S.J., West, C.E., Scarlett, A.G., Ho, C. and Jones, D. 2012. Differentiation of two industrial oil sands process-affected waters by two-dimensional gas chromatography/mass spectrometry of diamondoid acid profiles. *Rapid Communications In Mass Spectrometry*, 26:572-576.

Roy, M.C., Mollard, F.P.O. and Foote, A.L. 2014. Do peat amendments to oil sands wet sediments affect Carex

aquatilis biomass for reclamation success? *Journal of Environmental Management*, 139:154-163.

Roy, J.W., Bickerton, G., Frank, R.A., Grapentine, L. and Hewitt, L.M. 2016. Assessing risks of shallow riparian groundwater quality near an oil sands tailings pond. *Groundwater*, 54:545-558. 10.1111/gwat.12392.

Rundle, K.I., Sharaf, M.S., Stevens, D., Kamunde, C. and Van den Heuvel, M.R. 2018. Oil sands derived naphthenic acids are oxidative uncouplers and impair electron transport in isolated mitochondria. *Environ. Sci. Technol.*, 52:10803-10811. 10.1021/acs.est.8b02638.

Russell, M., Hakami, A., Makar, P.A., Akingunola, A., Zhang, J.H., Moran, M.D. and Zheng, Q. 2019. An evaluation of the efficacy of very high resolution air-quality modelling over the Athabasca oil sands region, Alberta, Canada. *Atmos. Chem. Phys*, 19:4393-4417. 10.5194/acp-19-4393-2019.

RWDI 2005. VOC emissions speciation profile development. RWDI Air, Inc., Fort McMurray, AL, Canada. http://www.cemaonline.ca/content/view/24/70/ (Accessed August 15, 2019)

RWDI 2005. NOx dispersion and chemistry assumptions in the CALPUFF Model. Cumulative Environmental Management Association, Fort McMurray, AL, Canada. http://www.cemaonline.ca/content/view/24/70/ (Accessed August 15, 2019)

Sakr, M. 2009. Performance of helical piles in oil sand. *Canadian Geotechnical Journal*, 46:1046-1061.

Sanaie, N., Watkinson, A.P., Bowen, B.D. and Smith, K.J. 2001. Effect of minerals on coke precursor formation. *Fuel*, 80:1111-1119.

Sandler, J., Fowler, G., Cheng, K. and Kovscek, A.R. 2014. Solar-generated steam for oil recovery: Reservoir simulation, economic analysis, and life cycle assessment. *Energy Conversion and Management*, 77:721-732. 10.1016/j.enconman.2013.10.026.

Sapkota, K., Oni, A.O., Kumar, A. and Ma, L.W. 2018. The development of a techno-economic model for the extraction, transportation, upgrading, and shipping of Canadian oil sands products to the Asia-Pacific region. *Applied Energy*, 223:273-292. 10.1016/j.apenergy.2018.04.047.

Sarkar, S. and Kumar, A. 2010. Biohydrogen production from forest and agricultural residues for upgrading of bitumen from oil sands. *Energy*, 35:582-591.

Sarmiento, S. and Palanisami, A. 2011. Coherence between atmospheric teleconnections and Mackenzie River Basin lake levels. *Journal of Great Lakes Research*, 37:642-649.

Sato, S., Sugimoto, Y., Sakanishi, K., Saito, I. and Yui, S. 2004. Diesel quality and molecular structure of bitumen-derived middle distillates. *Fuel*, 83:1915-1927.

Sauchyn, D.J., St-Jacques, J.M. and Luckman, B.H. 2015. Long-term reliability of the Athabasca River (Alberta, Canada) as the water source for oil sands mining. *Proceedings of the National Academy of Sciences of the United States of America*, 112:12621-12626. 10.1073/pnas.1509726112.

Scale, K.O., Korbas, T.S. and Fleming, I.R. 2017. Degradation and mobility of petroleum hydrocarbons in oil sand waste. *Environmental Geotechnics*, 4:402-414. 10.1680/jenge.15.00035.

Scale, K.O. and Fleming, I.R. 2019. Pore-gas dynamics in overburden and reclamation soil covers. *Environmental Geotechnics*, 6:171-185. 10.1680/jenge.17.00016.

Schiffer, S. and Liber, K. 2017. Estimation of vanadium water quality benchmarks for the protection of aquatic life with relevance to the Athabasca Oil Sands region using species sensitivity distributions. *Environmental Toxicology and Chemistry*, 36:3034-3044. 10.1002/etc.3871.

Schindler, D. 2010. Tar sands need solid science. *Nature*, 468:499-501. 10.1038/468499a.

Schindler, D.W. 2014. Unravelling the complexity of pollution by the oil sands industry. *Proceedings of the National Academy of Sciences of the United States of America*, 111:3209-3210.

Schmidt, E., Wacker, B. and Peuker, U.A. 2014. The non-aqueous processing of Canadian oil sand. *Chemie Ingenieur Technik*, 86:821-830.

Schramm, L.L., Kramers, J.W. and Isaacs, E.E. 2010. Saskatchewan's place in Canadian oil sands. *Journal of Canadian Petroleum Technology*, 49:12-21.

Schuster, J.K., Harner, T., Su, K., Mihele, C. and Eng, A. 2015. First results from the oil sands passive air monitoring network for polycyclic aromatic compounds. *Environ. Sci. Technol.*, 49:2991-2998.

Schuster, J.K., Harner, T., Su, K., Eng, A., Wnorowski, A. and Charland, J.P. 2019. Temporal and spatial trends of polycyclic aromatic compounds in air across the Athabasca Oil Sands Region reflect inputs from open pit mining and forest fires. *Environmental Science & Technology Letters*, 6:178-183. 10.1021/acs.estlett.9b00010.

Schutte, R., Thompson, G.R., Donkor, K.K., Duke, M.M.J.M., Cowles, R., Li, X.P. and Kratochvil, B. 1999. Estimation of particle size distribution in Athabasca oil sands by indirect instrumental neutron activation analysis. *Canadian Journal of Chemistry-Revue Canadienne de Chimie*, 77:1626-1637.

Schwalb, A.N., Alexander, A.C., Paul, A.J., Cottenie, K. and Rasmussen, J.B. 2015. Changes in migratory fish communities and their health, hydrology, and water chemistry in rivers of the Athabasca oil sands region: a review of historical and current data. *Environmental Reviews*, 23:133-150. 10.1139/er-2014-0065.

Scott, A.C., MacKinnon, M.D. and Fedorak, P.M. 2005. Naphthenic acids in athabasca oil sands tailings waters are less biodegradable than commercial naphthenic acids. *Environ. Sci. Technol.*, 39:8388-8394.

Scott, K.A., Wissel, B., Gibson, J.J. and Birks, S.J. 2010. Chemical characteristics and acid sensitivity of boreal headwater lakes in northwest Saskatchewan. *J. Limnol*, 69:33-44.

Seitz, N.E., Westbrook, C.J. and Noble, B.F. 2011. Bringing science into river systems cumulative effects assessment practice. *Environmental Impact Assessment Review*, 31:172-179. 10.1016/j.eiar.2010.08.001.

Seitz, N.E., Westbrook, C.J., Dube, M.G. and Squires, A.J.

2013. Assessing large spatial scale landscape change effects on water quality and quantity response in the lower Athabasca River basin. *Integrated Environmental Assessment and Management*, 9:392-404. 10.1002/ieam.1336.

Services, L.E. 2007. Compliance survey 26-1 FGD Stack. Edmonton, AB, Canada. (Accessed August 15, 2019)

Sharma, J., Moore, R.G. and Mehta, R. 2012. Effect of methane co-injection in SAGD-analytical and simulation study. *Spe Journal*, 17:687-704.

Sharma, P., Kostarelos, K. and Palayangoda, S.S. 2019. Hydrocarbon recovery from oil sands by cyclic surfactant solubilization in single-phase microemulsions. *Journal of Energy Resources Technology-Transactions of the Asme*, 141:10.1115/1.4042715.

Shaw, R.C. and Kratochvil, B. 1990. Near infrared diffuse reflectance analysis of Athabasca oil sand. *Anal. Chem*, 62:167-174.

Shephard, M.W., McLinden, C.A., Cady-Pereira, K.E., Luo, M., Moussa, S.G., Leithead, A., Liggio, J., Staebler, R.M., Akingunola, A., Makar, P., Lehr, P., Zhang, J., Henze, D.K., Millet, D.B., Bash, J.O., Zhu, L., Wells, K.C., Capps, S.L., Chaliyakunnel, S., Gordon, M., Hayden, K., Brook, J.R., Wolde, M. and Li, S.M. 2015. Tropospheric Emission Spectrometer (TES) satellite observations of ammonia, methanol, formic acid, and carbon monoxide over the Canadian oil sands: validation and model evaluation. *Atmos. Meas. Tech.*, 8:5189-5211. 10.5194/amt-8-5189-2015.

Sheremata, J.M., Gray, M.R., Dettman, H.D. and McCaffrey, W.C. 2004. Quantitative molecular representation and sequential optimization of Athabasca asphaltenes. *Energy & Fuels*, 18:1377-1384.

Shi, X.W., Wang, J.Y., Gong, L., Luo, H., Li, J.K., Fattahpour, V., Mahmoudi, M., Roostaei, M., Fermaniuk, B., Luo, J.L. and Zeng, H.B. 2019. Investigation of the antifouling mechanism of electroless nickel - phosphorus coating against sand and bitumen. *Energy & Fuels*, 33:6350-6360. 10.1021/acs.energyfuels.9b01212.

Shiell, L. and Loney, S. 2007. Global warming damages and Canada's oil sands. *Canadian Public Policy-Analyse de Politiques*, 33:419-440.

Shotyk, W., Belland, R., Duke, J., Kempter, H., Krachler, M., Noernberg, T., Pelletier, R., Vile, M.A., Wieder, K., Zaccone, C. and Zhang, S.Q. 2014. Sphagnum mosses from 21 Ombrotrophic bogs in the Athabasca bituminous sands region show no significant atmospheric contamination of "heavy metals". *Environ. Sci. Technol.*, 48:12603-12611. 10.1021/es503751v.

Shotyk, W., Belland, R., Duke, J., Kempter, H., Krachler, M., Noernberg, T., Pelletier, R., Vile, M.A., Wieder, K., Zaccone, C. and Zhang, S.Q. 2015. Response to Comment on "Sphagnum mosses from 21 ombrotrophic bogs in the Athabasca bituminous sands region show no significant atmospheric contamination of 'heavy metals'". *Environ. Sci. Technol.*, 49:6354-6357. 10.1021/acs.est.5b01229.

Shotyk, W., Appleby, P.G., Bicalho, B., Davies, L., Froese, D., Grant-Weaver, I., Krachler, M., Magnan, G., Mullan-Boudreau, G., Noernberg, T., Pelletier, R., Shannon, B., van Bellen, S. and Zaccone, C. 2016. Peat bogs in northern Alberta, Canada reveal decades of declining atmospheric Pb contamination. *Geophysical Research Letters*, 43:9964-9974. 10.1002/2016gl070952.

Shotyk, W., Bicalho, B., Cuss, C.W., Duke, M.J.M., Noernberg, T., Pelletier, R., Steinnes, E. and Zaccone, C. 2016. Dust is the dominant source of "heavy metals" to peat moss (Sphagnum fuscum) in the bogs of the Athabasca Bituminous Sands region of northern Alberta. *Environ. Intl.*, 92-93:494-506. 10.1016/j.envint.2016.03.018.

Shotyk, W., Appleby, P.G., Bicalho, B., Davies, L.J., Froese, D., Grant-Weaver, I., Magnan, G., Mullan-Boudreau, G., Noernberg, T., Pelletier, R., Shannon, B., van Bellen, S. and Zaccone, C. 2017. Peat bogs document decades of declining atmospheric contamination by trace metals in the Athabasca bituminous sands region. *Environ. Sci. Technol.*, 51:6237-6249. 10.1021/acs.est.6b04909.

Shotyk, W., Bicalho, B., Cuss, C.W., Donner, M.W., Grant-Weaver, I., Haas-Neill, S., Javed, M.B., Krachler, M., Noernberg, T., Pelletier, R. and Zaccone, C. 2017. Trace metals in the dissolved fraction (<0.45m) of the lower Athabasca River: Analytical challenges and environmental implications. *Sci Total Environ*, 580:660-669.

Shotyk, W., Bicalho, B., Cuss, C.W., Donner, M.W., Grant-Weaver, L., Haas-Neill, S., Javed, M.B., Krachler, M., Noernberg, T., Pelletier, R. and Zaccone, C. 2017. Trace metals in the dissolved fraction (< 0.45 mu m) of the lower Athabasca River: Analytical challenges and environmental implications. *Sci. Total Environ*, 580:660-669. 10.1016/j.scitotenv.2016.12.012.

Shotyk, W., Bicalho, B., Cuss, C.W., Grant-Weaver, L., Nagel, A., Noernberg, T., Poesch, M. and Sinnatamby, N.R. 2019. Bioaccumulation of Tl in otoliths of Trout-perch (Percopsis omiscomaycus) from the Athabasca River, upstream and downstream of bitumen mining and upgrading. *Sci. Total Environ*, 650:2559-2566. 10.1016/j.scitotenv.2018.09.318.

Shrestha, N.K., Du, X.Z. and Wang, J.Y. 2017. Assessing climate change impacts on fresh water resources of the Athabasca River Basin, Canada. *Sci. Total Environ*, 601:425-440. 10.1016/j.scitotenv.2017.05.013.

Shrestha, N.K., Thomas, B.W., Du, X.Z., Hao, X.Y. and Wang, J. 2018. Modeling nitrous oxide emissions from rough fescue grassland soils subjected to long-term grazing of different intensities using the Soil and Water Assessment Tool (SWAT). *Environmental Science and Pollution Research*, 25:27362-27377. 10.1007/s11356-018-2719-2.

Shrestha, N.K. and Wang, J.Y. 2018. Current and future hot-spots and hot-moments of nitrous oxide emission in a cold climate river basin. *Environ. Pollut.*, 239:648-660. 10.1016/j.envpol.2018.04.068.

Shun, D., Shin, J.S., Bae, D.H., Ryu, H.J. and Park, J. 2017. A comparison of fluidized bed pyrolysis of oil sand from Utah, USA, and Alberta, Canada. *Korean Journal of Chemical Engineering*, 34:3125-3131. 10.1007/s11814-017-0233-8.

Siddique, T., Fedorak, P.M. and Foght, J.M. 2006.

Biodegradation of short-chain n-alkanes in oil sands tailings under methanogenic conditions. *Environ. Sci. Technol.*, 40:5459-5464. 10.1021/es060993m.

Siddique, T., Fedorak, P.M., McKinnon, M.D. and Foght, J.M. 2007. Metabolism of BTEX and naphtha compounds to methane in oil sands tailings. *Environ. Sci. Technol.*, 41:2350-2356. 10.1021/es062852q.

Siddique, T., Gupta, R., Fedorak, P.M., MacKinnon, M.D. and Foght, J.M. 2008. A first approximation kinetic model to predict methane generation from an oil sands tailings settling basin. *Chemosphere*, 72:1573-1580. 10.1016/j.chemosphere.2008.04.036.

Siddique, T., Penner, T., Semple, K. and Foght, J.M. 2011. Anaerobic biodegradation of longer-chain n-alkanes coupled to methane production in oil sands tailings. *Environ. Sci. Technol.*, 45:5892-5899. 10.1021/es200649t.

Siddique, T., Penner, T., Klassen, J., Nesbo, C. and Foght, J.M. 2012. Microbial communities ionvolved in methane production from hydrocarbons in oil sands tailings. *Environ. Sci. Technol.*, 46:9802-9810. 10.1021/e53022024.

Simmons, D.B.D. and Sherry, J.P. 2016. Plasma proteome profiles of White Sucker (Catostomus commersonii) from the Athabasca River within the oil sands deposit. *Comparative Biochemistry and Physiology D-Genomics & Proteomics*, 19:181-189. 10.1016/j.cbd.2016.03.003.

Simpson, I.J., Blake, N.J., Barletta, B., Diskin, G.S., Fuelberg, H.E., Gorham, K., Huey, L.G., Meinardi, S., Rowland, F.S., Vay, S.A., Weinheimer, A.J., Yang, M. and Blake, D.R. 2010. Characterization of trace gases measured over Alberta oil sands mining operations: 76 speciated C-2-C-10 volatile organic compounds (VOCs), CO2, CH4, CO, NO, NO2, NOy, O-3 and SO2. *Atmos. Chem. Phys*, 10:11931-11954. 10.5194/acp-10-11931-2010.

Sinnatamby, R.N., Loewen, T.N., Luo, Y., Pearson, D.G., Bicalho, B., Grant-Weaver, I., Cuss, C.W., Poesch, M. and Shotyk, W. 2019. Spatial assessment of major and trace element concentrations from Lower Athabasca Region Trout-perch (Percopsis omiscomaycus) otoliths. *Sci. Total Environ*, 655:363-373. 10.1016/j.scitotenv.2018.11.168.

Sioris, C.E., McLinden, C.A., Shephard, M.W., Fioletov, V.E. and Abboud, I. 2016. Assessment of the aerosol optical depths measured by satellite-based passive remote sensors in the Alberta oil sands region. *Atmos. Chem. Phys. Discuss.*, 2016:1-25. 10.5194/acp-2016-748.

Sioris, C.E., McLinden, C.A., Shephard, M.W., Fioletov, V.E. and Abboud, I. 2017. Assessment of the aerosol optical depths measured by satellite-based passive remote sensors in the Alberta oil sands region. *Atmos. Chem. Phys*, 17:1931-1943. 10.5194/acp-17-1931-2017.

Sleep, S., Laurenzi, I.J., Bergerson, J.A. and MacLean, H.L. 2018. Evaluation of variability in greenhouse gas intensity of Canadian oil sands surface mining and upgrading operations. *Environ. Sci. Technol.*, 52:11941-11951. 10.1021/acs.est.8b03974.

Small, C.C., Hashisho, Z. and Ulrich, A.C. 2012. Preparation and characterization of activated carbon from oil sands coke. *Fuel*, 92:69-76.

Small, C.C., Ulrich, A.C. and Hashisho, Z. 2012. Adsorption of acid extractable oil sands tailings organics onto raw and activated oil sands coke. *Journal of Environmental Engineering-Asce*, 138:833-840. 10.1061/(asce)ee.1943-7870.0000543.

Small, C.C., Cho, S., Hashisho, Z. and Ulrich, A.C. 2015. Emissions from oil sands tailings ponds: Review of tailings pond parameters and emission estimates. *Journal of Petroleum Science and Engineering*, 127:490-501. 10.1016/j.petrol.2014.11.020.

Smith, S.B. 1981. Alberta oil sands environmental research program 1975-1980: Summary report. S.B. Smith Environmental Consultants Limited, Calgary, AB, Canada. https://era.library.ualberta.ca/items/76337388-362d-4732-bf52-061dfc3de694 (Accessed August 15, 2019)

Smith, D.F., Schaub, T.M., Kim, S., Rodgers, R.P., Rahimi, P., Teclemariam, A. and Marshall, A.G. 2008. Characterization of acidic species in Athabasca bitumen and bitumen heavy vacuum gas oil by negative-ion ESI FT-ICR MS with and without acid-ion exchange resin prefractionation. *Energy & Fuels*, 22:2372-2378.

Smith, C.E. 2011. Oil sands will reach US without Keystone XL line, report says. *Oil & Gas Journal*, 109:36-37.

Snow, N. 2011. Alberta oil sands regulation. *Oil & Gas Journal*, 109:25-25.

Sparks, B.D., Kotlyar, L.S., O'Carroll, J.B. and Chung, K.H. 2003. Athabasca oil sands: effect of organic coated solids on bitumen recovery and quality. *Journal of Petroleum Science and Engineering*, 39:417-430.

Speta, M., Rivard, B., Feng, J.L., Lipsett, M. and Gingras, M. 2015. Hyperspectral imaging for the determination of bitumen content in Athabasca oil sands core samples. *Aapg Bulletin*, 99:1245-1259. 10.1306/03021514121.

Squires, A.J., Dube, M.G. and Rozon-Ramilo, L.D. 2013. Assessing the sublethal effects of in-river concentrations of parameters contributing to cumulative effects in the Athabasca river basin using a fathead minnow bioassay. *Environmental Toxicology and Chemistry*, 32:662-672. 10.1002/etc.2081.

Stachiw, S., Bicalho, B., Grant-Weaver, I., Noernberg, T. and Shotyk, W. 2019. Trace elements in berries collected near upgraders and open pit mines in the Athabasca Bituminous Sands Region (ABSR): Distinguishing atmospheric dust deposition from plant uptake. *Sci. Total Environ*, 670:849-864. https://doi.org/10.1016/j.scitotenv.2019.03.238.

Strandman, S., Vachon, R., Dini, M., Giasson, S. and Zhu, X.X. 2018. Polyacrylamides revisited: flocculation of kaolin suspensions and mature fine tailings. *Canadian Journal of Chemical Engineering*, 96:20-26. 10.1002/cjce.22940.

Strausz, O.P., Mojelsky, T.W. and Lown, E.M. 1992. The molecular structure of asphaltene - An unfolding story. *Fuel*, 71:1355-1363.

Strausz, O.P., Morales-Izquierdo, A., Kazmi, N., Montgomery, D.S., Payzant, J.D., Safarik, I. and Murgich, J. 2010. Chemical composition of Athabasca bitumen: The saturate fraction. *Energy & Fuels*, 24:5053-5072.

Strausz, O.P., Lown, E.M., Morales-Izquierdo, A., Kazmi,

N., Montgomery, D.S., Payzant, J.D. and Murgich, J. 2011. Chemical composition of Athabasca bitumen: The distillable aromatic fraction. (Accessed March 1, 2017)

Stringham, G. 2012. Energy developments in Canada's oil sands, E.Percy, K. (Ed.) *Alberta Oil Sands: Energy, Industry, and the Environment,* Amsterdam, The Netherlands: Elsevier. 19-34. http://www.sciencedirect.com/science/article/pii/B9780080977607000020

Stroud, C.A., Makar, P.A., Zhang, J.H., Moran, M.D., Akingunola, A., Li, S.M., Leithead, A., Hayden, K. and Siu, M. 2018. Improving air quality model predictions of organic species using measurement-derived organic gaseous and particle emissions in a petrochemical-dominated region. *Atmos. Chem. Phys*, 18:13531-13545. 10.5194/acp-18-13531-2018.

Studabaker, W.B., Krupa, S., Jayanty, R.K.M. and Raymer, J.H. 2012. Measurement of polynuclear aromatic hydrocarbons (PAHs) in epiphytic lichens for receptor modeling in the Athabasca Oil Sands Region (AOSR): A pilot study, Percy, K.E. (Ed.) *Alberta Oil Sands: Energy, Industry, and the Environment,* Amsterdam, The Netherlands: Elsevier. 391-425. http://www.sciencedirect.com/science/article/pii/B9780080977607000172

Summers, J.C., Kurek, J., Kirk, J.L., Muir, D.C.G., Wang, X.W., Wiklund, J.A., Cooke, C.A., Evans, M.S. and Smol, J.P. 2016. Recent warming, rather than industrial emissions of bioavailable nutrients, is the dominant driver of lake primary production Shifts across the Athabasca oil sands region. *Plos One*, 11:10.1371/journal.pone.0153987.

Sun, N.A., Chelme-Ayala, P., Klamerth, N., McPhedran, K.N., Islam, M.S., Perez-Estrada, L., Drzewicz, P., Blunt, B.J., Reichert, M., Hagen, M., Tierney, K.B., Belosevic, M. and El-Din, M.G. 2014. Advanced analytical mass spectrometric techniques and bioassays to characterize untreated and ozonated oil sands process-affected water. *Environ. Sci. Technol.*, 48:11090-11099.

Sun, C.X., Shotyk, W., Cuss, C.W., Donner, M.W., Fennell, J., Javed, M., Noernberg, T., Poesch, M., Pelletier, R., Sinnatamby, N., Siddique, T. and Martin, J.W. 2017. Characterization of naphthenic acids and other dissolved organics in natural water from the Athabasca oil sands region, Canada. *Environ. Sci. Technol.*, 51:9524-9532. 10.1021/acs.est.7b02082.

Suvarna, M., Divakaran, M. and Nduagu, E.I. 2019. Process modelling and simulation of bitumen mining and recovery from oil sands. *Minerals Engineering*, 134:65-76. 10.1016/j.mineng.2018.12.024.

Swart, N.C. and Weaver, A.J. 2012. Commentary: The Alberta oil sands and climate. *Nature Climate Change*, 2:134-136.

Syncrude 2006. Application for renewal of Syncrude Canada Ltd.'s approvals under the Alberta Environmental Protection and Enhancement Act: Section C.1, Nature of the activity: General information. Syncrude Canada Ltd., Fort McMurray, AB, Canada. 2 (Accessed August 15, 2019)

Ta, C.H., Ingolfsson, A. and Doucette, J. 2013. A linear model for surface mining haul truck allocation incorporating shovel idle probabilities. *European Journal of Operational Research*, 231:770-778.

Tamer, M. and Gates, I.D. 2012. Impact of different SAGD well configurations (Dover SAGD Phase B case study). *Journal of Canadian Petroleum Technology*, 51:32-45.

Tamiz Bakhtiari, M., Harbottle, D., Curran, M., Ng, S., Spence, J., Siy, R., Liu, Q., Masliyah, J. and Xu, Z.H. 2015. Role of caustic addition in bitumen-clay interactions. *Energy & Fuels*, 29:58-69. doi: 10.1021/ef502088z.

Tang, J., Chen, X.N., Zhang, Y.M., Lu, C.X. and Shen, Z.Y. 2012. Minimum fluidisation velocities of burned oil sand particles. *Canadian Journal of Chemical Engineering*, 90:1494-1501.

Tarun, C.B., Croiset, E., Douglas, P.L., Gupta, M. and Chowdhury, M.H.M. 2007. Techno-economic study of CO2 capture from natural gas based hydrogen plants. *International Journal of Greenhouse Gas Control*, 1:55-61.

Tenenbaum, D.J. 2009. Oil sands development: A health risk worth taking? *Environ Health Perspect*, 117:A150-A156.

Thienpont, J.R., Desjardins, C.M., Kimpe, L.E., Korosi, J.B., Kokelj, S.V., Palmer, M.J., Muir, D.C.G., Kirk, J.L., Smol, J.P. and Blais, J.M. 2017. Comparative histories of polycyclic aromatic compound accumulation in lake sediments near petroleum operations in western Canada. *Environ. Pollut.*, 231:13-21. 10.1016/j.envpol.2017.07.064.

Timblin, L.O. 2009. Efficiency and environmental effects in the oil sands of Alberta. *Physics Today*, 62:8-8.

Timoney, K.P. and Marsh, J. 2004. Lichen trimlines in northern Alberta: Establishment, growth rates, and historic water levels. *Bryologist*, 107:429-440.

Timoney, K.P. and Marsh, J. 2005. Lichen trimlines in the Peace-Athabasca delta: Variations in flora, form, and disturbance regime. *Canadian Field-Naturalist*, 119:76-81.

Timoney, K. 2006. Landscape cover change in the Peace-Athabasca Delta, 1927-2001. *Wetlands*, 26:765-778.

Timoney, K.P. and Lee, P. 2009. Does the Alberta tar sands industry pollute? The scientific evidence. *Open Conservation Biology Journal*, 3:65-81.

Timoney, K.P. and Lee, P. 2011. Polycyclic aromatic hydrocarbons increase in Athabasca River delta sediment: Temporal trends and environmental correlates. *Environ. Sci. Technol.*, 45:4278-4284.

Timoney, K. 2012. Environmental and health impacts of Canada's bitumen industry: In search of answers. *Environ. Sci. Technol.*, 46:2496-2497.

Tippee, B. 2012. Oil sands alliance forms to build on environmental gains. *Oil & Gas Journal*, 110:27-27.

Tokarek, T.W., Huo, J.A., Odame-Ankrah, C.A., Hammoud, D., Taha, Y.M. and Osthoff, H.D. 2014. A gas chromatograph for quantification of peroxycarboxylic nitric anhydrides calibrated by thermal dissociation cavity ring-down spectroscopy. *Atmos. Meas. Tech.*, 7:3263-3283.

Tokarek, T.W., Odame-Ankrah, C.A., Huo, J.A., McLaren, R., Lee, A.K.Y., Adam, M.G., Willis, M.D., Abbatt, J.P.D., Mihele, C., Darlington, A., Mittermeier, R.L., Strawbridge, K., Hayden, K.L., Olfert, J.S., Schnitzler, E.G., Brownsey, D.K., Assad, F.V., Wentworth, G.R., Tevlin, A.G., Worthy, D.E.J., Li, S.M., Liggio, J., Brook, J.R. and Osthoff, H.D. 2018. Principal component analysis of summertime ground site measurements in the Athabasca oil sands with a focus on analytically unresolved intermediate-volatility organic compounds. *Atmos. Chem. Phys*, 18:17819-17841. 10.5194/acp-18-17819-2018.

Tollefsen, K.E., Petersen, K. and Rowland, S.J. 2012. Toxicity of synthetic naphthenic acids and mixtures of these to fish liver cells. *Environ. Sci. Technol.*, 46:5143-5150.

Tolton, J.L., Young, R.F., Wismer, W.V. and Fedorak, P.M. 2012. Fish tainting in the Alberta oil sands region:A review of current knowledge. *Water Quality Research Journal of Canada*, 47:1-13.

Toor, N.S., Franz, E.D., Fedorak, P.M., MacKinnon, M.D. and Liber, K. 2013. Degradation and aquatic toxicity of naphthenic acids in oil sands process-affected waters using simulated wetlands. *Chemosphere*, 90:449-458.

Touzi, R., Omari, K., Sleep, B. and Jiao, X. 2018. Scattered and received wave polarization optimization for enhanced peatland classification and fire damage assessment using polarimetric PALSAR. *Ieee Journal of Selected Topics in Applied Earth Observations and Remote Sensing*, 11:4452-4477. 10.1109/jstars.2018.2873740.

Tu, Y., Li, Z.F., Pleizier, G., Ng, S. and Chung, K.H. 2004. Separation and characterisation of problematic solids from athabasca oil sands and waste unit samples. *Canadian Journal of Chemical Engineering*, 82:678-686.

Turchenek, L.W., Abboud, S.A. and Holowaychuk, N. 1988. Modeling soil response to acid deposition in Alberta. *Communications in Soil Science and Plant Analysis*, 19:805-818. 10.1080/00103628809367977.

Turcotte, I. and Quideau, S.A. 2012. Phenolic profiles in natural and reconstructed soils from the oil sands region of Alberta. *Canadian Journal of Soil Science*, 92:153-164.

Upreti, S.R., Lohi, A., Kapadia, R.A. and El-Haj, R. 2007. Vapor extraction of heavy oil and bitumen: A review. *Energy & Fuels*, 21:1562-1574.

Usher, P.J. 2000. Traditional ecological knowledge in environmental assessment and management. *Arctic*, 53:10.14430/arctic849.

van Bellen, S., Magnan, G., Davies, L., Froese, D., Mullan-Boudreau, G., Zaccone, C., Garneau, M. and Shotyk, W. 2018. Testate amoeba records indicate regional 20th-century lowering of water tables in ombrotrophic peatlands in central-northern Alberta, Canada. *Global Change Biology*, 24:2758-2774. 10.1111/gcb.14143.

Van den Heuvel, M.R., Hogan, N.S., Roloson, S.D. and Van der Kraak, G.J. 2012. Reproductive development of yellow perch (Perca flavescens) exposed to oil sands-affected waters. *Environmental Toxicology and Chemistry*, 31:654-662.

Vignet, C., Frank, R.A., Yang, C., Wang, Z., Shires, K., Bree, M., Sullivan, C., Norwood, W.P., Hewitt, L.M., McMaster, M.E. and Parrott, J.L. 2019. Long-term effects of an early-life exposure of fathead minnows to sediments containing bitumen. Part I: Survival, deformities, and growth. *Environ. Pollut.*, 251:246-256. 10.1016/j.envpol.2019.05.007.

Vijayaraghavan, K., Cho, S., Morris, R., Spink, D., Jung, J.G., Pauls, R. and Duffett, K. 2016. Photochemical model evaluation of the ground-level ozone impacts on ambient air quality and vegetation health in the Alberta oil sands region: Using present and future emission scenarios. *Atmos. Environ.*, 141:209-218. 10.1016/j.atmosenv.2016.06.053.

Vijayaraghavan, V., Lau, E.V., Goyal, A., Niu, X.D., Garg, A. and Gao, L. 2019. Design of explicit models for predicting the efficiency of heavy oil-sand detachment process by floatation technology. *Measurement*, 137:122-129. 10.1016/j.measurement.2019.01.074.

Vittoratos, E. and Kovscek, A.R. 2019. Doctrines and realities in viscous and heavy-oil reservoir engineering. *Journal of Petroleum Science and Engineering*, 178:1164-1177. 10.1016/j.petrol.2019.03.044.

Volik, O., Petrone, R.M., Hall, R.I., Macrae, M.L., Wells, C.M. and Price, J.S. 2018. Organic matter accumulation and salinity change in open water areas within a saline boreal fen in the Athabasca Oil Sands Region, Canada. *Catena*, 165:425-433. 10.1016/j.catena.2018.02.028.

Volik, O., Petrone, R.M., Wells, C.M. and Price, J.S. 2018. Impact of salinity, hydrology and vegetation on long-term carbon accumulation in a saline boreal peatland and its implication for peatland reclamation in the Athabasca oil sands region. *Wetlands*, 38:373-382. 10.1007/s13157-017-0974-5.

Wade, K.S., Brown, S.G. and Roberts, P.T. 2007. Characterization of ambient air quality in the oil sands area of northern Alberta. Sonoma Technology, Inc., Petaluma, CA. (Accessed August 15, 2019)

Wang, Z.L. and Naterer, G.F. 2010. Greenhouse gas reduction in oil sands upgrading and extraction operations with thermochemical hydrogen production. *International Journal of Hydrogen Energy*, 35:11816-11828.

Wang, X.L., Watson, J.G., Chow, J.C., Kohl, S.D., Chen, L.-W.A., Sodeman, D.A., Legge, A.H. and Percy, K.E. 2012. Measurement of real-world stack emissions with a dilution sampling system, Percy, K.E. (Ed.) *Alberta Oil Sands: Energy, Industry, and the Environment,* Amsterdam, The Netherlands: Elsevier Press. 171-192. https://www.researchgate.net/publication/235341714_Measurement_of_Real-World_Stack_Emissions_with_a_Dilution_Sampling_System

Wang, Q., Jia, C.X., Jiang, Q.Q., Wang, Y. and Wu, D.Y. 2014. Pyrolysis model of oil sand using thermogravimetric analysis. *Journal of Thermal Analysis and Calorimetry*, 116:499-509.

Wang, Z.D., Yang, C., Parrott, J.L., Frank, R.A., Yang, Z., Brown, C.E., Hollebone, B.P., Landriault, M., Fieldhouse, B., Liu, Y., Zhang, G. and Hewitt, L.M. 2014. Forensic source differentiation of petrogenic, pyrogenic, and biogenic hydrocarbons in Canadian oil sands

environmental samples. *Journal of Hazardous Materials*, 271:166-177.

Wang, X.L., Chow, J.C., Kohl, S.D., Percy, K.E., Legge, A.H. and Watson, J.G. 2015. Characterization of $PM_{2.5}$ and PM_{10} fugitive dust source profiles in the Athabasca Oil Sands Region. *J. Air Waste Manage. Assoc.*, 65:1421-1433.

Wang, X.L., Chow, J.C., Kohl, S.D., Yatavelli, R.L.N., Percy, K.E., Legge, A.H. and Watson, J.G. 2015. Wind erosion potential for fugitive dust sources in the Athabasca Oil Sands Region. *Aeolian Res.*, 18:121-134.

Wang, C.J., Klamerth, N., Huang, R.F., Elnakar, H. and El-Din, M.G. 2016. Oxidation of oil sands process-affected water by potassium ferrate(VI). *Environ. Sci. Technol.*, 50:4238-4247. 10.1021/acs.est.5b04829.

Wang, X.L., Chow, J.C., Kohl, S.D., Percy, K.E., Legge, A.H. and Watson, J.G. 2016. Real-world emission factors for Caterpillar 797B heavy haulers during mining operations. *Particuology*, 28:22-30. http://dx.doi.org/10.1016/j.partic.2015.07.001.

Wang, X.L., Kohl, S.D., Chow, J.C. and Watson, J.G. 2016. Characterization of real-world emissions from heavy haulers and dozers in Syncrude. Desert Research Institute, Reno, NV. (Accessed August 15, 2019)

Wang, X.M., Kasperski, K., Cook, A. and Ilko, A. 2018. Preliminary studies on the impact of in situ oil sand extraction methods on the movement of water soluble organics and inorganics by a pilot scale test. *Environmental Science-Water Research & Technology*, 4:1124-1132. 10.1039/c8ew00279g.

Wang, H.W., Chao, L., Wei, X.F., Qi, X.W., Li, J.L., Jiang, L.H., Li, W.Z. and Jia, P.H. 2019. Design and preparation of flocculant with self-degrading characteristics for dewatering of oil sand tailings. *Journal of Dispersion Science and Technology*, 10.1080/01932691.2019.1634586.

Wang, H.W., Zhang, Y.K., Wang, G.Q., Ma, Y., Pu, H.Q., Xu, W.J.B., Gao, D.K., Zhang, Q.K., Xu, H.C., Wang, B.Z., Qi, X.W. and Yang, J. 2019. A molecular-based design of RGO/TiO2-PAM composite flocculant with photocatalytic self-degrading characteristics and the application of the oil sand tailings flocculant. *Acs Sustain Chem Eng*, 7:6758-6768. 10.1021/acssuschemeng.8b06041.

Wanvik, T.I. and Caine, K. 2017. Understanding indigenous strategic pragmatism: Metis engagement with extractive industry developments in the Canadian North. *Extractive Industries and Society-an International Journal*, 4:595-605. 10.1016/j.exis.2017.04.002.

Watkins, E. 2012. Canada, Alberta commit to 'improve' environmental monitoring of oil sands. *Oil & Gas Journal*, 110:16-17.

Watkins, E. 2012. IHS CERA: Canadian oil sands regs 'similar to Australia, Alaska'. *Oil & Gas Journal*, 110:21-22.

Watmough, S.A., Whitfield, C.J. and Fenn, M.E. 2014. The importance of atmospheric base cation deposition for preventing soil acidification in the Athabasca Oil Sands Region of Canada. *Sci. Total Environ*, 493:1-11.

Watmough, S.A., Bird, A., McDonough, A. and Grimm, E. 2019. Forest fertilization associated with oil sands emissions. *Ecosystems*, 22:1-14. 10.1007/s10021-018-0249-x.

Watson, J.G. and Chow, J.C. 2008. Real-world emissions characterization and data uses in Northern Alberta. Desert Research Institute, Reno, NV, USA. https://mafiadoc.com/real-world-emissions-characterization-and-data-_598ea9f51723ddcc692f0fce.html (Accessed August 15, 2019)

Watson, J.G., Chow, J.C., Wang, X.L. and Kohl, S.D. 2010. Emission characterization plans for the Athabasca Oil Sands Region, Tropp, R.J. and Legge, A.H. (Eds.), *Proceedings, 103rd Annual Meeting of the Air & Waste Management Association,* Pittsburgh, PA: Air & Waste Management Association. 1-6.

Watson, J.G., Chow, J.C., Wang, X.L., Kohl, S.D. and Gronstal, S. 2011. Winter stack emissions measured with a dilution sampling system. Desert Research Institute, Reno, NV. (Accessed August 15, 2019)

Watson, J.G., Chow, J.C., Wang, X.L., Lowenthal, D.H., Kohl, S.D. and Gronstal, S. 2011. Real-world emissions from non-road mining trucks. Desert Research Institute, Reno, NV. (Accessed August 15, 2019)

Watson, J.G., Chow, J.C., Wang, X.L., Kohl, S.D., Chen, L.-W.A. and Etyemezian, V.R. 2012. Overview of real-world emission characterization methods, Percy, K.E. (Ed.) *Alberta Oil Sands: Energy, Industry, and the Environment,* Amsterdam, The Netherlands: Elsevier Press. 145-170. https://www.researchgate.net/publication/235341867_Overview_of_Real-World_Emission_Characterization_Methods

Watson, J.G., Chow, J.C., Wang, X.L., Kohl, S.D., Gronstal, S. and Zielinska, B. 2013. Measurement of real-world stack emissions in the Athabasca Oil Sands Region with a dilution sampling system during March, 2011. Desert Research Institute, Reno, NV, USA. (Accessed August 15, 2019)

Watson, J.G., Chow, J.C., Wang, X.L., Kohl, S.D. and Sodeman, D.A. 2013. Measurement of real-world stack emissions in the Athabasca Oil Sands Region with a dilution sampling system during August, 2008. Desert Research Institute, Reno, NV, USA. (Accessed August 15, 2019)

Watson, J.G., Chow, J.C., Wang, X.L., Lowenthal, D.H., Kohl, S.D. and Gronstal, S. 2013. Characterization of real-world emissions from nonroad mining trucks in the Athabasca Oil Sands Region during October, 2010. Desert Research Institute, Reno, NV. (Accessed August 15, 2019)

Watson, J.G., Chow, J.C., Wang, X.L., Zielinska, B., Kohl, S.D. and Gronstal, S. 2013. Characterization of real-world emissions from nonroad mining trucks in the Athabasca Oil Sands Region during September, 2009. Desert Research Institute, Reno, NV. (Accessed August 15, 2019)

Watson, J.G., Chow, J.C., Kohl, S.D., Yatavelli, R.L.N. and Wang, X.L. 2014. Windblown fugitive dust characterization in the oil sands region. *WBEA@Work*,

November:7-13.
Watson, J.G., Chow, J.C., Wang, X.L. and Kohl, S.D. 2014. Chemical source profiles for geological dust samples from the Athabasca Oil Sands Region. Desert Research Institute, Reno, NV. (Accessed August 15, 2019)
Watson, J.G., Chow, J.C., Wang, X.L. and Kohl, S.D. 2014. Windblown fugitive dust characterization in the Athabasca Oil Sands Region. Desert Research Institute, Reno, NV. (Accessed August 15, 2019)
Watson, J.G., Altshuler, S.L. and Chow, J.C. 2019. Critical review discussion supplement: Oil sands research bibliography. *J. Air Waste Manage. Assoc.*, 69:S1-S36.
Wayland, M., Headley, J.V., Peru, K.M., Crosley, R. and Brownlee, B.G. 2008. Levels of polycyclic aromatic hydrocarbons and dibenzothiophenes in wetland sediments and aquatic insects in the oil sands area of Northeastern Alberta, Canada. *Environ. Mon. Assess*, 136:167-182.
WBEA 2014. Southern air monitoring plan. Wood Buffalo Environmental Association, Fort McMurray, AB, Canada. http://wbea.org/download/wbea_wbea_southern_air_monitoring_plan_2014.pdf (Accessed August 15, 2019)
WBEA 2015. Annual report 2014. Wood Buffalo Environmental Association, Fort McMurray, AB, Canada. http://wbea.org/download/wbea_2014_annual_report.pdf (Accessed August 15, 2019)
WBEA 2017. Integrated monitoring program annual report: Particulate matter (PM2.5) metals data summary 2016. Wood Buffalo Environmental Association, Ft McMurray, AB, Canada. (Accessed August 15, 2019)
WBEA 2019. Wood Buffalo Environmental Association. Wood Buffalo Environmental Association, Ft McMurray, AB, Canada. http://www.wbea.org/ (Accessed August 15, 2019)
Webster, K.L., Beall, F.D., Creed, I.F. and Kreutzweiser, D.P. 2015. Impacts and prognosis of natural resource development on water and wetlands in Canada's boreal zone. *Environmental Reviews*, 23:78-131. 10.1139/er-2014-0063.
Weinhold, B. 2011. Alberta's oil sands: Hard evidence, missing data, new promises (vol 119, pg A126, 2011). *Environ. Health Perspect*, 119:A381-A381.
Weinhold, B. 2011. Alberta's oil sands: Hard evidence, missing data, new promises. *Environ. Health Perspect*, 119:126-131.
Weinhold, B. and Booker, S.M. 2011. Oil sands contaminants: Editor's response. *Environ. Health Perspect*, 119:A330-A331.
Wells, C.M. and Price, J.S. 2015. A hydrologic assessment of a saline-spring fen in the Athabasca oil sands region, Alberta, Canada - a potential analogue for oil sands reclamation. *Hydrological Processes*, 29:4533-4548. 10.1002/hyp.10518.
Wells, C.M. and Price, J.S. 2015. The hydrogeologic connectivity of a low-flow saline-spring fen peatland within the Athabasca oil sands region, Canada. *Hydrogeology Journal*, 23:1799-1816. 10.1007/s10040-015-1301-y.
Wentworth, G.R., Aklilu, Y.A., Landis, M.S. and Hsu, Y.M. 2018. Impacts of a large boreal wildfire on ground level atmospheric concentrations of PAHs, VOCs and ozone. *Atmos. Environ.*, 178:19-30. 10.1016/j.atmosenv.2018.01.013.
Whaley, H. and Lee, G.K. 1978. An assessment of plume dispersion parameters measured in fall and winter at a tar-sands refinery complex. *J. Air Pollut. Control Assoc.*, 28:589-593.
Whaley, C.H., Makar, P.A., Shephard, M.W., Zhang, L.M., Zhang, J.H., Zheng, Q., Akingunola, A., Wentworth, G.R., Murphy, J.G., Kharol, S.K. and Cady-Pereira, K.E. 2018. Contributions of natural and anthropogenic sources to ambient ammonia in the Athabasca Oil Sands and north-western Canada. *Atmos. Chem. Phys*, 18:2011-2034. 10.5194/acp-18-2011-2018.
Whitfield, C.J., Aherne, J., Cosby, B.J. and Watmough, S.A. 2010. Modelling boreal lake catchment response to anthropogenic acid deposition. *J. Limnol*, 69:135-146.
Whitfield, C.J., Aherne, J., Cosby, B.J. and Watmough, S.A. 2010. Modelling catchment response to acid deposition: a regional dual application of the MAGIC model to soils and lakes in the Athabasca Oil Sands Region, Alberta. *J. Limnol*, 69:147-160.
Whitfield, C.J., Aherne, J., Watmough, S.A. and McDonald, M. 2010. Estimating the sensitivity of forest soils to acid deposition in the Athabasca Oil Sands Region, Alberta. *J. Limnol*, 69:201-208.
Whitfield, C.J. and Watmough, S.A. 2015. Acid deposition in the Athabasca Oil Sands Region: a policy perspective. *Environmental Monitoring and Assessment*, 187:10.1007/s10661-015-4979-3.
Whitfield, C.J., Mowat, A.C., Scott, K.A. and Watmough, S.A. 2016. A modified approach for estimating the aquatic critical load of acid deposition in northern Saskatchewan, Canada. *Atmos. Environ.*, 146:300-310. 10.1016/j.atmosenv.2016.05.025.
Wieder, R.K., Vitt, D.H., Burke-Scoll, M., Scott, K.D., House, M. and Vile, M.A. 2010. Nitrogen and sulphur deposition and the growth of Sphagnum fuscum in bogs of the Athabasca Oil Sands Region, Alberta. *J. Limnol*, 69:161-170.
Wieder, R.K., Vile, M.A., Scott, K.D., Albright, C.M., McMillen, K.J., Vitt, D.H. and Fenn, M.E. 2016. Differential effects of high atmospheric N and S deposition on bog plant/lichen tissue and porewater chemistry across the Athabasca Oil Sands Region. *Environ. Sci. Technol.*, 50:12630-12640. 10.1021/acs.est.6b03109.
Wiklund, J.A., Hall, R.I., Wolfe, B.B., Edwards, T.W.D., Farwell, A.J. and Dixon, D.G. 2012. Has Alberta oil sands development increased far-field delivery of airborne contaminants to the Peace-Athabasca Delta? *Sci. Total Environ*, 433:379-382.
Wiklund, J.A., Hall, R.I., Wolfe, B.B., Edwards, T.W.D., Farwell, A.J. and Dixon, D.G. 2014. Use of pre-industrial floodplain lake sediments to establish baseline river metal concentrations downstream of Alberta oil sands: a new approach for detecting pollution of rivers. *Environmental Research Letters*, 9:10.1088/1748-9326/9/12/124019.
Wilkinson, S.L., Moore, P.A., Flannigan, M.D., Wotton, B.M. and Waddington, J.M. 2018. Did enhanced

afforestation cause high severity peat burn in the Fort McMurray Horse River wildfire? *Environmental Research Letters*, 13:10.1088/1748-9326/aaa136.

Williams, L.B., Wieser, M.E., Fennell, J., Hutcheon, I. and Hervig, R.L. 2001. Application of boron isotopes to the understanding of fluid-rock interactions in a hydrothermally stimulated oil reservoir in the Alberta Basin, Canada. *Geofluids*, 1:229-240. 10.1046/j.1468-8123.2001.00016.x.

Willis, C.E., Kirk, J.L., St Louis, V.L., Lehnherr, I., Ariya, P.A. and Rangel-Alvarado, R.B. 2018. Sources of methylmercury to snowpacks of the Alberta Oil Sands Region: A study of in situ methylation and particulates. *Environ. Sci. Technol.*, 52:531-540. 10.1021/acs.est.7b04096.

Willis, C.E., St Louis, V.L., Kirk, J.L., St Pierre, K.A. and Dodge, C. 2019. Tailings ponds of the Athabasca Oil Sands Region, Alberta, Canada, are likely not significant sources of total mercury and methylmercury to nearby ground and surface waters. *Sci. Total Environ*, 647:1604-1610. 10.1016/j.scitotenv.2018.08.083.

Wiseman, S.B., He, Y.H., Din, M.G.E., Martin, J.W., Jones, P.D., Hecker, M. and Giesy, J.P. 2013. Transcriptional responses of male fathead minnows exposed to oil sands process-affected water. *Comparative Biochemistry and Physiology C-Toxicology & Pharmacology*, 157:227-235.

Wnorowski, A. 2017. Characterization of the ambient air content of parent polycyclic aromatic hydrocarbons in the Fort McKay region (Canada). *Chemosphere*, 174:371-379. 10.1016/j.chemosphere.2017.01.114.

Wnorowski, A. and Charland, J.P. 2017. Profiling quinones in ambient air samples collected from the Athabasca region (Canada). *Chemosphere*, 189:55-66. 10.1016/j.chemosphere.2017.09.003.

Wolfe, B.B., Karst-Riddoch, T.L., Hall, R.I., Edwards, T.W.D., English, M.C., Palmini, R., McGowan, S., Leavitt, P.R. and Vardy, S.R. 2007. Classification of hydrological regimes of northern floodplain basins (Peace -Athabasca Delta, Canada) from analysis of stable isotopes (delta O-18, delta H-2) and water chemistry. *Hydrological Processes*, 21:151-168.

Wolfe, B.B., Hall, R.I., Edwards, T.W.D. and Johnston, J.W. 2012. Developing temporal hydroecological perspectives to inform stewardship of a northern floodplain landscape subject to multiple stressors: paleolimnological investigations of the Peace-Athabasca Delta. *Environmental Reviews*, 20:191-210. 10.1139/a2012-008.

Woods, J.R., Kung, J., Pleizier, G., Kotlyar, L.S., Sparks, B.D., Adjaye, J. and Chung, K.H. 2004. Characterization of a coker gas oil fraction from athabasca oilsands bitumen. *Fuel*, 83:1907-1914.

Woods, J.R., Kung, J., Kingston, D., McCracken, T., Kotlyar, L.S., Sparks, B.D., Mercier, P.H.J., Ng, S. and Moran, K. 2012. The comparison of bitumens from oil sands with different recovery profiles. *Petroleum Science and Technology*, 30:2285-2293.

Woodworth, A.P.J., Frank, R.A., McConkey, B.J. and Muller, K.M. 2012. Toxic effects of oil sand naphthenic acids on the biomass accumulation of 21 potential phytoplankton remediation candidates. *Ecotoxicology and Environmental Safety*, 86:156-161.

Wu, J.Y. and Dabros, T. 2012. Process for solvent extraction of bitumen from oil sand. *Energy & Fuels*, 26:1002-1008.

Wu, Y.H., Lu, S.F., Chen, F.W., Xiao, H. and Yuan, D.D. 2015. Geological modeling on the reservoir of oil sand in estuary. *Acta Geologica Sinica-English Edition*, 89:106-108. 10.1111/1755-6724.12302_45.

Xia, Z., Idowu, I., Marvin, C., Thomas, P.J., Johnson, W., Francisco, O., Stetefeld, J., Crimmins, B., Fry, M. and Tomy, G.T. 2019. Identification of halogenated polycyclic aromatic hydrocarbons in biological samples from Alberta Oil-Sands Region. *Chemosphere*, 215:206-213. 10.1016/j.chemosphere.2018.10.050.

Xin, Q., Cheng, I., Yang, F.Q., Horb, E., Zhang, L.M. and Herner, T. 2017. Emissions databases for polycyclic aromatic compounds in the Canadian Athabasca Oil Sands Region – development using current knowledge and evaluation with passive sampling and air dispersion modelling data. *Atmospheric Chemistry and Physics Discussion*,

Xin, Q., Alvarez-Majmutov, A., Gieleciak, R., Chen, J.W. and Dettman, H. 2019. Hydrotreatment of olefins in thermally processed bitumen under mild conditions. *Energy & Fuels*, 33:3098-3107. 10.1021/acs.energyfuels.9b00157.

Xing, Z.Y. and Du, K. 2017. Particulate matter emissions over the oil sands regions in Alberta, Canada. *Environmental Reviews*, 25:432-443. 10.1139/er-2016-0112.

Xiong, H., Huang, S.J., Devegowda, D., Liu, H., Li, H. and Padgett, Z. 2019. Influence of pressure difference between reservoir and production well on steam-chamber propagation and reservoir-production performance. *Spe Journal*, 24:452-476. 10.2118/190107-pa.

Xu, Z., Wang, Z., Kung, J., Woods, J.R., Wu, X.A., Kotlyar, L.S., Sparks, B.D. and Chung, K.H. 2005. Separation and characterization of foulant material in coker gas oils from Athabasca bitumen. *Fuel*, 84:661-668.

Xu, G.J. 2018. Atmospheric benzo a pyrene and vanadium evidence for the presence of petroleum coke dust in the Athabasca Oil Sands Region, Alberta, Canada. *Journal of Cleaner Production*, 171:592-599. 10.1016/j.jclepro.2017.10.038.

Xu, X., Huang, H.P., Zhang, S.C. and Hu, S.Y. 2019. Gas generation potential and processes of Athabasca oil sand bitumen from gold tube pyrolysis experiments. *Fuel*, 239:804-813. 10.1016/j.fuel.2018.11.077.

Yahya, M.S., Sangapalaarachchi, D.M.T. and Lau, E.V. 2019. Effects of carbon chain length of imidazolium-based ionic liquid in the interactions between heavy crude oil and sand particles for enhanced oil recovery. *Journal of Molecular Liquids*, 274:285-292. 10.1016/j.molliq.2018.10.147.

Yan, E.R., Hu, Y.L., Salifu, F., Tan, X., Chen, Z.C. and Chang, S.X. 2012. Effectiveness of soil N availability indices in predicting site productivity in the oil sands region of Alberta. *Plant and Soil*, 359:215-231.

Yang, C., Wang, Z.D., Yang, Z.Y., Hollebone, B., Brown,

C.E., Landriault, M. and Fieldhouse, B. 2011. Chemical fingerprints of Alberta oil sands and related petroleum products. *Environmental Forensics*, 12:173-188.

Yang, H.Q., Wang, Y.H., Ding, M.S., Hu, B. and Ren, S.L. 2012. Water-assisted solvent extraction of bitumen from oil sands. *Industrial & Engineering Chemistry Research*, 51:3032-3038.

Yang, X.F., Wang, X.Z., Zhang, S.N., Tang, H., Zeng, D.M. and Xie, L. 2014. Reservoir characteristics and main controlling factors of oil sand in Houba area, northwestern Sichuan Basin, China. *Arabian Journal of Geosciences*, 7:2119-2128.

Yang, B.Q. and Duhamel, J. 2015. Extraction of oil from oil sands using thermoresponsive polymeric surfactants. *Acs Applied Materials & Interfaces*, 7:5879-5889.

Yang, L.F. and Sheng, J.J. 2019. Feasibility of using the Frank-Kamenetskii theory to predict the spontaneous ignition of the crude oi sand mixture. *Energy & Fuels*, 33:4816-4825. 10.1021/acs.energyfuels.9b00421.

Yang, L.F. and Sheng, J.J. 2019. Feasibility of using the Frank-Kamenetskii theory to predict the spontaneous ignition of the crude oil-sand mixture. *Energy & Fuels*, 33:4816-4825. 10.1021/acs.energyfuels.9b00421.

Yang, Z.Q., Wu, Y.Q., Zhang, Z.S., Li, H., Li, X.G., Egorov, R.I., Strizhak, P.A. and Gao, X. 2019. Recent advances in co-thermochemical conversions of biomass with fossil fuels focusing on the synergistic effects. *Renewable & Sustainable Energy Reviews*, 103:384-398. 10.1016/j.rser.2018.12.047.

Yassine, M.M. and Dabek-Zlotorzynska, E. 2017. Application of ultrahigh-performance liquid chromatography-quadrupole time-of-flight mass spectrometry for the characterization of organic aerosol: Searching for naphthenic acids. *J. Chromatogr. A*, 1512:22-33. 10.1016/j.chroma.2017.06.067.

Yeh, S., Jordaan, S.M., Brandt, A.R., Turetsky, M.R., Spatari, S. and Keith, D.W. 2010. Land use greenhouse gas emissions from conventional oil production and oil sands. *Environ. Sci. Technol.*, 44:8766-8772.

Yeung, A.T., Viswanathan, R. and Briaud, J.L. 1996. Field investigation of potential contamination by bitumen-coated piles. *Journal of Geotechnical Engineering-Asce*, 122:736-744.

Yi, Y., Brock, B.E., Falcone, M.D., Wolfe, B.B. and Edwards, T.W.D. 2008. A coupled isotope tracer method to characterize input water to lakes. *Journal of Hydrology*, 350:1-13.

Yi, Y., Gibson, J., Birks, J., Han, J. and Borchers, C.H. 2014. Comment on "Profiling Oil Sands Mixtures from Industrial Developments and Natural Groundwaters for Source Identification". *Environ. Sci. Technol.*, 48:11013-11014.

Yi, Y., Birks, S.J., Cho, S. and Gibson, J.J. 2015. Characterization of organic composition in snow and surface waters in the Athabasca Oil Sands Region, using ultrahigh resolution Fourier transform mass spectrometry. *Sci. Total Environ*, 518:148-158. 10.1016/j.scitotenv.2015.02.018.

Yin, P.F., Liu, G.D., Liu, Y.Q., Liu, C.L. and Liu, W.P. 2013. Evaluation of oil sands resources -A case study in the Athabasca Oil Sands, NE Alberta, Canada. *Petroleum Science*, 10:30-37.

Yui, S. 2000. Athabasca oilsands produce quality diesel and jet fuels. *Oil & Gas Journal*, 98:58-+.

Zhang, G.Y., Wasyliuk, K. and Pan, Y.M. 2001. The characterization and quantitative analysis of clay minerals in the Athabasca Basin, Saskatchewan: Application of shortwave infrared reflectance spectroscopy. *Canadian Mineralogist*, 39:1347-1363.

Zhang, Q., Huang, H.P., Zheng, L.J. and Qin, J.Z. 2007. Secondary hydrocarbon generation potential from heavy oil, oil sand and solid bitumen during the artificial maturation. *Organic Geochemistry*, 38:2024-2035.

Zhang, L., Cheng, I., Muir, D. and Charland, J.P. 2015. Scavenging ratios of polycyclic aromatic compounds in rain and snow in the Athabasca oil sands region. *Atmos. Chem. Phys*, 15:1421-1434.

Zhang, L.M., Cheng, I., Wu, Z.Y., Harner, T., Schuster, J., Charland, J.P., Muir, D. and Parnis, J.M. 2015. Dry deposition of polycyclic aromatic compounds to various land covers in the Athabasca oil sands region. *Journal of Advances in Modeling Earth Systems*, 7:1339-1350. 10.1002/2015ms000473.

Zhang, Y.F., Shotyk, W., Zaccone, C., Noernberg, T., Pelletier, R., Bicalho, B., Froese, D.G., Davies, L. and Martin, J.W. 2016. Airborne petcoke dust is a major source of polycyclic aromatic hydrocarbons in the Athabasca oil sands region. *Environ. Sci. Technol.*, 50:1711-1720. 10.1021/acs.est.5b05092.

Zhang, J.H., Moran, M.D., Zheng, Q., Makar, P.A., Baratzadeh, P., Marson, G., Liu, P. and Li, S.M. 2018. Emissions preparation and analysis for multiscale air quality modeling over the Athabasca Oil Sands Region of Alberta, Canada. *Atmos. Chem. Phys*, 18:10459-10481. 10.5194/acp-18-10459-2018.

Zhao, S., Kotlyar, L.S., Woods, J.R., Sparks, B.D. and Chung, K.H. 2000. Molecular nature of Athabasca bitumen. *Petroleum Science and Technology*, 18:587-606.

Zhao, S., Kotlyar, L.S., Woods, J.R., Sparks, B.D., Hardacre, K. and Chung, K.H. 2001. Molecular transformation of Athabasca bitumen end-cuts during coking and hydrocracking. *Fuel*, 80:1155-1163.

Zhao, B. and Shaw, J.M. 2007. Composition and size distribution of coherent nanostructures in Athabasca bitumen and Maya crude oil. *Energy & Fuels*, 21:2795-2804.

Zhao, N.N., Al Bitar, H., Zhu, Y.Y., Xu, Y.M. and Shi, Z.Q. 2018. Flocculation performance of anionic starch in oil sand tailings. *Water Science and Technology*, 78:1268-1275. 10.2166/wst.2018.405.

Zheng, E.Z., Szymanski, J. and Hu, C.S. 2018. Three-dimensional modelling of oil sand multiphase flow in at face slurry system. *International Journal of Oil Gas and Coal Technology*, 19:35-58. 10.1504/ijogct.2018.093957.

Zhou, J., Li, H.H., Zhao, L.Y. and Chow, R. 2018. Role of mineral flotation technology in improving bitumen extraction from mined Athabasca oil sands: I. Flotation chemistry of water-based oil sand extraction. *Canadian Journal of Chemical Engineering*, 96:1986-1999.

10.1002/cjce.23139.

Zhu, Y. and Gueguen, C. 2016. Evaluation of free/labile concentrations of trace metals in Athabasca oil sands region streams (Alberta, Canada) using diffusive gradient in thin films and a thermodynamic equilibrium model. *Environ Pollut*, 219:1140-1147.

Zhu, Y.L., Yan, C., Liu, Q.X., Masliyah, J. and Xu, Z.H. 2018. Biodiesel-assisted ambient aqueous bitumen extraction (BA(3)BE) from Athabasca oil sands. *Energy & Fuels*, 32:6565-6576. 10.1021/acs.energyfuels.8b00688.

Zou, C.N., Yang, Z., Zhu, R.K., Zhang, G.S., Hou, L.H., Wu, S.T., Tao, S.Z., Yuan, X.J., Dong, D.Z., Wang, Y.M., Wang, L., Huang, J.L. and Wang, S.F. 2015. Progress in China's unconventional oil & gas exploration and development and theoretical technologies. Acta Geologica Sinica-English Edition, 89:938-971. 10.1111/1755-6724.12491.