CONTAMINATION OF THE ATHABASCA RIVER FROM THE OIL SANDS: SHOULD PEOPLE BE WORRIED?

OBJECTIVES

The objective of our analysis is to investigate the overall extent of arsenic and mercury contamination along the Athabasca River in order to understand how bitumen and PAC containing sediment may also move throughout the area. We will show the areas where levels of detectable mercury and arsenic have been found along the river area, and from there gain a visual understanding of where higher levels are found upstream or downstream of the oil sands, or if there is no general relationship with the oil sands. We will compare the levels of arsenic and mercury found along the river against the maximum levels of arsenic and mercury allowed in drinking water, as outlined by the government. We then wish to map this in relation to human settlement patterns, in order to understand the possible hazards for humans living in proximity to the Athabasca River, and if they should be worried for their health. A hydrology analysis of flow accumulation, watershed and so on in relation to the levels of mercury, arsenic and communities will be executed for current, and possibly future, predictions of health hazards regarding the extent of the oil sands' river contaminants. This will hopefully prove or disapprove the claims of the article done by Erin N. Kelly et al "Oil Sands Development Contributes Polycyclic Aromatic Compounds to the Athabasca River and its Tributaries" in 2009. This is intended to head in the direction of settling the dispute between the inhabitants and the government/ industry regarding health hazards due to the oil sands.

Table 1: Attribute table for Mercury points.

AS

	OBJECTID *	Value	Count	AS_PPM
▸	1	1	93	
	2	5	1	1.4
	3	6	1	1.0
	4	16	1	3.0
	5	26	1	13.2
	6	27	1	13.1
	7	28	1	2
	8	29	1	11.3
	9	30	1	4.3
	10	32	1	21.7
	11	34	1	3.6
	12	35	1	2.5
	13	36	1	6.7

Table 2: Attribute table for Arsenic points.

HG

	OBJECTID *	Value	Count	HG_PPM
▸	1	1	92	
	2	2	1	bdl
	3	4	2	0.01
	4	9	3	0.02
	5	11	1	0.14
	6	12	1	0.04
	7	13	1	0.08
	8	14	1	0.09
	9	15	1	0.19
	10	16	1	0.05
	11	17	1	0.07

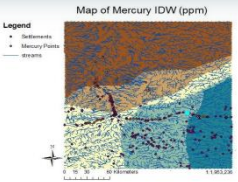


Figure 1: Prediction of Mercury allocation where dark blue represents values above 0.002ppm.

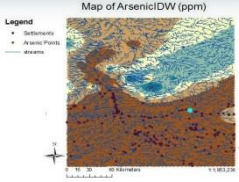


Figure 2: Prediction of Arsenic allocation where dark blue represents values above 0.010ppm.

METHODS

I. Data Collection:

The data we found and used was from the government of Canada, under the natural resources sector. The data is by Hannigan, PK and it is a geological/ geographical survey of Canada. This GIS data set is a comprehensive compilation of information for 596 mineralized and non-mineralized samples collected within the TGI project area. The area of the dataset that we focused on was around Fort McMurray and the Athabasca River which is known in the data set as zone 12. We also retrieved data from the database "Geobase", which was DEM data and geographical name data for zone 12. The DEMs (Digital Elevation Models) and geographical area names are for regions 74d and 74e.

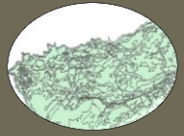
II. DEM to Raster and Mosaic:

III. Extraction of Mercury and Arsenic Points:

IV. IDW (Inverse Distance Weighting):

V. Hydrology:

a. *Filling the sinks*
b. *Determine the direction of flow*
c. *Calculate flow accumulation*
d. *Create streams from the flow accumulation*
e. *Clean up the streams*



DISCUSSION

- The arsenic and mercury levels in the Athabasca area do not appear to be related to one another. They are both slightly related to the flow direction of water (the arsenic more than the mercury) and thus it can be speculated that other environmental factors are influencing where these sediments are concentrated.
- This analysis was meant to investigate the distribution of arsenic and mercury across the Athabasca region and relate this movement to the results of other papers that have researched the distribution of toxic oil sand chemicals. Since the two maps were not related to one another, and were related very insignificantly to the direction of the waterways, there can be no certain conclusions about how PAC and bitumen levels fluctuate around the oil sands area.
- What is known is that chemical levels are highest near their source area and are cleansed by various natural processes with increasing distance. If there are high amounts of chemicals though it will take longer for nature to cleanse the ecosystem of toxins and they will be carried over a further area.
- Thus, PAC and bitumen levels pose a threat in the Athabasca river area simply because of the enormity at which they are being produced. Further in situ studies and subsequent GIS analyses would help to further understand where bitumen and PAC are specifically being allocated to in the Athabasca area and whether or not their levels are toxic

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