

facsimile

TRANSMITTAL

to: Serena Domville - SEACOR Environmental Engineering
fax #: (604) 244-2246
re: Request for Proposal on Review of Arsenic Properties
date: August 15, 1995
pages: 47 including this cover sheet.

We are currently working on an engineering study to better develop the methods proposed for the ultimate close out of the underground arsenic trioxide storage vaults located at the Giant mine in Yellowknife. We are proposing the use of man made ice plugs to seal the surrounding areas from groundwater movement.

As part of this study we would like to commission a third party independent review of what information is currently available in the literature on the following areas:

- A review of the physical and chemical properties of arsenic and more specifically arsenic trioxide. This would include presenting in a summarized form what information is available on the solubility of arsenic trioxide in water, the change in solubility as a result of temperature, the specific gravity, etc.
- A review of the known effects of arsenic and arsenic trioxide on the natural environment. This would include a review of what is known about the environmental impacts of arsenic on plant life, fish, benthic species and animals. Can you also look at what information is available on what concentration levels of arsenic in surface waters and groundwaters are considered necessary for protection of the environment in different regulatory jurisdictions..
- A review of the toxicological and health effects of arsenic and arsenic trioxide on human beings. Is arsenic a carcinogen or a co-carcinogen?, What are the acute toxicity levels? How does arsenic effect the body? Can you also look at what concentration levels of arsenic in surface waters and groundwaters are considered necessary for the protection of human health in different regulatory jurisdictions.

Our intention is to include in the study report a section that deals with the known facts as they relate to the physical, chemical, environmental and toxicological properties of arsenic and specifically arsenic trioxide. With your knowledge and experience with arsenic chemistry over the years we felt you would be an ideal person to turn to for this expertise. Would it be possible for you to provide us with a proposal for such a literature search and summary on this subject matter.

From the desk of...

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The material stored U/G at Giant is not pure arsenic trioxide (90% Arsenic Trioxide - approximately 75% As), consequently its properties will be slightly different than for pure substances. Could you also suggest a series of laboratory investigations designed to obtain the specific physical properties of the Giant arsenic trioxide. The properties that I see as being important to our study include:

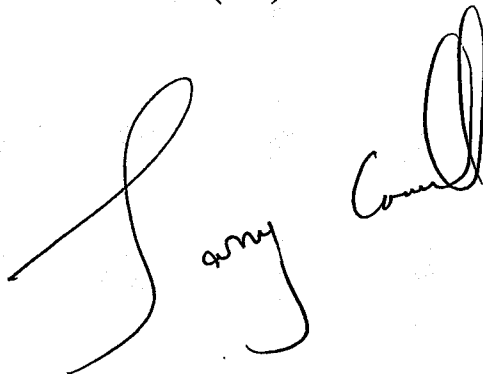
- specific gravity
- solubility in water at different temperatures, ie from freezing to say 30 degrees C
- particle size distribution
- thermal insulating properties if any
- permeability

Please feel free to make any suggestion that you might feel relevant.

On an unrelated matter, I am looking for advice on analytical methods both direct and indirect that I could apply to determine in what form arsenic is present in soil samples. In the summer of 1995 we undertook a surface contamination study of the Giant minesite. We collected samples from both surface and a depth of 0.2 metres. We had Chemex Labs conduct analysis for total arsenic, copper, nickel, lead, zinc, cyanide, ammonia, paste pH and oil & grease. We later had Chemex conduct a BC SWEP Leachate Extraction test on some of the samples and had the leachate analyzed for total arsenic. I have attached two tables that show the results of the samples in the immediate heart of the minesite. In most cases the arsenic was not readily soluble under the SWEP test procedure. I am now looking for what analytical tools I can use to better determine in what form this arsenic is present in the soil. Some of it will be in the form of arsenopyrite however several members of the TAC committee have indicated their belief that most of the arsenic will have co-precipitated with iron and is thus not soluble. I would appreciate any advice you can give me.

I will be at the Giant mine through Thursday night. My phone number there is (403) 873-6301 ext 136. The FAX number is (403) 669-9424. On Friday I will be back in Kirkland.

Thanks,

The block contains two handwritten signatures. The first signature, on the left, is written in a cursive style and appears to be 'Gary'. The second signature, on the right, is also cursive and appears to be 'Conrad'. Both signatures are written in black ink.

Giant Mine - Surface Contamination Study

Table A1: SWEP Leachate Test Results for Arsenic

Sample Location	Station #	Lab Sample I.D. #	Initial Soil Analysis Total As mg/Kg	SWEP Leachate Soluble As mg/l	SWEP Leachate Soluble As mg/Kg	% of Total As Soluble at pH 5.2
CCME Remediation Criteria			50		50	
Near Yacht Club	S3	35255	3,240	0.093	1.86	0.06%
Near Townsite	S6	35261	2,000	0.198	3.96	0.20%
Old PCB Storage Building	S19	35287	3,180	2.950	59.00	1.86%
B3 Open Pit Area	S24	35297	3,100	0.194	3.88	0.13%
North Pond to GSL	S27	35303	2,020	15.900	318.00	15.74%
ICG Tank Farm	S30	35309	2,940	0.086	1.72	0.06%
Near 22B Dam	S35	35319	2,240	0.045	0.90	0.04%
Main Gate Area	S39	35327	2,440	0.044	0.88	0.04%
Near Catchbasin at C Dry	S40	35329	4,400	0.720	14.40	0.33%
Diesel Fuel Storage	S42	35333	2,880	0.128	2.56	0.09%
Diesel Fuel Storage	S43	35335	2,320	0.160	3.20	0.14%
Rail	S45	35339	2,000	0.060	1.20	0.06%
Old Electrical Shop	S46	35341	2,900	0.131	2.62	0.09%
Crusher	S49	35347	7,920	0.146	2.92	0.04%
Open Pit Crusher	S53	35355	5,680	22.100	442.00	7.78%
Near Open Pit Crusher	S54	32357	9,760	0.260	5.20	0.05%
Crusher	S55	35359	5,040	0.185	3.70	0.07%
BC Crusher	S56	35361	3,280	0.670	13.40	0.41%
MEG	S57	35363	2,140	17.100	342.00	15.98%
MEG	S58	35365	6,000	38.300	766.00	12.77%
Southwest Mill	S60	35369	3,260	0.200	4.00	0.12%
Adjacent to Assay Lab	S63	35375	11,800	0.166	3.32	0.03%
Fuel Storage - Lumber Yard	S64	35377	5,360	0.244	4.88	0.09%
Lumber Yard	S71	35391	5,280	0.111	2.22	0.04%
Lumber Yard Stack	S73	35393	2,320	0.560	11.20	0.48%
Quonset Hut	S74	35397	2,680	0.860	17.20	0.64%
Mill Yard	S75	35399	2,340	0.358	7.16	0.31%
Stack	S83	35415	14,200	271.000	5420.00	38.17%
Stack	S86	35421	2,120	0.363	7.26	0.34%
Stack	S87	35423	8,400	62.000	1240.00	14.76%
Stack	S88	35425	2,100	4.600	92.00	4.38%
Average			4,366		283.83	6.50%
Column 1	2	3	4	5	6	7