

Amy Selvaraj (DELWP)

From: Andrew Helps [REDACTED]
Sent: Friday, 26 February 2021 11:41 AM
To: Amy Selvaraj (DELWP)
Subject: Ongoing submissions of data.
Attachments: 8319Rev4.pdf; 8330 Rev 34.pdf

EXTERNAL SENDER: Links and attachments may be unsafe.

Good morning Amy.

I am sending you these two Documents as my further submissions.

- 1. Radionuclide Carcinogenicity Slope Factor report** (my Serial # 8319.pdf Revision 4) developed in accordance with the USEPA Federal Guidance Report No. 13.
This report uses data supplied by KALBAR.
This report outlines the lifetime excess total Cancer Risks from exposure to dust and polluted water.
The report deals with:
 1. Polluted drinking water ingestion Risk at pCi level;
 2. Polluted Food ingestion Risk at pCi level;
 3. Soil ingestion Risk (Pica events) at pCi level;
 4. Inhalation Risk at pCi level;
 5. External Exposure (Risk/y per pCi/g)

As you would be aware (I hope) the Joyner report did not address any of these critical issues. That is why I used USEPA data to do this work, work which has not yet been carried out by the KALBAR Consultants. I can send you the base US EPA data if you are interested – it probably should be up on your website as well.

Rare Earth/ Toxic Element/Compound Calculation Template (my Serial 8330.pdf Revision 34)

This report is a common type of report used by Global NGO's to measure various risks at proposed RADNUC mine sites. For instance, if I was doing a pre-feasibility report for a global funding organisation that was considering an investment decision for this type mine, I would use this report template to set a pre investment toxicity baseline. The data in this report came from a "snapshot" test on the 13th of October 2020. The lab testing was financed by an exceptionally concerned local farmer and I donated my time to travel to Lindenow to take the samples and convey them under a chain of custody to the ENVIROLAB Laboratory.

As you can see the model is at Revision 34 in my system and is widely used in various rebadged forms by a number of countries in Asia.

My concerns are that there are a number of highly toxic elements in this orebody that have not been identified (?Exposed) by the KALBAR hand-picked experts/consultants.

You will have a further email on the late arriving centrifuge issue on Monday – I am just waiting to see if I can get some photo's from China of centrifuges that were being used at a similar mine when they self-destructed. It may well be yet another case of maintenance failure!

Kindest Regards

Andrew Helps
[REDACTED]
[REDACTED]

Mobile [REDACTED]
UNEP Global Mercury Partnership
Waste Management Partnership - designated expert
Mercury added products and alternatives – designated expert
Mercury Fate and Transport Group

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Radionuclide Table: Radionuclide Carcinogenicity - Slope Factors

Data Source US EPA Federal Guidance Report No. 13 Morbidity Risk Coefficients, in Units of Picocuries

Revision #2

File: 8319.xlsx
20/08/2020

HBTOM

The curie (Ci) is the customary unit of activity and is equal to 3.7×10^{10} nuclear transformations per second.
Handbook of the Toxicology of Metals (Nordberg ET AL) 4th Edition

NOTE:

US EPA Regulates radium in drinking water to no more than 5 pCi of combined radium-226 and radium 228 per litre of water.

Slope Factor Morbidity Risk Coefficient
Lifetime excess Total Cancer Risk

Element	Kalbar Analysis	Element (Atomic Number)	HBTOM * Reference Pagess	Isotope	Radioactive Half Life (Years)	ICRP Lung Type	Gi Absorption Factor (f ₁) ⁹	Water Ingestion (Risk/pCi)	Food Ingestion (Risk/pCi)	Soil Ingestion (Risk/pCi)	Inhalation Risk (Risk/pCi)	External Exposure (Risk/y per pCi/g)	
Aluminium	260-4500 mg/kg	13	549-560	Al-26	716000	M	0.0100	0.001730	2490	0.47000	0.000000000069	0.0000133	
				Al-28	2.240							0.0000092	
Antimony	<0.5 mg/kg Carcinogen		565-572	Sb 115	31.80	M	0.1000	0.00000000000051	0.00000000000001	0.11600	0.00000000000002	0.0000039	
				Sb 116	15.80	M	0.1000	0.00000000000051	0.00000000000001	0.11600	0.00000000000002	0.0000105	
				51	Sb-126	12.40	M	0.10000	0.000000000001	0.000000000002	0.29	0.000000000115	0.00000649
				Sb 127	3.85	M	0.1000	0.000000000001	0.000000000147	0.0000000003	0.0000000008	0.00000307	
Arsenic	61-491 mg/kg Carcinogen	33	582-610	As-69	15.20	M	0.50	0.00000000000105	0.00000000000015	0.2390	0.00000000000004	0.00000443	
				As-70	52.60	M	0.50	0.00000000000320	0.00000000000045	0.000000000001	0.000000000014	0.0000196	
				As-71	64.80	M	0.50	0.00000000000320	0.000000000003	0.000000000001	0.000000000152	0.0000237	
				As-72	26.00	M	0.50	0.10	0.000000000001	0.000000000003	0.000000000004	0.0000082	
				As-73	80.30	M	0.50	0.000000000002	0.000000000002	0.000000000004	0.000000000004	0.00000006	
				As-74	17.80	M	0.50	0.000000000007	0.000000000010	0.000000000002	0.000000000001	0.0000034	
				As-76	26.30	M	0.50	0.000000000010	0.000000000001	0.000000000003	0.000000000000	0.0000020	
				As-77	38.80	M	0.50	0.000000000003	0.000000000004	0.000000000001	0.000000000002	0.00000036	
				As-78	90.70	M	0.50	0.000000000006	0.000000000009	0.000000000001	0.000000000003	0.0000061	
Thorium	1.0 -120 mg/kg Carcinogen	90		Th-226	30.90	m S	0.001	0.000000000001	0.00000000000923	0.000000000016	0.00000000016	0.0000002	
				Th-227	18.70	d S	0.0005	0.000000000005	0.000000000005	0.00000000007	0.0000000014	0.0000004	
				Th-228	1.91	y S	0.001	0.0000000001	0.0000000001	0.00000000029	0.00000013	0.00000001	
				Th-228+D	1.91	y S	0.001	0.0000000003	0.0000000004	0.00000000081	0.00000014	0.00000776	
				In Kalbar ore body	Th-229	7340.00	y S	0.001	0.0000000002	0.0000000003	0.00000000050	0.00000018	0.0000023
				See pages 38-40 of TENORM Handbook	Th-229+D	7340.00	y S	0.001	0.0000000005	0.0000000007	0.0000000129	0.00000023	0.00000117
					Th-230	77000.00	y S	0.001	0.0000000001	0.000000000119	0.00000000020	0.00000003	0.00000000
					Th-231	25.50	h S	0.001	0.0000000000	0.00000000003	0.00000000001	0.00000000002	0.00000002
				Decays to Radium 228	Th-232	14 Billion Years	y S	7340.00	0.0000000001	0.000000000133	0.00000000023	0.00000004	0.000000003
					Th-234	24.10	d S	0.001	0.0000000000	0.00000000034	0.0000000007	0.0000000003	0.00000002
Tin	1.7 mg/kg	50	1242-1276	Sn-110	4.00	h M	0.020	0.000000000019	0.00000000003	0.00000000005	0.000000000067	0.000001130	
				Sn-111	35.30	m M	0.020	0.000000000019	0.000000000008	0.00000000000	0.000000000003	0.000002290	
				Sn-113	115.00	d M	0.020	0.000000000019	0.000000000006	0.00000000012	0.0000000001000	0.000000020	
				Sn-117m	13.60	d M	0.020	0.000000000019	0.000000000001	0.00000000013	0.0000000000884	0.000000469	
				Sn-119m	293.00	d M	0.020	0.000000000019	0.000000000003	0.00000000006	0.0000000000781	0.000000001	
				Sn-121	27.10	h M	0.020	0.000000000019	0.000000000015	0.00000000004	0.000000000102	0.000000000	
				Sn-121m	55.00	y M	0.020	0.000000000019	0.000000000023	0.00000000007	0.0000000001540	0.000000001	
				Sn-123	129.00	d M	0.020	0.000000000019	0.000000000140	0.00000000040	0.0000000003030	0.000000039	
				Sn-123m	40.10	m M	0.020	0.000000000019	0.000000000001	0.00000000000	0.000000000006	0.000000462	
				Sn-125	9.64	d M	0.020	0.000000000019	0.000000000201	0.00000000058	0.0000000001410	0.000001530	
				Sn-126	100000.00	y M	0.020	0.000000000019	0.000000000256	0.00000000071	0.0000000009950	0.00000100	
				Sn-127	2.10	h M	0.020	0.000000000019	0.000000000008	0.00000000002	0.000000000044	0.000009250	
				Sn-128	59.10	m M	0.020	0.000000000019	0.000000000004	0.000000000001	0.000000000023	0.000002620	
				Titanium	44-154 mg/kg Carcinogen	22		Ti-44	47.30	S	0.01000	0.000000000026	0.00000000004
Ti-45	3.08	S	0.0100					0.000000000006	0.000000000009	0.00000000018	0.00000000003	0.00000379	
Tungsten	<1 mg/Kg	74		W-176	2.30	h F	0.3000	0.000000000004	0.000000000001	0.00000000011	0.00000000001	0.00000032	

			W-177	135.00	m F	0.3000	0.000000000002	0.000000000000	0.000000000005	0.000000000001	0.00000363
			W-178	21.70	d	0.3000	0.000000000012	0.300000000000	0.000000000033	0.000000000004	0.00000002
			W-179	37.50	m F	0.3000	0.000000000000	0.000000000000	0.000000000000	0.000000000000	0.00000006
			W-181	121.00	d F	0.3000	0.000000000004	0.000000000001	0.000000000011	0.000000000001	0.00000005
			W-185	75.10	d F	0.3000	0.000000000029	0.000000000004	0.000000000084	0.000000000009	0.00000000
			W-187	23.90	h F	0.3000	0.000000000037	0.000000000005	0.000000000103	0.000000000011	0.00000204
			W-188	69.40	d F	0.3000	0.000000000140	0.000000000021	0.000000000400	0.000000000005	0.00000001
Uranium	3-9 mg/kg Carcinogen	234	U-230	20.80	d M	0.0200	0.000000002090	0.000000002980	0.000000005660	0.000000455000	0.00000003
			U-231	4.20	d M	0.0200	0.000000000018	0.000000000026	0.000000000050	0.000000000018	0.00000016
			U-232	72.00	y M	0.0200	0.000000002920	0.000000003850	0.000000005740	0.000000195000	0.00000001
			U-233	159000	y M	0.0200	0.000000000718	0.000000000969	0.000000001600	0.000000116000	0.00000000
			U-234	245000.00	y M	0.0200	0.000000000707	0.000000000955	0.000000001580	0.000000114000	0.00000000
			U-235	704000000	y M	0.0200	0.000000000696	0.000000000944	0.000000001570	0.000000101000	0.00000052
			U-235+D	704000000	y M	0.0200	0.000000000718	0.000000000976	0.000000001630	0.000000101000	0.00000054
			U-236	234000000	Y M	0.0200	0.000000000670	0.000000000903	0.000000001490	0.000000105000	0.00000000
			U-237	6.75	d M	0.0200	0.000000000049	0.000000000071	0.000000000139	0.000000000064	0.00000038
			U-238	4470000000	y M	0.0200	0.000000000640	0.000000000866	0.000000001430	0.000000093200	0.00000000
			U-238+D	4470000000	y M	0.0200	0.000000000871	0.000000001210	0.000000002100	0.000000093500	0.00000011
			U-239	23.50	m M	0.0200	0.000000000001	0.000000000001	0.000000000002	0.000000000001	0.00000012
			U-240	14.10	h M	0.0200	0.000000000070	0.000000000103	0.000000000202	0.000000000030	0.00000000
			Vanadium	17-130 mg/kg Carcinogen	V-47	32.60	m M	0.0100	0.000000000001	0.000000000002	0.000000000003
V48	16.20	d M			0.0100	0.000000000081	0.000000000117	0.000000000213	0.000000000093	0.00001400	
V49	330.00	d M			0.0100	0.000000000001	0.000000000002	0.000000000004	0.000000000001	0.00000000	
Zirconium	6,250-42,750 mg/kg Carcinogen	40	Zr-97	16.90	m	0.0100	0.000000000125	0.000000000183	0.000000000375	0.000000000005	0.000008620
			70kg Male	Inhalation of	50.4 M ³	Per Day					

