From:	[redacted]
To:	Glyn Rhonwy Pumped Storage Scheme
Subject:	Glyn Rhonwy Pumped Storage EN010072 - Submission for Deadline 7 from Jeff Taylor Reference number: 10031989
Date:	10 August 2016 02:34:31
Attachments:	Water Analysis composite Results consolidated NEW.xlsx Jeff Taylor Written Submission for Deadline 7.docx

Glyn Rhonwy Pumped Storage EN010072
WRITTEN SUBMISSION AT DEADLINE 7 IN RESPONSE TO APPLICANTS COMMENTS AT DEADLINES 4 & 5
9th Aug 2016
FROM JEFF TAYLOR ON BEHALF OF THE GROUP "CONCERNED ABOUT GLYNRHONWY"
Reference number: 10031989

Dear Mr Cowperthwaite

I write on behalf of the Concerned about Glyn Rhonwy Group.

I attach our comments in relation to water analysis and sampling for Deadline 7, and a table of data relating to water quality test results.

Yours Sincerely
Jeff Taylor
On behalf of the "Concerned about Glyn Rhonwy Group"

Glyn Rhonwy Pumped Storage EN010072

WRITTEN SUBMISSION AT DEADLINE 7 IN RESPONSE TO APPLICANTS COMMENTS AT DEADLINES 4 & 5

9th Aug 2016

FROM JEFF TAYLOR ON BEHALF OF THE GROUP "CONCERNED ABOUT GLYNRHONWY"

Reference number: 10031989

Dear Mr Cowperthwaite

We remain unsatisfied with the Applicants approach to water analysis and sampling

Possible contamination from munitions and other anthropogenic sources

We note that in their document of 20th june *SPH_GREX_WED5_01 Deadline 5 – Applicants Response to Written Submissions made at Deadline 4* pp 79-82 the Applicants robustly refute the need to look any harder than they have done so far for evidence of contamination deriving from anthropogenic sources (essentially the dumping of munitions but also including industrial and domestic waste)

Accordingly, because we feel it is in the public interest and also our public duty to do so, we have done some independent water testing of our own

We obtained several liters of water from Q6 and subjected it to analysis by a rather more sensitive method than those employed by the Applicants

Attached is a table of results from a professionally conducted analysis using *inductively coupled plasma mass spectrometry (ICPMS)* to measure metalloids

Three samples of water were tested. By filtration through glass micro-fibre filter paper then rotary evaporation they were taken to dryness to obtain residues of around 200mg. These are minute amounts but sufficient for ICPMS analysis at least as an initial "look-see"

Additionally, rock samples of the surrounding country rocks (both a pure Glyn Rhonwy slate sample and a composite country rock/soil sample) were tested to provide qualitative comparison

The results are difficult to interpret precisely but, whilst fully accepting that for a truly scientific investigation our protocols would need to be be more rigorous, we believe that it is possible to make some initial observations which justify looking much harder and more critically at the quality of the quarry water bodies. Aided by comment from several experts in related fields we note that there are some unusual results in the data

B, Cu, Sr and the rare earth elements Er, Hf (Hafnium), Pr occur at concentrations that we are advised seem unusually high and if the data were sufficiently robust would be suggestive of some unusual, perhaps anthropogenic source. The high Ba and S are also unusual in the context. Additionally Dy (Dysprosium) shows up in the analysis, albeit at very low concentrations.

We have previously in this enquiry made known our views about the likely contamination of the quarry waters from Chemical Weapons in Q6 and the from incineration of thousands of tons of munitions at several sites around the quarry complex, and we suspect this to be the most plausible explanation for some of the data revealed by our analysis.

The elements Hafnium and Dysprosium have in particular caught our attention because we understand, as neutron absorbers, they have had applications in nuclear technology in manufacture of reactor control rods.

Significantly, there was no detection of these elements in the surrounding country rocks.

Using the Applicants argument on pp79-80 of *SPH_GREX_WED5_01* (in our view not necessarily correct – we think the highest concentrations of contaminants lie at the bottom of the Q6 lake) that the water column is effectively mixed and therefore representative of the whole water body, thereby justifying their protocol of sampling just below the surface (its still not clear exactly how far below .. 10cm? 100cm? 10m?) we can extrapolate the data in our tables up to the volume of the Q6 water body, so for instance with Hafnium at 0.021mg/g of residue from a 2liter sample, then *very very roughly* that makes 50 to 100kg Hafnium dissolved in this slightly acidic water body of perhaps 100,000 cubic meters.

It is a small but nonetheless surprising result given that there is none in the surrounding rocks and the same kind of calculation can be performed for some of the other elements. It certainly wouldn't pass drinking water standards with the measured levels of Arsenic or Chromium, but more to the point we think it should not be dumped into the Llyn Padarn river system during the dewatering phase. We think the data hints at the kind of contamination to be found at the bottom of Q6.

We have mentioned previously the close connections between Llanberis and Rhydymwyn forty miles away where early nuclear military research was carried out, and it is now also well established that surplus munitions material was brought from elsewhere to be disposed of at Llanberis. So we feel there is enough circumstantial evidence to warrant a much more precautionary approach as to what material may have been disposed of at Glyn Rhonwy

The Applicants now have proposed to stop the dewatering exercise half way through and review water quality, but since this essentially seems to involve little more than looking and smelling then it is clear that they will miss the more subtle contaminants that we fear are in the water body, and which we think they may already have overlooked.

It is our strongly held view that before proceeding with this project the Applicants should investigate the chemistry of the water in the whole quarry system, but particularly Q6, at a much more detailed level than they previously have done, and that if they are unwilling to do this then in the interests of the environment, as well as public safety, the regulators Natural Resources Wales and Gwynedd Council should require them to do so.

The kind of analysis that we performed would be very cheap compared to the cost of the whole project and if, as the Applicants assert, the quarry waters are proven by this much more sensitive analytical approach to truly be essentially rainwater then the results would serve to allay public fears about what contaminants are or are not present in the quarries. Would the Applicants consider this approach?

Water inputs from Q5 and above

In document of 4th July *SPH_GREX_WED6_02* pp113 responding to NRW's concerns and ExA's second written questions 8.6 the Applicants say

Question 8.6 ExA a) Further to the applicant's further response [REP4-011] to NRW's comments [REP3-032] regarding the proposal to form a drain between Q5 and Q6, does NRW still consider that an amendment to the discharge consent application is required? b) If an amendment to the discharge consent is required, what confidence is there that this can be granted before the close of the examination? c) Do NRW consider that that the content of the revised discharge consent permit could affect the conclusions of the HRA? NRW Our permitting group advise us that an amendment to any discharge consent application would be needed if this drainage option is required, as the volumes, frequency and drainage strategy for the development may have changed. If such a change is applied for NRW will assess this as necessary. Assessments will include an HRA.	The Applicant wishes to clarify again that this proposed arrangement has been suggested as a precautionary position to ensure that the current drainage mechanism between Q5 and Q6 is maintained. Under current arrangements water does not pond at the base of Q5. Water drains into the ground and further down into the existing groundwater system. In order to ensure that any works to Q6 does not obstruct such below ground drainage routes and cause a change to the drainage mechanisms within Q5, a drainage pipe was proposed between Q5 and Q6. Should the bottom level of Q5 be above the operational water level of Q6 this will not be required and therefore is subject to confirmation as part of Requirement 5 of the DCO. The Applicant maintains that discharge consent is not required and has requested clarification for this requirement from NRW. If the detailed design identifies that some form of drainage arrangement is required, this would be a replication of the natural arrangement, albeit a formalized arrangement of the surface water drainage which has existed since the quarries were worked. The water in question is uncontaminated surface water and therefore does not require an Environmental Permit. The proposed measures do not change the drainage strategy for the Development and has no impact on the other discharge consent applications.
Question 8.9	The Applicant confirms that this is already contained within the revised Silt Management Plan

They are continuing to assert, without supporting analytical data, that the water in the bottom of the quarries is essentially rainwater .. this may be the case for water *entering* the quarry system from rain and surrounding terrain run-off but in the lower quarry pits this is most unlikely for water ponding at the quarry bottoms .. Q5 and 4 (pits 3a b and c in the military nomenclature) held vast amounts of burnt magnesium/munitions debris – as acknowledged by consultants Zetica – much of which was removed to elsewhere on the site and the remains covered with slate rubble such that little surface water is now visible. But the contamination from this material is very likely still present, and the water leaching downhill through the quarry system towards Llyn Padarn is undoubtedly picking up such contaminants so cannot be simplistically regarded as rainwater

radiology

In the same document *SPH_GREX_WED6_02* addressing radiological surveying the Applicant says on p115 responding to ExA's second written questions 9.1

> The Applicant has already stated in its response to NRWs response to Question 8.7 c
> Written Questions (SPH_GREX_WED3_01) that it does not consider radioactivity su
> required. Investigations and research undertaken to date does not indicate that w
> radioactive waste has been or was stored at Glyn Rhonwy. Gwynedd Council conc
> conclusion.

so the applicant refutes the need to look for radiological contamination, even though this is a relatively cheap exercise, and effectively is arguing that absence of evidence is evidence of absence.

We remain of the view, as expressed in our submission of 4th July for Deadline 6, and as discussed above in relation to Dysprosium and Hafnium that there is good reason to look much harder for such contamination and design appropriate mitigation strategies before proceeding with this project.

Table 1 below shows the total dried residue obtained from all three samples and that of tap water.

	Depth of sample	Volume of water (ml)	Dry residue (mg)	Dry residue %
Tap water	n/a	120	13.7	0.0114
Sample 1	80-100cm	120	19.7	0.0164
Sample 2	30-40cm	2112	193.6 [a]	0.0092
Sample 3	30-40cm	2110	182.2	0.0086

Table 1. Mass of dried residue . Note** [a] **Only 168.4 mg was used in the ICP method for sample 2.

table 2 below shows results of ICP analysis of tapwater, three samples water from Q6 just subsurface, and two rock samples from surrounding terrain

	Client Samples									
		Sample depth 80-100cm	**Sample depth 30-40cm**							
	Tap water	**Sample 1**	**Sample 2**		**Sample 3**		**Blank**			
Metalloid el	**mg/l**	**mg/l**	**mg/l**	**mg/g ppt**	**mg/l**	**mg/g ppt**	**mg/l**	**GR slate**	**GR composite**	
Ag 328.068	BLD	BLD	0.002	BLD	BLD	BLD	0.001	BLD	BLD	**Ag 328.068**
Al 396.152	0.108	0.162	0.153	0.013	0.296	0.032	0.044	8.427	13.488	**Al 396.152**
As 188.980	BLD	BLD	0.168	0.019	0.161	0.018	0.008	0.006	0.014	**As 188.980**
Au 242.794	BLD	BLD	BLD	BLD	BLD	BLD	0.000	BLD	BLD	**Au 242.794**
B 249.772	BLD	BLD	1.102	0.130	1.692	0.185	0.004	BLD	BLD	**B 249.772**
Ba 455.403	BLD	BLD	19.051	2.264	21.494	2.354	0.001	0.046	0.032	**Ba 455.403**
Be 313.042	BLD	BLD	BLD	BLD	BLD	BLD	-0.001	Trace	Trace	**Be 313.042**
Bi 223.061	BLD	BLD	0.014	BLD	BLD	BLD	0.004	BLD	BLD	**Bi 223.061**
Ca 396.847	37.928	39.716	64.027	7.579	62.668	6.864	0.247	1.115	4.891	**Ca 396.847**
Ca 422.673	75.080	85.270	263.969	31.323	261.116	28.600	0.386			**Ca 422.673**
Cd 214.439	BLD	BLD	0.001	BLD	0.002	0.000	0.035	BLD	BLD	**Cd 214.439**
Ce 418.659	BLD	BLD	0.008	BLD	BLD	BLD	-0.003	0.018	0.011	**Ce 418.659**
Co 238.892	BLD	BLD	0.002	BLD	BLD	BLD	0.001	BLD	BLD	**Co 238.892**
Cr 267.716	0.001	0.008	0.071	0.008	0.081	0.009	0.007	0.010	0.027	**Cr 267.716**
Cs 697.327	BLD	BLD	BLD	BLD	BLD	BLD	-6.710	BLD	BLD	**Cs 697.327**
Cu 327.395	2.348	0.088	0.233	0.027	0.764	0.084	0.003	0.018	0.040	**Cu 327.395**
Dy 353.171	BLD	BLD	0.012	0.001	0.012	0.001	0.001	BLD	BLD	**Dy 353.171**
Er 349.910	BLD	BLD	0.192	0.023	0.176	0.019	0.000	BLD	BLD	**Er 349.910**
Eu 420.504	BLD	BLD	BLD	BLD	BLD	BLD	0.001	Trace	Trace	**Eu 420.504**
Fe 238.204	0.064	0.087	0.110	0.007	0.195	0.021	0.047	15.914	23.569	**Fe 238.204**
Ga 294.363	BLD	BLD	0.031	0.003	BLD	BLD	0.008	0.003	0.007	**Ga 294.363**
Gd 342.246	BLD	BLD	0.005	BLD	BLD	BLD	-0.001	BLD	BLD	**Gd 342.246**
Ge 209.426	BLD	BLD	0.024	BLD	BLD	BLD	-0.006	BLD	BLD	**Ge 209.426**
Hf 264.141	BLD	BLD	0.156	0.018	0.195	0.021	0.002	BLD	BLD	**Hf 264.141**
Hg 184.887	BLD	BLD	0.001	BLD	BLD	BLD	0.001	BLD	BLD	**Hg 184.887**
Ho 345.600	BLD	BLD	0.000	BLD	BLD	BLD	0.000	BLD	BLD	**Ho 345.600**
In 230.606	BLD	BLD	0.009	BLD	BLD	BLD	0.011	BLD	BLD	**In 230.606**
Ir 224.268	BLD	BLD	0.066	BLD	BLD	BLD	-0.001	BLD	BLD	**Ir 224.268**
K 766.491	16.868	5.694	39.771	4.722	53.782	5.891	0.034	2.947	1.217	**K 766.491**
La 333.749	BLD	BLD	0.010	BLD	BLD	BLD	0.001	0.010	0.007	**La 333.749**
Li 670.783	0.002	0.012	0.084	0.010	0.095	0.010	0.000	0.028	0.080	**Li 670.783**
Lu 261.541	BLD	BLD	BLD	BLD	BLD	BLD	0.000	Trace	Trace	**Lu 261.541**
Mg 279.553	14.392	18.825	37.827	4.493	36.642	4.013	0.021	1.945	3.796	**Mg 279.553**
Mn 257.610	0.035	0.024	0.028	0.003	0.085	0.009	0.001	0.236	0.610	**Mn 257.610**
Mo 202.032	BLD	BLD	0.024	0.0003	0.017	0.002	0.022	Trace	Trace	**Mo 202.032**
Na 589.592	88.231	64.874	210.471	24.945	232.495	25.465	0.557	0.604	0.308	**Na 589.592**
Nb 313.078	BLD	BLD	0.003	BLD	BLD	BLD	0.003	BLD	BLD	**Nb 313.078**
Nd 401.224	BLD	BLD	BLD	BLD	BLD	BLD	-0.005	BLD	BLD	**Nd 401.224**
Ni 231.604	BLD	BLD	0.012	0.001	0.038	0.004	0.004	0.020	0.022	**Ni 231.604**
P 213.618	0.142	0.338	0.712	BLD	4.885	0.535	3.232	0.209	0.867	**P 213.618**
Pb 220.353	BLD	BLD	0.013	BLD	0.025	0.003	0.006	0.004	0.011	**Pb 220.353**
Pd 340.458	BLD	BLD	BLD	BLD	BLD	BLD	-0.003	BLD	BLD	**Pd 340.458**
Pr 417.939	BLD	BLD	0.259	BLD	BLD	BLD	-0.007	BLD	BLD	**Pr 417.939**
Pt 214.424	BLD	BLD	BLD	BLD	BLD	BLD	-0.002	BLD	BLD	**Pt 214.424**
Rb 780.026	BLD	BLD	BLD	BLD	BLD	BLD	-0.027	BLD	BLD	**Rb 780.026**
Re 227.525	BLD	BLD	0.006	BLD	BLD	BLD	0.005	BLD	BLD	**Re 227.525**
Rh 343.488	BLD	BLD	0.016	BLD	BLD	BLD	0.016	BLD	BLD	**Rh 343.488**
Ru 267.876	BLD	BLD	0.037	BLD	BLD	BLD	0.004	BLD	BLD	**Ru 267.876**
S 181.972	11.594	6.102	56.736	6.739	37.979	4.160	0.026	0.005	0.317	**S 181.972**
Sb 206.834	BLD	BLD	0.013	BLD	BLD	BLD	0.011	BLD	BLD	**Sb 206.834**
Sc 361.383	BLD	BLD	BLD	BLD	BLD	BLD	0.000	0.002	0.003	**Sc 361.383**
Se 196.026	BLD	BLD	0.034	BLD	BLD	BLD	0.020	BLD	BLD	**Se 196.026**
Si 251.611	BLD	BLD	8.374	0.990	17.980	1.969	0.045	0.321	0.247	**Si 251.611**
Sm 359.259	BLD	BLD	0.004	BLD	BLD	BLD	0.003	BLD	BLD	**Sm 359.259**
Sn 189.925	BLD	BLD	0.007	BLD	BLD	BLD	0.018	BLD	BLD	**Sn 189.925**
Sr 407.771	0.185	0.326	3.380	0.402	3.448	0.378	0.000	0.016	0.022	**Sr 407.771**
Ta 268.517	BLD	BLD	BLD	BLD	BLD	BLD	0.001	BLD	BLD	**Ta 268.517**
Tb 350.914	BLD	BLD	0.002	BLD	BLD	BLD	0.001	BLD	BLD	**Tb 350.914**
Te 214.282	BLD	BLD	0.038	BLD	BLD	BLD	0.013	BLD	BLD	**Te 214.282**
Th 283.730	BLD	BLD	0.006	BLD	BLD	BLD	0.000	BLD	BLD	**Th 283.730**
Ti 336.122	BLD	BLD	BLD	BLD	BLD	BLD	0.001	0.269	0.820	**Ti 336.122**
Tl 190.794	BLD	BLD	0.009	BLD	BLD	BLD	0.007	BLD	BLD	**Tl 190.794**
Tm 313.125	BLD	BLD	0.001	BLD	BLD	BLD	0.001	BLD	BLD	**Tm 313.125**
U 385.957	BLD	BLD	0.043	BLD	BLD	BLD	0.005	BLD	BLD	**U 385.957**
V 292.401	BLD	BLD	0.007	0.001	0.009	0.001	0.002	0.016	0.041	**V 292.401**
W 207.912	BLD	BLD	0.014	BLD	BLD	BLD	0.003	BLD	BLD	**W 207.912**
Y 371.029	BLD	BLD	0.000	BLD	BLD	BLD	0.000	Trace	Trace	**Y 371.029**
Yb 328.937	BLD	BLD	0.000	BLD	BLD	BLD	0.000	Trace	Trace	**Yb 328.937**
Zn 213.857	0.578	0.408	0.721	0.084	0.658	0.072	0.010	0.066	0.040	**Zn 213.857**
Zr 343.823	BLD	BLD	0.001	BLD	BLD	BLD	0.000	0.008	0.007	**Zr 343.823**
Totals	**247.555**	**221.933**	**708.067**	**81.543**	**736.989**	**80.722**	**-1.887**	**32.267**	**50.496**	

	Client Samples								
		Sample depth 80-100cm	Sample depth 30-40cm						
	Tap water	Sample 1	Sample 2		Sample 3		GR Slate	GR Composite	
Metalloid el	%	%	%	%	%	%			
Ag 328.068			0.00						Ag 328.068
Al 396.152	0.04	0.07	0.02	0.02	0.04	0.04	26.12	26.71	Al 396.152
As 188.980			0.02	0.02	0.02	0.02	0.02	0.03	As 188.980
Au 242.794									Au 242.794
B 249.772			0.16	0.16	0.23	0.23			B 249.772
Ba 455.403			2.69	2.78	2.92	2.92	0.14	0.06	Ba 455.403
Be 313.042									Be 313.042
Bi 223.061			0.00						Bi 223.061
Ca 396.847	15.32	17.90	9.04	9.30	8.50	8.50	3.46	9.69	Ca 396.847
Ca 422.673	30.33	38.42	37.28	38.41	35.43	35.43	0.00	0.00	Ca 422.673
Cd 214.439			0.00		0.00	0.00			Cd 214.439
Ce 418.659			0.00				0.06	0.02	Ce 418.659
Co 238.892			0.00						Co 238.892
Cr 267.716	0.00	0.00	0.01	0.01	0.01	0.01	0.03	0.05	Cr 267.716
Cs 697.327									Cs 697.327
Cu 327.395	0.95	0.04	0.03	0.03	0.10	0.10	0.05	0.08	Cu 327.395
Dy 353.171			0.00	0.00	0.00	0.00			Dy 353.171
Er 349.910			0.03	0.03	0.02	0.02			Er 349.910
Eu 420.504									Eu 420.504
Fe 238.204	0.03	0.04	0.02	0.01	0.03	0.03	49.32	46.67	Fe 238.204
Ga 294.363			0.00	0.00			0.01	0.01	Ga 294.363
Gd 342.246			0.00						Gd 342.246
Ge 209.426			0.00						Ge 209.426
Hf 264.141			0.02	0.02	0.03	0.03			Hf 264.141
Hg 184.887			0.00						Hg 184.887
Ho 345.600			0.00						Ho 345.600
In 230.606			0.00						In 230.606
Ir 224.268			0.01						Ir 224.268
K 766.491	6.81	2.57	5.62	5.79	7.30	7.30	9.13	2.41	K 766.491
La 333.749			0.00				0.03	0.01	La 333.749
Li 670.783	0.00	0.01	0.01	0.01	0.01	0.01	0.09	0.16	Li 670.783
Lu 261.541									Lu 261.541
Mg 279.553	5.81	8.48	5.34	5.51	4.97	4.97	6.03	7.52	Mg 279.553
Mn 257.610	0.01	0.01	0.00	0.00	0.01	0.01	0.73	1.21	Mn 257.610
Mo 202.032			0.00	0.00	0.00	0.00			Mo 202.032
Na 589.592	35.64	29.23	29.72	30.59	31.55	31.55	1.87	0.61	Na 589.592
Nb 313.078			0.00						Nb 313.078
Nd 401.224									Nd 401.224
Ni 231.604			0.00	0.00	0.01	0.01	0.06	0.04	Ni 231.604
P 213.618	0.06	0.15	0.10		0.66	0.66	0.65	1.72	P 213.618
Pb 220.353			0.00		0.00	0.00	0.01	0.02	Pb 220.353
Pd 340.458									Pd 340.458
Pr 417.939			0.04						Pr 417.939
Pt 214.424									Pt 214.424
Rb 780.026									Rb 780.026
Re 227.525			0.00						Re 227.525
Rh 343.488			0.00						Rh 343.488
Ru 267.876			0.01						Ru 267.876
S 181.972	4.68	2.75	8.01	8.26	5.15	5.15	0.02	0.63	S 181.972
Sb 206.834			0.00						Sb 206.834
Sc 361.383							0.01	0.01	Sc 361.383
Se 196.026			0.00						Se 196.026
Si 251.611			1.18	1.21	2.44	2.44	1.00	0.49	Si 251.611
Sm 359.259			0.00						Sm 359.259
Sn 189.925			0.00						Sn 189.925
Sr 407.771	0.07	0.15	0.48	0.49	0.47	0.47	0.05	0.04	Sr 407.771
Ta 268.517									Ta 268.517
Tb 350.914			0.00						Tb 350.914
Te 214.282			0.01						Te 214.282
Th 283.730			0.00						Th 283.730
Ti 336.122							0.83	1.62	Ti 336.122
Tl 190.794			0.00						Tl 190.794
Tm 313.125			0.00						Tm 313.125
U 385.957			0.01						U 385.957
V 292.401			0.00	0.00	0.00	0.00	0.05	0.08	V 292.401
W 207.912			0.00						W 207.912
Y 371.029			0.00						Y 371.029
Yb 328.937			0.00						Yb 328.937
Zn 213.857	0.23	0.18	0.10	0.10	0.09	0.09	0.20	0.08	Zn 213.857
Zr 343.823							0.03	0.01	Zr 343.823