



State of Utah

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MEMORANDUM

TO: File **DRC-2014-002081**

THROUGH: Phil Goble, Manager, Compliance Section *PRG 3/5/14*

FROM: Tom Rushing, P.G. *JR 3/5/14*

DATE: March 5, 2014

SUBJECT: DRC Review of Energy Fuels Resources (USA) Inc. Documents Dated January 13, 2014 (Source Assessment Report for Gross Alpha in Groundwater Monitoring Well MW-32), and January 28, 2014 (Removal of Certain Groundwater Monitoring Parameters from Accelerated Monitoring Status)

Summary:

This memorandum is to summarize Utah Division of Radiation Control ("DRC") findings regarding review of two submittals from Energy Fuels Resources (USA) Inc. ("EFR") and regarding the White Mesa Uranium Mill ("Mill") as follows:

- EFR January 13, 2014, *Source Assessment Report for Gross Alpha in MW-32, White Mesa Uranium Mill*
- EFR January 28, 2014, *State of Utah Ground Water Discharge Permit No. UGW370004 White Mesa Uranium Mill – Removal of Certain Groundwater Monitoring Parameters from Accelerated Monitoring Status*

DRC review findings regarding each of the documents are below.

EFR January 13, 2014 Source Assessment Report for Gross Alpha (MW-32)

DRC review findings regarding the EFR document dated January 13, 2014 (Received by DRC January 14, 2014) and titled *Source Assessment Report for Gross Alpha in MW-32, White Mesa Uranium Mill* ("SAR") are summarized in this section. Monitoring well MW-32 is located at the southeast corner of tailings cell 2.

When conducting source assessment evaluations, EFR first categorizes the well and out-of-compliance ("OOC") parameter into one of five categories as follows:

1. Constituents in wells with previously identified rising trends.
2. Constituents in pumping wells.
3. Constituents potentially impacted by decreasing trends in pH across the site.
4. Newly installed wells with interim GWCLs.
5. Other constituents and wells.

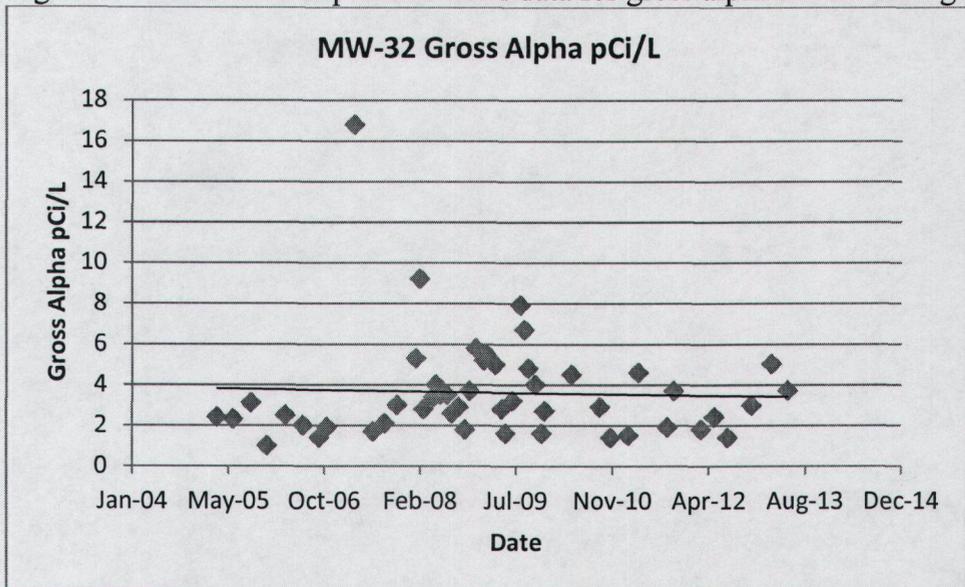
In the case of gross alpha in monitoring well MW-32 EFR conducted the assessment under the category “*other constituents and wells.*” EFR considers this category to be appropriate since the proposed cause of the OOC is due to limited data at the time of the GWCL statistical analysis and development. EFR notes that at the time of the original GWCL calculation only eight sample results were available; since that time forty-two sample results have been obtained.

In order to determine if the OOC was due to natural background fluctuations or leakage from the Mill tailings cells, EFR conducted reviews of reports and data results for indicator parameters and groundwater flow calculations. Findings regarding EFR review and determination of background are as follows.

Background Report

EFR notes that at the time of the background evaluation for monitoring well MW-32 a small amount of data was available for statistical evaluation (MW-32 was reviewed based on eight sample results for most parameters). Since the time of the background evaluation a significantly larger amount of data has been collected for gross alpha (currently forty two sample results). This allows for a more representative pool of samples and also allows for evaluation of potential trends in the data. As shown on the plot below, no apparent upward trend is evident for gross alpha in monitoring well MW-32.

Figure 1 – Ground water plot and trend data for gross alpha in monitoring well MW-32



U of U Study

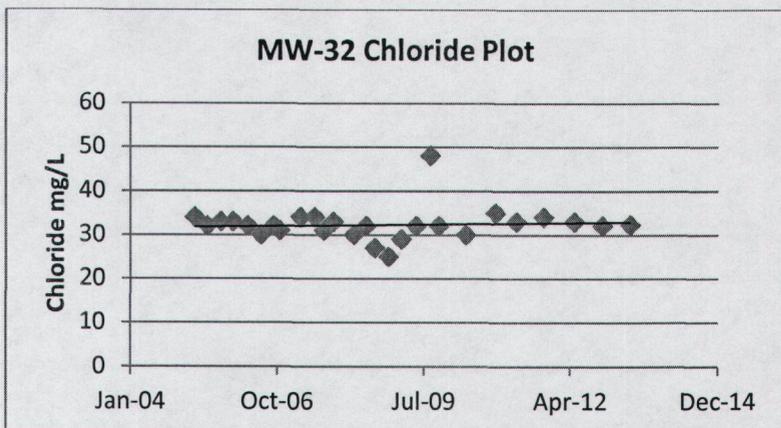
The SAR notes that the University of Utah (“U of U”) Study (Hurst and Solomon, 2008) concludes that groundwater at the White Mesa Uranium Mill has not been affected by Mill operations. The SAR additionally notes that monitoring well MW-32 was not specifically analyzed during the U of U Study; however, site study indicated that groundwater in the vicinity of the White Mesa Mill is older than the age of the Mill “*indicating no mill-related impacts to groundwater.*”

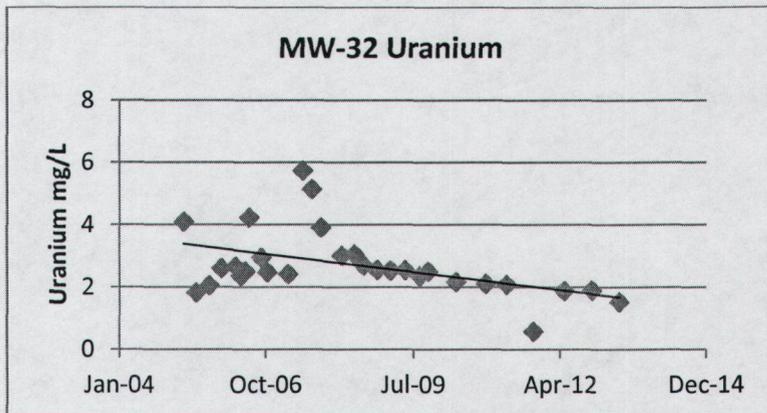
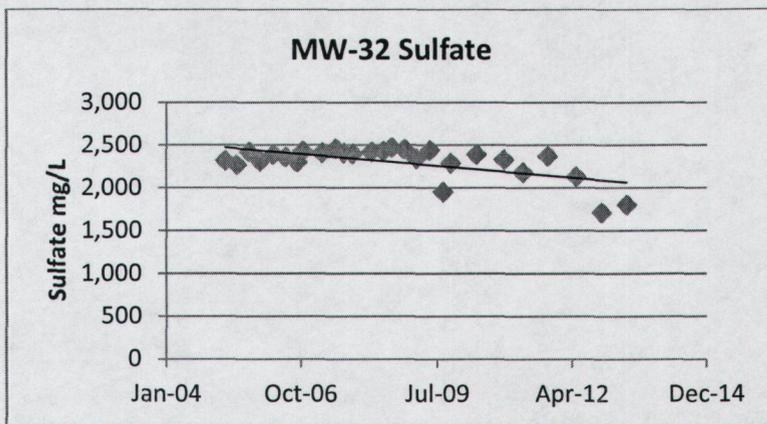
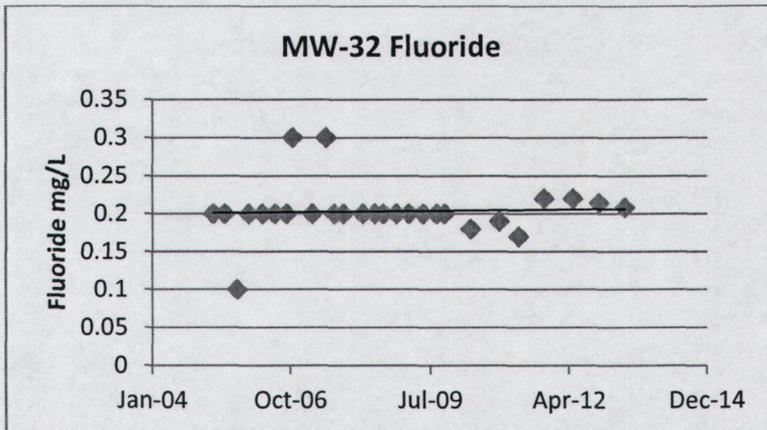
DRC notes that the U of U Study included monitoring well MW-31 which is located approximately ¼ mile west of monitoring well MW-32 and is hydraulically cross gradient (per kriged 4th Quarter 2013 water levels). Per isotopic results for chlorofluorocarbons and tritium, it was noted that the Burro Canyon Formation ground water at that location predated the Mill and was not likely impacted by Mill activities (seepage from tailings cell 2). The results of isotopic sampling, comparison of CFC’s and tritium, also indicated slow recharge water velocities through the vadose zone in the area of MW-31.

Helium isotope ratios indicate tritiogenic helium-3 in shallow zones in monitoring well MW-30 (approximately ½ mile west from monitoring well MW-32 and hydraulically downgradient) indicating a “potential” that some “young” water has been transported to the water table (source assumed to be the upper wildlife ponds). The study concludes that helium concentrations without supporting concentrations of other radiological isotopes indicate that the recharge source was not from the tailing cells.

Indicator Parameters

Per EFR analysis of indicator parameters chloride, fluoride and sulfate and uranium concentrations in MW-32 are not exhibiting significant trends, with the exception of uranium which is exhibiting a significantly decreasing trend. DRC plots and trend-lines are included below:





Per the EFR report there are some differences between concentration plots at the time of the background report and current concentration plots for chloride and sulfate. Specifically, chloride showed a decreasing trend at the time of the background report and now shows a slight increasing trend. Sulfate concentrations showed a significantly increasing trend at the time of the background report and are now slightly decreasing. EFR attributes these differences to the small set of data results which were available at the time of the background report.

Although some inconsistencies with the EFR background report are evident, it appears that the EFR conclusion that the differences were caused by a relatively small set of data results at the time of preparation of that report is likely. Based on DRC review of the SAR and data results it appears unlikely that the gross alpha results above the GWCL are due to tailings cell leakage.

EFR Proposed Modified GWCL

Based on the EFR conclusion that gross alpha exceedances in monitoring well MW-32 are due to a small background data set at the time of the background calculation and/or due to background geochemical influences, the SAR includes statistical tests and calculations for an EFR proposed revised GWCL. DRC reviewed the statistical tests and calculated background calculations as follows:

- DRC reviewed the data used in statistical analysis of gross alpha at well MW-32 to ensure that the data was appropriate (e.g. outliers and autocorrelation removed).
- Shapiro-Wilk Test for Normality of Data was cross checked by DRC (see attachment 1) using the EFR data set to ensure consistency (comments below).
- DRC cross checked the EFR statistical process against the Director approved Statistical Process Flow Chart to ensure conformance with the required tests.

Shapiro Wilk Test Cross Check

Per DRC cross check of the EFR Shapiro-Wilk Test for Normality for gross alpha in monitoring well MW-32, using the EFR data set, it was noted that the results are similar. EFR and DRC calculations are compared on the table below:

Parameter	EFR Calculation	DRC Calculation
W (Critical Value 0.922)	0.99	0.93
Mean	3.36	3.36
Standard Deviation (0.01)	1.83	1.78
Calculated GWCL	7.0	6.9

Based on the findings the DRC and EFR calculations are comparable and the EFR calculation appears to be appropriate. Therefore, DRC staff recommends that the EFR proposed modified GWCL be approved through inclusion in a permit modification or renewal subject to public participation and hearing requirement included in the *Utah Administrative Code R317-6-6.5*.

Well No.	Parameter	Current GWCL	EFR Proposed GWCL
MW-32	Gross Alpha	3.33 pCi/L	7 pCi/L

EFR January 28, 2014 Request to Return Groundwater Monitoring Parameters to Baseline Monitoring Frequency

A January 28, 2014 EFR letter requests that the following wells/parameters be returned to baseline monitoring frequency:

- Monitoring Well MW-14/Manganese
- Monitoring Well MW-23/Manganese
- Monitoring Well MW-25/Chloride
- Monitoring Well MW-11/Field pH
- Monitoring Well MW-31/Field pH
- Monitoring Well MW-15/Iron

The January 28, 2014 request is based on the most recent laboratory results for these wells/parameters showing results less than the Ground Water Compliance Limits (“GWCL’s”) listed in the White Mesa Uranium Mill Facility Ground Water Discharge Permit, Permit No. UGW370004 (“Permit”), for more than eight consecutive monitoring events (monthly accelerated monitoring).

Per DRC review of the laboratory results it was noted that the requested wells/parameters showed more than eight consecutive monthly laboratory results below the GWCL as follows:

Monitoring Well No.	Parameter	# Consecutive Lab Results below the GWCL
MW-14	Manganese	10 – Since 1 st Quarter 2013
MW-23	Manganese	8 – Since 4 th Quarter 2011
MW-25	Chloride	8 – Since 1 st Quarter 2013
MW-11	Field pH	8 – Since April 2013
MW-31	Field pH	8 – Since April 2013
MW-15	Field pH	8 – Since 4 th Quarter 2011

DRC also notes that laboratory analytical data sheets and sample collection field sheets were included with the January 28, 2014 letter, to provide confirmation of data results which had not yet been received by DRC in quarterly ground water reports. The 4th Quarter 2013 Groundwater Monitoring Report for the White Mesa Uranium Mill was also received by the Division of Radiation Control on February 14, 2014.

Based on DRC review of the January 28, 2014 EFR request and confirmation by DRC that at least eight consecutive sampling results are below the GWCL’s, it is recommended that the following wells/parameters be authorized to be returned to baseline monitoring frequency, approval by Director letter, for the listed parameters as follows:

Well Number	Parameter	Baseline Monitoring Frequency (Permit Part I.E.1.b)
MW-14	Manganese	Quarterly

Well Number	Parameter	Baseline Monitoring Frequency (Permit Part I.E.1.b)
MW-23	Manganese	Semi-annual
MW-25	Chloride	Quarterly
MW-11	Field pH	Quarterly
MW-31	Field pH	Quarterly
MW-15	Field pH	Semi-annual

The wells/parameters are subject to future accelerated monitoring requirements per the requirements of the Permit Part I.G. should future exceedances of GWCL's occur.

Conclusions

Based on review of the EFR SAR and letter request to return several wells/parameters to baseline monitoring frequency, and as discussed in findings above, the following conclusions were made:

1. The SAR claim that OOC status for gross alpha in monitoring well MW-32 is due to premature analysis to set GWCL's, using only eight data points, appears to be appropriate based on review of subsequent data points, justifications made according to the background report, U of U study, and indicator parameter concentrations. The statistical evaluation of gross alpha data appears to be appropriate and in conformance with the Director Approved statistical flow chart for the White Mesa Uranium Mill facility.

Therefore, it is recommended that the proposed modified GWCL of 7 pCi/L replace the current GWCL (3.3 pCi/L) and be included in a modified or renewal permit. The current GWCL is required and enforceable until such time as the Permit modification has been approved by the Director, after the permitting process including public participation and hearing requirements set forth in the *Utah Administrative Code R317-6-6.5*.

2. The EFR request to return the wells/parameters listed in the table below is recommended to be approved based on at least eight consecutive sample results below the GWCL since the last exceedance:

Well Number	Parameter	Baseline Monitoring Frequency (Permit Part I.E.1.b)
MW-14	Manganese	Quarterly
MW-23	Manganese	Semi-annual
MW-25	Chloride	Quarterly
MW-11	Field pH	Quarterly
MW-31	Field pH	Quarterly
MW-15	Field pH	Semi-annual

References

Denison Mines (USA) Corp., October, 2007, *Revised Background Groundwater Quality Report, Existing Wells for Denison Mines (USA) Corp.'s White Mesa Mill Site, San Juan County, Utah*

Energy Fuels Resources (USA) Inc., January 13, 2014, *Source Assessment Report for Gross Alpha in MW-32 White Mesa Uranium Mill*, Prepared by INTERA Geoscience & Engineering Solutions

Energy Fuels Resources (USA) Inc., January 28, 2014, *State of Utah Ground Water Discharge Permit No. UGW370004 White Mesa Uranium Mill – Removal of Certain Groundwater Monitoring Parameters from Accelerated Monitoring Status*

Hurst, T.G. and Solomon, D.K., 2008, *Summary of Work Completed, Data Results, Interpretations and Recommendations for the July 2007 Sampling Event at the Denison Mines, USA, White Mesa Uranium Mill Near Blanding, Utah*, Prepared by Department of Geology and Geophysics, University of Utah

U.S. Environmental Protection Agency, March 2009, *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance*

Appendix 1 – DRC Cross Check of the Shapiro-Wilk Test for Data Normality Gross Alpha in
Monitoring Well MW-32

Shapiro Wilk (n<50) Method DRC Cross Check Data Entered 3/3/2014 TR

Energy Fuels Monitoring Well MW-32 Gross Alpha Shapiro Wilk

i	x(i)	x(n-1+1)	x(n-i+1)*x(i)	a(n-i+1)	bi	Date	Data Result pCi/L
1	1	9.2	8.2	0.3917	3.21194	2/20/2008	9.2
2	1.4	8.8	7.4	0.2701	1.99874	11/10/2010	8.8
3	1.4	6.46	5.06	0.2345	1.18657	7/9/2013	6.46
4	1.5	5.8	4.3	0.2085	0.89655	12/9/2008	5.8
5	1.6	5.5	3.9	0.1874	0.73086	2/2/2009	5.5
6	1.6	5.3	3.7	0.1694	0.62678	1/29/2008	5.3
7	1.7	5.02	3.32	0.1535	0.50962	2/19/2013	5.02
8	1.8	4.6	2.8	0.1392	0.38976	4/1/2011	4.6
9	1.8	4.5	2.7	0.1259	0.33993	4/20/2010	4.5
10	1.9	4	2.1	0.1136	0.23856	5/14/2008	4
11	1.9	4	2.1	0.102	0.2142	10/14/2009	4
12	2	3.9	1.9	0.0909	0.17271	1/12/2010	3.9
13	2.4	3.72	1.32	0.0804	0.106128	5/13/2013	3.72
14	2.4	3.7	1.3	0.0701	0.09113	11/5/2008	3.7
15	2.5	3.7	1.2	0.0602	0.07224	10/3/2011	3.7
16	2.6	3.5	0.9	0.0506	0.04554	6/5/2008	3.5
17	2.6	3.5	0.9	0.0411	0.03699	7/9/2008	3.5
18	2.7	3.4	0.7	0.0318	0.02226	4/29/2008	3.4
19	2.8	3.1	0.3	0.0227	0.00681	9/22/2005	3.1
20	2.9	3	0.1	0.0136	0.00136	10/24/2007	3
21	2.9	2.97	0.07	0.0095	0.000665	11/6/2012	2.97
22	2.97	2.9	-0.07			9/8/2008	2.9
23	3	2.9	-0.1			9/13/2010	2.9
24	3.1	2.8	-0.3			3/12/2008	2.8
25	3.4	2.7	-0.7			12/1/2010	2.7
26	3.5	2.6	-0.9			8/5/2008	2.6
27	3.5	2.6	-0.9			8/19/2009	2.6
28	3.7	2.5	-1.2			3/22/2006	2.5
29	3.7	2.4	-1.3			3/30/2005	2.4
30	3.72	2.4	-1.32			4/30/2012	2.4
31	3.9	2	-1.9			6/21/2006	2
32	4	1.9	-2.1			10/25/2006	1.9
33	4	1.9	-2.1			8/30/2011	1.9
34	4.5	1.8	-2.7			10/13/2008	1.8
35	4.6	1.8	-2.8			2/21/2012	1.8
36	5.02	1.7	-3.32			6/21/2007	1.7
37	5.3	1.6	-3.7			5/13/2009	1.6
38	5.5	1.6	-3.9			11/18/2009	1.6
39	5.8	1.5	-4.3			2/9/2011	1.5
40	6.46	1.4	-5.06			9/13/2006	1.4
41	8.8	1.4	-7.4			7/9/2012	1.4
42	9.2	1	-8.2			12/14/2005	1
					total =		
					10.899343		

Standard Deviation Calculation:

Mean = 3.358809524 Variables = 131.2630295

Standard Deviation = 1.767854696

W Statistic = 0.927093743 .01 Critical n(42) = 0.922

DRC Calculated Limit 6.9

Energy Fuels Calculated Limit 7