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MEMORANDUM

TO: File

THROUGH: Phil Goble, Manager PRG 11/20/2019

FROM: Tom Rushing, P.G. JR 11/20/19

DATE: November 20, 2019

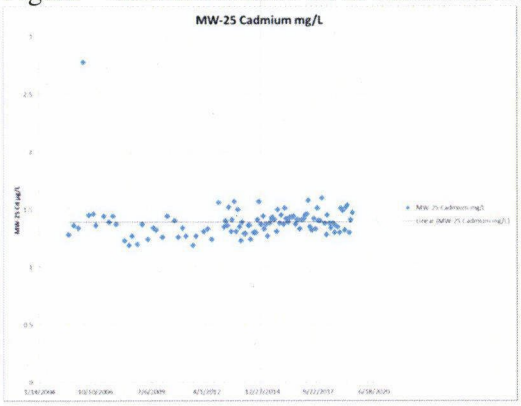
SUBJECT: Review of the Energy Fuels Resources (USA) Inc. (EFR), White Mesa Uranium Mill, Blanding, Utah September 23, 2019 Source Assessment Report for Cadmium in Monitoring Well MW-25
Groundwater Discharge Permit No. UGW370004

Summary

A Source Assessment Report ("SAR") for Cadmium in Monitoring Well MW-25 at the White Mesa Uranium Mill (Mill) was submitted by Energy Fuels Resources (USA) Inc. ("EFR") dated September 23, 2019, and received by the Utah Division of Waste Management and Radiation Control (DWMRC) on September 24, 2019. The SAR was submitted for DWMRC review and approval of proposed revised cadmium Ground Water Compliance Limit (GWCL) for monitoring well MW-25 in the Groundwater Discharge Permit No. UGW370004 (Permit).

Monitoring well MW-25 is located on the eastern berm of the Mill Tailings Cell 3 and is hydraulically cross-gradient from Mill Tailings and processing areas. The figure below is a historical time-concentration plot of cadmium in monitoring well MW-25.

Figure - Cadmium Data Plot of Historical Data at MW-25



Per DWMRC review the data results show a higher variability starting approximately 2012 and no apparent data trend. This coincides with the time period that EFR changed laboratories. The higher variability of the data is likely due to higher sensitivity of laboratory equipment and analytical methods.

DWMRC does not agree with EFR findings in the SAR regarding trend analysis and statements that a significant increasing trend is present in the complete data set for cadmium in MW-25 (Page 10 and Appendix E). Review of the statistical analysis shows a normal distribution of data for both the complete data set and for a culled data set (data after the 2012 laboratory change); and visual examination of the data plots do not depict a significant increasing trend. Per the EFR SAR analysis of trends using only the post 2012 data (Mann Kendall Trend Analysis), it was noted that no significant trend was evident. Proposal of a revised GWCL based on a modified approach, due to a significant data trend as suggested in the SAR is not warranted and is not in conformance with the currently approved statistical flow chart. Per the flow chart a revised GWCL should be calculated based on mean + 2 standard deviations.

DWMRC Review of Recent Compliance Limit Modifications in MW-25

Field pH – DWMRC notes that the GWCL (pH range) was modified to 5.77 S.U. – 8.5 S.U. (from 6.5 S.U. to 8.5 S.U.) in the January 19, 2018 Permit renewal. Per review of the field pH monitoring data since the permit renewal Jan. 2018 through the 2nd Quarter 2019 sampling, all samples have been within the GWCL pH range.

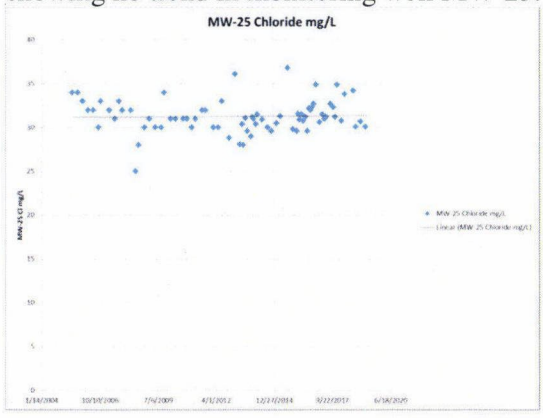
Uranium – DWMRC notes that the GWCL for uranium was modified in the January 19m 2018 Permit renewal, from 6.5 µg/L to 7.25 µg/L. No exceedances of the modified GWCL have occurred through the most recently received data results.

Tailings Solution Groundwater Indicator Parameters at Monitoring Well MW-25

The SAR Section 3.4 discusses four primary indicator parameters (Chloride, Fluoride, Sulfate and Uranium) which would be detected in ground water in the event of a discharge from the Mill tailings cells.

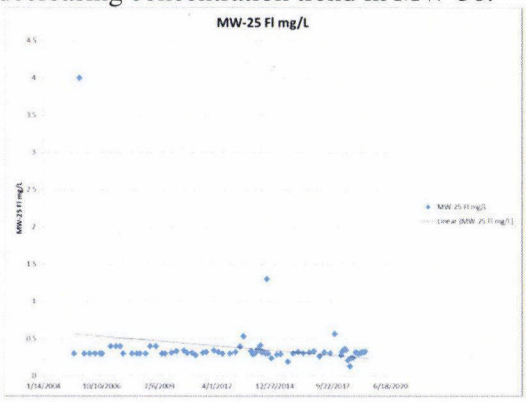
Chloride

Chloride is highly concentrated in the tailings wastewater and is highly mobile in groundwater. Chloride is showing no trend in monitoring well MW-25.



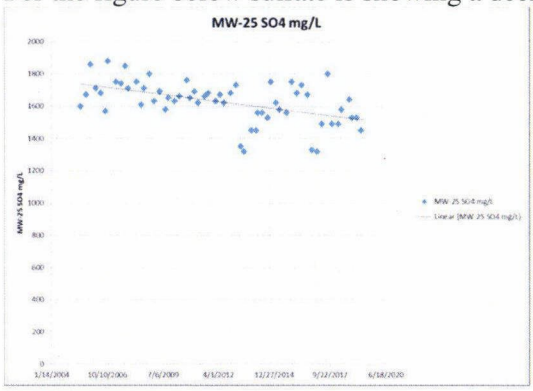
Fluoride

Fluoride is highly concentrated in tailings wastewater and per literature and mill groundwater transport modeling has been shown to be highly mobile in groundwater. Per the figure below, fluoride is showing a decreasing concentration trend in MW-30.



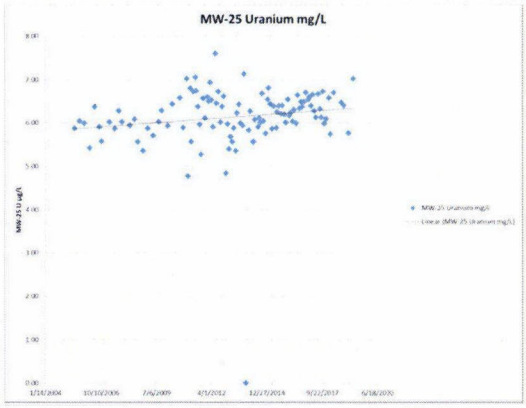
Sulfate

Sulfate is also abundant in the tailings wastewater and is a relatively mobile constituent in groundwater. Per the figure below sulfate is showing a decreasing trend in MW-25.



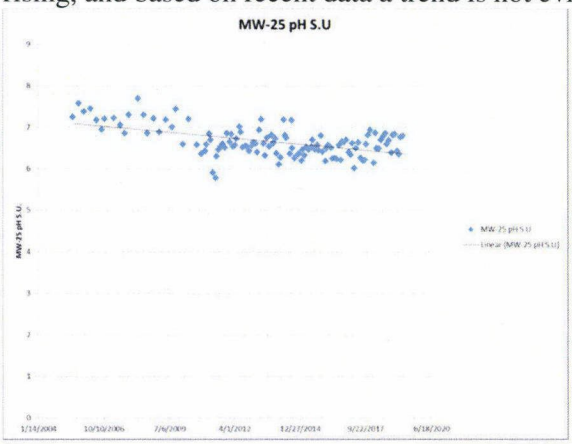
Uranium

Uranium is showing a relatively stable concentration. The GWCL for uranium in MW-25 was recently re-set based on the post 2012 data and due to increased data variability after the EFR laboratory change.



pH

Based on all historical pH data, a decreasing trend is plotted, however it is noted that recent pH data is rising, and based on recent data a trend is not evident.



Indicator parameter analysis supports the SAR finding that tailings wastewater is not present in groundwater at MW-25.

Source Assessment Conclusions

The SAR discusses several lines of evidence to support that Mill activities are not the source of the selenium and uranium GWCL exceedances in monitoring well MW-25, including; 1. Evaluation of tailings solution indicator parameters (chloride, sulfate, fluoride and uranium): 2. Evaluation of the historical data for all monitoring parameters at MW-25, and: 3. Findings of the 2007/2008 University of Utah Groundwater Study at the Mill. Additionally, monitoring well MW-25 is cross-gradient from the Mill and tailings cells and contamination is unlikely to occur in the monitoring well. A clear point of inflection in the data occurs during 2012 when EFR contracted with a different environmental laboratory and it is likely that exceedances since that time are due to the higher data variability caused by higher method sensitivity at the new laboratory after the point of inflection.

Per DWMRC review, these findings are consistent with previous EFR SAR's and it does not appear that the GWCL exceedances are being caused by Mill activities. Adjustment of the GWCL for MW-25 cadmium in the Permit is appropriate. Evaluation of the comprehensive list of monitoring parameters and evaluation of data by EFR and DWMRC at monitoring well MW-25 is ongoing.

The table below summarizes the EFR calculations and rationale for the proposed modified GWCL's.

Well Number	Parameter	Current GWCL	EFR Proposed GWCL Revision	Method to Determine GWCL	DWMRC Finding – Is Proposed GWCL in Conformance with the Statistical Flow Chart?	DWMRC Recommended Modified GWCL Based on SAR Review	Method to Determine GWCL
MW-25	Cadmium	1.5 µg/L	2.5 µg/L	Fraction of GWQS	The data set is normally distributed and no increasing trend is evident. Per the statistical flow chart the GWCL should be calculated	1.6 µg/L	Mean + 2 SD

Well Number	Parameter	Current GWCL	EFR Proposed GWCL Revision	Method to Determine GWCL	DWMRC Finding – Is Proposed GWCL in Conformance with the Statistical Flow Chart?	DWMRC Recommended Modified GWCL Based on SAR Review	Method to Determine GWCL
					according to mean + 2 standard deviations.		

Conclusions:

Based on review a letter will be sent to EFR of initial approval of the modified GWCL on the table above (MW-25 Cadmium). The letter will include notification that the modifications are subject to public notice and public participation requirements, and that the modifications will not be effective until formal issuance of a modified Permit.

References

[1] Energy Fuels Resources (USA) Inc., September 23, 2019, *Transmittal of Source Assessment Report for MW-25 White Mesa Mill Groundwater Discharge Permit UGW370004*

[3] Energy Fuels Resources (USA) Inc., August 22, 2019, *White Mesa Uranium Mill Ground Water Monitoring Quality Assurance Plan (QAP), Revision 7.6*

[4] Energy Fuels Resources (USA) Inc., October 12, 2012, *Source Assessment Report*, Prepared by Intera

[5] Energy Fuels Resources (USA) Inc., November 9, 2012, *pH Report*, Prepared by Intera

[6] Hurst, T.G., and Solomon, D.K. University of Utah, 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

[7] Hydro Geo Chem, December 7, 2012, *Pyrite Investigation Report*

[8] Intera, 2007, *Groundwater Data Preparation and Statistical Process Flow for Calculating Groundwater Protection Standards, White Mesa Mill Site, San Juan County, Utah*

[9] United States Environmental Protection Agency, 2009, *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance EPA530/R-09-007*

[10] Utah Department of Environmental Quality, January 19, 2018, Modified on March 19, 2019, *Utah Division of Radiation Control, Ground Water Discharge Permit, Permit No. UGW370004, Energy Fuels Resources (USA) Inc.*