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MEMORANDUM

TO: File

THROUGH: Phil Goble, Manager Phillip Goble Phillip Goble (Aug 2, 2021 15:59 MDT) 08/02/2021

FROM: Tom Rushing, P.G. TR TR (Aug 2, 2021 07:49 MDT) 08/02/2021

DATE: July 1, 2021

SUBJECT: Review of the Energy Fuels Resources (USA) Inc. (EFR), White Mesa Uranium Mill, Blanding, Utah April 29, 2021, Source Assessment Report for Uranium in Monitoring Well MW-31
Ground Water Discharge Permit No. UGW370004 (Permit)

Summary

An April 29, 2021, Source Assessment Report ("SAR") for uranium in Monitoring Well MW-31 at the White Mesa Uranium Mill (Mill) was submitted to the Director by Energy Fuels Resources (USA) Inc. ("EFR") and received by the Utah Division of Waste Management and Radiation Control (DWMRC) on April 30, 2021. The SAR was submitted for review and approval of source assessment investigation findings and proposed revised Ground Water Compliance Limits (GWCLs) for uranium.

Monitoring well MW-31 is located on the southern berm of the Mill Tailings Cell 2 and is hydraulically downgradient from portions of Cell 2 and from the Mill processing and storage areas. MW-31 is within the defined nitrate/chloride plume, and non-compliance for nitrate and chloride are regulated through a separate consent order (UGW12-04) issued by the Director.

Monitoring well MW-31 has been subject to four previous SAR's (After submission of the comprehensive sitewide 2012 SAR) for various constituents as summarized on the table below:

Monitoring Well	SAR Date	Monitoring Constituents
MW-31	8/30/2013	Se
MW-31	12/19/2015	Se, SO4, TDS, pH
MW-31	8/20/2017	Se, SO4, TDS, U
MW-31	6/24/2020	SO4, TDS

Therefore, per previous MW-31 SAR's, uranium was most recently reviewed per the 8/20/17 SAR which constituted a very rigorous review of a potential release of tailings wastewater from cell 2. Per that review DWMRC determined that tailings wastewater was not the source of the exceedances based on multiple lines of evidence. Per DWMRC review of the 2017 SAR, it was recognized that an increasing concentration trends was present for uranium in monitoring well MW-31. Specifically, it was stated that:

"*Uranium*

Uranium concentrations in monitoring well MW-31 are similar to sulfate concentrations in that site-wide they are low, as demonstrated by box plot evaluation comparing uranium concentration in MW-31 to all monitoring wells site wide. Box plot evaluation finds that the uranium concentrations in MW-31 are within background concentration range and are low for the mill site. The SAR discusses that rising uranium concentrations are likely associated with lower pH in the groundwater.

Indicator parameters, other than chloride, are seen to have low site wide concentrations regardless of trends. Per SAR evaluations of ratios of the mobile contaminants in groundwater with the tailings wastewater concentrations, it appears that the source of the mobile contaminants is due to causes other than tailings wastewater."

The basis of the DWMRC review of potential uranium due to a tailings solution release to the groundwater has not changed, although it is noted that the concentration trend is steepening per review of data scatter plots and trend lines. In comparison to the 8/20/17 SAR findings, the uranium concentrations are still within the range of background concentrations, as are other primary indicator parameters of tailings solution release, except for chloride which is subject to review per the nitrate/chloride plume corrective action plan (CAP).

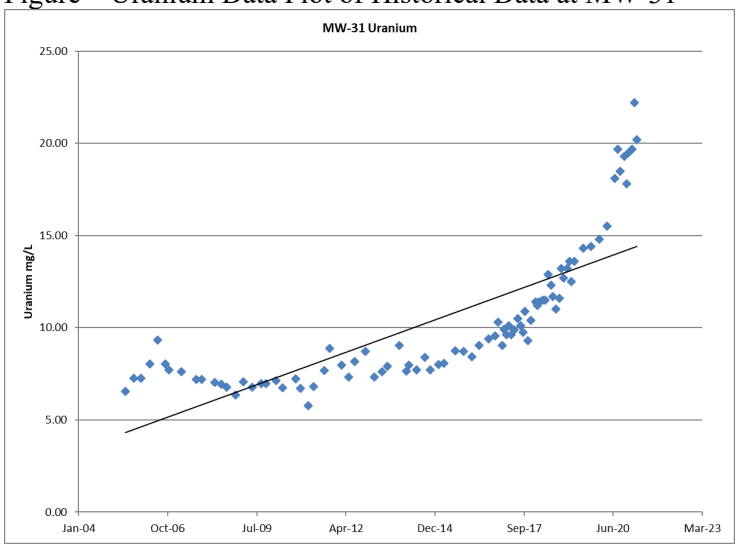
Per the previous SAR's, it was agreed that continuing review of MW-31 is necessary to ensure that the criteria has not changed, and that no additional information has been generated to potentially refute the original findings of SAR reviews. Review of the April 29, 2021, SAR is therefore a continuation of investigation of a previously identified increasing trend for uranium. Therefore, as discussed below, a GWCL adjustment and additional monitoring of uranium in MW-31 is warranted. Ongoing compliance requirements of the Permit will require a re-visiting of the adjusted uranium GWCL if trends continue and MW-31 returns to out-of-compliance (OOC) status.

SAR Review

The April 29, 2021, SAR is broken up into four primary sections: 1. Categories and approach for analysis of potential sources of the contamination; 2. Results of the analysis (e.g. sitewide pH, changes in groundwater in MW-31, indicator parameter analysis, pH, and mass balance analysis); 3. Statistical evaluation and calculation of revised GWCL's for trending parameters, and; 4. Conclusions and recommendations.

The figure below depicts the time/concentration plots for uranium in monitoring well MW-31. As discussed above it is noted that the concentrations are steepening, although still low per site-wide evaluation:

Figure – Uranium Data Plot of Historical Data at MW-31



Per the EFR SAR findings, the GWCL exceedances and data trends are not found to be caused by Mill activities (leakage from the tailings impoundments), and based on the increasing trends, EFR is proposing that a modified approach (background x 1.5) of a post July 2020 data set be used as a basis for the uranium GWCL. Per the plot, it does appear that the post July 2020 data represents a data inflection (steepening and new distribution). EFR statistical review finds that the data within this period shows a normal distribution and justifies the use of the modified data set based on that finding and the finding that the increasing trend was previously identified and studied. The EFR proposal is consistent with the Director approved statistical flow chart and Environmental Protection Agency Guidance (EPA 2009) which allows consideration of a modified approach if a significant trend is evident. DWMRC review findings regarding the SAR, sitewide concentration comparisons, and the EFR proposed revised GWCL's is discussed below.

DWMRC Review of Compliance Data and Trends

Uranium – DWMRC notes that the Permit GWCL was modified/raised to 15 µg/L (from 9.1 µg/L) in the 2017 Permit modification. Uranium concentrations in MW-31 are comparable to other monitoring wells at the site including wells upgradient and far downgradient. Although it is noted that large variability in uranium concentrations is measured across the area, the concentrations in MW-31 are within background range, similar to sitewide concentrations and considerably lower than upgradient monitoring well MW-18 and far downgradient monitoring wells MW-03A and MW-29.

Monitoring Well No.	Location Relative to Tailings Cells	Highest Historic Measured Uranium Value (µg/L)	Average Uranium Concentration (Complete Data Set) (µg/L)
MW-31	Downgradient Cell 2	22.2	10.34
MW-1	Upgradient	10.7	1.08
MW-18	Upgradient	49	38.5
MW-19	Upgradient	12.8	7.0
MW-20	Far Downgradient	34.6	7.45
MW-03A	Far Downgradient	35.2	20.2

MW-29	Downgradient Cells 1 and 2	49	13.07
MW-11	Downgradient Cells 2 and 3	1.33	0.8

EFR Investigations of Potential Sources of Increasing Trends at Monitoring Well MW-31 including the Current Uranium Trend

1. Changes in Mill Groundwater Operations

Per section 3.2 of the SAR and review of previous SAR's for MW-31, there are several Mill operational and environmental changes that have occurred and that appear to be consistent with data inflections seen on the time series plots. Specifically these changes are; 1. The initiation of monthly groundwater sampling in 2010; 2. A well redevelopment project in 2011; 3. A change in environmental laboratory used in 2012; 4. A peak groundwater elevation at MW-31 in 2013; and, 5. Five new chloroform wells brought online on the east side of Cell 2 in 2014. Per DWMRC review of the time series plot it is observable that the trends in MW-31 and at other sitewide monitoring wells appear to begin in late 2010 and 2011, during the time of initiation of increased frequency (monthly monitoring) and the well redevelopment project, which included over pumping all monitoring wells at the Mill. These actions may have introduced/allowed oxygen to enter pores within the sandstone and shales of formations in the well screened intervals and caused geochemical reactions within the minerals of those zones. Also, an inflection in certain monitoring analytes and wider scattering of data is clearly seen in 2012 when the analytical laboratory was changed, although the increasing trend is more pronounced in recent time and is likely influenced by migration of the nitrate/chloride plume.

Per DWMRC findings regarding time series plots of data, the data inflection seen late 2012, for certain parameters indicates a shift in background concentrations due to the laboratory change. For parameters where this is observed in MW-31, and consistent with the EPA 2009 Unified Statistical Guidance, it is appropriate to use the data after this inflection to evaluate the background data. The Director approved statistical flow chart also allows for the use of a modified approach if an upward trend is apparent, providing that the cause of the trends is not from Mill activities (or addressed through separate compliance action such as the corrective action plan for the nitrate/chloride plume).

2. Discussion of Tailings Solution Groundwater Indicator Parameters at Monitoring Well MW-31

The SAR Section 3.3 discusses four usual primary indicator parameters (Chloride, Fluoride, Sulfate and Uranium) which would be detected in ground water in the event of discharge from the Mill tailings cells. Additionally, SAR appendices include plots of data for the indicator parameters and the SAR Appendix A-1 and A-2 present descriptive statistics for indicator parameters.

Per previous DWMRC review Piper diagrams evaluating chemical relationships of Cell 1 wastewater and observed groundwater concentrations; fluoride, sulfate and uranium concentrations in MW-31 are within the same background range of monitoring wells upgradient and far downgradient from the Mill. The evaluation confirmed that chloride concentrations in MW-31 are well above background range, as expected, based on the MW-31 location within the nitrate/chloride plume.

Chloride

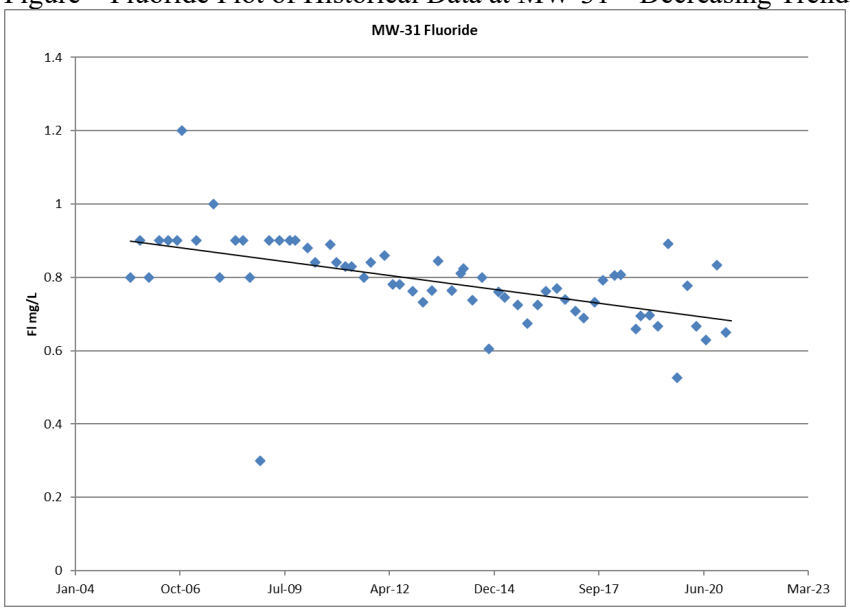
The use of chloride as an indicator parameter in the case of monitoring well MW-31is complicated by the fact that MW-31 is screened within a nitrate/chloride plume, and chloride is therefore above background and is not a reliable primary indicator of cell leakage for MW-31. Chloride at monitoring well MW-31 is

showing a significant increasing trend. Findings related to comparisons of MW-31 chloride and background wells outside of the nitrate/chloride plume show chloride well outside of background range. The chloride plume has been delineated based on concentrations and plots which clearly show that the plume leading edge is hydraulically upgradient from the mill tailings cells and is not attributed to tailings cell leakage based on groundwater flow data and mass balance calculations. Chloride concentration are subject to DWMRC administrative order which requires implementation of the nitrate/chloride corrective action plan.

Fluoride

Fluoride is highly concentrated in tailings wastewater and per literature and mill groundwater transport modeling has been shown to be highly mobile in the vadose zone and groundwater beneath the tailings impoundments. Per the figure below, fluoride is showing a decreasing concentration trend in MW-31.

Figure – Fluoride Plot of Historical Data at MW-31 – Decreasing Trend



Mass balance calculations for fluoride have been reviewed by DWMRC. Per findings the concentration of fluoride in groundwater when compared with less mobile constituents in tailings wastewater are much lower; additionally, as per the figure above overall concentrations are declining but would be increasing due to input of tailings wastewater which is high in fluoride concentration. Previous EFR SAR's used a comparison of selenium and fluoride in Cell 1 tailings wastewater and MW-31 groundwater and concluded that selenium is found at much higher percentages in groundwater than fluoride. DWMRC has additionally conducted additional Cell 1 evaluation of mass concentrations in tailings wastewater compared to concentrations in MW-31 and found that that the MW-31 concentrations are not consistent with a tailings source. Fluoride concentrations should be over 20 times higher to indicate a relationship with tailings wastewater.

Sulfate

Sulfate concentrations in MW-31 are very low in comparison with other monitoring wells at the site, including upgradient and far downgradient monitoring wells. The highest historic value of sulfate in MW-

31 is 1,210 mg/L (March 2021). This concentration is compared with highest historical values of other site monitoring wells (nearby MW-31) on the table below which shows a lower maximum concentration and average concentration of sulfate at MW-31:

Monitoring Well No.	Location Relative to Tailings Cells	Highest Historic Measured Sulfate Value (mg/L)	Average Sulfate Concentration (Complete Data Set) (mg/L)
MW-31	Downgradient Cell 2	1,210	702
MW-1	Upgradient	1,990	837
MW-18	Upgradient	2,020	1,828
MW-19	Upgradient	1,320	669
MW-20	Far Downgradient	4,130	3,526
MW-03A	Far Downgradient	5,940	3,568
MW-29	Downgradient Cells 1 and 2	2,980	2704
MW-11	Downgradient Cells 2 and 3	1,410	1,105

Per DWMRC review of the data and SAR box plots comparing groundwater chemistry and concentration of ugradient and downgradient monitoring wells with MW-31, the sulfate concentrations in MW-31 are low by comparison site wide.

The relatively low concentration of sulfate in MW-31 indicates a source other than tailings solution.

Uranium

Uranium concentrations in monitoring well MW-31, like sulfate concentrations, are low and within range of background concentrations site-wide as discussed above. Rising uranium concentrations are likely associated with lower pH in the groundwater. DWMRC evaluation of pH trends and EFR studies are ongoing, and will more specifically include MW-31 in the near future.

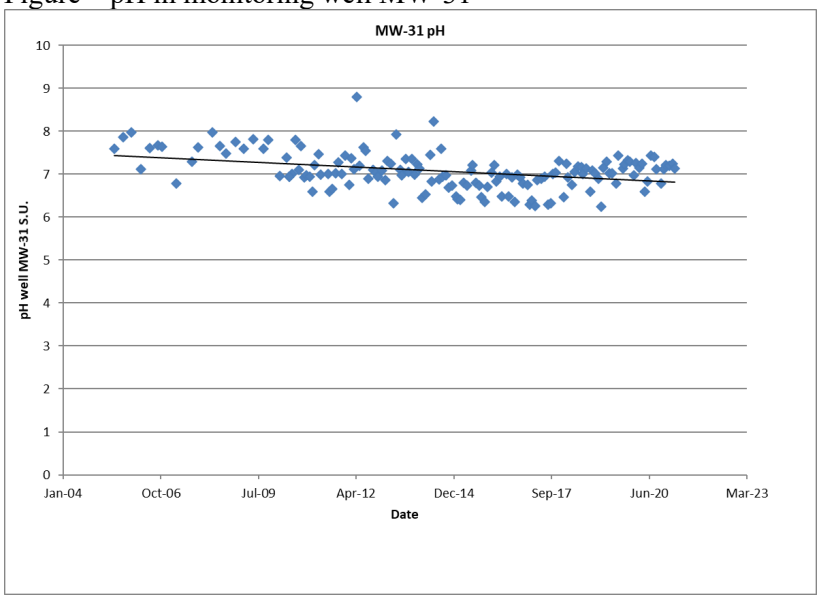
Indicator Parameter Summary

Indicator parameters, other than chloride, are seen to have low site wide concentrations regardless of trends. Chloride concentrations are higher than background due to impacts from the chloride/nitrate plume. Per SAR evaluations of ratios of the mobile contaminants in groundwater with the tailings wastewater concentrations, it appears that the source of the mobile contaminants is due to causes other than tailings wastewater.

3. pH Analysis

Section 3.1 of the SAR includes a summary of site-wide decreasing pH and refers specifically to the discussion of "Site-Wide Decreasing pH," and, Section 3.4 and Appendix D of the previous 2020 SAR which included a comprehensive evaluation of pH in MW-31 and evaluation of the decreasing trend. Per the current SAR and statistical analysis (included in Appendix A of the SAR) more recent data show that pH is stable to increasing at near neutral values. Review of the recent pH data is not consistent with a tailings source and may support findings of the previous and ongoing EFR pH and pyrite investigations.

Figure – pH in monitoring well MW-31



4. Mass Balance

The SAR section 3.4 discusses the mass balance evaluation for MW-31 and refers to the evaluation in the 2020 SAR which was comprehensive. Specifically, the 2020 SAR included a mass balance evaluation (Section 3.5 and Appendix E) of concentrations of fluoride, uranium, chloride, sulfate in MW-31, and mean concentrations of the same parameters in cell 1 wastewater (mean of data 2013 through 2019). This evaluation was the same method used to evaluate mass balance in the 2017 SAR for MW-31. The mass balance calculations evaluate the data for comparisons due to dilution and do not consider relative mobility of contaminants.

Based on large inconsistencies between the tailings wastewater concentrations and the expected diluted concentrations, the previous EFR SAR's conclude that "*the mass balance analysis indicates that potential tailings system seepage is an unlikely contributor to the groundwater chemistry at MW-31*." Per DWMRC review, the analysis indicated that the groundwater concentrations of the evaluated parameters in MW-31 were not consistent with a tailings source. The findings/conclusions are of the mass balance evaluation in the 2020 and 2017 SARs for MW-31, which showed significant underestimation or overestimation of expected observed constituent concentrations in the event of tailings cell seepage and a determination that tailings wastewater was an unlikely cause of the observed concentrations in MW-31 were consistent. Per the current SAR, no contradictory data has been collected since these previous investigations.

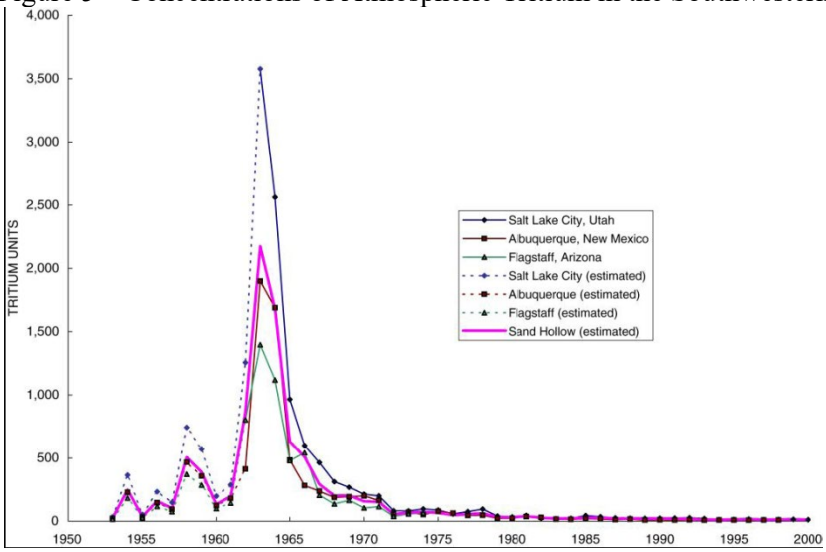
5. University of Utah Study

Monitoring well MW-31 was included in a University of Utah study conducted at the White Mesa Uranium Mill during 2007 (Final Report of Study Findings Dated May, 2008). Based on groundwater age dating at monitoring well MW-31 [chlorofluorocarbon ("CFC") analysis], the groundwater was found to exhibit CFC recharge dates which predate the construction of the Mill in 1980.

Additionally, tritium concentrations in monitoring well MW-31 were found to be non-detect. If ground water in monitoring well MW-31 had a surface infiltration source post 1950's (time period of atmospheric injection of tritium during above-ground thermonuclear weapons testing) then tritium concentrations would

be expected in ground water samples in monitoring well MW-31. Figure 5 below is taken from the University of Utah ("U of U") Report (Hurst and Solomon 2008) and depicts atmospheric concentrations of tritium in the southwest by year.

Figure 5 – Concentrations of Atmospheric Tritium in the Southwestern United States



Based on review of the U of U Report and specific data results for monitoring well MW-31 age dating of groundwater at the well indicates that the MW-31 groundwater predates Mill construction.

6. Source Assessment Conclusions

Section 3.5 of the SAR discusses the summary of results for evaluation of uranium in monitoring well MW-31.

Based on EFR evaluations and studies performed and discussed in the SAR, and DWMRC review and findings as discussed above, it appears that the Out of Compliance status and rising trend for uranium is not due to tailings wastewater release from the mill. Per discussion above, uranium has been previously studied and reviewed for MW-31.

Investigations of indicator parameters and other constituent concentrations, pH evaluation, and mass balance evaluations of the tailings wastewater does not support that rising uranium concentrations at MW-31 is Mill caused. Additionally, the University of Utah Study confirmed that identified rising trends for constituents in MW-31 were not Mill caused but were present before construction and operation of the Mill.

EFR Proposed Modified GWCL Statistical Evaluation of Data:

Based on DWMRC review of the SAR statistical analysis it was noted that analysis was conducted for the complete historic data set for MW-31, for a post September 2012 data set, for a post May 2014 data set, and for a post July 2020 data set. The complete data set, the post September 2012 data set, and the post May 2014 data set did not show normal or log normal distribution for uranium. The post July 2020 data showed normality for uranium. Statistical

methods used included 1. Descriptive statistics for the complete and modified data sets; 2. Mean and Standard Deviation Calculation; 3. Shapiro-Wilk Test for normality; and, 4. Mann-Kendall Trend Analysis (non-normally distributed data sets). Proposed GWCL's were calculated based on Fraction of the GWQS, Mean + 2 Standard Deviation, Upper Tolerance Limit, Highest Historical Value and Background Mean Concentration times 1.5. The calculations and findings are summarized on a table in the SAR (Appendix B-1 of the SAR).

Per the DWMRC approved statistical flow chart for the White Mesa Mill groundwater monitoring wells, it was noted that if an upward trend is apparent for an analyte, then a modified approach should be considered. The modified approach should allow for a GWCL which considers the increasing concentrations. Based on this, EFR calculated GWCL's according to the Utah Groundwater Rules (Utah Administrative Code R317-6) which allow maximums to be set according to Mean + 2 Standard Deviations, 0.5 times the GWQS (Class III Water), or 1.5 times the background concentration. DWMRC findings note that setting the GWCL at a maximum value for these parameters is reasonable, given that the wells will likely exceed a more conservative GWCL in a short period of time when considering the increasing trends.

Therefore, when comparing the various calculated GWCL's it is found appropriate to set GWCL's for uranium according to 1.5 times background for post July 2020 data set since this method provides the highest concentrations approved by the statistical flow chart. The concentration is still relatively low since it does not exceed the uranium GWQS. This value is in conformance with the approved statistical flow chart, the Utah Groundwater Rules, EPA Statistical Guidance and considers the increasing data trend.

A cross review of EFR calculated mean concentrations for parameters using 1.5 X background was conducted as shown on the table below. Per evaluation, the EFR mean calculations are correct and are representative of the data set used for evaluation.

Table – Comparison of EFR Background Data Set Mean Value in the SAR with DWMRC Calculated Mean for Uranium in MW-31

Parameter	EFR Calculated Mean	DWMRC Calculated Mean
MW-31 Uranium (Post July 2020)	19.35 µg/L	19.44 µg/L

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

Table of EFR Proposed Revised GWCL's for Monitoring Well MW-31:

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
MW-31	Uranium	15 µg/L	29.03 µg/L	1.5 X Background of Recent (Post July 2020) Data Set	Increasing Trend allows for modified approach on Flow Chart. Per UAC 317-6, Class III water is allowed to be calculated by 1.5 X Background. Per DWMRC Review of the Uranium Data the modified approach appears appropriate. The post July 2020 data set is appropriate since data in that range shows a normal distribution but is below the GWQS and within range of site background concentrations per comparisons with upgradient and far downgradient monitoring wells at the White Mesa Mill. Per the approved statistical flow chart, a modified approach to setting the GWCL is allowed when an upward trend is apparent.	29.03 µg/L

Conclusions:

Based on DWMRC review of the background statistics and findings that the uranium OOC is not shown to be caused by the Mill, it is appropriate to set GWCL for uranium at background x 1.5 (Utah Administrative Code (UAC) R317-6 for Class III Groundwater) for the modified data set. This review is consistent with the Director approved statistical flowchart which states that a modified approach is appropriate for parameters showing statistically significant increasing trends.

Based on review, a letter will be sent to EFR of initial approval of the modified uranium GWCL on the table above. 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., October 12, 2012, *Source Assessment Report*, Prepared by Intera

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

[3] Energy Fuels Resources (USA) Inc., August 15, 2017, *White Mesa Uranium Mill Ground Water Monitoring Quality Assurance Plan (QAP), Revision 7.4*

[4] Energy Fuels Resources (USA) Inc., August 20, 2017, *Transmittal of Source Assessment Report for Sulfate, Selenium, Total Dissolved Solids, and Uranium in MW-31 White Mesa Mill Groundwater Discharge Permit UGW370004*

[5] Energy Fuels Resources (USA) Inc., June 24, 2020, *Transmittal of Source assessment Report for MW-31 White Mesa Mill Groundwater Permit UGW370004*

[6] Energy Fuels Resources (USA) Inc., April 29, 2021, *Transmital of Source Assessment Report for MW-31 White Mesa Mill Groundwater Discharge Permit UGW370004*

[7] United States Environmental Protection Agency. 2009. *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance*. EPA 530/R-09-007.

[8] 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

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

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

[12] Utah Department of Environmental Quality, January 19, 2018, Modified on March 8, 2021, *Utah Division of Radiation Control, Ground Water Discharge Permit, Permit No. UGW370004, Energy Fuels Resources (USA) Inc.*

[13] Utah Department of Environmental Quality, March 14, 2018, *Review of the Energy Fuels Resources (USA) Inc., White Mesa Uranium Mill, Blanding, Utah August 21, 2017 Source Assessment Report for Selenium, Sulfate, Total Dissolved Solids (TDS) and Uranium in Monitoring Well MW-31*.

[14] Utah Department of Environmental Quality, August 5, 2020, *Review of the Energy Fuels Resources (USA) Inc., White Mesa Uranium Mill, Blanding, Utah June 4, 2020 Source Assessment Report for Sulfate and TDS in Monitoring Well MW-31*.