



State of Utah

GARY R. HERBERT  
Governor

SPENCER J. COX  
Lieutenant Governor

Department of  
Environmental Quality

Amanda Smith  
Executive Director

DIVISION OF RADIATION CONTROL  
Rusty Lundberg  
Director

June 5, 2014

**DRC-2014-003781**

Kathy Weinel, Quality Assurance Manager  
Energy Fuels Resources (USA) Inc.  
225 Union Blvd.  
Suite 600  
Lakewood, CO 80228

Subject: Energy Fuels Resources (USA) Inc. March 18, 2014 Source Assessment Report for Sulfate in Monitoring Well MW-1 and Total Dissolved Solids in Monitoring Well MW-3A: DRC Review Findings

Dear Ms. Weinel:

The Utah Division of Radiation Control ("DRC") has reviewed the Energy Fuels Resources (USA) Inc. ("EFR") March 18, 2014 "*Source Assessment Report for Sulfate in MW-01 and Total Dissolved Solids in MW-3A White Mesa Uranium Mill*" ("SAR").

The SAR is broken up into two primary sections: 1) An analysis of potential sources of contamination, and 2) A discussion and tables of data used for statistical evaluation and generation of proposed modified GWCL's.

***Proposed GWCL Revision for Sulfate in Monitoring Well MW-1***

EFR proposes to modify the GWCL for TDS in Monitoring Well MW-1 from the current 838 mg/L to 846 mg/L based on source investigation and statistical evaluation in the SAR.

***EFR Source Assessment Findings (Sulfate MW-1)***

EFR notes that per the 2009 groundwater background report: 1) Chloride was showing an increasing trend, 2) Fluoride was showing a decreasing trend, and 3) Uranium was showing a significant decreasing trend. Per comparisons with current plots of indicator parameters EFR makes the statement in the Report that "*groundwater in MW-01 is behaving consistently with background conditions and is not being affected by potential Mill activities.*"

Per DRC review of the SAR, it appears that the indicator parameter concentrations are consistent with findings of the October, 2007 White Mesa Mill Background Report, as stated on p. 1-7,



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Per DRC review of the SAR, it appears that the indicator parameter concentrations are consistent with findings of the October, 2007 White Mesa Mill Background Report, as stated on p. 1-7,

*“there are significant increasing trends upgradient in MW-1, MW-18 or MW-19 in uranium, sulfate, total dissolved solids (TDS), iron, selenium, thallium, ammonia and fluoride and far downgradient in MW-3 in uranium and selenium, sulfate, TDS and pH (decreasing trend). This provides very strong evidence that natural forces at the site are causing increasing trends in these constituents (decreasing in pH) in other wells and supports the conclusion that natural forces are also causing increasing trends in other constituents as well.”*

Significant trends in sulfate, TDS and iron are specifically noted on Table 7.1-1 of the background report. Based on the consistency with previous studies and the location of monitoring well MW-1, hydraulically upgradient from the White Mesa Mill it appears that the OOC status for sulfate at MW-1 is likely due to background concentrations in the Burro Canyon Formation.

#### *DRC Approval to Modify the Permit – Removal of GWCLs at MW-1*

DRC notes that a previous agreement to modify the Permit (formal process including public notification) by removing all GWCL's at monitoring well MW-1 was included in an April 25, 2013 letter to EFR from the Director. This decision was based primarily on the location of monitoring well MW-1, hydraulically upgradient from the White Mesa Mill.

Since the proposal to remove GWCLs at MW-1 precedes the GWCL modification request for sulfate in the March 18, 2014 SAR, and since the modifications would both need approval through Permit modification, the GWCL modification for sulfate (proposed revised GWCL) will not be included in the Permit. Therefore, no further action will be undertaken regarding the March 18, 2014 proposed sulfate GWCL modification.

#### ***Proposed GWCL Revision for Total Dissolved Solids (“TDS”) in Monitoring Well MW-3A***

EFR proposes to modify the GWCL for TDS in Monitoring Well MW-3A from the current 5,805 mg/L to 6,028 mg/L based on source investigation and statistical evaluation in the SAR.

#### *EFR Source Assessment Findings (TDS MW-3A)*

##### 1. MW-3A Area Groundwater Velocity:

DRC notes that monitoring well MW-3A is located approximately 2,000 feet downgradient from the White Mesa Mill Facility. Local groundwater velocities in the area south of the facility are very low (pore velocities in the range of 0.55 ft/yr to 0.89 ft/yr) per findings of an EFR 2012 report titled, *“Hydrogeology of the Perched Groundwater Zone in the Area Southwest of the Tailings Cells, White Mesa Uranium Mill Site.”* Based on these estimated values for groundwater velocity (developed through EFR hydraulic slug testing of installed area monitoring wells) it is unlikely that monitoring well MW-3A has been impacted by potential tailings solution seepage from the facility embankments. Per the SAR *“travel times in the perched aquifer at the Mill are estimated to be 0.9 feet per year in the area between the Mill's tailings cells and MW-03A, resulting in a travel time of over 2,000 years.”*

## 2. University of Utah Study:

Monitoring well MW-3A 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). Tritium concentrations in monitoring well MW-3A were found to be non-detect. If groundwater in monitoring well MW-3A 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 groundwater samples in monitoring well MW-3A.

In support of the time periods when atmospheric tritium was present, the University of Utah ("U of U") Report (Hurst and Solomon 2008) Figure 18 includes a plot of atmospheric concentrations of tritium in the southwest by year based on a 2006 study conducted by V.M. Heilwell and D.K. Solomon.

The U of U Report additionally justifies that groundwater in site monitoring wells (other than those impacted by recharge from the local wildlife ponds) is older than uranium tailings embankments at the White Mesa Mill based on  $\delta^{34}\text{S}$  and  $\delta^{18}\text{O}$  isotopic ratios. DRC notes that monitoring well MW-3A was found not to have a stable (surface water) signature.

Based on our review of the U of U Report and specific data results for monitoring well MW-3A age dating of groundwater at the well indicates that the MW-3A groundwater predates Mill construction and that uranium concentrations in groundwater at MW-3A does not appear to be from tailings solution.

## 3. Indicator Parameter Evaluation

Per the SAR Part 3.2 "*comparing the current, complete data set for TDS and indicator parameters shows that groundwater behavior in MW-03A has not changed since the time of the Background Reports. Additionally, concentrations of indicator parameters in MW-3A are exhibiting decreasing trends when plotted over time.*" Per DRC review of concentration plots for indicator parameters in monitoring well MW-3A, it appears that concentration trends are essentially flat for indicator parameters (Cl, Fl, U, and SO4).

### *EFR Proposed Modified GWCL (MW-3A TDS) Statistical Evaluation of Data*

The following statistical methods were used by EFR to develop the proposed modified GWCLs:

Standard Deviation Calculation  
Shapiro-Wilk Test for Normality  
Least Squares Regression Analysis  
Mann-Kendall Trend Analysis

A DRC cross-check of the Shapiro-Wilk Test for normality and standard deviation was conducted. The DRC calculation results were essentially the same as the EFR conclusions. The EFR proposed modified GWCL is based on the mean value of historic data plus two standard

deviations and appears to be in conformance with the Director approved statistical flow chart which outlines a decision making process when calculating background GWCL's (Intera 2007).

The table below summarizes the EFR calculations and background rationale for the proposed TDS GWCL.

*Table of EFR Proposed Revised GWCL for TDS at Monitoring Well MW-3A:*

Well Number	Parameter	Location	Current GWCL (mg/L)	EFR Proposed GWCL Revision (mg/L)	EFR Background Rationale	EFR Method to Determine GWCL	DRC Finding – Is Proposed GWCL in Conformance with the Statistical Flow Chart?
MW-3A	TDS	Downgradient from White Mesa Mill Facility	5,805	6,028	Well Location Downgradient of Facility  Indicator Parameters Consistent with Background Report  U of U Study Showing Old Groundwater	Mean + 2(SD)	Yes Mean + 2(SD)

***GWCL Modification (MW-3A TDS) Recommended for Inclusion in the Groundwater Discharge Permit***

Based on DRC review findings of the EFR SAR, it is recommended that the modified GWCL for TDS in monitoring well MW-3A (TDS 6,028 mg/L) be included with the Groundwater Permit Renewal, Permit No. UGW370004. Note that the modified GWCL will not be effective until future issuance of a revised Groundwater Discharge Permit, and that the modification will be subject to formal public notice and public participation requirements.

Sincerely,

Rusty Lundberg  
Director

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