UNITED STATES
NUCLEAR REGULATORY COMMISSION
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December 12, 2019

Mr. Mark Kautsky
UMTRCA Program Manager
U.S. Department of Energy
Office of Legacy Management
2597 Legacy Way
Grand Junction, CO 81503

SUBJECT: U.S. NUCLEAR REGULATORY COMMISSION STAFF REVIEW OF THE U.S. DEPARTMENT OF ENERGY DRAFT INTERIM TREATMENT SYSTEM EVALUATION REPORT, TUBA CITY, ARIZONA, DISPOSAL SITE (Docket No. WM-00073)

Dear Mr. Kautsky:

I am writing in response to your September 18, 2019, request for the U.S. Nuclear Regulatory Commission (NRC) staff's review and comment on the U.S. Department of Energy's (DOE's) report entitled "Draft Interim Treatment System Evaluation Report, Tuba City, Arizona, Disposal Site" dated September 2018 (Agencywide Documents Access and Management System [ADAMS] Accession Number ML19267A154).

The NRC staff reviewed the draft report and have the following comments and suggestions:

General Comments:

1. We believe that the most important new conclusion in the report is "The testing with simulated pore fluid (showing potential for solid uranium presence in the unsaturated subsurface) and contaminated core (showing gradual release of solid uranium into soluble form) contradict the previous basis for remediation: that uranium was almost exclusively present in soluble form, within the boundaries of the contaminant plume (as established by groundwater sampling and analyses)." This is a significant revision to the DOE's understanding of the geochemistry at the site and is important to a better understanding of the chemical processes that will influence the groundwater remedy selection.
2. Beginning in Section 2.3.5.2, and through Section 2.3.7, the report discusses the potential for flushing of contaminants in the unsaturated zone as a result of water infiltration from the ground surface (i.e., rainfall). NRC believes that the discussion about the flushing of contaminants in the subsurface from rainfall infiltration although informative from a technical perspective is not a probable pathway at the site. Rainfall infiltration into the disposal area has been reduced by the cover design. In addition, ambient rainfall in the area is extremely small (approximately 6 inches/year (in/yr)) and evapotranspiration is high, therefore infiltration of rainfall from the surface of the site through the unsaturated zone which mobilizes contamination into the groundwater is not a realistic or significant pathway. We suggest that the discussion be caveated to indicate that the pathway is being included for completeness, but that it is highly

improbable that rainwater infiltration is a significant contributor to the groundwater flow and transport at the site. By adequately caveating the discussion about this unlikely pathway for contaminant transport, DOE can better ensure that the public understands the major drivers of contaminant transport at the site. In addition, this may save DOE from the need to expend time and resources addressing this pathway in the future.

Specific comments

1. Section 2.1.1, Page 8: The third method for determining annual evaporative capacity, discussed in Appendix A, page A-1, uses a potential evapotranspiration value. The annual potential evapotranspiration is the total potential (i.e., not the actual) sum of evaporation and plant transpiration that an area can experience. This annual potential evapotranspiration rate should be higher than a measured or calculated evaporation rate. However, despite representing evaporation plus transpiration, the rate is the lowest of the three methods used (51 inches per year (in/yr) compared to 56 in/yr and 67.7 in/yr). Suggest that the DOE review the manner in which the annual evaporative capacity was determined and if appropriate, revise the report.

2. Section 2.1.2, Page 9: Table 3 shows the calculations used to obtain the measured/calculated correlation factor of 1.09 to be applied to the calculated evaporation rate. However, this factor was derived from a four-week period within a specific year. That four-week period had minimal rain so that the net evaporation amount changed little in relationship to the evaporation amount (see Table 3). If the mid-July through mid-August values for 2016 had been used instead of the 2017 values, the correlation factor would be different. For example, assuming the rainfall had equaled the rainfall from August 2016 (2.28 inches taken from Table 2), the correlation factor would be equal to 10.98/5.83 = 1.88. Although the report states that the rainfall during the period from June 2016 through May 2017 was higher than normal, it may be more appropriate to use the average measured rainfall from this period or historical average rainfall information for the past several years to derive the correlation factor.

3. Figure 10, Page 26. The 6.5 pH contour line appears to be incorrect as it does not reflect the pH at wells numbered 0267, 0908 and 0934.

4. Section 2.3.2, Page 32. It is unclear why DOE used a stop-flow approach to the column tests and it would be helpful if this approach was referenced and discussed. There is no discussion about how the post column solids were treated, or if the column will have a gradient from bottom to top (unless the stop-flow thing helps eliminate this) and it would be helpful if it were stated whether or not the samples were well homogenized and subsampled or if the whole sample was treated.

5. Section 2.3.5, Pages 37-38. Uranium partitions readily into calcite as it forms. It may do the same with precipitation of gypsum. If that is true, some of the uranium retention that was observed may be related to uptake and later release during dissolution of uranium bearing gypsum. Some SEM/EDAX analysis of solids generated in the columns would be useful to confirm, the proposed mechanisms of retention.

6. Section 2.3.5, Page 38. There is a trade-off in the first pore volume between dissolution of calcite, and precipitation of $Fe(OH)_3$ and gypsum. It is not clear if the potential for

pore plugging could occur such that flow will be altered. Note that there was increased backpressure noted on page 38.

7. Section 2.3.5, Pages 38-40. It would be helpful if the measurements of pore volumes for the columns, and their masses were provided as DOE will need to consider the porosity of the Navajo sandstone, preferential flow paths and the relationship to the experiments.

8. Section 2.3.7, Page 57. It would be helpful if the discussion on the uranium-234 and uranium-238 ratios included substantiation and references.

9. Section 2.3.7, Page 57. The Surface Complexation model was not detailed in the report. Surface area is a significant factor and it is important to understand how it was estimated in the model. For example, the value for a thin layer(monolayer) on quartz will be different than a bulk value. Other parameters should also be discussed.

10. Section 2.3.7, Page 59. Their appeared to be a good relationship among experiments, a conceptual model and the geochemical model. However, some of the PHREEQC figures were confusing. In particular Fig. 30 for Fe which showed $Fe(OH)_3$ as a line at 1.0 in the Low pH zone seems to indicate that $Fe(OH)_3$ is precipitated throughout that zone, but it may be that Fe would be mostly in solution in the low pH zone and that there should be a curve up to a value of 1.0 as the boundary with the Buffered Plume is approached.

11. Section 2.4.1.1, Page 67: Figure 35 shows the measured temporal flow and observed drawdown for pumping test 1404. Except for a few of the observation wells from pumping test 1407 being represented in Fig. 41, similar drawdown results are missing from the other four pumping tests. To obtain relatively quick risk insights, a visual representation, similar to Fig. 35, of all the observation well drawdowns associated with a pumping test would be helpful.

12. Section 2.4.4, Page 83: The ending of the section states that, “Because each of the three wells sampled had a concentration trend different than the other two wells, uranium sample results are inconclusive regarding the impact of aquifer pumping on localized dissolved uranium concentrations.” Although the results are of interest and provide insights into the hydrogeologic regime of the Tuba City site, it was not clear what the overall objective of uranium sampling was, and it would be helpful if this was stated in the report.

In accordance with Title 10 of the *Code of Federal Regulation*s (10 CFR)2.390 of the NRC's "Agency Rules of Practice and Procedure," a copy of this letter will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records component of NRC's ADAMS. ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html.

If you have any questions concerning the NRC comments, please feel free to contact me at 301-415-6749 or at Dominick.Orlando@nrc.gov.

Sincerely,

Dominick Orlando, Senior Project Manager
Uranium Recovery and Materials
Decommissioning Branch
Division of Decommissioning, Uranium Recovery
and Waste Programs
Office of Nuclear Material Safety
and Safeguards

Docket No.: WM-00073
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