



Department of Energy

Washington, DC 20585

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U.S. Nuclear Regulatory Commission
Attn: Brittany Bolz
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Subject: U.S. Department of Energy Office of Legacy Management Response to the U.S. Nuclear Regulatory Commission Staff Review of the DOE Report *Annual Performance Report April 2019 through March 2020 for the Shiprock, New Mexico, Disposal Site* Dated August 2021 (WM-00058)

Dear Ms. Bolz:

The U.S. Department of Energy Office of Legacy Management (LM) has received the subject U.S. Nuclear Regulatory Commission (NRC) assessment of LM's August 2021 submittal dated November 18, 2021. In its review, NRC identified two primary issues warranting explanation or additional technical justification: (1) Mann-Kendall trend test results not fully capturing apparent increases between 2017 and 2021 in some floodplain wells and (2) the technical basis or assumptions used to produce the terrace water elevation contours in Figure 18 of the subject report. LM's responses to NRC's comments are provided below; supporting information is included in Attachment 1.

NRC Comment 1

New to this performance report are the results of the Mann-Kendall trend analysis results for floodplain wells presented in Appendix B. NRC staff finds this analysis a useful addition to the performance report. However, it is not clear why some of the wells listed did not show an increasing uranium concentration trend. For example, wells 0611, 0612, 0622, and 0855 show an upward trend since the suspension of pumping in 2017 as can be seen in the uranium time-concentration trends in Figure 13. None of the four wells are labeled as increasing after the Mann-Kendall trend test was completed (see Table B-3) even though Section 3.3.1 states "Since the last reporting period, uranium levels increased markedly in two wells: central floodplain well 0622 and western floodplain well 0855." If the reason for this lies in the fact that the analysis was performed for lengthier time period, i.e., 2006 – 2019, than the time period at Shiprock with very little pumping, i.e., 2017 – 2021, then NRC staff would find the results of a Mann-Kendall trend analysis very useful for the shorter timeframe. NRC staff is aware that the data set for the 2017–2021 timeframe is much smaller, and that DOE may decide that it is too small for the Mann-Kendall trend analysis to be performed.

LM Response to NRC Comment 1:

The reason the Mann-Kendall tests did not yield an increasing concentration trend for the floodplain wells in question (0611, 0612, 0622, and 0855) is because of the longer time frame evaluated in the 2019–2020 annual performance report (APR). The period evaluated was 2006–2019, in which 2006 marked the beginning of the expanded remediation system on the floodplain (the trenches were installed in spring 2006). LM acknowledges the apparent upticks in uranium concentrations in these wells, most evident for wells 0622 and 0855 as noted in the APR.

To address NRC's comment, LM ran the Mann-Kendall trend test for the shorter period following pumping reduction (2017–2019). Figure 1 (in Attachment 1) plots uranium concentrations for the four wells in question along with linear regression lines corresponding to both the 2006–2019 and 2017–2019 time frames. Despite the positive slopes shown for the linear trend lines for all four wells for the 2017–2019 period, none of the Mann-Kendall tests identified a statistically significant increasing trend (p -values ≤ 0.13 ; Figure 1). This is most likely because of the small sample sizes ($n=6$ measurements). Results from the recent September 2021 sampling effort are also plotted in Figure 1, mainly to demonstrate that the elevated concentrations measured in September 2019 were not sustained.

NRC Comment 2

In addition, NRC staff is interested in understanding why DOE decided to use the surface water features along Bob Lee Wash and Many Devils Wash as “Contouring Control Points” to produce the terrace water elevation contours in Figure 18. Has DOE concluded that the water in these washes are directly connected with the groundwater below (as opposed to disconnected streams or washes)? Has DOE concluded that it represents the water table of the terrace and, therefore, the groundwater elevation? If so, could DOE please provide the NRC staff with the technical basis documents supporting this conclusion.

LM Response to NRC Comment 2

LM's reasoning for using contour control points within Bob Lee Wash and Many Devil's Wash for creating an equipotential map on the terrace is as follows:

The topography at the Shiprock site varies greatly, particularly at Bob Lee Wash, Many Devils Wash, and the escarpment. Contouring groundwater elevations without either manual adjustments or control points would lead to an erroneous interpretation that shallow groundwater is above the ground surface at these features. Control points were added within Bob Lee Wash and Many Devil Wash to better constrain (1) the interpolated groundwater elevation and (2) the orientation of the hydraulic gradient. Because these control points only approximate the maximum potential elevation of shallow groundwater, contours are dashed on Figure 18 near their location. The control points are included on Figure 18 with a footnote stating: “*Note: Contouring Control Points were utilized at surface water features along Bob Lee Wash, Many Devils Wash, Artesian well drainage, and Seep 0425 and 0426 while auto-contouring to depict groundwater at the surface.*”

The technical basis supporting use of the surface elevation of Bob Lee Wash for contouring groundwater elevations on the terrace is as follows:

LM's conceptual site model is that discharge from well 0648 (approximately 64 gpm reported in DOE 2000) flows into Bob Lee Wash and some component of the surface flow is lost as recharge to shallow groundwater beneath the channel (DOE 2018). This connection is supported by similar values of tritium, enriched $\delta^{34}\text{S}_{\text{sulfate}}$, and depleted $\delta^2\text{H}_{\text{water}}$ and $\delta^{18}\text{O}_{\text{water}}$ between well 0648 and terrace monitoring well 0725. These details are included and discussed in the upcoming resubmittal of the report titled *Investigation of Non-Mill-Related Water Inputs to the Terrace Alluvium at the Shiprock, New Mexico, Site*.

The technical basis supporting use of the surface elevation of Many Devils Wash for contouring groundwater elevations on the terrace is as follows:

Though upstream of most of the interpolated area, groundwater is known to discharge into Many Devils Wash through a series of seeps along the east bank at the confluence of the East Fork and a knickpoint in the channel north of well 1049 (DOE 2011). Evidence of groundwater seeping into the Many Devils Wash channel is also documented in DOE (2011). Groundwater elevations observed in “Tributary 1” of the East Fork in 2010 indicated that groundwater flows northward beneath the channel along the loess-Mancos Shale contact (DOE 2011). The source of groundwater beneath Many Devils Wash was interpreted to be focused recharge from precipitation (Robertson et. al. 2016). Absent water levels downstream of well 1049, LM assigned elevations based on the knowledge that groundwater cannot exceed the elevation of the channel.

In conclusion, control points were used to facilitate contouring along Bob Lee Wash and Many Devils Wash. References supporting this response are provided in Attachment 1.

Please contact me at (970) 248-6018 or Mark.Kautsky@lm.doe.gov, if you have any questions. Please address any correspondence to:

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Sincerely,



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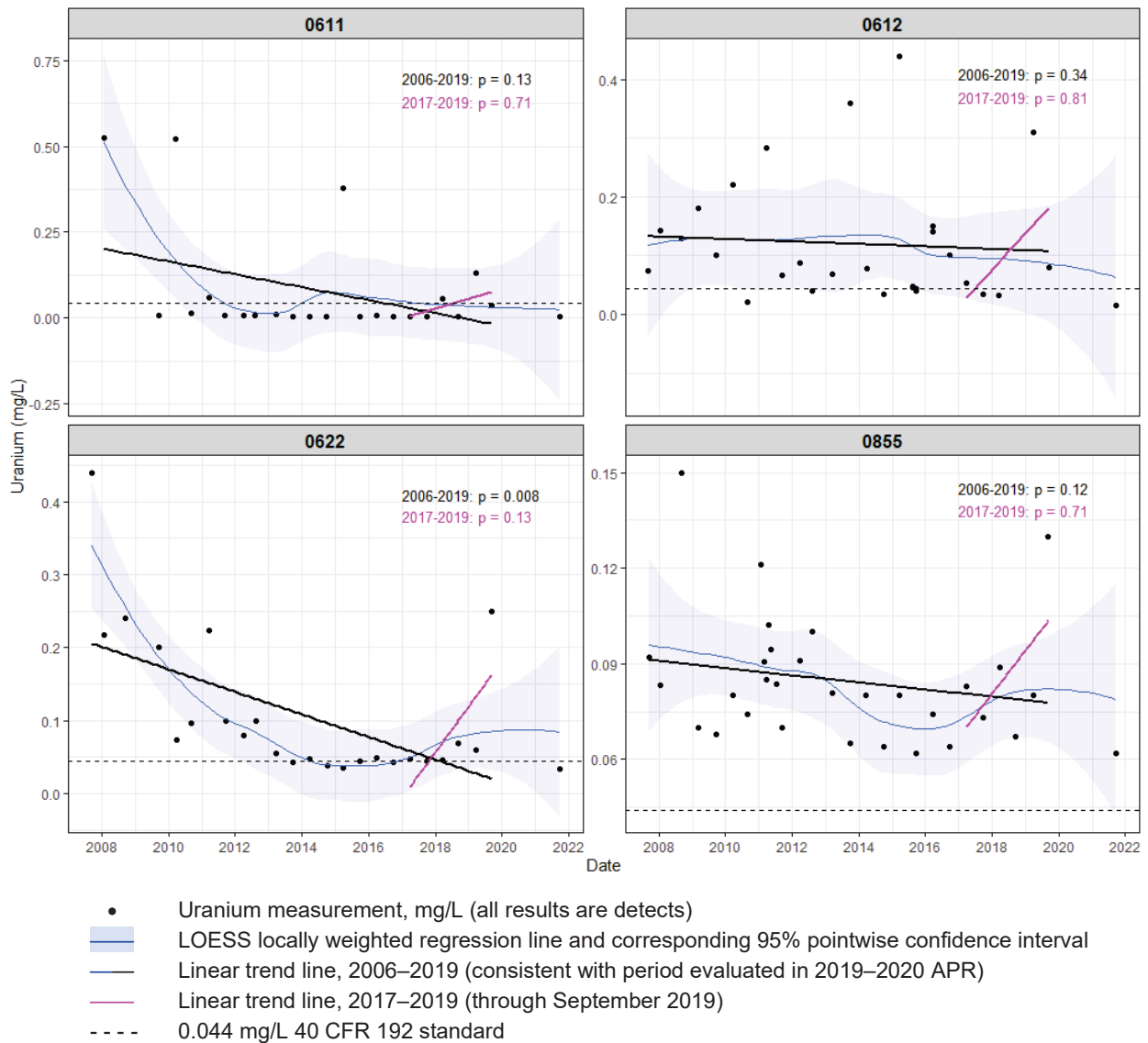
Mark Kautsky
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cc via email:

Brittany Bolz, NRC
Tracy Atkins, DOE
Jeff Carman, RSI
Anthony Farinacci, RSI
DOE Read File
File: E/20/2275 F/20/827

Attachment 1

Information Supporting LM's Response to NRC Comment 1



Notes:

Plots are overlain with two-sided p-values yielded from Mann-Kendall trend tests for the periods shown. Despite the positive slope shown for the linear trend lines for 2017-2019 period, none of these trends are significant, likely due in part to the corresponding small sample sizes (n=6 measurements). Results for the recent September 2021 are also plotted (but not included in the trend analyses), mainly to demonstrate that the elevated concentrations measured in September 2019 were not sustained.

*Figure 1. Uranium Concentrations in Floodplain Wells 0611, 0612, 0622, and 0855: 2006–2021
Shiprock, New Mexico, Disposal Site*

References Supporting LM's Response to NRC Comment 2

DOE (U.S. Department of Energy), 2000. Final Site Observational Work Plan for the Shiprock, New Mexico, UMTRA Project Site, GJO-2000-169-TAR, Rev. 2, Grand Junction, Colorado, November.

DOE (U.S. Department of Energy), 2011. Geology and Groundwater Investigation, Many Devils Wash, Shiprock Site, New Mexico, LMS/SHP/S06662, ESL-RPT-2011-02, Office of Legacy Management, Grand Junction, Colorado, April.

DOE (U.S. Department of Energy), 2018. *Flow Processes in the Floodplain Alluvial Aquifer at the Shiprock, New Mexico, Disposal Site*, LMS/SHP/S07318, Office of Legacy Management.

Robertson, A.J., A.J. Ranalli, S.A. Austin, and B.R. Lawlis, 2016. The Source of Groundwater and Solutes to Many Devils Wash at a Former Uranium Mill Site in Shiprock, New Mexico, U.S. Geological Survey Scientific Investigations Report 2016-5031, Reston, Virginia, prepared in cooperation with the Navajo Nation Environmental Protection Agency.