Memorandum

Date: April 1, 2022

To: James Smith

From: John Saxton

Docket No.: 070-00925

License: SNM-928

Re: Response to CERT's Comments in Emails dated February 1 and March 24, 2022

The purpose of this memorandum is to provide written responses to requests by Cimarron Environmental Response Trust (CERT) in the March 23, 2022, teleconference between CERT, NRC and the Oklahoma Department of Environmental Quality, and the letter dated March 29, 2022 (ML22088A133). Specifically, the written responses discussed below are intended to provide clarity on the comments listed in the following:

- 1/31/22 Staff's email with comments from the pre-submission audit of the revised Decommissioning Plan and discussed at the March 10, 2022, public meeting (ML22031A162)
- 2/1/22 CERT's email requesting clarification of Staff's comments in the 1/31/22 email (Ml22040A147)
- 3/10/22 Staff's follow-up email with a list of requested items as was agreed to at the March 10, 2022, pre-audit public meeting (ML22081A186)
- 3/24/22 CERT's email with comments Staff's 1/31/22 and 3/10/22 emails (ML22087A019)

1/31/22 and 2/1/22 Emails

RSI-1 Tc-99 Sampling

NRC staff agrees that four (4) quarters of sampling is adequate and consistent with NRC's earlier (4/22/13) request. Staff's present issue is that, as currently written in the revised Decommissioning Plan[1] (DP), at the time of the proposed sampling (presumably near the end of remediation), CERT may elect to remove the sampling through License Condition 27.e., unless staff specifically addressed this issue in the Safety Evaluation Report (SER) approving the DP. To remedy this issue, NRC Staff could assume that CERT "committed" to the sampling though

[1] Staff no longer has access to the revised DP because the pre-submission audit was based on non-submitted documents and the current replies are based on staff's recollections.

ENCLOSURE

the DP is devoid of this specific wording. However, based on experience, assumptions in a SER should be avoided (i.e., a Request for Additional Information (RAI) should have been issued). Alternatively, to resolve this issue, NRC staff would require a license condition.

The request for supplemental information (RSI), which was originally issued with comments on the pre-submission audit, was intended to resolve this issue without the need for a RAI or license condition by having the licensee specifically commit to the sampling in the DP.

Staff's recommended removal of the first full paragraph on page 15-9 was included because it was staff's understanding that the DP was to be revised to remove references to meeting criteria other than NRC's release criteria for license termination. If the paragraph is meant for informational purposes only, it would be acceptable. If it is removed on page 15-9, then it should be removed from other pages as well.

RSI-1 Alternate Schedule

Staff's comment was a suggestion to include all requested "text" changes to license conditions in one location, ideally in the cover letter. Including the licensee's proposed text for any license condition revision would reduce any miscommunication. Details and justification for the amended license condition should be included in the DP, as CERT has done for most license conditions except notably for the Alternate Schedule request.

Regarding an Alternate Schedule request, guidance in NUREG-1757, Volume 1, Revision 2, Chapter 5.1 (last paragraph on page 5-4) and NRC's longstanding practice is to have an alternate schedule request for completion of decommission activities include a determination that the schedule is in the public's best interest. For example, one may argue that it is in the public's best interest to excavate the contaminated transition material with offsite disposal which could be accomplished within the 2-year timeframe. Staff will issue an RAI if a request does not address the public's interest.

RSI-3 Continued operation of the Western Area (WA) activities

First, CERT is misconstruing the comment by stating "[i]f the NRC would prefer to leave as much uranium in the groundwater as possible while achieving the NRC criterion, so that it is clear that the primary objective is to achieve the NRC criterion, the DP can be revised to state that all WA systems will be shut down as soon as the NRC criterion are achieved in all WA remediation areas." NRC staff's comment was to segregate the efforts required to achieve license termination from those additional efforts to reduce the mass in the aquifer. The additional efforts are consistent with NRC's ALARA principle and would normally be routinely accepted. In this case, with the limitations on available funding, it is imperative that CERT maintains sufficient funding to achieve license termination. In making this decision, Staff expects CERT to evaluate the risks and make a risk-informed decision on whether to keep removing mass after achieving the release criterion. For example, the DP states that the uranium MCL cannot be achieved no matter how long the remediation is applied. As a result,

though continued remediation may lower the concentrations (and thus risks), some risk above acceptable levels would always remain after the remediation is terminated. Therefore, the CERT decision should evaluate the cost for risk reduction for the continued remediation compared to the risk of expending funding. If that is clear in the DP, staff will not have to ask an RAI.

Second, the intent of this RSI is to remove any confusion in Figure 9-3. Although NRC no longer has access to the revised figures, Figure 9-3 listed the timeline for the WA area as "to reduce to uranium to less than NRC criterion," which is incorrect. CERT should break that listing into two entries, one "to reduce to less than NRC criterion" and "for the greatest removal of contaminant mass."

Similarly, CERT should check for inconsistencies in the DP. For example, the text in the DP narrative indicates a 38-month duration and the calculations in the Basis of Design indicate 38 months for WAA U>DCGL on PDF page 94 of 197 for the October 30, 2018, memorandum, but lists 146.3 months for WAA U>DCGL on PDF page 169 of 197 for the February 24, 2021, Addendum No 2. It appears that the difference is attributed to an increase in remediation area by a factor of four, but it is confusing.

If 146.3-month duration is correct, please provide the following:

- excel files upon which the remediation areas used to estimate the 38- and 146.3-month duration were calculated;
- a statement that the two intervening addenda (between the original and Addendum 2) are not material to NRC's review; and
- revision to the DP text.

If 38-month duration is correct, NRC suggests that CERT provide an estimate of the mass removed after the DCGL is achieved and the reduction in lifetime cancer risk to an individual for that extra removal of mass. Based on CERT's estimates, the MCL will not be reached until a significant period beyond 146 months. If, in the future and it is decided to extend the remediation, having those calculations reviewed by NRC in the DP would permit CERT to modify the remediation without a license amendment.

<u>RSI-5 Two or Three years of Post-Remediation Monitoring</u>

In accordance with License Condition 27b., the requirement is eight consecutive quarterly samples. While 12 samples would be "nice," it is not a requirement. It is assumed that the addition sampling is to achieve consistency with RCRA's requirements in 10 CFR 264.100(f) and to ensure no impacts occurred to groundwater during the decommission of the treatment facilities after the groundwater has met the release criterion.

While twelve samples would be nice, the DP proposed beginning of decommissioning of the infrastructure after one year (four consecutive quarters) of post remediation sampling is not acceptable. Under that scenario, if the trends during the second year of sampling resulted in an

exceedance of the release criterion, funding to replace the infrastructure that was removed may not be available. If not revised, Staff will include a RAI based on the current language in the DP. If the intent of the third year of sampling is intended to verify that the decommissioning activity after remediation is complete, the monitoring locations may be adjusted.

RSI-6 Tables

CERT response was sufficient (see comment below on Groundwater Elevations).

RSI-7 First Paragraph 100-year Flood Event

The information provided in the revised DP for justification of the 100-year flood event was sufficient.

RSI-7 Second Paragraph Low Flow

Staff agrees with the licensee that the surface water pathway is unlikely to be significant in terms of existing and potential future exposures to the public. This conclusion is based in part on the historical, existing and expected future low levels of uranium in the alluvial aquifer and the surface water monitoring program. However, to demonstrate that the current and future public exposure to surface water is in compliance with 10 CFR 20.1302, guidance in NUREG-1757 Appendix I suggests licensees determine the physical processes that are relevant to each exposure media pair, including groundwater:surface water pair, and a pathway can be screened out from a dose calculation provided the licensee documents its decision for excluding the surface water pathway that is transparent and traceable. Guidance in Section 5, Appendix F of NUREG-1757 Volume 2 Revision 1 suggests that the surface water sampling:

> *should be supplemented by additional sampling to characterize the surface system at representative low or high stage flow conditions (e.g., minimum annual, 7-day average low flow or maximum annual, 7-day average high flow). This information should be used to bound the existing and projected impacts of the release of contamination on adjacent surface water bodies*.

It is acknowledged that NUREG-1757 contains minimal guidance for establishing surface water low flow conditions. Nevertheless, licensees should include the conventionally used benchmark low flows in their analysis, such as the benchmark low flows listed in NUREG-1757.

NRC staff is confused about CERT's statement in the March 29, 2022, letter regarding the cost of performing that analysis:

> [*Environmental Properties Management] does not feel changing the benchmark to "more commonly used benchmarks" will provide sufficient benefit, accuracy, or appropriateness to offset the cost to conduct additional evaluation.*

To facilitate the analysis, NRC Staff herein provides guidance on the type of analysis that would be acceptable for this site. First, as provided in the original January 31, 2022, RSI, the U.S. Geological Survey had established a steam gauging station on the site (07159400) that operated for two water years (1971-1972). The flow data from that site for that period of record can be downloaded from USGS Current Conditions for USGS 07159400 Cimarron River near Crescent, OK.

Unfortunately, two years of data may not be sufficient to establish the low flow regime. On the other hand, using established methodologies (e.g., USGS WRI 92-4130,) the benchmark low flow at the Cimarron site can be estimated by establishing a relation between flows during the same time period at a nearby gaged station on the Cimarron River (e.g., USGS Station 07160000 near Guthrie, Oklahoma) using a scatter plot. The relationship then can be used to adjust the published low flow benchmark flow for the gaged station to the ungagged station. The lag time may make the above invalid. Staff also used the watershed area ratio method using the contributing watersheds at both stations which yield a similar relationship.

Staff's effort in calculating a benchmark low flow using the above methodologies was less than two hours and thus should not be too much of a burden for the licensee.

3/10/22 and 3/24/22 Emails

First, staff acknowledges that the information provided by CERT is sufficient for the DP detailed technical review. Staff's comments are merely suggestions to correct minor errors and/or inconsistencies in CERT's database, or for clarifications on the source-term uranium concentration used in Staff's calculations.

Surface Water Elevation Data

The information provided was sufficient.

Groundwater Elevation Data

Staff appreciates CERT providing the additional information (groundwater elevations, boring logs, etc.), which was helpful. Staff's earlier comments were intended to identify potential errors in your database. As a modeler, abnormal groundwater elevations, if valid, may require more complexity to a model. However, the validity for the abnormal elevations needs to be verified before such undertaken. If the abnormal elevations appear to be associated with a single measurement, as was the case for two of the four measurements listed in the March 10, 2022, correspondence, then no additional complexity is needed. If abnormal elevations are observed over multiple events, then a review of the boring logs or other processing information may help explain the observed data. If uncertainty remains, then the data are given zero weight by staff.

In the case of groundwater elevations at wells TMW-19 and TMW-24 on July 31, 2017 (sorry for the earlier transcription of the dates), the problem appears to be the formula in the spreadsheet

(CERT JUL 2021 Evaluated Gauging Data.xlsx) that was used to calculate the groundwater elevations. The elevations are reported as 918.51 feet above mean sea level (ft-MSL) and 918.42 ft-MSL, respectively. These elevations are more than 10 feet below the elevations reported for the previous sampling event, and most importantly, below the elevation of the river. A review of the formulae in the cells indicates that the refence was not the correct TOC.

In the case of groundwater elevations at well 02W23 on April 17, 2017, and at well 1373 on February 15, 2016, the data appear to be errors of approximately 1 foot. These errors were noted during calibration simulations for the model that was used in Staff's calculations. Upon further review, other apparently anomalous elevations were noted for several nearby wells (see below):

Well	**2/15/16**	**5/6/16**	**8/8/16**	**10/14/16**	**2/6/17**	**4/17/17**	**7/31/17**	**11/6/17**	**Gradient**
1372	927.55	928.91	926.71	926.95	927.08	928.20	926.37	927.03	Down
1373	925.89	929.16	926.78	926.96	927.13	928.34	926.40	927.19	
1371	928.37	929.45	926.90	927.03	927.19	928.48	927.52	927.35	
02W21	930.05	931.88	928.41	926.52	927.77	929.33	927.49	928.78	
02W24	930.12	931.89	927.83	927.49	927.78	929.43	927.44	928.75	
02W23	930.15	932.01	927.89	927.53	927.81	928.41	927.54	928.85	
02W22	929.46	932.08	927.89	927.54	928.80	929.43	927.61	928.86	Up

Yellow highlight indicates apparent anomalous elevation during model simulation

The "apparently anomalous" designation is assigned to those elevations because they are not consistent with an expected gradient in a homogeneous aquifer under steady state conditions. The elevations may reflect transient state immediately following precipitation. However, the purpose of the model was not to evaluate transient conditions in the alluvium. Furthermore, a model would not be able to simulate several of the reported apparently anomalous elevations with the river as the only sink. Finally, it is unknown if it is correct that all measurements as listed in the data-table occurred on a single date. Consequently, a zero weight was given to this collection of data for staff's calculations.

The correction by CERT for wells GE-BA1-01 and GE-WA-01 does not appear to be complete. Contrary to the statement in the March 24, 2022, email, it is likely that the reference elevations for the wells remain switched. Again, the surface water elevations for these wells appear to be anomalous relative to nearby wells during calibration simulations. Importantly, the elevations listed in the excel sheet that accompanied the March 24, 2002, email for wells GE-BA1-01 and GE-WA-01 in "December 2012" as 926.51 and 933.87 feet above mean sea level (ft-MSL), respectively, are not consistent with values listed in the 2013 Pilot Test report (931.25 ft-MSL for well GE-BA1-01 on December 12, 2012 (Figure 9-1); 929.19 ft-MSL for well GE-WA-01 on December 12, 2012 (Figure 9-2). If the reference elevations were switch, the calculated elevations for the "December 2012" data-table would correlate with the values listed in the 2013 report (931.23 ft-MSL for GE-BA1-01 and 929.15 ft-MSL for well GE-WA-01). Given the uncertainty, a zero weight was assigned to these wells for staff's calculations.[2]

[2] Staff also notes that the formulae for the October 14, 2016, elevations on the sheet for miscellaneous wells is incorrect.

In summary, the information provided by the license has been extremely helpful for the most part, but there are uncertainties with respect to a subset of wells. A weight of zero given to this subset of wells will not substantively alter staff's calculations as will be documented in staff's eventual safety evaluation report. Consequently, the response from CERT with respect to this information request is sufficient.

Source-Term Uranium Strength

As discussed in the public meeting, staff's calculations are based on a model calibrated to the migration of uranium from the source (i.e., the former burial pits). As staff indicated, a source term equivalent to a leachate with a uranium concentration of 35 mg/L appear to best explain the data. Staff requested whether CERT had specific information to quantify that source term. In the March 24, 2002, email, CERT suggested based on the historical measured data, specifically uranium concentrations of 11749 and 9779 picoCuries per liter (pCI/L) in 1999 at well TMW-03, a source term of 12-15 milligrams per liter (mg/L) was reasonable but believed that a source term of 35 mg/L was too high. The licensee acknowledged that the measured concentrations were observed decades after the pits were excavated.

Staff disagrees with CERT and provides the following assessment.

Staff was aware of the 1999 elevated uranium concentrations at well TMW-03. However, the 2000 Groundwater Study submitted to the NRC (ML003678053) did not include any supporting data. From the limited descriptions in that report, staff was unsure whether the data were derived from grab samples that were analyzed onsite, which may have a large degree of uncertainty, or from a certified laboratory. Additionally, staff relied on information on uranium concentrations for water samples from the area excavated north of the burial pits when those pits were excavated. The concentrations are reported in a January 31, 1989, ORAU's Interim Report (ML20247K998). The date of the sampling is unknown, however, uranium concentrations of up to 10,850 pCi/L were identified in the groundwater approximately 100 feet north of the pits. Therefore, staff's initially assigned concentrations to the source area at values that CERT deemed reasonable.

Another assumption for the initial conceptual model was that the burial pits were located above the water table (i.e., unsaturated) based on the cross-sections included in the 2000 Groundwater Study, and consistent with the former licensee's undated (2003?) conceptual model (ML21119A066) and 2018 conceptual model (ML18100A297). To simulate this conceptual model in a numerical model, a source concentration was assigned to the recharge (infiltration) flowing through the pits.

Results for the earliest simulations to match the observed data required the recharge to have significantly elevated uranium concentrations, on the order of 1300 mg/L. Staff's concern was that the concentrations may have been unrealistic, typically the highest uranium concentrations in seepage from a tailings impoundment at a uranium recovery facility is on the order of 100-200

mg/L; however, it may have been possible that the elevated concentrations was an artifact of the modeling (e.g., a portion of the recharge was absorbed to materials in the pits) and may not have impacted the pertinent calculations.

Although staff did not identify any data on leachate concentrations from the material in the original burial pits, the existing documentation suggests that the uranium mass concentrations in the material excavated from the pits was high, at 1200 pCi/g (ML20150B930). Using an activity ratio of 0.88 pCi/ug, the mass uranium concentration in the pits is calculated to be 1364 ug/g, which is equal to 0.14 weight percent uranium.

As an analogue, the model conventional mill in the 1980 Final Generic Environmental Impact Statement (EIS) on uranium milling (ML0327516631) was assigned an uranium value of 39 pCi/g for the solid waste in the tailings impoundment and 3300 pci/L for the tailings liquid.[3] The EIS concluded that the transport mechanisms for uranium were extremely complex but estimated that 95 to 98 percent of the seepage from the impoundment was adsorbed in the sediments directly underlying the impoundment (ML032751667). The typical siting for tailings impoundments is placement of several 10's of feet above the water table not at or within saturated sediments. Furthermore, published data on uranium tailing impoundments indicated the highest tailing pore water uranium concentration at 138 mg/L and maximum plume uranium concentration in the uppermost aquifer of 2.4 mg/L (ML102500234). Observed uranium concentrations in the uppermost aquifer of on the order of 150 mg/L have been reported for a few legacy uranium mill sites. The source strength used in staff's calculations are consistent with the analogue data given the anticipated higher concentrations within the source material and disposal of that material into or close to saturated conditions.

Based on the above, staff has reasonable assurance that the source term values used in its calculation likely represent actual historic field conditions, and, most importantly, will have minimal impacts on the calculations undertaken (this will be more fully discussed in the final report).

[3] The uranium is naturally occurring (not enriched) and the activity ratio is 0.67 pCi/ug