



September 13, 2022

ATTN: Brittany Bolz

United States Nuclear Regulatory Commission
Washington, DC

Re: **Rare Element Resources
Rare Earth Element Separation and Processing Demonstration Project
Application for Source Material Possession License – Resubmittal in Response to
Request for Supplemental Information**

Dear Ms. Bolz,

On July 28, 2022, U.S. Nuclear Regulatory Commission (NRC) staff provided Rare Element Resources, Inc. (RER) with a Request for Supplemental Information (RSI) (Agencywide Documents Access and Management System Accession No. [ML22206A150](#)) associated with RER's application for source material possession license for its Rare Earth Element Separation and Processing Demonstration Project ([ML22144A419](#) and [ML22144A420](#)). RER provided an RSI response submittal on August 26, 2022.

As requested by NRC staff, attached is a resubmittal of RER's license application *Technical Report* (TR) and *Environmental Report* (ER) incorporating changes committed to in RER's RSI responses. [Table 1](#) provides a brief description of changes to applicable sections of the license application documents in response to NRC's RSIs.

RER will also provide an updated *TR Appendix C* under separate cover via Federal Express expedited courier. RER requests NRC withhold the *TR Appendix C* from public disclosure as allowed by 10 CFR 2.390.

If you have any questions or need any additional information, please do not hesitate to contact me at 720-278-2460.

Sincerely,

A handwritten signature in black ink, appearing to read "Randy Scott", with a long horizontal flourish extending to the right.

Randy Scott, President & Chief Executive Officer
Rare Element Resources, Inc.

cc: Document Control
Enclosures: As stated

Table 1. Summary of license application changes in response to NRC's requests for supplemental information

RSI	NRC Request	Changes to License Application
1-1	Clarify which dosimetry models will be used for public dose exposure calculations and submit an exemption request, if necessary.	ER App F section 1.1 - added scope clarification ER App F section 1.3.4 - included a review of combined DCFs for thorium-232 and uranium-238 series radionuclides from multiple references
1-2	Discuss how compliance with public dose limits will be demonstrated	TR section 10.5 - adjusted with additional details TR Table 7 (now 18) - updated with new measurement locations TR Figure 6 - new figure indicating locations relevant to public dose monitoring ER Appendix F section 1.1 - added scope clarification ER Appendix F Table 1 footnote e - adjusted monitoring location
1-3	Provide additional details for the basis of the source term for the public dose estimate due to airborne particulates	ER Appendix F section 1.3.3.2 - referenced air quality permit (new ER Appendix I) for particulate source term ER Appendix F section 3.2.5, Figure 10, section 3.3, Table 9 (now 12), and Attachment 1 - updated particulate CAP-88 model to use 3.86E-4 of the exploration sample activity for particulates and updated calculated doses
1-4	Provide additional details for the basis of the source term for the public dose estimate due to radon and its decay products	ER Appendix F section 1.3.3.2 - referenced NRC guidance and adjusted source term to 100% of total radon gas inventory released ER Appendix F section 3.2.5, Figure 11, section 3.3, Table 9 (now 12), and Attachment 1 - updated radon CAP-88 model to use 100% of the exploration sample activity for radon gas and updated calculated doses
1-5	Provide additional details for the determination of the equilibrium fraction for the public dose estimate due to radon and its decay products	ER Appendix F section 3.2.5, Table 9 (now 12), and Attachment 1 - updated text and added footnote a to table to clarify that CAP-88 calculates radon decay product concentration using ingrowth (equilibrium fraction is not considered) in the public dose estimate TR Section 10 Table 7 (now 18) footnote d - clarified that NRC's recommended equilibrium fractions will be used for operational public dose estimates
2-1	Clarify which dosimetry models will be used for occupational exposure calculations and submit an exemption request, if necessary	ER App F section 1.1 - added scope clarification ER App F section 1.3.4 - included a review of combined DCFs for thorium-232 and uranium-238 series radionuclides from multiple references
2-2	Provide additional details for basis of external dose estimates. a. Discuss application of external DCFs to the exploration sample. b. Provide additional details on predicted external dose rate from stored waste.	ER Appendix F Table 4 (now 7) footnote b - moved note on waste storage area reduced dose rates to section 2.3.2 (now 2.3.3) and added detail ER Appendix F Table 7 (now 10) footnote b, section 2.3.2 (now 2.3.3) - added clarification that external dose conversion factors represent a wall source of stored sample
2-3	Describe the chemical forms of uranium anticipated throughout the demonstration project process and whether there will any 10 CFR Part 20, Appendix B, inhalation class D or W uranium compounds for which the limit specified in 10 CFR 20.1201(g), "Occupational dose limits for adults," for soluble uranium applies.	ER Appendix F section 1.3.2 - updated description ER Appendix F Table 7 (now 10) footnote a - corrected editorially ER Appendix F Table 4 (new) - indicated uranium compounds in relevant processing streams TR section 10 - added commitment to limit soluble uranium intake
2-4	Describe the chemical forms of thorium (Th) and actinium (Ac) anticipated throughout the demonstration project process and whether there will any 10 CFR 20, Appendix B, inhalation class D (Ac) or W (Ac and Th) compounds	ER Appendix F section 1.3.2 - updated description ER Appendix F Table 7 (now 10) footnote a - corrected editorially

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		ER Appendix F Table 5 & 6 (new) - indicated thorium and actinium compounds in relevant processing streams
2-5	Clarify radiation dose estimate for maximally exposed workers	ER Appendix F Table 4 (now 7) - clarified radiation dose estimates and justifications for various areas and activities
2-6	Clarify expected radon levels in the pug/sample storage and main process facilities	ER Appendix F section 1.3.3.2 - added discussion of indoor/occupational exposure to radon and estimate for PUG/Sample Storage Facility radon during PUG processing ER Appendix F section 2.3 and Table 8 (now 11) - added a dose estimate for occupational inhalation of radon TR section 10.1.1 - added action level for workplace radon to specific elements of the ALARA program
2-7	Discuss surveys to ensure monitoring and control systems for the facilities are located to optimize their intended function	TR sections 10.1.1 and 10.7 - updated language and included Process Control Safety Interlock Philosophy Overview as new TR Appendix E
2-8	Provide details of policy and procedures for declared pregnant women	TR sections 10.1.1 and 10.4 - added ALARA level and policies for declared pregnant workers ER Appendix F section 2 - added note on applicability
2-9	Clarify requirements for occupational external dose monitoring	TR section 10.4 - clarified occupational external dose monitoring requirement TR Table 7 (now 18), footnote a - added justification for 5-day criterion for proposed external monitoring.
2-10	Clarify requirements for radiation work permits (RWPs)	TR section 10.6.2 and Table 7 (now 18) footnote a - addressed as an editorial change to NRC's preferred language for the preparation of RWPs.
3-1	Describe the proposed acceptable surface contamination levels (alpha and beta) in units of disintegrations per minute per 100 centimeters squared (dpm/100 cm ²) that will be used for personnel monitoring, surveys of restricted and unrestricted (e.g., eating rooms, offices, etc.) areas, and releasing equipment and items for unrestricted use. a. Discuss expected individual radionuclides and radionuclide mixtures generated from operations to support the proposed acceptable surface contamination levels. b. Discuss assumptions (e.g., equilibrium status) and any proposed characterization surveys to support the proposed mixtures and acceptable surface contamination levels.	TR section 10.7.1 - new subsection to discuss acceptable surface contamination levels TR Table 17 (new) - new table of proposed surface contamination levels inserted
3-2	Provide example calculations demonstrating the radionuclide-weighted surface contamination detection capability (minimum detectable concentration (MDC)) for radiation survey instruments, including scan MDC for portable instruments, used for releasing equipment and materials for unrestricted use, personnel contamination monitoring, and other routine surveys. The detection capability for static and scanning modes should be provided in terms of dpm/100 cm ² for the alpha and beta radiation expected at the facility as discussed in 1.a above.	TR Section 10.2.3 - new subsection to discuss surface contamination detection capability TR Tables 7, 8, 9, 10, 11, 12, 13, and 14 (new) - new tables inserted to support surface contamination detection discussion
3-3	Provide a rationale for the proposed monthly frequency for contamination surveys of process areas for the main process facility	TR Table 7 (now 18) - adjusted survey frequency to daily in the main process facility in accordance with NUREG 1156, Volume 12, Appendix M, Table M-1

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3-4	Describe additional personnel contamination survey locations, if any. a. If there is only one personnel contamination survey location, please describe controls that will be in place to ensure potentially contaminated workers don't return to offices or leave the restricted area without performing a survey.	TR Table 7 (now 18) - added clarification and footnote f describing personnel contamination surveys and associated controls
4-1	Provide instrument sensitivities in Table 6 of the TR in units used for regulatory compliance (e.g., dpm/100 cm ² , µCi/ml, etc.).	TR Table 6 - updated estimated instrument sensitivities to units used for regulatory compliance
4-2	Indicate how the exposure rate limit in Note 6 in NUREG-1556, Vol. 12, Table M-2, "Acceptable Surface Contamination Levels for Equipment," will be demonstrated	TR section 10.2.3 - added new subsection 10.2.3.3 discussing dose rate limit and energetic beta emissions
5-1	Clarify where berm(s) will be constructed	ER Section 4.4.2 - added plan for site grading ER Map 25 - replaced site grading plan with latest version
5-2	Provide the location of the waste storage area	TR Appendix C - updated Attachment 1 (facility process layout) TR Table 7 (now 18) - cited Appendix C to identify location of waste storage area
5-3	Provide additional details on emission control equipment	TR section 9.2.1 - referenced Table 5 and new ER Appendix I for additional information on emission control equipment ER Table 1-2 - updated status of air quality permitting ER section 4.6.2 - referenced new ER Appendix I ER Appendix I - new Air Quality Permit Application and Approval
5-4	Clarify all locations of potential radiological effluent releases from facilities and, if there are additional locations, whether they will be monitored	TR sections 9.2.1, 9.2.2 and Figure 5 - updated to clarify potential radiological effluent releases TR Table 7 (now 18) - updated airborne effluent release monitoring for PUG processing
5-5	Discuss any accident controls associated with the effluent control system designs	TR section 9.2.5 - added subsection to describe accident control and referenced new TR Appendix E TR Appendix E (new) - Process Control Safety Interlock Philosophy Overview
6-1	Provide data for all site-specific sampling performed for baseline radiological investigations for the demonstration plant	ER Appendix H (new) - added 2015 baseline report reference and 2022 soil sampling analytical results and cited in ER Section 3.12.2.3
6-2	Provide additional discussion on using baseline radiological investigations performed for the Bear Lodge Project site and applying them to the Demonstration plant site. The applicant should provide all data sets from the Bear Lodge Project site investigation that will be used for the Demonstration plant site.	ER sections 1.3 and 3.12 - clarified applicability of previous radiological baseline work
7-1	Clarify aspects of Rare Element Resources, Inc.'s (RER) process related to mass balance issues	TR section 9.1.1 - editorially clarified onsite PUG volume and temporary storage in PUG/Sample Storage Facility TR Appendix B page B6 - clarified intended waste shipment volume and mass rate and reiterated that entire tailings mass will be disposed of in this way ER section 4.13.3 - edited consistent with RSI response
7-2(P1)	Provide additional information on RER's proposed facility and process description -ER Figure 17 presents an overhead picture of the Upton facility as it currently exists. ER Map 3 shows the layout of the facility buildings once readied for RER's planned demonstration plant. The applicant should provide a description	TR section 9.2 - added details regarding buildings to be constructed

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	of and discussion for the additional features shown on ER Map 3 that do not appear in ER Figure 17. These include the auxiliary plant, the building expansion, the scrubber area, and the electrical control room.	
7-2(P2)	Section 9.1.1 of the TR states that the exploration sample would undergo physical upgrading over an approximately two-week period, at a rate of approximately 100 tons per day, with the comminuted product stored in super sacks. The applicant should clarify how the super sacks are filled with the comminuted product, how replacement super sacks are provided to continue filling and storage, and how filled sacks are removed and placed into storage within the PUG/Sample Storage Facility.	TR section 9.1.1 - integrated details regarding the procedure of filling, replacing (if needed) and transporting super sacks
7-2(P3)	In Table 4 in Section 9.1.5 of the TR, various acids, ammonia water, and organic reactants are indicated as being stored in the Chemical Containment Area. Please indicate and describe what changes to this containment area would be needed to store these materials safely and securely in preparation for their use in RER's process. The applicant should discuss how each of these materials would be transferred to the Main Process Building as needed and in time to support RER's process. The applicant should discuss aspects of the Chemical Containment Area that would be relied on to contain spills should they occur.	TR section 9.2.3 - updated with information regarding chemical containment TR Figure 7 (new) - chemical tank layout included as a new figure
7-2(P4)	In Table 4 in Section 9.1.5 of the TR, the total inventory of the process-related acids, ammonia water, and organic reactants is provided. The applicant should clarify if this means the cumulative mass of these materials to be stored at the site over the course of RER's processing of the REOs or the maximum mass of these materials to be stored at any point during RER's operations. Section 9.1.5 of the TR also mentions the potential use of bentonite to absorb excess liquid in the process tailings. The applicant should clarify if RER intends to store bentonite at the Upton site, and if so, where on the site, and if not, how would RER receive the bentonite for its in-time use.	TR Table 4 - updated with editorial change and maximum mass of materials included as new column TR section 9.1.5 - updated with info regarding bentonite
7-2(P5)	In Table 5 in Section 9.2.5 of the TR, ventilation of the Chemical Containment Area is stated as routing through the Main Processing Facility scrubber. This implies that the Chemical Containment Area will be enclosed, a state that ER Figure 17 does not show. The applicant should describe the activities to enclose the Chemical Containment Area and how the routing to the Main Processing Facility scrubber would be accomplished.	TR section 9.2.3 - updated with information regarding chemical containment and a reference to the air quality permit
7-2(P6)	In Section 9.2 of the TR, a laydown yard is identified as one of areas outside the restricted area but within the site boundary. ER Map 3 does not show the laydown area. The applicant should indicate where the laydown area would be located within the site boundary and how RER intends to dispose of equipment and supplies that are stored in this area.	TR section 9.2 - updated with more information about laydown yard and a reference to updated TR Figure 5
7-2(P7)	In Section 1.4.3 of Appendix B to the TR, physical upgrading (i.e., PUG) equipment is identified for early decontamination and demobilization. The applicant should discuss the activities to accomplish this and any environmental effects of doing so. The applicant should discuss its planned uses for the PUG/Sample Storage Facility following removal of the PUG equipment and as	TR Appendix B section 1.4.3 - added detail on potential for environmental effects of PUG equipment decommissioning, as well as future use of PUG/Sample Storage Facility.

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	the stockpile of comminuted exploration sample is reduced over time during RER's operational period.	
7-2(P8)	"Section 9.1.5 of the TR is entitled "Chemical Recycling and Waste Facilities." The applicant should identify where these facilities would be located. The applicant should confirm that the four produced solid waste and wastewater streams would be combined, along with organic liquid wastes from the Thorium-Cerium Separation stage, into a single waste product for offsite disposal. The applicant should discuss how the non-radioactive organic liquid waste from the	TR section 9.1.5 - updated to include detail from RSI response and referenced TR Appendix C for updated facility process layout.
8-1	Provide a more complete discussion of the alternatives to the proposed action and the impacts of these alternatives in comparison to those from the proposed action.	ER section 2.1.1 - provided additional detail on no action alternative ER section 2.2 - added reference to full review of alternatives for commercial facility ER section 2.4, Table 2-3 - clarified that there will be impacts from no-action (no economic benefit, potential security harm) ER section 4.10.1 - addressed socioeconomic and national security impacts of no action consistent with list of impacts in section 2.1.1
Admin-1	Section 7.3.1 in the TR specifies the specialized knowledge for the Radiation Safety Officer. This includes "...how the hazards are generated and controlled during the uranium recovery [emphasis added] process." This appears to be a typographical error.	TR section 7.3.1 - corrected typographical error ("uranium" replaced with "REE").
Admin-2	Section 7.3.2 in the TR specifies the education, training, and experience necessary for a safety technician. This includes: "The safety technician(s) will have one of the combinations of education, training, and experience in Table 2 consistent with Section 2.4.1 [emphasis added] of RG 8.31 (NRC 2002)." This appears to be a typographical error as the recommended qualifications for health physics technicians are provided in Section 2.4.2 of RG 8.31.	TR section 7.3.2 - corrected typographical error (Section 2.4.1 replaced with Section 2.4.2)
Admin-3	In Sections 2.2 and 3.2.5 in Appendix F in the ER, the applicant refers to Section 1.1.1.1 (presumably also in the ER). This appears to be a typographical error as there is no Section 1.1.1.1 in the ER. The NRC staff notes that clicking on the link brings the reader to Section 1.3.3.2 in the ER.	ER Appendix F sections 2.2 and 3.2.5 - updated cross reference to 1.3.3.2

Ac – actinium
ALARA – as low as is reasonably achievable
DCF – dose conversion factor
ER – Environmental Report
MDC – minimum detectable concentration

NRC – US Nuclear Regulatory Commission
PUG – physical upgrade
RSI – request for supplemental information
RWP – radiation work permit
TR – Technical Report