RIO GRANDE RESOURCES CORPORATION

December 27, 2021

Mr. David Ohori
Supervisor/Senior Reclamation Specialist
Mining and Minerals Division
New Mexico Energy, Minerals and Natural Resources Department
1220 South St. Francis Drive
Santa Fe, NM 87505

Subject: RGR Response to Comments on Reclamation and Post-Reclamation Radiological Survey Work Plan, MMD Permit No. CI002RE and NMED Discharge Permit 61, Rio Grande Resource Corporation, Mount Taylor Mine

Dear Mr. Ohori,

Rio Grande Resources Corp. (RGR) respectfully submits its responses to the comment letter it received from New Mexico Mining and Minerals Division (MMD) and New Mexico Environment Department (NMED), dated October 28, 2021. That letter presented comments on the Reclamation and Post-Reclamation Radiological Survey Work Plan RGR submitted to MMD on June 8, 2020 (Work Plan).

The Work Plan was titled "*Work Plan for Post-Mining Radiological Surveys of Permit Area and Impacted Lands.*" The Work Plan was a condition (Section 9.L.3) of Revision 13-2 to Permit No. CI002RE for the Mount Taylor Mine in Cibola County, New Mexico.

Along with its responses, RGR is also providing an Addendum that contains proposed changes and additions to the Work Plan. RGR believes these will help clarify the responses, based on the comments made by MMD/NMED.

Comments by MMD/NMED are in **Bold**. Responses by RGR are in regular font.

1. **General comment – an Acronym and Definition page at the beginning of the document would be helpful.**

   RGR Response: An Acronyms/Abbreviations page for the Work Plan is presented in the Addendum.

2. **Section 1. Introduction, Page 2, paragraph 4th states, "The commitment for post-closeout contamination surveys of building retained for the PMLU is not specific, and there is no discussion of this issue in the MMD/NMED Joint Guidance". Condition 9.L.2 of MMD Permit Revision 13.2 requires that, "Radiation levels in the facilities that will be retained for PMLU shall not exceed NMED Radiation Control Bureau 20.3 NMAC criteria for the facilities' unrestricted release and use." Bruce Norquist has stated that the Multi-Agency Radiation Survey and Site Investigation Manual (MARRSIM) requirements of 25 mrem/yr. alpha and gamma is the standard that these building must meet. Clarification of the acceptable radiation levels in the PMLU buildings is needed.**

   RGR Response: Mr. Norquist may have mis-spoke about the reference to MARSSIM. The RCB/NMED regulation as referenced in Mine Permit Condition 9.L.2 is a radiological dose-based release criterion found in 20.3.4.426(B) NMAC, which is equivalent to a Total Effective Dose Equivalent (TEDE) of 25 mrem/yr. RGR will comply with Condition 9.L.2 and 20.3 NMAC.

Please refer to the Addendum for RGR's proposed modifications to Section 2 of the Work Plan and addition of Appendix A. Section 2.2 addresses radiological release criteria for buildings and infrastructure. Appendix A details the derivation of release criteria for radiological surface contamination that equates to a TEDE of 25 mrem/yr.

3. **Section 2.0, Radiological Release Criteria, Page 3, #2 states that the "Site Post-Reclamation Radiation Level ("PRRL")...shall not exceed the site-specific value of gamma radiation that correlates to 5 pCi/g Ra-226 above background at the 95th percentile." The next paragraph states that an equivalent PRRL of 24 uR/hr has been identified based on based on a prior, Site-specific statistical regression between Ra-226 concentrations and terrestrial gamma radiation levels (see Section 3.2.1). Based on a review of Figure 5 and Section 3.2.1, the PRRL appears to correspond with the 17.5 uR/hr value, not the 24 uR/hr value. In addition, it appears that only seven data points were used to correlate the mean Ra-226 with the mean gamma and to calculate the 95th percentile. A sample size of n=7 may not yield a strong statistical correlation and also decrease the statistical accuracy when calculating the 95th percentile. Please provide additional justification as to why the 24.5 uR/hr is being chosen as the upper limit and not the 17.5 uR/hr. In addition, please address if the sample size used in the correlation should be increased to yield a more reliable statistical correlation and calculation of the 95th percentile.**

RGR Response: With respect to sample size, the number of data points visible in Figure 5 (n = 7) is an artifact of zooming in on the lower portion of the regression. The actual sample size for the identical regressions shown in both Figures 4 and 5 is n = 9 (the correlation data set is tabulated in Table 3). While additional correlation samples might slightly increase the coefficient of determination (R^2), the range of correlation values is representative of the site, the variation attributable to the regression relationship is high (R^2 = 0.97), and the slope on the regression is highly significant (P-value = 0.00001). The correlation data are statistically suitable for the intended use, and the number of correlation samples/measurements is expected to be adequate. Note that direct soil sample analysis results will be the fundamental determinant of compliance with the soil cleanup level during the final status survey (FSS).

With respect to the 95th percentile, reference to this statistical parameter in the MMD/NMED "*Joint Guidance for the Cleanup and Reclamation of Existing Uranium Mining Operations in New Mexico*" (MMD/NMED, 2016) (*Joint Guidance*) pertains to the 95th percentile on a background data set. This interpretation is supported by the fact that a "percentile" is not a statistical parameter used in regression analysis, but it is a common statistical measure to represent an upper threshold value from a background data distribution. The reference to this parameter in connection with "background" in the *Joint Guidance* is consistent with EPA conventions on defining background threshold values (BTVs) at a 95th percentile or 95% upper tolerance limit (UTL) on the distribution of sampling results from a background reference area (USEPA, 2015).

The 17.5 µR/hr gamma cutoff value shown in Figure 5 is determined at the one-sided, 95% upper prediction limit (UPL) on the regression. A 95% UPL is not synonymous with a 95th percentile (these are different statistical concepts). It is apparent that the PRRL described in the *Joint Guidance* is intended to be defined at the regression line (not an upper confidence or prediction limit) since by definition, a least squares regression line will be (on average) the most accurate statistical predictor of Ra-226 concentrations based on gamma radiation data. Use of the 95% UPL to define the PRRL would necessitate cleaning up soils to an average Ra-226 concentration that is well below the approved 6.8 pCi/g cleanup criterion, and this is not the intent of the PRRL as described in the *Joint Guidance*.

It should be noted that the gamma cutoff is made solely to guide excavation work. The final compliance point is the 5 pCi/g plus background, which will be evaluated during the final status survey.

REFERENCES

Mining and Minerals Division, New Mexico Environment Department (MMD/NMED). 2016. Joint Guidance for the Cleanup and Reclamation of Existing Uranium Mining Operations in New Mexico. March 2016.

U.S. Environmental Protection Agency (USEPA). 2015. ProUCL Version 5.1.002 Technical Guide.

4. **Section 3.1, Operational History, Page 3, paragraph 2 states, in part, "potential impacted land areas are in expected to include..., 2) adjacent and/or hydrologically downgradient arroyos or ephemeral runoff drainages,". Affected areas may include impacts from windblown sources must be considered.**

   RGR Response: RGR will consider impacts from windblown sources when investigating potentially affected land areas. The mention of impacts from windblown sources was inadvertently omitted from this section of the original Work Plan.

5. **Section 3.2.1, Onsite Gamma Radiation Surveys, Pages 4-6. See Comment Number 3, above. The proposed radiation cleanup requirements and the MMD/NMED Joint Radiation Cleanup Guidance requirements needs clarification.**

   RGR Response: This section discusses existing gamma survey data for land areas, along with the gamma/Ra-226 correlation data. Soil cleanup levels from the *Joint Guidance* are reproduced verbatim in Section 2 of the Work Plan. Please refer to RGR's response to Comment No. 3.

6. **Section 3.2.1, Onsite Gamma Radiation Surveys, Pages 4-6. Larger scale drawings of Figure 3 are needed to depict more clearly the measured and predicted Ra-226 concentrations in surface soil at the mine site. In addition, the Figure 3 drawing of the predicted Ra-226 concentrations shows an area of elevated in the Borrow Area A. Borrow Area A may need additional investigation of the source of the higher predicted Ra-226 concentrations in that area.**

   RGR Response: Figure 3 has been enlarged for improved readability (see Addendum).

   The elevated gamma readings appearing in the northern portion of Borrow Area A resulted from clearing and grubbing activities prior to excavation of the soils for construction of the Disposal Cell cover in late 2020. Prior to construction activities, a couple of areas in Borrow Area A indicated elevated gamma readings, most likely a result of windblown contamination. The soil removed during the grubbing process was set at the location where the elevated gamma readings are observed in Figure 3. There may also be shine effects influencing readings in this area from the nearby low-grade ore removal project. The contamination will be removed before excavation continues in Borrow Area A.

7. **Section 3.2.1, Onsite Gamma Radiation Surveys, Figures 4 and 5, Page 5. See Comment Number 3, above. Discussion on the Sampling Adequacy and calculation of the 95th Percentile Value data is needed.**

   RGR Response: Please refer to RGR's response to Comment No. 3

8. **Section 3.2.1, Onsite Gamma Radiation Surveys, Page 6, paragraph 1. See Comment Number 3, above. According to the Joint MMD/NMED Radiation Cleanup Guidance of Existing Mining Operations in New Mexico, March 2016, in order to demonstrate adequate radiation reclamation, the Post-Reclamation Radiation Level (PRRL) will not exceed the 95th percentile value. If 17.5 uR/hr. gamma exposure rate is the background radiation 95th percentile value for the Mt. Taylor Mine, as stated in this section, then the statement that, "a gamma exposure rate of 24.5 uR/hr. will be the PRRL" is not in accordance with the Joint MMD/NMED Radiation Cleanup Guidance, rather a gamma exposure rate of 17.5 uR/hr. should be the PRRL.**

   RGR Response: As described in response to Comment Number 3, the PRRL as described in the *Joint Guidance* is intended to be defined at the regression line, not at a prediction limit on the regression. The 95th percentile as cited in connection with background in the *Joint Guidance* pertains to selection of a background threshold value. The gamma cutoff value described in the Work Plan is determined at the 95% UPL (17.5 µR/hr), and this value is more conservative than required by the *Joint Guidance*. The gamma cutoff will be used at RGR's discretion only as part of Remedial Support Surveys (RSS) to help guide soil cleanup work as remediation progresses.

9. **Section 3.2.2, Radiological Data for Offsite Areas, Page 6 and Figure 6 and Table 1, Page 7. Using the 17.5 uR/hr. gamma exposure rate as the PRRL, Sample Location # MTE-1, MTE-3, MTE-4, and MTE-5 are above the PRRL. Additional gamma exposure rate sampling and soil sampling for Ra- 226 concentration may be needed.**

   RGR Response: See response to Comment Number 3 and response to Comment No. 8. A PRRL of 24.5 µR/hr (predicted equivalent to a Ra-226 soil concentration of 6.8 pCi/g) is consistent with the specifications of the *Joint Guidance* from MMD/NMED. Offsite areas represented by sampling locations shown in Figures 6 and 7 will be scanned as part of Remedial Support Surveys (RSS) as described in the Work Plan. Where the RSS data indicate compliance with the PRRL, the data may also serve as FSS data. Release of these areas to the Post Mining Land Use (PMLU) will require that both the PRRL and the Ra-226 soil cleanup level as defined in the *Joint Guidance* are demonstrated to have been satisfied based on FSS gamma scanning and direct soil sampling results.

10. Section 3.2.2, Radiological Data for Offsite Areas, Page 6 refers to a study performed in 2012 (Fitch, 2012). See Comment Number 3, above. The 2012 Fitch field soil investigation studied the gamma exposure rate and the Ra-226 concentration in soil samples taken from "offsite" areas nearby the controlled area of the mine. The report states that, "Regression analysis of the data [in Table 2] indicates very poor statistical correlation between the dose rates and the concentrations of Radium-226 in the soil." Please provide the data and results of the regression analysis.

    RGR Response: The 2012 survey was neither designed nor intended for use in a sitewide correlation. Instead, it was done prior to RGR's 12/3/2019 decision to close the mine, with the purpose of investigating potential waterborne dispersal along the Marquez Arroyo and into its fluvial deposits. As such, the survey purposed discrete locations for sampling and measurement and depended on Ra-226 concentrations in the soil samples for evaluating dispersal (not the gamma exposure rates). Contributions from gamma shine from adjacent areas nullified reasonable correlation of the survey's data. As requested, the data and regression analysis from the 2012 study is included in the attached Addendum.

11. **Figure 7, Page 8. A larger scale drawing of this figure is need that more clearly show the sample location identifications.**

RGR Response: Figure 7 has been enlarged to increase legibility of the location ID numbers (see Addendum).

12. **Section 3.2.3, Data Gap Analysis, Page 9, paragraph 1 states that, "Subsurface soil core samples will be collected only in areas where, based on operational history and Site knowledge, buried radiological contamination may exist...". Subsurface core samples should be collected wherever the soil surface exceeds the PRRL.**

    RGR Response: RGR will perform subsurface characterization of the depth of Ra-226 impacts to soil in areas where gamma survey data exceeds the PRRL, including the collection of soil core samples.

13. **Section 4., Methods, Page 9 lists the approaches, methods and analytical objectives of the proposed reclamation and post-reclamation radiological surveys. See Comment 2, above regarding the radiation cleanup levels in the facilities retained for the PMLU. In addition, this section does not address the State of New Mexico Radiation Cleanup Criteria (Section 2.0 of the Joint MMD/NMED Radiation Cleanup Guidance for Existing Mining Operations, March 2016) for contaminated material repository cover material to achieve a radon flux equal or less than 20 pCi/m²/s.**

    RGR Response: Please refer to RGR's response to Comment #2 above regarding the cleanup levels in the facilities retained for the PMLU. Two new sub-sections are proposed for Section 4 of the Work Plan (see Addendum) to address radon flux surveys (section 4.2) and radiological surveys of the PMLU facilities (section 4.3).

14. **Section 4.1.1, Instrumentation, Page 10, 1st paragraph states that, "the detector will be positioned at approximately 0.5 meters above the ground surface..." Please specify whether the detector will be shielded or un-shielded and explain why.**

    RGR Response: The detector will be unshielded for the FSS as this is what the gamma/Ra-226 correlation (figures 4 and 5 in the Work Plan) is based on. While shielded readings can partially mitigate gamma shine from adjacent areas, after soil cleanup and placement of contaminated materials in the disposal cell, gamma shine across the site will be minimized, and use of an unshielded detector for the FSS will be more sensitive to small changes in Ra-226 concentrations near the cleanup level.

15. **Section 4.1.5, Gamma/Ra-226 Correlation. Comment No. 3 applies to this section.**

    RGR Response: See response to Comment No. 3.

16. **Section 5.1 Remedial Support Surveys, General Approach, Page 14, paragraph 2. See Comment 3, above.**

    RGR Response: Please see response to Comment No. 3.

17. **Section 5.4, RSS Soil Sampling, Page 16. This section states that, "RGR has recently developed a rapid, onsite Ra-226 soil sample analysis capability..." Please provide information that demonstrates that this sample analysis capability is an acceptable method for on-site soil analysis for Ra-226.**

    RGR Response: The onsite Ra-226 soil sample analysis technique is intended to be used for screening purposes only during remedial support surveys (RSS). For the final status survey (FSS) to determine compliance with the cleanup level for Ra-226 (6.8 pCi/g), all samples will be sent

offsite to a qualified (NELAP-accredited) commercial laboratory for analysis.

The objective of using the rapid soil sampling analysis tool in conjunction with the RSS is to provide screening-level data to assist with decisions as to whether or not excavations in a given remediation area appear sufficient to meet the cleanup level, and whether the remediated survey unit is ready for the FSS. RSS data are intended only for internal use by the mine operator in guiding soil cleanup and will not be submitted to MMD/NMED for review or evaluation. All FSS data will be included in the FSS Report for submittal to MMD/NMED for review and approval.

The rapid Ra-226 soil sample analysis technique developed by **RGR's radiation consultant,** Environmental Restoration Group, Inc. (ERG), is not an EPA-approved technique nor a peer-reviewed method. RGR will therefore submit a written protocol with data to MMD at least 90 days prior to its RSS utilization to inform the agencies about the technique.

18. **Section 6.1, FSS Statistical Design and Compliance Evaluation, Page 17-19. The Agencies request a meeting to discuss the statistical design and compliance evaluation methodology proposed in this section. A meeting should be scheduled within 30-days of receipt of this letter.**

RGR Response: RGR contacted MMD/NMED and held two meetings to discuss the topics of this comment; one on November 19, 2021 and one on December 8, 2021. One of the main issues discussed during these meetings was the use of the Sign test for statistical demonstration of compliance with the cleanup level.

A portion of the description of the nature of the Sign test in the Work Plan was based on a misinterpretation of how the Sign test evaluates the data, but this has now been corrected (refer to the Addendum for proposed changes to sub-section 6.1 of the Work Plan).

"Adjusted" values in the Sign test represent the DCGL minus the measured value. When the measured value is smaller than the DCGL, the resulting adjusted value will be a positive number, and when the measured value is larger than the DCGL, the resulting adjusted value will be a negative number. **The Sign test does not evaluate the magnitude of "adjusted" values** (as mistakenly implied in the original Work Plan), but rather the proportion of adjusted values that have a positive sign (values >0). The median is defined as the value at which 50% of values are above, and 50% of values are below. The sign test, as explicitly defined in the below excerpt from Section 8 of MARSSIM, evaluates the proportion of adjusted values that are positive numbers (>0). For example, if 75% of values are >0, this provides evidence that the median concentration in the survey unit is below the DCGL, and depending on the corresponding test statistic (S+) in relation to the applicable critical values for the specified degrees of freedom and confidence level, whether the null hypothesis (that the median value in the survey unit exceeds the DCGL) should be rejected at a 95% level of confidence.

8.3.2 Applying the Sign Test

The Sign test is applied as outlined in the following five steps, and further illustrated by the examples in Sections 8.3.3 and 8.3.4.

1. List the survey unit measurements, X_i, $i = 1, 2, 3.... N$.

2. Subtract each measurement, X_i, from the $DCGL_W$ to obtain the differences:
   $D_i = DCGL_W - X_i$, $i = 1, 2, 3.... N$.

3. Discard each difference that is exactly zero and reduce the sample size, N, by the number of such zero measurements.

4. Count the number of positive differences. The result is the test statistic S+. Note that a positive difference corresponds to a measurement below the $DCGL_W$ and contributes evidence that the survey unit meets the release criterion.

5. Large values of S+ indicate that the null hypothesis (that the survey unit exceeds the release criterion) is false. The value of S+ is compared to the critical values in Table I.3. If S+ is greater than the critical value, k, in that table, the null hypothesis is rejected.

If you have any questions, please call me at (505) 287-7971 or email bruce.norquist@ga.com.

Sincerely,

Bruce L. Norquist

Bruce Norquist
Facilities Manager, Mt. Taylor Mine
Rio Grande Resources Corporation

cc: Anne Maurer, MECS-NMED, via email