



State of Utah

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Environmental Quality

Amanda Smith
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DIVISION OF RADIATION CONTROL
Rusty Lundberg
Director



DRC-2011-00720

August 11, 2011

CERTIFIED MAIL
(Return Receipt Requested)

Jo Ann Tischler, Director, Compliance and Permitting
Denison Mines (USA) Corp.
1050 17th Street, Suite 950
Denver, CO 80265

Subject: Nitrate Investigation Revised Phase 2 to 5 Work Plan Rev. 1.0, White Mesa Mill Site,
dated August 4, 2011: **DRC Review Comments**

Dear Ms. Tischler:

DRC review comments regarding the June 3, 2011 Denison Mines (USA) Corporation (DUSA) "Nitrate Investigation Revised Phases 2 through 5 Work Plan Rev. 1.0" are enclosed (via URS Memorandum).

If you have questions or concerns regarding the comments, or would like to arrange a meeting or teleconference to discuss the comments, please contact me at (801) 536-0080. Thank you.

Sincerely,

Thomas Rushing, P.G.
Geotechnical Services Section

Enclosure: URS Memorandum

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MEMORANDUM

To: Tom Rushing (DRC), Loren Morton (DRC), Phil Goble (DRC)
From: Paul Bitter (URS), Jeremy Cox (URS)
cc: Robert Baird (URS)
Date: 11 August 2011
Re: Comments on the Nitrate Investigation Phase 2-5 Work Plan, Rev 1.0, for White Mesa Mill Site dated August 4, 2011.

This memorandum contains the comments by URS and the Utah Department of Environmental Quality, Division of Radiation Control (DRC) on the Phase 2- 5 Work Plan, Rev. 1.0, for the Nitrate Investigation at the White Mesa Mill Site. The Work Plan was prepared by Denison Mines USA (DUSA) and was dated August 4, 2011. Comments have been provided by URS as a deliverable for Contract No. 116259 issued through the DRC. This review also is in accordance with the amended Memorandum of Understanding (MOU) between the DRC and DUSA dated May 19, 2011. For purposes of expediency, the URS and DRC comments are edited for conciseness and combined into one memo. Note that format, grammar, and punctuation in the Work Plan were not reviewed for accuracy and consistency.

The comments regarding the Phase 2-5 Work Plan, Rev 1.0, are presented below. Please note that, per the June 30, 2011 Revised Tolling Agreement (Rev. 2), all DRC / URS comments must be addressed and resolved, and the revised Phase 2-5 Work Plan Rev 1.0 must be submitted, on or before August 18, 2011.

1. General Comment: Most of the DRC/URS comments on the previous submittal of this document have been adequately addressed. The comments listed below concern some of the previous comments that may not have been adequately addressed, or comments related to revised material in the document that was not previously reviewed by DRC and URS.
2. Section 2.3.3.1: The emphasis on the potential effect of the Mancos Shale paleoridge in the "known conditions" sections for multiple potential or possible source areas does not appear to correspond with the conclusions regarding the effects of the slope and thickness of the Mancos Shale in Section 2.3. In Section 2.3, based on the demonstrated transport of chloroform away from the presumed source areas at the site, DUSA concludes that "Mancos Shale surface topology and/or thickness may or may not exert a significant influence on seepage from potential nitrate sources." Please revise the text regarding the potential effects of the Mancos Shale paleoridge accordingly in the "known conditions" subsections within Section 2.3.3.1.

3. Section 2.3.3.1: The text in the "decision process" subsections regarding the criteria for Phase 3 sampling appears to differ from the language used in Section 3.3.1. In Section 3.3.1, the criterion for Phase 3 sampling is presented as twice the background level, which is defined as the 95% UCL of data collected in Phase 1A. In Section 2.3.3.1, the criterion is presented as "above background". DRC recommends use of the language from Section 3.3 throughout Section 2.3.3.1 or insertion of references to Section 3.3 to explain the criterion.
4. Section 2.3.3.1: The text in the "decision process" subsections suggests that "archived" samples could be utilized for Phases 4 and 5. Groundwater samples or soil/bedrock samples may not be archived for any period that would violate sample preservation and / or holding times for the analyses. Please specify sample preservation and holding time requirements for both types of samples. In addition, it is not clear which groundwater or soil samples might be archived. Please specify the process for archiving the samples in the appropriate subsections in Section 3. Assuming that archiving samples does not result in a violation of sample preservation or holding times, the samples must be stored under proper chain of custody controls in a secure location that is both cool and dark, such as a refrigerator or freezer.
5. Section 3.2.4.2: The method for perchlorate analysis was specified as Method 6850 in the Final Phase 2 Work Plan dated July 12, 2011. Please revise the method number accordingly in Section 3.2.4.2.
6. Section 3.3.1: The preliminary data from Phases 1A and 1B are now available, which enables selection of the sampling locations in Phases 3A and 3B. Please indicate the specific sampling locations for Phases 3A and 3B in this Work Plan. Proper selection of the number and locations of the deep borings cannot be determined until after resolution of DRC concerns / open issues with the Phase 1 results DUSA provided on August 4, 2011 (email). Some of these concerns were briefly discussed with DUSA in a conference call on August 11, 2011. With regards to the Phase 1 submittal, please resolve the following open issues:
 - a. Provide copies of all laboratory reports (including EDD format) for the soil sample analysis from all phases of Phase 1.
 - b. Describe and justify derivation of the statistics used to calculate: "background" soil concentrations, the Upper Confidence Levels (UCLs), and the selection of a 2-times UCL value.
 - c. Describe and justify all assumptions and calculations used in the Table 1 mass balance calculations in the August 1, 2011 Intra memo. Provide evidence, or cite references where written evidence is found to support all assumptions. Please demonstrate why the assumptions and calculations are representative of actual conditions experienced on White Mesa and during mill site operations, both historic and modern. In the event that evidence is not available to support the assumptions / calculations, please describe and justify why they are conservative for purposes of protection of the environment.
7. With regards to Phase 3B, and as an alternative to the description / justification requested in Item 6, above, DUSA may opt to drill deep bedrock borings to the water table at each surface source location investigated in Phase 1B. Under this option, please ensure that the deep

bedrock boring is co-located with the Phase 1B geoprobe boring site that shows the highest ammonia (N) and nitrate/nitrite (N) inventory in the soil profile.

8. For all deep bedrock borings drilled, please ensure the depth of each extends to the upper geologic contact of the Brushy Basin Member of the Morrison Formation. We also recommend that upon completion of each boring, that a permanent monitoring well be installed. Be advised that the number and location of groundwater monitoring wells that might be required will be determined after DRC review of the bedrock core sample analysis (laboratory) results from the Phase 3 effort.
9. Please provide deadlines by which draft results will be provided to the DRC for Phases, 2, 3, 4, and 5.
10. Sections 3.4 and 3.5: No plan is described for how stable isotope compositions will be evaluated in Phase 4 and 5. Criteria must be provided in the work plan for determining whether nitrate is representative of natural or anthropogenic sources.
11. Sections 3.4 and 3.5: It is not possible to fully evaluate these sections without the updated QAP, which is to be completed at a future date. Please provide the QAPs with the DUSA Phase 2-5 Workplan revision due on or before August 18, 2011.
12. Section 3.4, second paragraph, 1st sentence: "The stable isotopic composition of nitrogen, oxygen (NO₃, NH₄) and sulfur (SO₄) will be measured..." should be corrected to be consistent with later statements: "The stable isotopic composition of nitrogen (NO₃, NH₄), oxygen (NO₃, SO₄) and sulfur (SO₄) will be measured..." Please include the oxygen isotopes.
13. Section 3.4: Oxygen and hydrogen stable isotope compositions of water should be measured as originally proposed. These data are critical for evaluating the oxygen isotopes' compositions of sulfate and nitrate, and for determining mixing between surface water and groundwater sources. Please revise the work plan accordingly.
14. Section 3.4, first numbered item: Method 300.0 is proposed for analysis of ammonia. Method 350.2 was previously recommended for ammonia analysis for groundwater or wastewater samples in the DRC/URS comment #34 in the March 2011 comments on the initial Work Plan. Please review the selected analytical method for ammonia in these matrices and revise the Phase 4/5 Work Plan as appropriate. Be aware that the detection limits of any method must meet data quality objectives (DQOs). The method detection limits and DQOs and must be included in the Phase 4 and 5 QAPs.
15. Section 3.4, second to last paragraph: "First the δ¹⁸O of both sulfate and nitrate molecules will be analyzed, because the exchange of oxygen isotopes in these molecules occurs in both atmospheric and aqueous environments."

The use of the word "exchange" is not an accurate description here. The oxygen isotopes in nitrate are only exchangeable at low pH values not typically encountered in groundwater systems. Oxygen isotopes are, however, inherited from an atmospheric (O₂) and/or aqueous (H₂O) environment, which reflect their source. For example, nitrate formed by nitrification of ammonium typically inherits oxygen from the atmosphere and from water in the

environment where nitrification occurs. The oxygen isotope composition of nitrate formed by nitrification, therefore represents a mix (typically in a 1:2, O₂:H₂O ratio) of oxygen from this environment. Nitric acid only contains oxygen from the atmosphere, and therefore has a much different oxygen isotope signature. Please revise the workplan to describe how these phenomenon / processes will be considered during review / evaluation of the data from Phases 4 and 5.

16. Section 3.5, last paragraph: The proposed submittal date for the Phase 5 QAP (June 29, 2012) is unacceptably protracted and does not correspond to the submittal date of November/December 2011 shown in the June 2011 Revised Phase 2-5 Work Plan. Further, during past meetings and an August 3, 2011 meeting with DRC and DUSA management, the Executive Secretary provided his expectation that: 1) all DUSA fieldwork for Phases 2 – 5 will be completed on or before December 31, 2011, and 2) the DUSA final revised Contamination Investigation Report (CIR) for all phases of the Nitrite Investigation be submitted for review and approval on or before June 1, 2012. Please revise the Phase 2 – 5 Workplan / schedule accordingly or justify why additional delays are necessary.
17. Figure 18: This figure may mistakenly refer to Phase 5 sampling instead of Phase 4 groundwater sampling. Please update the label as appropriate. In addition, this figure indicates that isotopic sampling for groundwater would occur only if fingerprints for agricultural or military activities are detected during Phase 2. This approach is not consistent with the weight of evidence approach requested by DRC in reviews of previously submitted documents, see DRC comments dated March 21, 2011 and June 23, 2011. In addition, the decision logic in Figure 17 suggests that isotopic fingerprints collected from soil at potential source areas will be compared to the Phase 4 isotopic fingerprints in groundwater. If Phase 4 is not conducted, a comparison of isotopic fingerprints between the potential sources and the groundwater, as indicated by Figure 17, would not be possible. DRC requests that logic in Figure 18 be revised to indicate that, although the Phase 4 sampling would occur at a later time than Phase 2, the results of both Phase 2 and Phase 4 are evaluated jointly (i.e., in parallel, not in series) in a weight of evidence approach.
18. Table 1: The proposed schedule with an end point (June 2013) is unacceptably protracted and is inconsistent with schedules previously discussed by DRC and DUSA management, see comment 16 above. Please revise the table according to discussed timelines, as outlined in comment 16 above, or justify why additional delays are necessary.

[End of comments]

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RE: 8/11/11; Nitrate phase 2 to 5 rev 1 / TR

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