From: Whited, Jeffrey
To: Bush, Richard
Subject: New Rifle Draft GCAP RAIs
Date: Monday, June 19, 2017 11:20:04 AM
Attachments: New Rifle GCAP Request for Additional Information.pdf

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Mr. Bush,

By letter dated January 19, 2017, (ADAMS Accession No. ML17023A222), the Department of Energy (DOE) submitted a Draft Groundwater Compliance Action Plan (GCAP) for the New Rifle, Colorado, Processing Site, to the U. S. Nuclear Regulatory Commission (NRC) staff for review and comment.

The NRC staff has reviewed the information submitted by DOE, and based on this review, determined additional information is required to complete the assessment of the Draft GCAP. Please find attached a DRAFT copy of the NRC staff's additional information request. These DRAFT RAIs are being sent to you to ensure that the questions are understandable, the regulatory basis for the questions are clear, and to determine if the information was previously docketed. Please notify me by Thursday, June 22, 2017, if you desire to hold a teleconference to discuss the questions.

Thank you,

Jeffrey Whited
Project Manager
Materials Decommissioning Branch
Division of Decommissioning, Uranium Recovery
and Waste Programs
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
(301)415-4090
jeffrey.whited@nrc.gov

REQUEST FOR ADDITIONAL INFORMATION

DRAFT GROUNDWATER COMPLIANCE ACTION PLAN

NEW RIFLE, COLORADO, PROCESSING SITE

DOCKET NO. WM-00062

By letter dated January 19, 2017, the U. S. Department of Energy (DOE) submitted the Draft Ground Water Compliance Action Plan (GCAP) for the New Rifle, Colorado, Processing Site, to the U. S. Nuclear Regulatory Commission (NRC) staff for review and comment (DOE, 2017). This request for additional information identifies additional information needed by the NRC staff to complete its review of the report. Unless otherwise noted, information provided in the comments is referencing the draft GCAP.

Comment 1: Additional receptor scenarios should be considered to determine that the proposed alternative concentration limits (ACLs) will be protective. The point of exposure (POE) evaluated by DOE are the Roaring Fork Ponds. The receptor is a member of the public who swims in the ponds and spends time on the banks of the ponds. DOE identifies some locations on the site (0452, 0453, 0320) that dry up during periods of low-water flow, but DOE did not evaluate the risk associated with direct exposure and inhalation that may occur from land use in these areas. Uranium and its daughter products should be included.

> **Basis:** The GCAP submitted by DOE proposes to meet the regulatory standards of 40 CFR Part 192 (Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings) by changing from a natural flushing and alternate concentration limit (ACL) strategy for contaminants of concern (COCs) to no remediation with application of ACLs. Derivation of ACLs requires an assessment to determine that levels of contaminants that will not pose a substantial present or potential hazard to human health and the environment. 40 CFR Part 192, Subpart A, §192.02 (c)(3)(ii)(B)(2), specifies that an evaluation of potential hazards from proposed ACLs must consider several factors, including potential adverse effects on hydraulically-connected surface-water quality.

Path Forward: Evaluate the risks associated with land use of the portions of the site where groundwater discharges to onsite surface water bodies and then evaporates (page 9).

Comment 2: In an environment with moderate to high evaporation, concentrations of contaminants may build up over time if the rate of addition exceeds the rate of loss, or if the geochemistry of the discharge point is sufficiently different from the geochemistry of the aquifer. As a result of the long half-life and persistence of the COCs, protection of human health and the environment may be necessary for an indefinite period of time.

> **Basis:** The GCAP submitted by DOE proposes to meet regulatory guidelines by using a natural flushing and ACL strategy for COCs. 40 CFR Part 192, Subpart A, §192.02 (c)(3)(ii)(B)(2), specifies that an evaluation of potential hazards from proposed ACLs

must consider several factors, including the potential for health risks caused by human exposure to constituents.

Path Forward: Analyze the potential buildup of contaminant concentrations in the Roaring Fork ponds and other locations where contaminated groundwater may discharge and then evaporate. Determine maximum risk-based concentrations (RBCs) associated with the scenario. Determine if additional controls or physical barriers to restrict use are necessary. Describe monitoring that will be performed to ensure buildup is not occurring.

Comment 3: The site and Roaring Fork ponds are located within the 100 year floodplain of the Colorado River. While the ponds may not be a current source of recreational fishing, flooding of rivers is commonly observed to result in transferal of fish to nearby surface water bodies.

Basis: The GCAP submitted by DOE proposes to meet regulatory guidelines by using a natural flushing and ACL strategy for COCs. 40 CFR Part 192, Subpart A, §192.02 (c)(3)(ii)(B)(2), specifies that an evaluation of potential hazards from proposed ACLs must consider several factors, including the potential for health risks caused by human exposure to constituents.

Path Forward: Evaluate the risks associated with fishing in the ponds or describe the controls in place that will prohibit use of the ponds for future recreational fishing. Determine maximum risk-based concentrations (RBCs) associated with the scenario. Determine if additional controls or physical barriers to restrict use are necessary.

Comment 4: The revised GCAP was necessary, in part, because vanadium and other contaminants were observed to be elevated and mobilized as a result of surface and subsurface disturbance. The previous GCAP had institutional controls providing for a “no dig zone” and a “limited disturbance zone”, however these controls were “not formally implemented.” Because the strategy for protection of human health and the environment relies significantly on institutional control of the site, assurance of fulfillment of the controls is essential.

Basis: Subpart B, §192.12 (c)(2)(i)(B), describes institutional control as having a high degree of permanence and which will effectively protect public health and the environment. Institutional controls must be enforceable by administrative or judicial branches of government entities and must be instituted and maintained.

Path Forward: Provide a description of administrative actions, inspection procedures, and other actions that will ensure institutional controls are being properly implemented and are effective. Provide a description of private properties that previously had wells within the Zone Overlay boundary, and how it is ensured that those wells are not being used.

Comment 5: The GCAP document does not address the potential for groundwater contamination by organic chemicals listed in Appendix I to Part 192. Past sampling at the site indicated the presence of some chemicals in monitoring wells (e.g. toluene) (DOE,

1992). It was speculated that toluene was possibly used for cleaning of equipment, though it was not used in the milling process. In addition, large amounts of kerosene and tributyl phosphate were used in processing operations (DOE, 1996).

> **Basis:** Subpart B, §192.12 (c)(1), states that the Secretary shall determine which of the constituents listed in Appendix I to Part 192 are present in or could reasonably be derived from residual radioactive materials at the site. These constituents can be a source of groundwater contamination.

Path Forward: Describe the historical use of organic chemicals at the New Rifle Site including the types and quantities used. Provide a summary of characterization done to identify the potential presence of organic chemicals including the sampling dates, locations, depths, types of environmental media sampled, and analytical results.

Comment 6: The groundwater model and associated geochemical analyses do not have sufficient accuracy to support the argument that the POE can be limited to the Roaring Fork ponds, and monitoring at the western edge of the institutional control zone is not necessary. The previous DOE GCAP strategy of natural flushing is being revised because model predictions of natural flushing are unlikely to be achieved. Though that modeling has been shown to be inaccurate, new modeling is used to support the revised GCAP strategy. Without additional model validation, other actions may be necessary to account for uncertainty in the modeling.

> **Basis:** From early hydrogeological modeling to the present, the preponderance of flow direction has changed from mostly south (directly towards the river) to mostly west (parallel to the river). Limited information is available to accurately define the flow direction west of the past gravel mining operations. DOE states that "it is likely that existing groundwater flow processes will cause remaining groundwater contamination to discharge to the river several thousand feet upgradient of the IC area's west boundary." This is a key assumption to the strategy. If accurate, then the POE location (subject to the other comments provided in this document), is reasonable. However, if groundwater continues on a westerly direction paralleling the river then contaminated groundwater can eventually reach the western boundary of the IC zone where there are not limitations on normal groundwater usage. The risk assessment of the ponds evaluated children swimming for a limited period of time each year. Normal water usage at an offsite location may result in much higher risk even if the concentrations of contaminants are lower due to dilution and dispersion. The adequacy of the proposed ACL's to protect human health and the environment must be demonstrated.

Path Forward: Provide additional technical basis to support the assumption that all contaminated water will discharge into the Colorado River prior to reaching the western edge of the IC zone, or provide a risk assessment demonstrating the adequacy of the ACL's if contaminated water at the point of compliance (POC) were to be transported out of the IC zone and used for normal purposes. Establish a monitoring point at the western edge of the IC zone to verify the assumption that contaminated water will not exit the IC zone.

Comment 7: DOE indicated that site field investigations have shown that the alluvial aquifer is the only aquifer affected by the former milling operations (page 15). This conclusion seems to contradict previous characterization data.

Basis: Data from DOE's 1992 remedial action plan (DOE, 1992) shows contamination of the Wasatch formation by a variety of COC's. That document indicates that groundwater was contaminated to depths of 27 m [90 ft] and distances of 1100 m [3500 ft]. The figures below provide isopleths for sulfate, uranium, and molybdenum. In the case of uranium and molybdenum, it appears there is limited characterization data to estimate contaminant concentrations south of interstate 70 from the previous location of the tailings pile. The closest well is 0217, which showed the second highest uranium value in the alluvium [0.13 mg/L] as of November 2015 in Figure B-2 of the draft GCAP. DOE indicated that the Shire Member (uppermost layer of the Wasatch Formation) is hydraulically connected to the overlying alluvium though flow is not dominant from one unit to the other. During milling operations, very large quantities of water were used compared to the present day, which may confound the development of a conceptual model to describe the extent of groundwater contamination. High water usage may have driven contamination much deeper in the system than would be anticipated by present day hydrologic measurements.

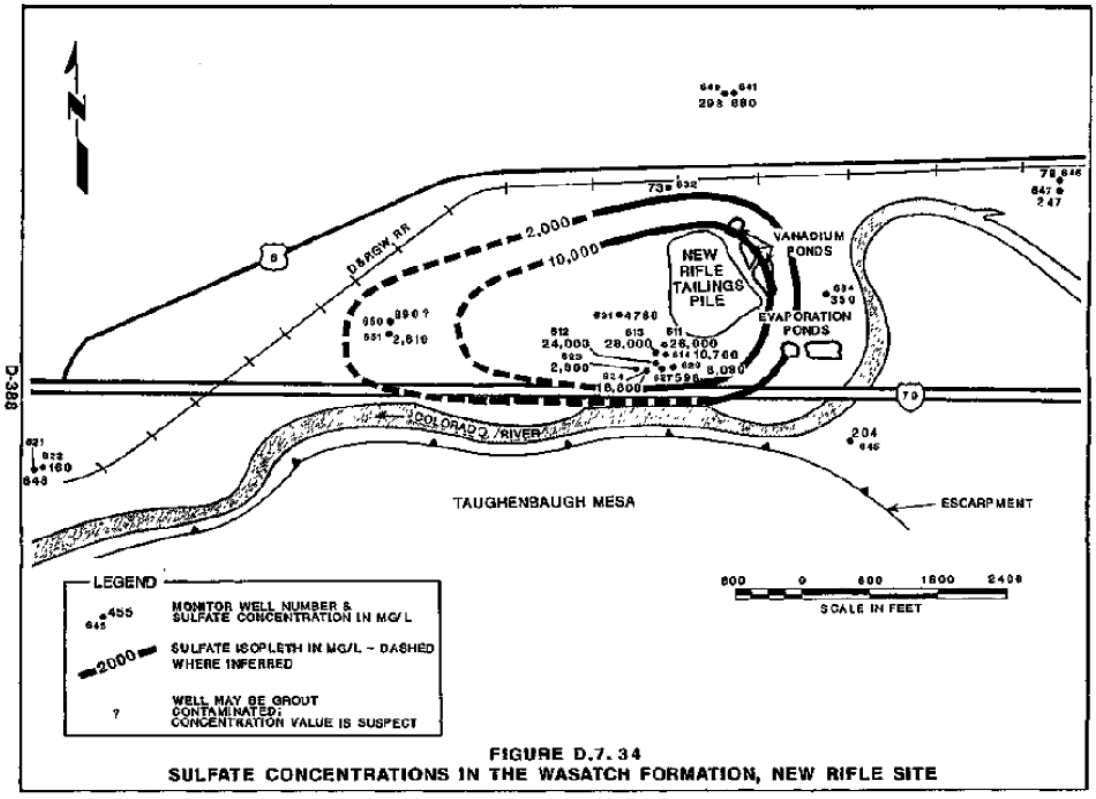

FIGURE D.7.34
SULFATE CONCENTRATIONS IN THE WASATCH FORMATION, NEW RIFLE SITE

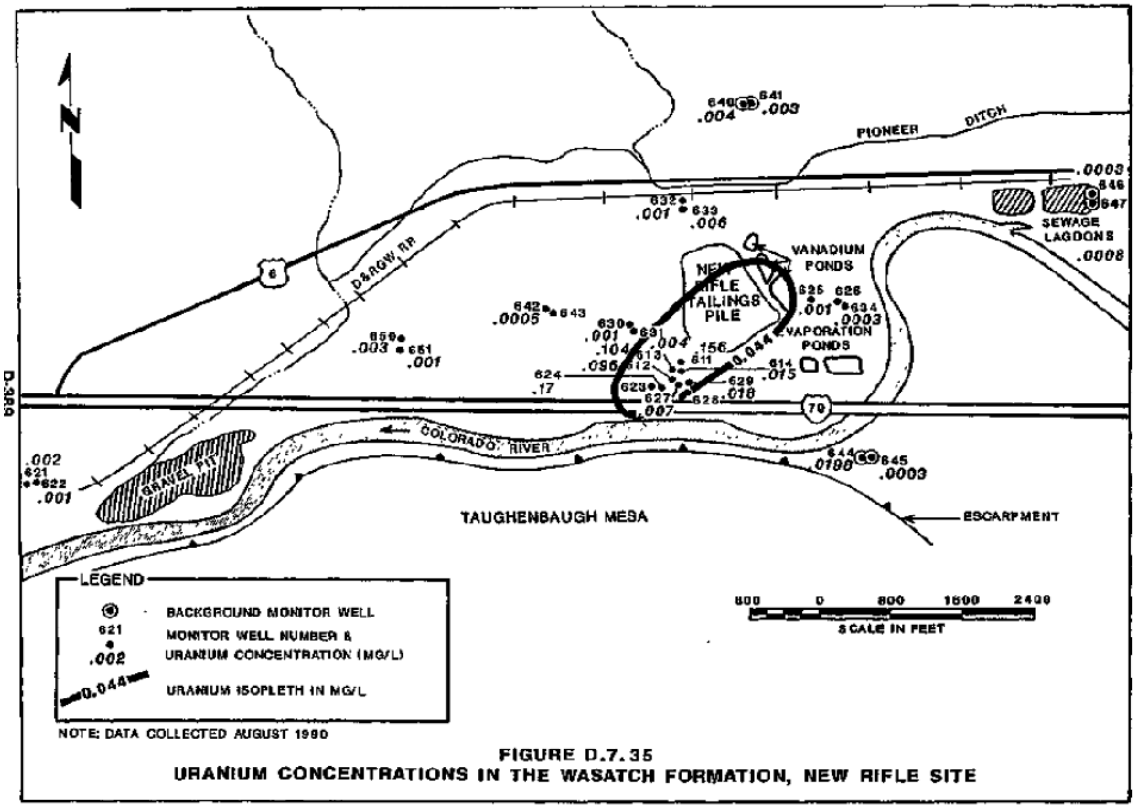

FIGURE D.7.35
URANIUM CONCENTRATIONS IN THE WASATCH FORMATION, NEW RIFLE SITE

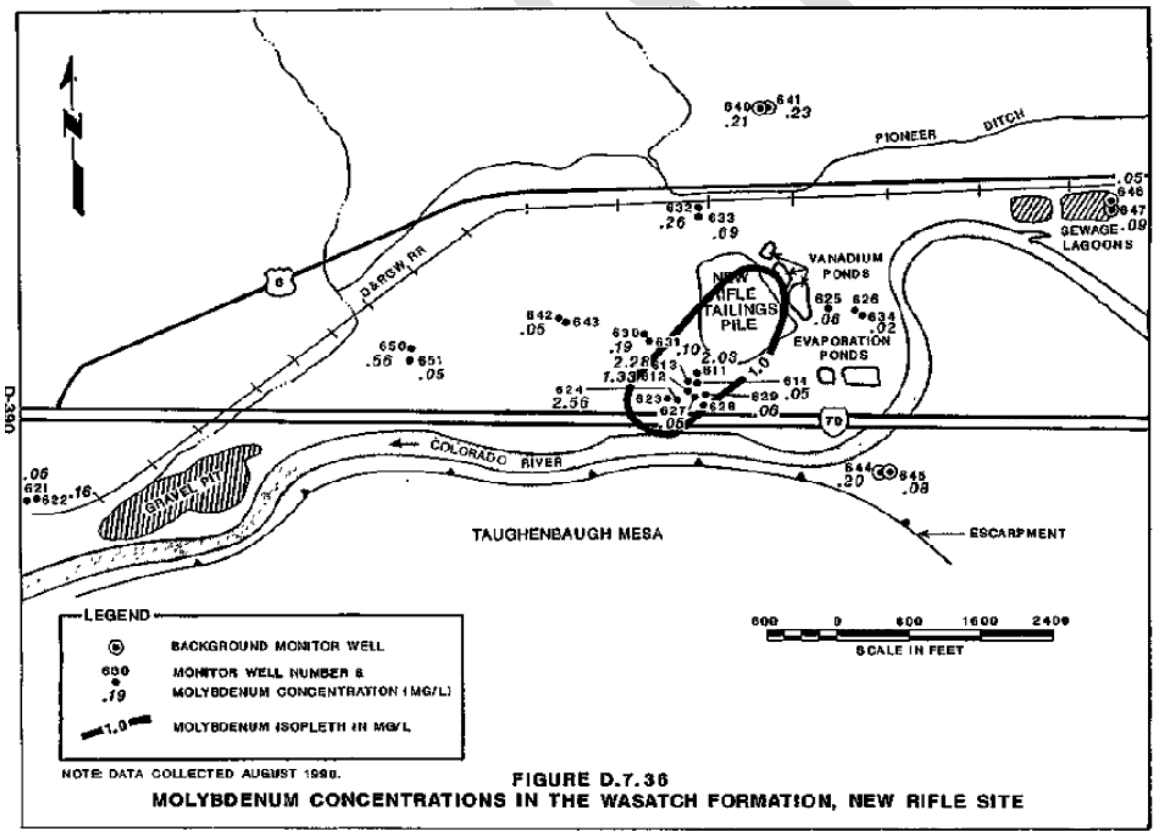

FIGURE D.7.36
MOLYBDENUM CONCENTRATIONS IN THE WASATCH FORMATION, NEW RIFLE SITE

Path Forward: Provide a description of monitoring data collected for the Shire and Molina Members of the Wasatch Formation. Reconcile the characterization data presented in the 1992 remedial action plan with the present day GCAP summary. If necessary, revise the monitoring network, and POE locations and analysis to account for contamination of the Wasatch Formation.

Comment 8: The technical basis provided is not sufficient to justify that the area west of the ponds has not been impacted by contaminated groundwater. DOE compares downgradient monitoring data to background values measured at the Old Rifle site to argue that areas west of the ponds has been minimally impacted by contaminated groundwater. DOE also performed geochemical analyses using stiff diagrams and activity ratios (ARs) to assert that the water east of the ponds was impacted but the water west of the ponds was minimally impacted.

Basis: There is no basis for using maximum background values at the Old Rifle site (0.067 mg/L uranium) to justify that the impact of contamination at the New Rifle site is limited in areal extent. New Rifle has two wells (0169, 0173), that based on the hydrologic data such as the flow direction and magnitude, would appear to be suitable for establishing background concentrations. As of November 2015 well 0169 had a uranium concentration of 0.02 mg/L, below the MCL of 0.044 mg/L.

Activity ratios (ARs) of $^{234}U/^{238}U$ were developed by DOE to help identify if observed contamination can be attributed to milling operations of if the contamination results from natural or other sources. The ARs are a useful tool to help develop understanding of the hydrogeological system. For example, as of November 2012 upgradient well 0169 had the highest observed AR of 1.87, again supporting its use as a background well for New Rifle. Wells proximate to the old mill site and tailings locations had ARs of ~1.0. However there is uncertainty associated with intermediate AR values (1.2 to 1.5) and their interpretation, especially for the more distant wells. ARs can reflect the degree of mixing between contaminated water and fresh water. DOE referenced Zielinski 1997, who used an AR of 1.3 to distinguish the source of contamination. DOE selected a value of 1.2 without explaining why the lower value is appropriate. The still active distant wells (0170, 0172, 0195, 0620) had ARs ranging from ~1.26 to 1.7 as of 2012. In 1998, the intermediate wells (0171, 0220, 0210, 0211) that have since been decommissioned had ARs of ~1.18 to 1.68. Well 0172 had an AR value of 1.33 in 1998 and a value of 1.7 in 2012, indicating that there can be significant volatility in a relatively short amount of time. DOE also generated stiff diagrams in an attempt to determine geochemical differences in different monitoring locations. Well 0172 does appear to be impacted by activity associated with a nearby gas well. Otherwise the differences in the stiff diagrams are not significant.

The time history plot of well 0195 suggests a plume of uranium has moved past well 0195 location and is likely now in the area where the decommissioned wells are located and therefore no data is being collected. Uranium was >0.14 mg/L in 2002 and is currently <0.02 mg/L. Nitrate displays similar behavior (Nitrate was > 60 mg/L in 2002 and is currently <1 mg/L). More strongly sorbing contaminants are being transported more slowly through the system and have likely not yet reached well

0195. Past DOE documents have indicated the extent of contamination as reaching 5 km (3 miles) from the site.

Path Forward: Provide additional technical basis to support the use of an Old Rifle site maximum background value when the New Rifle site has existing upgradient wells. Otherwise, revise the extent of contamination attributed to past site operations in the GCAP to be consistent with previous documentation and currently observed time history plots and concentrations. As discussed in Comment 6, the protectiveness of the ACL's for a POE at the western boundary must be established.

Comment 9: The quitclaim deed for the former mill site indicates that any habitable structures constructed on the property shall employ a radon ventilation system or other radon mitigation measures. The city of Rifle constructed a waste water treatment facility and associated structures on the former mill site. The radon mitigation measures and monitoring data for radon resulting from residual radioactive material and contaminated groundwater is not provided in the GCAP.

Basis: Subpart A, §192.02 (b)(2), states that releases of radon to the atmosphere must not result in an increase in the annual average concentration of radon-222 in air at or above any location outside the disposal site by more than one-half picocurie per liter. Subpart B, §192.12 (b)(1), states that radon decay product concentrations must not exceed 0.02 WL in any occupied or habitable building.

Path Forward: Describe the radon mitigation measures taken at the city of Rifle waste water treatment facilities as well as the results of radon monitoring performed within these structures. Provide inspection procedures used to verify that the requirements for protection from radon are being achieved.

Comment 10: The proposed location of the POC wells may not account for uncertainty in the present groundwater flow directions or for future groundwater flow patterns. In addition, areas of highest residual radioactive material (which could result in future groundwater contamination) should be described.

Basis: DOE indicated that wells 0664, 0669, 0659, and 0217 are located outside and downgradient from the secondary source areas. There are no active monitoring wells located due south of the former mill site area, which may be a flow direction for contaminated water depending on the climatic conditions and associated river stage. Appendix D of the DOE RAP identifies stream sediments contaminated at up to 149 pCi/g Ra-226 (DOE, 1992). It is not clear if those sediments were remediated or exactly where on the site the contamination was observed. If those locations coincide with the locations of discharge of contaminated groundwater, then residual radioactive material would contribute to the risk at this POE.

Path Forward: Include a POC monitoring well in the area due south of the former mill site. Describe the final status of the site after surface reclamation with an overlay map from verification activities showing Ra-226 concentrations in each survey unit.

Comment 11: DOE selected a reference dose (RfD) for vanadium (0.0009 mg/kg-d) that has been under review since 2011 and is an order of magnitude less the value that would be obtained from the Integrated Risk Information System (IRIS).

> **Basis:** A reference dose for vanadium that has been under review since 2011 was selected rather than, as will all other COC's, selecting the current value from IRIS. If the current value from IRIS is selected, then the maximum RBC (1.74 mg/L) would be approximately equal to the maximum observed in persistent ponds (1.68 mg/L) and substantially less than the maximum observed in upgradient groundwater (14.3 mg/L). The proposed vanadium ACL of 52 mg/L would be much higher than the maximum RBC.

Path Forward: Provide a basis for using a reference dose that is under review, including a plan to revise the vanadium RBC if the under review reference dose is not formally adopted. Demonstrate how the proposed vanadium ACL of 52 mg/L will result in concentrations at the POE that will not exceed the RBC.

Comment 12: DOE's groundwater monitoring program indicates that downgradient monitoring wells will be analyzed for ammonia, nitrate, molybdenum, and uranium only, as other COCs have never been detected in the wells. Other far-downgradient wells may be eliminated or monitored less frequently. DOE also indicated that if monitoring indicates that the plume has spread beyond current plume boundaries that the sampling plan can be reevaluated and adjusted. DOE did not provide adequate technical basis for the proposed compliance implementation strategy.

> **Basis:** The plan does not address why it is appropriate to eliminate slower moving contaminants from the monitoring program. Just because slower moving contaminants have not been observed to date, does not mean they are not expected to be observed in the future. DOE did not provide contaminant plume maps (such as those generated in 1992) to justify the current extent of contamination and therefore provide support for the proposed monitoring strategy. In addition, it is not clear how DOE would determine that the plume has spread beyond current boundaries if the monitoring system is not around the boundaries of the current plumes.

Path Forward: Provide additional basis for removing the slower-moving contaminants from the monitoring program or otherwise include them. Provide contaminant plume maps demonstrating the current extent of contamination. Describe how the proposed monitoring system is sufficient to identify when the plume has spread beyond the current plume boundaries.

Comment 13: The dynamic nature of the groundwater flow in the alluvial aquifer was not adequately addressed in the report. A general description of the alluvial (e.g., groundwater occurrence, depth, flow direction, hydraulic conductivities, recharge, and groundwater interaction with the Colorado River) is provided in the report as part of its site conceptual model, but field groundwater level monitoring data and a detailed evaluation of ground water flow are not included or discussed in DOE's strategy.

Basis: The GCAP provided by DOE indicates a significant transient nature of the groundwater flow and raises concerns about the ability of natural flushing as the groundwater remedial strategy for meeting site protection standards within the remaining compliance period at the site. This concern arises because the large increase in groundwater level (e.g., 5 ft or more) causes additional leaching of residual contamination located in the fine-grained materials as they become saturated. NRC staff is also concerned about the impact of an elevated water level in the Colorado River during each spring on the movement of the contaminated groundwater near the river and effectiveness of the natural flushing at the site. The groundwater discharges to the Colorado River along the southern site boundary. As the water level in the Colorado River rises above the water level in the adjacent aquifer during each spring, the groundwater reverses its flow direction near the river as the river begins to recharge the aquifer, which may create an immobile or stagnation zone in the alluvial aquifer along the river. This immobile zone with contaminated groundwater may adversely impact the site flushing strategy, with the extent of impact depending on the persistence of the immobile zone.

Path Forward: Provide groundwater level measurement data collected from the site, including the elevation contour maps, and perform an evaluation on the spatial and temporal variation of groundwater flow. In order to evaluate the spatial and temporal characteristics of a potential immobile zone in the alluvial aquifer along the river, it may be necessary to collect additional water levels through installing multi-level piezometers near the river to assess the vertical hydraulic gradient.

Comment 14: The discussion on the site conceptual groundwater flow model in the GCAP does not include any results of hydrogeologic investigation for the area across from the site (south of the Colorado River). There is no indication of presence of any monitoring wells (e.g., Figure 4).

Basis: As illustrated in Figure 5 of the GCAP, the site alluvial aquifer is recharged at the east site boundary from the Colorado River. The aquifer also may receive a significant amount of water from the Wasatch Formation along its north border. There is possibility that part of the impacted groundwater in the alluvial aquifer from the site may migrate underneath the Colorado River, depending on the magnitude of groundwater hydraulic gradients in the alluvial aquifer system. It's not clear whether this hypothesis has been addressed.

Path Forward: Submit results or analysis from previously conducted site hydrogeologic characterization of the alluvial aquifer in the area south of the river, if they exist, and demonstrate that the impacted groundwater from the site will not likely migrate off site and impact the alluvial aquifer across the river. Otherwise, install monitoring wells to determine the groundwater flow and other hydraulic parameters if necessary (also see RAI Comment 10).

Comment 15: The subsurface contamination source at the site is not adequately characterized. The current concentrations of chemical of concerns in the groundwater based on the on-site monitoring wells have not been decreasing at the originally projected rate after a decay of monitoring. High levels of contaminant concentrations are currently still persist in

the groundwater in the source areas at the site (e.g., wells 0855 and 0658). As discussed in the DOE GCAP, the previous removal of tailings and contaminated surface soils and other materials based on radium-226 cleanup standard have left elevated levels of arsenic, molybdenum, selenium, uranium, and vanadium beneath the former tailings piles and other areas (e.g., former evaporation, gypsum and vanadium ponds). There has a limited investigation conducted to understand the magnitude and extent of this residual soil contamination at the site.

> **Basis:** The currently proposed ACLs as discussed in the GCAP were based on a statistical analysis of groundwater monitoring data from source area of the site. As indicated by the GCAP, NRC-approved ACLs for Title II sites are most commonly set based on maximum groundwater concentrations associated with source areas at a site. The source term for all contaminants of concern is required to be adequately characterized (NRC 2003), which should provide reliable estimates of the release rates of hazardous constituents. Given the limited characterization of the residual contamination source and geochemical process in the aquifer system, a further define of the contamination source term and understanding of geochemical reactions in the aquifer may help evaluate the natural flushing strategy and increase the confidence on the proposed ACLs for the site.

Path Forward: Conduct a targeted field soil sampling in the source areas at the site to further define the magnitude and extend of contaminants, including arsenic, molybdenum, selenium, uranium, and vanadium.

References

DOE, January 19, 2017 letter from Richard Bush to the US NRC, “Draft Groundwater Compliance Action Plan for the New Rifle, Colorado, Processing Site (RFN/S01920),” Office of Legacy Management, Grand Junction, CO, January 2017 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17023A222)

DOE (U.S. Department of Energy), “Final Remedial Action Plan and Site Design for Stabilization of the Inactive Uranium Mill Tailings Site at Rifle, Colorado, Appendix D”, Albuquerque, NM, February 1992

DOE, “Work Plan for Preliminary Investigation of Organic Constituents in Ground Water at the New Rifle Site, Rifle, Colorado,” DOE/AL/62350-213 Rev. 2, Albuquerque, NM, January 1996

US NRC, Standard Review Plan for the Review of a Reclamation Plan for Mill Tailings Sites Under Title II of the Uranium Mill Tailings Radiation Control Act of 1978, NUREG-1620, Rev. 1, 2003 (ADAMS Accession No. ML003725860)

Zielinski, R.A., D.T. Chafin, E.R. Banta, and B.J. Szabo, "Use of234U and 238U Isotopes to Evaluate Contamination of Near-Surface Groundwater with Uranium-Mill Effluent: A Case Study in South-Central Colorado, U.S.A.," Environmental Geology, 32(2): 124-136, 1997