



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

WASHINGTON, D.C. 20460

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OFFICE OF
LAND AND EMERGENCY
MANAGEMENT

MEMORANDUM

SUBJECT: National Remedy Review Board Recommendations for the Homestake Mining Site. Feasibility Study Scoping Meeting.

FROM: Christine Poore, Chair, on behalf of the Board Review Team
National Remedy Review Board *Christine Poore*

TO: Wren Stenger, Director
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PURPOSE

The National Remedy Review Board (NRRB/Board) Review Team for the Homestake Mining Company (HMC) Site has conducted a review of the site information package, including groundwater background, human health and ecological risk assessments, and a draft alternatives screening memo for the HMC Site in Milan, New Mexico. This memorandum documents the Board Review Team's recommendations and advisory considerations.

CONTEXT FOR BOARD REVIEW

The U.S. Environmental Protection Agency (EPA) Administrator established the Board as one of the October 1995 Superfund Administrative Reforms to help control response costs and promote consistent and cost-effective remedy decisions. The purpose of the Board was to review proposed cleanup decisions to help evaluate whether they are consistent with current law, regulations, and Agency guidance.

In 2020 the Office of Superfund Remediation and Technology Innovation (OSRTI) re-envisioned headquarters/regional engagement throughout the remedial process with a focus on earlier engagement, including the Board's scope and role. The NRRB continues to focus on ensuring national consistency in remedy selection at selected sites. To this end the Board advises and evaluates ongoing, selected sites' Regional technical work during the Feasibility Study Scoping stage for response decisions, with a focus on overall site management/response strategy, evaluation of technologies and data necessary to support nationally consistent remedy selection, and the range of alternatives that should be considered.

The NRRB's intent is to provide support to the Regional Site Team in developing a robust conceptual site model, a comprehensive risk assessment, and a range of remedial alternatives while developing the Administrative Record (AR) to support remedy selection. The Board

Review Team considers the information provided on the nature of the site; potential site risks; Regional, state, tribal, community advisory group and potentially responsible party (PRP) positions. The review's overall goal is to ensure sound decision-making consistent with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), and applicable Agency guidance.

Generally, the Board Review Team makes a set of recommendations and a set of advisory considerations to the appropriate Regional Division Director. The recommendations will identify technical and programmatic opportunities and limitations with a focus on early issue resolution. While the NRRB's recommendations are expected to carry substantial weight, other important factors may influence the Region's implementation of Board recommendations. The NRRB expects the Regional Division Director to respond to the OSRTI Office Director in writing to address implementation of each Board recommendation and those advisory considerations that the Region is not adopting. The Board Review Team's recommendations, while of considerable import, do not change the Agency's current delegations or alter the public's role in providing EPA with input on remedy selection. Typically, before the Region issues the proposed plan for public comment, the Region includes the recommendations memo and Regional response memo in the site's AR. Once the AR is published, the memos will be posted to the NRRB webpage.

BRIEF DESCRIPTION OF THE SITE

The HMC Site is located in Cibola County, New Mexico, about 5.5 miles north of the village of Milan. The site includes a former uranium mill and the impacted portions of the underlying groundwater aquifers. Uranium milling operations began at the site in 1958 under a license issued by the Atomic Energy Commission. The mill was decommissioned and demolished from 1993 to 1995. Site operations and seepage from two tailings impoundments contaminated soil and groundwater with hazardous chemicals. The site sits on the lower floodplain of the San Mateo Creek drainage basin near multiple geologic faults. There are over 80 legacy uranium mines and four former uranium mill facilities that operated in the San Mateo basin, including HMC Site.

The HMC Site is one of four National Priorities List (NPL) sites subject to both EPA and Nuclear Regulatory Commission (NRC)/Department of Energy (DOE) regulation, under CERCLA and Title II of the Uranium Mill Tailings Radiation Control Act (UMTRCA), respectively. The site occupies approximately 1,085 acres and includes a large unlined tailing pile containing approximately 21 million tons of tailing material, a small unlined tailing pile containing approximately 1.2 million tons of tailing material, three evaporation ponds, two collection ponds, a reverse osmosis (RO) water treatment plant, and a zeolite filtration water treatment system that are part of an ongoing groundwater corrective action.

SITE REVIEW

The Board Review Team reviewed OU1, Tailing seepage contamination of groundwater aquifers, and OU2, Long-term tailing stabilization, surface reclamation, and site closure, of the HMC Site on March 25-26, 2021, via remote webinar meetings. The meeting addressed the site history including a discussion on the nature and extent of contamination, background determination, site risks, remedial action objectives (RAOs), and potential remedial alternatives. Input was provided to the Board Review Team by the Region, the New Mexico Environmental

Department (NMED), the Pueblo of Acoma, the Pueblo of Laguna, Homestake Mining Co., the Bluewater Valley Downstream Alliance (BVDA), and the Multicultural Alliance for a Safe Environment (MASE).

RECOMMENDATIONS

1. Current Tailings and Treatment Operations

As stated earlier, the HMC Site includes two unlined tailings piles. Based on the information provided to the Board, the flanks of the large tailings pile (LTP) have a permanent radon cover, but the top of the LTP has an interim cover. Despite the partial cover, it is the Board's understanding that radon exfiltration from the large pile at the site may currently exceed UMTRCA standards. Additionally, the zeolite filtration system sits atop the uncovered portion of the LTP. Based on the information provided to the Board, there are two large scale water treatment systems operating at the site: a RO system and a zeolite filtration system. It's the Board's understanding that neither system has operated at full capacity, though the reasons for reduced operations were unclear. The RO system has operated at nearly half capacity and the zeolite filtration system has operated at nearly one third capacity. Despite the limited capacity, it was indicated that approximately 100 pounds of uranium was recovered.

Recommendations

- a. The Board recommends that the Region assess the challenges that prevented the treatment systems from operating at full capacity. Based on the information provided to the Board, the current water treatment systems, operating at full capacity, may be inadequate to treat the current seepage from the piles at the site. It was unclear to the Board if this is due to the current limited treatment capacity or if it was due to a high seepage rate. Understanding and resolving the challenges associated with limited system operations may improve treatment capacity, thereby reducing seepage. Additionally, improvements to the treatment systems may improve the recovery of uranium, in effect resulting in secondary recovery of the uranium (i.e., resource recovery/reprocessing).
- b. Should the tailings piles remain in place, the site will likely have to comply with UMTRCA cover standards that address radon emissions. Based on the information provided to the Board, it was unclear if the tailings piles are fenced off from the public. If there is not a complete fence line enclosing the Source Materials License boundary, the Board recommends the implementation of engineering and institutional controls (i.e. fencing and signage) to minimize access to the uncovered portion of the LTP until a final remedy is constructed. This should prevent the public from accessing the large pile until a final remedy is constructed.

2. Technical Impracticability Waiver

The Site Information Package included a "Development and Screening of Remedial Alternatives Technical Memorandum" that discussed Technical Impracticability (TI), as a potential remedial component. The selection of a TI waiver is the acknowledgement that the applicable or relevant and appropriate regulation (ARAR) is waived due to "technical impracticability from an

engineering perspective.”¹. The NCP Preamble states that TI determinations should be based on “...engineering feasibility and reliability, with cost generally not a major factor unless compliance would be inordinately costly.”² This determination is based on contaminant properties, subsurface conditions and appropriate remedial technologies evaluation. The TI zone should be as minimal as appropriate and can be multiple zones³. The TI zone may not necessarily encapsulate the whole groundwater plume and should include source control as part of the Alternate Remedial Strategy. The Alternate Remedial Strategy is essential to controlling the contribution from the source to the groundwater⁴.

Recommendations

- a. In assessing the appropriateness of a TI waiver, the conclusion that it is not possible from an engineering perspective to restore groundwater to its beneficial use is based upon the factors identified in Section 1.1 of the 1993 Guidance for Evaluating the Technical Impracticability of Ground-Water Restoration (TI Guidance). Additionally, as stated on page 2 of the TI Guidance, “Failure to achieve desired cleanup standards resulting from inadequate system design or operation is not considered by EPA to be a sufficient justification for a determination of technical impracticability of ground-water cleanup.” Recommendation 1a supports the assessment of current system design and operation. Should the Region pursue a TI waiver component, the Board recommends that the Regional Site Team work closely with their Regional TI representative, and the Headquarters TI point of contact, currently Dave Bartenfelder, in developing the TI evaluation package.
- b. Should a TI waiver be supported and a component of the preferred alternative, the Board recommends the TI zone be appropriately sized based on the site characterization and analysis. Per Section 4.4.2 of the TI Guidance, the potential TI zone should be “limited to as small an area as possible, given the circumstances of the site.” Generally, the TI zone is based on current site conditions rather than projected modeling results. The TI zone can be modified (expanded/contracted) if conditions change in the future and can be justified (e.g., discovery of new sources), per Section 6.2 of the 1993 TI Guidance.
- c. The information provided to the Board highlighted the complexity of the hydrogeologic setting. The Board recommends additional geochemical and hydrogeologic modeling (e.g., EPA-Office of Research and Development (ORD) or United States Geological Survey (USGS)) to better understand the subsurface conceptual site model behavior. The Board further recommends the Region assess, and if appropriate, augment the current modeling with those models conducted by the NMED. A more refined conceptual site model of the geochemical and hydrogeologic conditions should better support the remedy development and selection process.

¹ Guidance for Evaluating the Technical Impracticability of Ground-Water Restoration. September 1993. (Page 9) <https://semspub.epa.gov/work/HQ/175387.pdf>

² See NCP Preamble, 55 FR 8748, March 8, 1990.

³ Guidance for Evaluating the Technical Impracticability of Ground-Water Restoration. September 1993. (Section 4.4.2)

<https://semspub.epa.gov/work/HQ/175387.pdf>

⁴ Guidance for Evaluating the Technical Impracticability of Ground-Water Restoration. September 1993. (Section 5.0)

<https://semspub.epa.gov/work/HQ/175387.pdf>

3. Background Groundwater and Soil

The information provided to the Board included a discussion of historical mining activities in the San Mateo Creek Basin. This area of New Mexico has historically been a viable source of uranium with over 80 legacy mines and several milling operations. Some of these mines were “wet” mines, meaning that mine waters had to be pumped from the mine to allow access for mining activities. Based on the information provided to the Board, groundwater impacted by these activities may be flowing downgradient through the basin. If this is the case, uranium levels in groundwater may be elevated due to the presence and practices of upgradient mine sites.

Recommendations

- a. The Board recommends the Region refine the background investigation for uranium, radium and thorium with additional monitoring wells to identify background in this complex geologic setting and influenced by up-gradient mine discharges (~125B gallons). The geochemical report developed by New Mexico is a good resource, and additional sampling and analysis might augment the report analysis to benefit the site understanding. To support this effort, the Region should consider the option to identify an unimpacted area in the surrounding environment to identify a naturally occurring soil background concentrations of uranium, radium, and thorium. The Board also recommends reaching out to Matt Jefferson (OSRTI/Technology Innovation and Field Services Division), Dave Kappelman (OSRTI/Environmental Response Team), and Felicia Barnet (ORD; Site Characterization & Monitoring Technical Support Center Director).

4. Principal Threat Waste

The LTP covers about 234 acres and contains approximately 21 million tons of tailing material, and the STP covers about 40 acres and contains approximately 1.2 million tons of mill tailings, with both tailing piles being unlined. Of great concern is the ongoing release of contaminants from the LTP and STP to the groundwater due to these piles being unlined. The Site Information Package identifies the LTP and STP as the primary sources of contamination in the groundwater, soil and air at the site. The contaminants of concern (COCs) in groundwater are uranium, selenium, radium-226, radium 228, thorium-230, molybdenum, sulfate, chloride, nitrate and total dissolved solids. The maximum concentrations of COCs detected in groundwater were detected in the alluvial groundwater directly beneath or near the LTP. In addition to the COCs’ mobility as evidenced by the leaching of uranium and other contaminants to groundwater, the toxic tailings pose risks to future receptors. For example, in the revised risk assessment presentation for the Board, the future composite worker’s total cancer risk is estimated at 2E-02, which exceeds the acceptable risk range by two orders of magnitude (approximately a factor of 100).

Recommendations

- a. The Site Information Package states that no principal threat waste has been identified. However, there are significant amounts of mill tailings present at the site that may be highly toxic and mobile, as evidenced by the site data. The Board recommends the Region give further consideration as to whether the mill tailings present at the site constitute principal threat waste (PTW) as discussed in OSWER Directive No. 9380.3-06FS, November 1991, *A Guide to Principal Threat and Low Level Threat Wastes*

(Principal Threat Waste Guidance and OSWER Directive 9355.0-69, August 1997, *Rules of Thumb for Superfund Remedy Selection* at page 11).

- b. If the Region determines that portions of the mill tailings are PTW, as the Region further develops or considers the range of alternatives for the Site, it should consider the Principal Threat Waste Guidance, the statutory preference for treatment or resource recovery to the maximum extent practicable in CERCLA section 121(b), and the NCP's expectations for treatment of principal threats posed by the site, wherever practicable.

5. Risk Analysis

Recommendations

- a. Consideration of Land Use Restrictions in Risk Analysis - Based on the information provided to the Board, there may be portions of the Site that lie outside of the tailings piles boundaries for which Institutional Controls (ICs) have already been established to restrict land use. Consideration should be given as to whether the ICs should be established as a part of the CERCLA remedial action in those areas. The Board recommends the Region update the risk assessment to assess if unacceptable risks under one or more unrestricted exposure scenarios exist, or if uncertainties in predicting reasonably anticipated future land use exist. This information may inform the need for including ICs as part of the CERCLA remedial action despite the current land restrictions. OSWER Directive 9355.0-30 which is titled, "*Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions*" may serve as a resource for this assessment. For example, the second paragraph on page 3 states, "*This cumulative site baseline risk...should not assume that institutional controls or fences will account for risk reduction.*" Further discussion is provided in the sections titled "*Risks Considered in Risk Management Decision*" and "*Risks Warranting Remedial Action*" on pages 4-6. In order to demonstrate that an IC is necessary to ensure protectiveness of human health and the environment as part of a CERCLA remedial action, (i.e., selected as part of the remedy in the Record of Decision (ROD)), risks should be estimated and documented for exposure scenarios without consideration of current or proposed land use restrictions.
- b. LTP and STP - A conclusion presented in the Revised Risk Assessment Presentation noted that although there are excess cancer risks from soil and air for a composite worker, the risks are associated with soil and air concentrations that are below soil and air ARARS. As discussed in OSWER Directive 9200.4-23 which is titled "*Clarification of the Role of Applicable, or Relevant and Appropriate Requirements in Establishing Preliminary Remediation Goals under CERCLA*," "*EPA's policy of generally establishing PRGs[Preliminary Remediation Goals] based on ARARs in the absence of multiple pathways or contaminants, is based on the assumption that individual ARARs will be protective. For example, the NCP expressly authorizes consideration of the cumulative risk range in setting PRGs where attainment of ARARs would result in a cumulative risk in excess of 10^{-4} due to multiple contaminants or pathways. (40 C.F.R. 300.430(e)(2)(I)(D).*" This may be relevant to the radon exfiltration noted in recommendation 1b. Additionally, because the future composite worker evaluated in the risk assessment is exposed via the inhalation, submersion, ingestion, dermal contact, and gamma radiation pathways to multiple contaminants and is estimated to receive a total cancer risk outside the CERCLA risk range, an evaluation to determine whether ARARs are sufficiently protective should be completed. If not, PRGs should be established in

accordance with CERCLA and EPA guidance including OSWER Directive 9200.4-23, which includes consultation with Headquarters contacts, currently Robin Anderson for OSRTI and Charles Openchowski for the Office of General Counsel.

6. Remedial Action Objectives

Based on the information provided to the Board, the NRC is the lead agency for byproduct material disposal area reclamation and closure, but tailings closure is part of OU2. The “*Development and Screening of Remedial Alternatives Technical Memorandum, HOMESTAKE MINING COMPANY SUPERFUND SITE*” lists in table 7-1 the various ARARs and TBC criteria for the Site. The listed ARARs include 10 CFR Part 40 Appendix A, 6, as well as, 40 CFR Part 192 Subparts A, C, and D which include various requirements for the design of the controls for residual radioactive material.

Recommendations

- a. These required controls pertain to more than just the emanation of radon. For example, 10 CFR Part 40 Appendix A, 6(1) states, “*In disposing of waste byproduct material, licensees shall place an earthen cover (or approved alternative) over tailings or wastes at the end of milling operations and shall close the waste disposal area in accordance with a design which provides reasonable assurance of control of radiological hazards to (i) be effective for 1,000 years, to the extent reasonably achievable, and, in any case, for at least 200 years...*” (underlined for emphasis). Although NRC is the lead for closure of the tailings piles, a CERCLA remedial action (among other things) must ensure protectiveness of human health and the environment, consistent with the NCP and existing EPA CERCLA guidance; at this site, that includes a cover to prevent exposure to COCs and to protect groundwater. Given that the radiological hazards from the tailings are expected to include exposure to external gamma radiation, ingestion, and inhalation of the various radiological contaminants of concern, the Board recommends the Region include an analysis of the risk related to the tailings piles material and, as appropriate, develop additional RAOs to achieve protectiveness of human health and the environment as required by CERCLA. Examples of RAOs that may be appropriate for the OU2 tailings piles include:
 - i. Prevent direct contact to contaminated media (including waste material, stormwater, sediments, leachate and groundwater) located on or emanating from the tailings piles.
 - ii. Limit inhalation and external radiation exposure from contaminated media (including waste material, fill, leachate, and emissions) located on or emanating from the tailings piles to within the acceptable risk range (10⁻⁴ to 10⁻⁶ cancer risk or a HI of less than 1 for non-carcinogenic risk).
 - iii. Prevent migration of contaminants to groundwater above levels protective for the beneficial use of groundwater and reasonably anticipated use of surface water.
- b. The Board also notes that guidance should be considered pertaining to the groundwater protection standards in 40 CFR Part 192. The Board recommends the Region refer to “Use of Uranium Drinking Water Standards Under 40 CFR Part 141 and 40 CFR Part

192 as Remediation Goals for Groundwater at CERCLA Sites”⁵ to support the approach for determining groundwater protection standards.

7. Coordination with NRC and DOE

As stated in the site description above, the overlapping regulatory requirements of UMTRCA Title II and CERCLA present unique challenges to developing a remedial approach for the site that satisfies the legal and technical requirements of both statutes. This issue is particularly relevant in at least two specific instances, identifying ARARs/PRGs/RAOs and site deletion. For example, taking a site off the NPL may have implications for the UMTRCA site closure and transfer process including long-term maintenance and care under the DOE Legacy Management Program. EPA has not established policy and guidance that address future EPA, NRC and DOE overlapping regulatory requirements.

As noted earlier, Homestake is one of four NPL sites subject to NRC regulations regarding closure and EPA oversight of CERCLA cleanup actions. The four sites are located in two EPA regions and are in varying stages of the Superfund cleanup process. Additionally, the Office of Mountains, Deserts, and Plains (OMDP), established in 2020, focuses on hardrock mining NPL sites in the western portion of the United States. It is the Board’s understanding that while each Region works directly with NRC and DOE for their respective site(s), there may be an intra-agency workgroup focused on this unique cadre of sites.

Recommendations

- a. Coordination that affects remedy selection including ARARs/PRGs/RAOs
 - i. Inter-Agency Coordination
 1. The Board recommends that, as part of the feasibility study, the Region clearly enumerate the underlying basis (e.g., UMTRCA ARARs related to closure; Safe Drinking Water Act Maximum Contamination Levels for ground water remediation) for cleanup criteria for each impacted environmental medium. The Board notes that CERCLA’s requirement to ensure protectiveness of human health and the environment will need to be met for NPL deletion purposes.
 2. The Board further recommends that the Region clarify with the NRC the criteria for identifying areas for potential transfer into the DOE Legacy Management Program. Clarity from NRC/DOE on what are their criteria for accepting these areas may help inform the selection of appropriate treatment technologies when selecting a CERCLA remedy.
 3. It is EPA’s concern that DOE may not accept an NPL site into its Legacy Management Program due to the expenses associated with the potential need for additional work. Since the HMC Site is on the NPL, EPA may be requested to delete the site prior to site transfer. If this is the case, EPA will need to conduct a formal notice and comment rulemaking in order to delete this site. As part of that formal rulemaking process, EPA will need to include data and information in the rulemaking docket to support the deletion process. In particular, the NCP provides that deleting a site from

⁵ <https://semspub.epa.gov/work/06/619832.pdf>

the NPL can occur when there is no further federal or PRP-lead response needed at that site (e.g., because CERCLA protectiveness of human health and the environment has been achieved). While EPA can acknowledge and take into account the work being done pursuant to the NRC license process, various aspects of that process (e.g., prior calculation of background concentrations in ground water, development of alternative concentration limits) do not appear to be consistent with the CERCLA program guidance. That potential gap may be significant at a point when the Agency undertakes an NPL deletion rulemaking process in the future, especially with regard to the no further federal or PRP-lead response needed requirement. It also may be significant if NRC concludes its license process and DOE refuses to accept the site into its Legacy Management Program due to the potential need for additional response actions (e.g., for groundwater) to ensure protectiveness of human health and the environment. Therefore, the Board recommends that the site's administrative record file, including the RI/FS and other documentation used to support the remedy development and selection process, fully address how the approach to various aspects of the cleanup at this site are being undertaken consistent with CERCLA, the NCP and existing EPA CERCLA guidance. For example, the administrative record file should explain how the approach for calculating the soil and ground water background concentrations, the use of MCLs and UMTRCA groundwater standards for uranium in developing PRGs, RAOs, and cleanup levels, the point of compliance for attaining ground water ARARs, and consideration of a technical impracticability waiver, is consistent with the NCP preamble and various guidance documents, such as the Role of Background guidance, the RI/FS guidance, Use of Soil Cleanup Criteria in 40 CFR Part 192 as Remediation Goals for CERCLA Sites guidance, Remediation Goals for Radioactively Contaminated CERCLA Sites Using the Benchmark Dose Cleanup Criteria in 10 CFR Part 40 Appendix A, I, Criterion 6(6), the 2009 Summary of Key Existing Ground Water guidance, Use of Uranium Drinking Water Standards under 40 CFR 141 and 40 CFR 192 as Remediation Goals for Groundwater at CERCLA sites guidance, and the TI waiver guidance.

ii. EPA Coordination

1. The Board recommends the Region coordinate within Region 6 and with Regions 8 and 9, as well as with OMDP and OSRTI, where appropriate. Additionally, there is a multi-agency team that is actively working to establish operations and maintenance (O&M) expectations and the team may be positioned to provide valuable feedback.

8. Suite of Remedial Alternatives

The HMC Site is unique in that the site is currently subject to interim reclamation/remedial components. As discussed earlier, while the flanks of the large tailing pile have a radon barrier, the top of the pile has only an interim cover that may not protect to UMTRCA standards. Without a permanent cover, there may be current human health exposures and rain may

penetrate, resulting in ongoing source migration from the tailings pile (seepage) to groundwater. The groundwater at Homestake is currently subject to containment through pumping clean water from the San Andreas/Glorietta (SAG) aquifer and injecting it into the alluvial aquifer to create a groundwater mound. The Region provided a Remedial Alternative Technical Memorandum for the site as part of the site information package. The tailing remedial alternatives considered included on-site remediation and tailing closure; and removal and off-site disposal (outside of the San Mateo Creek Basin and Milan) of the tailings piles. The remedial alternatives considered for groundwater included long-term monitoring and ICs; groundwater containment and removal; groundwater containment, removal, and in-situ treatment; and groundwater restoration via containment and removal; and technical impracticability.

Recommendations

- a. In addition to the current remedial technologies, the Board recommends that the Region assess a wider selection of remedial alternatives, including source control actions, before conducting the detailed alternatives analysis. The Region may want to consider the Board's recommendations on RAOs when assessing remedial alternatives for source control and/or protection of drinking water. Below are a few recommended options for consideration that could be used alone or in combination to expand the suite of alternatives:
 - i. Given the importance of the SAG aquifer to local communities, the Board recommends the Region consider utilizing pumping and treating the alluvial aquifer to prevent migration rather than creating a hydraulic mound. The remediated water from the treatment systems could be reinjected to the alluvial, Chinle, or SAG aquifers, depending on the level to which it is treated. This would allow for containment while preventing the use of clean water to create a mound in the contaminated alluvial aquifer. Additionally, this approach would minimize the use of the SAG aquifer for remedial purposes, reserving it for domestic use.
 - ii. Should the current hydraulic barrier be considered as a remedial alternative, the Region should consider evaluating the hydraulic head, similar the analysis performed upgradient, to better understand the influence of the ceased LTP flushing operation on downgradient migration.
 - iii. As noted in recommendation 1a, assessing the challenges facing the RO and zeolite treatment systems may improve current operations, but this information may also be valuable to inform optimization opportunities moving forward.
 - iv. It was stated that a permeable reactive barrier (PRB) may be utilized as a contingency alternative. The Board recommends that the Region consider the use of a PRB in the current suite of alternatives rather than only as a contingency. Similar to pump and treat, a PRB may be an option to replacing the current hydraulic mound.
 - v. In terms of waste disposal, the HMC Site is one of many mines and mills in the San Mateo Basin, some of which the Homestake Mining Company is responsible for. The Board recommends that the Region consider the use of a regional waste disposal facility or consolidation at another DOE facility, that may result is cost efficiencies over the long-term.
 - vi. In addition to the closure of the LTP and STP, the Region may consider alternative on-site source control options such as a lined cell adjacent to the current cell. If the material is moved to a lined cell, the primary source of contamination to

groundwater (seepage) would be substantially reduced, if not eliminated. This approach has been used at another Superfund site in Region 10.

- vii. Should the Region consider alternatives that maintain the LTP and SPT, the Region may also consider solidifying the base of the tailings piles through injections. This may create a less permeable surface at the base of the landfill that would limit source migration/seepage to groundwater much like a liner.
- viii. Should the tailings material remain onsite, the Board recommends the Region work with NRC and DOE to design a cap that meets their requirements while preventing infiltration into the tailings.
- ix. Based on the information provided to the Board, the UMTRCA radon emission standards are above the CERCLA human health risk range for unlimited use and unrestricted exposure. As a result, the Board recommends that, should the Region select a remedial alternative that includes on-site waste management, the Region consider alternatives that utilize institutional controls and fencing to limit access to the piles to reduce exposures.

9. Climate Change

As noted on EPA's Climate Change website⁶, understanding and addressing climate change is critical to EPA's mission to protect human health and the environment. With regards to the Superfund program, it's important to consider the impact of severe weather events, potential flooding, changes in rain patterns and temperature changes into remedy selection and design. It may be necessary to incorporate elements of climate resilience, especially for sites subject to groundwater contamination and/or material being left in place, such as the HMC Site.

Recommendation

- a. The Board recommends that the Region, when evaluating remedial alternatives, consider the potential impacts of climate change that may negatively affect the protectiveness of alternatives. The June 2014 OLEM Climate Change Adaptation Implementation Plan⁷ (Implementation Plan) discusses potential program vulnerabilities to climate change. Per Table 1 in the Implementation Plan, such vulnerabilities may include: design and placement of storage facilities to accommodate climate change impacts, changing climate conditions may impact continued remedy effectiveness, current assumptions regarding protectiveness of remediation and containment methods may not reflect changing climate impacts, or conducting periodic evaluations of implemented remedies, including changes to frequency and intensity that may impact remedy effectiveness. Examples of vulnerabilities that may be applicable to Homestake include: evapotranspirative covers may be less effective in areas with stronger drought/rain cycles, the depth to groundwater may be affected by climate change, or a site's O&M needs may change based on more extreme weather events.

⁶ <https://www.epa.gov/climate-change>

⁷ <https://www.epa.gov/sites/production/files/2018-08/documents/oswer-climate-change-adaptation-plan.pdf>

10. Environmental Justice

Based on the information provided to the Board, two downgradient tribes, the Pueblo of Acoma and the Pueblo of Laguna, as well as the cities of Milan and Grants are dependent upon the SAG aquifer for drinking water. These vulnerable communities may be disproportionately impacted by the HMC Site. Impacts to the SAG aquifer may create environmental justice (EJ) concerns for tribal communities, as they cannot move their homelands, and the tribes' relationship to the resource includes cultural as well as public health considerations.

Recommendations

- a. Based on the presentations made by the Region and other stakeholders, the Board recommends the Region address the potentially disproportionate impact of site-related contamination and potential EJ concerns related to cleanup approaches. In particular, the policies articulated in section 1 of Executive Order 13990 (e.g., using science to improve public health, protect the environment, ensure access to clean water, consideration of impacts on EJ and low income communities) and public statements made by the Administrator since the issuance of that Order, as well as long-standing Agency EJ guidance, offer a framework that can inform policy considerations in evaluating alternatives for limiting exposure to highly toxic/carcinogenic and mobile constituents of concern (radionuclides). Given the evolving priorities related to environmental justice (EJ), the Board recommends the site team engage with Region 6's designated EJ coordinator and OSRTI's EJ coordinator, currently Lavar Thomas, to address potential EJ concerns.
- b. Given the impact to two tribes, the Board recommends that the Region ensure adequate tribal consultation with regard to resources that may be negatively impacted by site-related contamination and potential response action alternatives.

ADVISORY CONSIDERATIONS

Advisory considerations are Board Review Team suggestions that are meant to support the Regional Site Team in moving forward, but do not necessarily rise to the level of recommendations. Please take these comments under consideration as the RI is finalized and the FS is initiated.

1. Utilize Lessons Learned from Other Sites

As noted earlier, there are over 80 legacy uranium mines and four former uranium mill facilities that operated in the San Mateo basin, including the HMC Site. Some of these, such as Bluewater, have already undergone some remedial/reclamation activity. Similarly, other NPL sites also subject to UMTRCA Title II may be further in the remedy selection process. It might be helpful for the Region to learn more about those sites to determine if there are any lessons learned that may inform the HMC Site. Those site lessons may provide useful information and approaches for addressing inter-agency coordination, groundwater management and other related issues as the Region moves forward with remedy selection at this site.

CONCLUSION

The Board Review Team commends the Region's collaborative efforts in working with the State, tribes and site stakeholders. We would also like to thank the Regional Site Team for the thought and effort that went into preparation of the Board package and presentations.

Per the NRRB Charter, approximately six weeks after receipt of these recommendations, the Board expects the Regional Division Director to respond to the OSRTI Office Director in writing to address implementation of each Board recommendation and those advisory considerations that the Region is not adopting. The OSRTI Office Director will then discuss the response with the Regional Division Director within approximately two weeks of receiving the Region's written response level. Typically, before the Region issues the proposed plan for public comment, the Region includes the recommendations memo and regional response memo in the site's AR. Once the Board recommendations and Regional responses are made a part of the AR, they will be posted to the NRRB website (<https://www.epa.gov/superfund/national-remedy-review-board-nrrb>).

Thank you for your support and the support of your managers and staff in preparing for this review. The Board looks forward to working with the Regional Site Team during the Detailed Alternatives Analysis meeting. Should you have any questions, please contact me at poore.christine@epa.gov or call me at 703-603-9022. Thank you for the opportunity to engage on the Homestake Superfund Site.

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