TECHNICAL MEMORANDUM

Date: June 20, 2023

To: Bonnie Gestring, Earthworks

From: Rina Freed, Ph.D., P.Eng., Patrick Littlejohn, Ph.D., P.Eng.

Subject: Review of the Smoky Canyon Mine Remedy Report

Introduction

Source Environmental Associates Inc. (Source) was retained by Earthworks, a non-profit conservation organization, and the Crow Creek Conservation Alliance, a set of downstream landowners, to review the cleanup plan for the Smoky Canyon Mine Site plan in the Caribou County, Idaho, near the Wyoming border. This review provides a technical assessment of the cleanup plan for the mine and evaluates the alternatives. This submission is expected to form a part of the public comment period for landowners downstream of the mine.

Smoky Canyon is an operating mine that has caused contamination of fish tissue, surface water and groundwater, a key focus of this review. The cleanup plan has been evaluated by the Forest Service as required by the CERCLA (or Superfund Act) and the regulations that implement CERLA, the National Contingency Plan. The Forest Service, as the lead agency, provides direction and oversight to Simplot in the development of the remediation plan.

The issues at the Smoky Canyon Mine have persisted for many years, and remediation actions have been delayed. Source supports the achievement of clear environmental objectives that must be met by specified timelines. In general, Source recommends more clarity on timelines for achieving targets be required in the Record of Decision (ROD).

Key Documents reviewed include the following:

- Forest Service, USDA, 2023. Smoky Canyon Mine Caribou-Targhee National Forest
- Simplot, 2023. Smoky Canyon Mine Remedial Investigation/ Feasibility Study (RI/FS) Final Feasibility Study technical Memorandum #2: Detailed Analysis of Remedial Alternatives. Feb 8, 2023.
- Simplot, 2019. Smoky Canyon Mine RI/FS. Feasibility Study technical Memorandum #1: Identification of Screening of Remedial technologies. December, 2023.

Background

Mine contamination is released from disturbed overburden placed in backfilled mine pits and external overburden disposal areas (ODAs). The main pathways of concern are 1) groundwater transport of selenium to the Wells Formation and 2) surface water transport via Hoopes Springs and South Fork Sage Creek Springs. The main groundwater contaminants of concern are selenium, aluminum, arsenic, iron, and manganese. The main surface water contaminants of concern are selenium and cadmium. Selenium is the primary risk driver for remediation planning.

The remediation action objectives (RAOs) for groundwater, surface water and soils are based largely on selenium reduction in these media as well as improved drinking water through reduction of arsenic and cadmium.

Detailed Comments

1. Selenium Speciation and Bioavailability

Neither the Phase 2 Treatability Study Report nor the Feasibility Study Report discuss mitigating or monitoring actions related to organoselenium species. Organoselenium species are highly relevant in the context of bioavailability and bioaccumulation of selenium in fish tissue and so this is a major gap. Organoselenium species are a class of selenium bearing molecules such as selenocysteine and selenomethionine that tend to be significantly more bioavailable and bioaccumulative than inorganic selenium. The previous 8-10 years of results from other reference sites in the field of selenium water treatment have shown that an appreciation of organoselenium is necessary in order to develop a mine water treatment and management plan that addresses the risk of environmental impacts.

While the selenium in the untreated mine contact water is unlikely to contain any significant amount of organoselenium species, inorganic selenium can be converted to organoselenium species through biological mechanisms, such as those employed in biological treatment systems including the existing Smoky Canyon WTP. While the extent of selenium bioaccumulation and toxicity depends on many factors, organoselenium species generally present an order of magnitude higher rates of uptake in the receiving environment and therefore higher toxicity compared to other forms of selenium in water (Baines 2001, Fournier 2006).

This difference in bioavailability of the different forms of selenium means that if a WTP removes the majority of selenium from the water but transforms some portion of the remaining selenium into organoselenium species, the net selenium toxicity of the treated effluent can be equal to or greater than of the untreated water because organoselenium species are taken up orders of magnitude more by organisms in the receiving environment. Therefore, it is critical to understand not only how treatment processes change total or dissolved selenium concentrations, but also how they change selenium speciation.

This type of conversion has been proven to occur in through other biological treatment systems that use similar treatment technology as the type employed in the existing WTP. Several case studies exist that can be used for comparison and reference in this regard and apply their lessons learned to avoid similar issues at Smoky Canyon. Teck's Westline Creek facility is an example of a biological treatment system where treatment reduced the overall selenium loading to the environment but also resulted in formation of organoselenium species and a net increase in selenium uptake downstream of the treatment facility (Davidson 2019, McKevitt 2019, de Bruyn 2019). A post-treatment system involving advanced oxidation was installed at this facility to convert organoselenium species into less bioavailable, inorganic forms of selenium, which resolved the issue. Another example includes monitoring treatment effects on invertebrate tissue downstream of an algal-bacterial selenium reduction (ABSR) system for treatment of agricultural drainage. Over a period of two years of monitoring, although the system removed 80% of influent selenium, selenium bioavailability was measured to be 2-10x higher in the treated water compared to the untreated water leading to greater selenium exposure (Amweg 2004, NAMC 2020).

Currently, the mass loading of selenium present in the receiving environment in the Smoky Canyon area is very high. With the application of additional mitigation and management measures including expansion of the WTP capacity this mass loading will be reduced significantly, however to avoid the time-consuming and costly experience of other industrial outfits, it is critical that this issue be proactively addressed, with appropriate mitigations incorporated into the expanded WTP as necessary.

Potential treatment options for the removal of organoselenium species can include physico-chemical precipitation, adsorption, and reduction. The existing water treatment plant incorporates addition of ferric chloride into the post-treatment process, which is likely to remove some portion of inorganic selenite selenium. However, iron addition is unlikely to remove any amount of organoselenium species, should they be present.

Recommendations:

- Selenium speciation testing should be conducted on effluent from the existing Hoopes WTP in order to assess the presence of organoselenium species with the current plant. Such monitoring should be conducted on a regular basis to capture system variability.
- If organoselenium species are found in any significant amount, the WTP design should be modified to incorporate some method of organoselenium removal. As far as Source is aware, Teck's advanced oxidation process is one of the only proven methods of removing

organoselenium from treated mine contact water, though other potential methods have been identified.
- Ongoing monitoring after the expanded WTP is operational should include periodic analysis of selenium speciation.
- If post-treatment for organoselenium species is not included in the base case design of the expanded system, then the results of WTP analysis should be integrated with fish tissue monitoring so that if organoselenium species do prove to be present in treated effluent that appropriate post-treatment systems can be implemented.

2. Downstream Objectives: Fish Tissue versus Water Column:

Elevated levels of selenium in fish tissue monitoring data makes it clear that fish in the downstream area are ingesting and bioaccumulating selenium. This is the direct impact of selenium contamination on downstream aquatic life. However, the remedy report focuses on reduction of selenium levels in the water column. While this is no doubt important and linked to levels of selenium in fish tissue, the relationship between selenium levels in water column and selenium levels in fish tissue is complex and not easy to predict. Focusing on achieving a specific selenium level in the water column downstream may not achieve a reduction in selenium levels in fish tissue to the point where aquatic life is protected.

Recommendation:

Regulatory targets that are mandated to be met should include both selenium water quality concentrations as well as fish tissue targets. The approach should include a provision that if targets for selenium in the water column are reached but that selenium in fish tissue stays elevated, then water column targets must be revised downwards.

3. Water Column Targets and Locations

The feasibility study refers to a target of 4 µg/L of selenium in water column at Crow Creek at the Wyoming border. This target, based on Idaho regulations, is above the 1.5 and 3.1 µg/L selenium water quality criteria for lentic/lotic environments as set out by the EPA in 2021[1]. As described in comment 1 and 2, there is uncertainty around what level of selenium the water column is required in order to reduce levels of selenium in fish tissue to the point where fish population health is protected. The use of a 4 µg/L target seems unaligned with the scientific/regulatory community's best understanding of protective levels. Achieving a level of 4 µg/L in water column would be an improvement from current conditions but should not be taken as a success in and of itself, as values lower than that may be required to protect fish populations.

[1] https://www.epa.gov/wqc/aquatic-life-criterion-selenium

Regarding location, the last monitoring station is at CC-WY-01. Historic data at this point exceeds standards, meaning that the extent of selenium contamination in the downstream environment is not clear. Additional monitoring stations at downstream locations with associated targets based on standards, should apply to locations further downstream than Crow Creek at the Wyoming border.

Recommendation:

Source recommends that the recent EPA selenium criteria be used in setting water quality targets for Crow Creek. Water quality targets required to protect fish population health may be lower than the 4 µg/L target referred to in the feasibility study.

Source also recommends that the remedy include additional monitoring stations to identify the extent of the pollution in Crow Creek beyond the Wyoming border. This/these station(s) should be used to confirm attainment of water quality and fish tissue objectives down stream and also to confirm the extent of pollution over the Wyoming border. The water quality standards and fish tissue standards applicable to station(s) across the Wyoming border should be clarified, specifically whether the recent EPA selenium criteria is used or the less stringent Idaho specific regulations.

4. Water Treatment Plant Design Basis

The design basis for the expanded WTP is not clear. The remedy report recommends expansion of the WTP from 2,000 gpm to 4,000 gpm. The expansion of the plant is clearly warranted to address the untreated contact water leaving the site, but the basis of selecting 4,000 gpm as the capacity is not clear. Section 1.1 of Appendix C of the 2023 Technical Memo refers to average flows of 4,100 gpm at HS-3, representing the combined discharge of upstream springs. The variability of this flow (i.e., min/max or 95^{th} percentile) is not clear from the report.

In any case, the WTP should be designed to have sufficient capacity to handle all practically capturable contact water. From the report, this appears to be a minimum of 4,100 gpm, but further allowance may be warranted if there is additional selenium bearing contact water that can be captured prior to it entering Sage/Crow creek. The technology used in the water treatment plant is highly modular and so additional or increased hydraulic capacity beyond 4,000 gpm is technically feasible. The same ultimate goal of treating all contact water from this area of the mine may also be achieved through a combination of water storage and water treatment (i.e., storing water from high flow events in ponds while treatment catches up).

Recommendation:

The WTP should be expanded to be able to treat all practically capturable mine contact water. This may require capacity greater than 4,000 gpm.

5. Water Treatment Redundancy and Outage Preparedness Planning

Any remedy should include improvements related to the reliability of the existing or expanded WTP system to ensure that mine contact water is treated before leaving the site. The existing WTP has been offline on multiple occasions for long periods of time (January 28-April 3, 2019, January 18-March 22, 2021), allowing untreated water to bypass the system. The Simplot team attributed these outages to a variety of issues including a seal failure on the clarifier, power outages, pump failures, and failure of the nutrient delivery device (Lusty 2022). The site has a demonstrated history of struggling to maintain treatment plant uptime that should be addressed in the remedy.

Recommendation:

Source recommends that the remedy should involve development of operational plans and associated infrastructure to address these issues in multiple ways:

- First, a better spare equipment and maintenance regime is required in order to maintain critical spares on hand and execute preventative maintenance in such a way to avoid surprising outages of the system.
- Second, the revised design should include a greater degree of system redundancy design, such as inclusion of installed spares for critical equipment components such as pumps or power generation equipment. Use of multiple treatment trains may allow treatment of part of the flow one with train while the other is offline for maintenance or malfunctions.
- Third, a contingency water management plan should be developed that accounts for the potential for 1-2 months of treatment outage without release of contaminated water to the environment. This could involve storage of contact water in a temporary surge pond, similar to the concept mentioned in Comment #4 of this document.

6. Improving the Selenium Removal Efficiency of the Hoopes Water Treatment Plant to Meet Design Basis

The Phase 2 Treatability Study Report (Appendix C) states that “In January 2021, the system removed 91% of the influent total selenium load (Simplot 2021). The most recent data indicate that the RO and FBR systems are capable of <u>**routinely**</u> removing more than 95% of the selenium from the influent water, and ongoing upgrades and optimization of the treatment plant have shown improvement in the amount of selenium reintroduced by the post treatment system, Appendix C”.

Based on the influent and effluent sampling results shown in Tables C-6 and C-9 of Appendix C, the average influent selenium concentration to the Hoopes WTP between 2018 and 2021 was 0.16 mg/L and the average effluent selenium concentration during this period was 0.024 mg/L. Effluent concentrations were consistently higher than the design basis of 0.007 mg/L and represented only about 85% selenium removal, which is in contrast to the 95% removal rate mentioned in the report. Nevertheless, even at 95% selenium removal the WTP would still be underperforming with respect to the design basis.

Based on the information shown in Table C-7 of Appendix C and as stated in the Feasibility Study Report the FBR units can remove 97-98% of the selenium reporting to them so it is not clear what is causing the underperformance of the system as a whole.

While it is expected that the ability of the system to remove selenium will change depending on factors such as influent selenium and nitrate concentrations and water temperature, several industrial installations of these systems with and without RO are currently operational and have been demonstrated over the years to achieve higher degrees of selenium removal compared to the Hoopes WTP. A review of the available data from existing installations and comparison of the key design and influent characteristics would help to identify the root causes for the lower performance of the Hoopes WTP for selenium removal.

For example, selenium removal from agricultural drainage using a combination of RO and bioreactors is demonstrated to below 0.005 mg/L in California (Golder 2020). Teck's Westline Creek facility also uses biological treatment that although not used in combination with RO, consistently achieves effluent concentrations lower than 0.02 mg/L in streams that are relatively more challenging to treat (Teck 2022).

A wealth of information in this regard exists within the North American Metals Council (NAMC) including updates and reviews of the state-of-knowledge for selenium removal technologies. NAMC is a group formed to provide a collective voice for North American metals producers and users on science and policy-based issues and is also the secretariat for the Selenium Work Group (NAMC SWG) that comprises professionals from industry and consulting engaged in sharing and commissioning technical research on issues pertaining to ecological and human health effects, regulation, and water treatment of selenium in the context of industrial discharges.

Recommendations:

- Source recommends an investigation into the root cause of the lower-than-expected performance of the Hoopes WTP specific to selenium removal. This investigation should include comparison of key process parameters and influent streams with analogue sites with the objective to identify ways and devise action plans to improve the selenium removal efficiency of Hoopes WTP be it related to the RO units, bioreactors, or other potentially limiting factors that have resulted in underperformance of the system compared to the design for selenium removal.
- The expansion of the FBR system through addition of capacity or addition of a second FBR train should be considered to increase the overall removal of selenium from the RO retentate system.

- Investigate the purity of reagents used in the existing WTP to see if selenium contamination is being introduced through chemical consumables.
- Ensure that the assumptions used in the water balance/water quality model used for predictive overall site performance align with the actual performance of the Hoopes WTP. Modeling should be based on target concentrations that are **consistently** achievable by the Hoopes WTP so that all remediation activities can be planned accordingly.

7. Size of Water Treatment System and Impact on Time to Achieve Objectives

The 2023 feasibility study shows predictions of how different mitigations will improve water quality in Crow Creek over time and compares the impact of implementing the expanded water treatment design versus continuing with the existing system. Figure 5-1 of the 2023 Final Technical Memo shows the difference in water quality improvement with a 2,000 gpm WTP and a 4,000 gpm WTP. These scenarios lead to achieving the 4 µg/L target in 2043 and 2029 respectively. Both water treatment plant sizes achieve a 4 µg/L target, though the smaller plant takes much longer to get there. Based simply on the delay in achieving this water quality target as stated, the implementation of the 4,000 gpm WTP is warranted.

Beyond that, as stated in comment 2 the water column target of 4 µg/L may not be sufficiently low to protect fish population health. If a target of 1.5 to 3 µg/L is required to protect fish population, then the smaller system is not appropriate, as the predicted trajectory of selenium in Crow Creek at the Wyoming border shown in Figure 5-1 bottoms out at ~3 µg/L, whereas the larger system ultimately approaches ~1.5 µg/L. Given that a key objective of the project is to protect fish populations in the downstream environment, and recognizing that there is uncertainty in the relationship between selenium concentrations in water column and fish tissue, the larger system is warranted.

Recommendation:

Source supports the recommendation to expand the WTP rather than continuing to use the existing system with 2,000 gpm throughput.

8. Timelines for Implementing Remedial Actions:

Source is concerned that the timeline for meeting the RAOs appears to be longer than necessary and has been drawn out already more than may be appropriate. Source suggests that every effort be made to define clear timelines that must be met within the minimum timeframe possible. For example, the timeline for meeting fish tissue levels that are protective should be defined. In addition, a risk reduction approach should be taken to reduce uncertainty by aiming to achieve targets in fish tissue that are lower than the site-specific standards.

The Forest Service states that data trends for individual remedy components will be evaluated every 5 years and if they are not achieving the RAOs within a “reasonable time frame”, other remedial actions will be considered. However, this approach lacks clarity as a “reasonable timeframe” for one party may be different for another party. Less ambiguity in the requirements is recommended, and shorter timeframes are recommended. Otherwise, remediation actions will be unnecessarily delayed in a process that has already taken considerable time. Source recommends a continuous improvement framework whereby clear objectives and timelines to meet objectives are outlined within short timeframes, based on remediation planning. For example, the ROD should specify the need to meet surface water goals resulting from increased treatment by 2025 and improved goals by 2035 based on construction and implementation of the cover system.

Clear timelines/deadlines for building the expanded WTP and a timeline for constructing covers over the different panels of mine waste is required. The feasibility study states that construction and commissioning of the expanded WTP could be achieved in one year. In Source’s professional opinion, this is a reasonable timeline for executing this work.

Recommendation:

All reasonable steps to expedite the remedial actions should be taken in a timely fashion, with calendar date deadlines mandated for completion of key works, such as deadlines for construction, commissioning and operation of the WTP, as well as deadlines for construction and placement of covers.

9. Arsenic Downstream of the Permeable Reactive Barrier (PRB)

Source is supportive of the PRB program and agrees the system has the potential to prevent release of a certain amount of contaminants including selenium from the site. The use of a passive system with significantly less operations and maintenance requirements is supported as a measure to incrementally decrease the selenium loading from the site. That said, the feasibility study report noted that the use of a PRB at the Conda/Woodall Mountain Mine led to increased release of arsenic and uranium in downstream water. Specifically, the report states that, “within the initial 2-year period of PRB operation, the treatment system reduced total selenium concentrations to below the MCL within the STC, PRB, and shallow groundwater immediately downgradient of the system. However, arsenic and uranium are present in overburden material and the changes in redox conditions introduced by the PRB allowed for their mobilization from the overburden.” The report also states that “If arsenic release from the PRB at Pole Canyon was an issue, it would be expected to be limited in extent and would be addressed by a combination of institutional controls (ICs) for groundwater in the area immediately downgradient of the system and monitored natural attenuation (MNA) along the groundwater flow path”.

The PRB treatment media tested and described in Alternative 2C includes a carbon source (e.g., woodchips, and alfalfa hay) for microbial use and inert sand to create matrix permeability and maintain preferential flow through to support the microbially-mediated reduction process for the treatment of selenium. Within this zone an anaerobic zone is created that then reduces and removes selenium from the water. Under these conditions, selenium is removed from solution, but the resultant oxygen deprived waters favour mobilization of arsenic and uranium. Recognizing that arsenic is also a contaminant of concern for the project, Source recommends assessing design changes to the PRB for the Pole Canyon ODA that addresses the risk of anaerobic water releasing arsenic. For example, incorporation of zero-valent iron into the PRB media may improve mobilization of arsenic by encouraging iron co-precipitation with arsenic. Alternatively, if water downstream from the PRB can be directed to surface before entering arsenic bearing mine wastes, then re-oxygenation of the water will occur and this water will be less likely to mobilize arsenic.

Recommendation: Evaluation and testing of alternative media or amendments to the existing media for PRB operations is recommended to avoid mobilization of arsenic and other contaminants. These could for example include iron amendments such as Zero Valent Iron (ZVI) or changes to the PRB design to allow some degree of re-oxygenation prior to flowing over other arsenic bearing mine waste.

10. Operations and Maintenance 5 Year Reviews:

The Forest Service's Proposed Plan summary describes how the CERCLA process may involve 5-year reviews of operations and maintenance if necessary. Given the uncertainty and long duration for remediative actions to improve water quality in Crow/Sage Creeks, Source strongly recommends that periodic reviews of operating data be conducted, with minimum frequency of every 5 years. A key aspect of such reviews should be the comparison of predicted versus actual water quality data to track how contact water quality and volumes change over time, how treatment performs, and how water quality in the environment and selenium levels in fish tissue improve/change over time. The trajectories for improvement laid out in the feasibility study are subject to uncertainty and so this type of reconciliation between predictions and actual results is required to ensure that the project is on track. It may be necessary to make changes or improvements to site remediation activities and mitigation measures if designs do not perform as intended or if site contact water quality worsens unexpectedly. Such periodic reviews should be transparent and should involve engagement with community groups and other stakeholders to improve public trust that the site is being managed appropriately and that remediation actions are actually solving the problem as intended.

Further, the learnings from these periodic reviews should then be incorporated into future mine and reclamation/remediation planning for other parts of the site.

Recommendations:

Source recommends that periodic reviews of operation and maintenance data for the site be conducted at minimum every 5 years, including the following activities:

- Comparison of actual site contact water quality data, water treatment performance data, and environmental data with predictions.
- Revision of predictive models to reflect site data, if warranted by divergence between the two.
- Note lessons learned for future reclamation/remediation activities.

These reviews should be conducted with public engagement in mind to improve public trust that the project is being managed and remediated effectively.

11. Source Control Cover Alternatives:

Source generally agrees with the Forest Service's analysis and preferred alternative for covers including alternatives 3C or 3D. Alternative 3C and 3D are effective and provide certainty in terms of risk reduction. The preferred alternative (i.e., 3C) is required to meet the water quality goals in a reasonable timeline and with reduced risk and uncertainty. It is not appropriate to assume that the effectiveness of the other alternatives is well characterized, as significant uncertainty exists with infiltration rates and contaminant loadings for alternatives 3A and 3B without the use of bentonite or the geomembrane. It is possible that the mitigation will eventually be limited to covers only, and a more robust, reliable cover system is anticipated to assist with achieving the goal of ceasing to operate the water treatment plant in the long-term, once cover systems are put in place. In the groundwater model presented, the reduction in load attributed to the alternatives is not well supported by data. For the no further action alternative, monitoring data does not support the model predictions. Until such time as monitoring data supports the model predictions with clear downward trends, it is important to maintain a conservative approach to interpretation of model predictions based on simplifying assumptions.

Source does not support the other alternatives for cover design (1 / 3A / 3B). This is because 1) these cover alternatives do not adequately reduce the loadings of selenium to the receiving environment within an appropriate timeframe, and 2) these cover alternatives are less certain (include additional risks) for meeting mode predictions and reaching the CERCLA criteria. In particular, the CERLA criteria, compliance with ARARs, has a high risk of not being met with the no further action alternative. This is demonstrated in the existing data set that has a continuous upward trend in selenium loadings and concentrations. To claim a do nothing alterative will be sufficient, a significant data set showing a downward trend should be required. In the absence of such data, the no further action alternative is not reasonable and not supported. The timeline to reach a target, i.e., 2035, is inherently uncertain. Source believes there is a need to reduce risks and ensure CERCLA criteria are achieved.

Source disagrees with the statement in the section titled - Compliance with ARARs: "There are no differences in the performance relative to action-specific and location-specific ARARs for Alternatives 3a through 3d." The timeline for reaching targets is not that similar for the cover alternatives and there is uncertainty that CERCLA targets will be reached for the less protective covers proposed. The analysis provided appears to be somewhat biased to lead to a conclusion that bentonite and geomembrane covers are not required. Source strongly supports the use Alternative 3C and 3D cover types as a risk-reduction solution. These alternatives have a much higher certainty of meeting the CERCLA criteria given they have redundancy built in and are proven technologies from numerous mine sites.

Source control mechanisms should be evaluated based on realized load reduction, not only model predictions that show a reduction to a target level. This is not a valid or fair comparison of alternatives. The reduction in infiltration capacity for the alternatives 3C and 3D is substantial and critical for success in meeting CERCLA targets.

Summary Comments

Source concurs with the Forest Service Assessment that action is necessary to protect public health and the environment from releases of hazardous substances. Source supports the preferred alternative (2b, 2c and 3c combined) with the qualifications listed within this technical memorandum including the need to reduce uncertainty by taking more aggressive remediation actions and reducing timeframes to meet goals. Affected stakeholders, such as landowners, expect that targets will be met as soon as possible with as little uncertainty as possible.

Table 1 summarizes the ARARs – applicable or relevant and appropriate regulatory requirements as understood by Source for the surface water mitigation planning. Further information should be provided to explain the large difference in water column selenium concentrations proactive of Sage Creek and Crow Creek as this is not immediately apparent from the information package reviewed.

Table 1. Fish Tissue targets and Water Column Exceedances

Stream	Site-Specific Selenium Whole-Body Fish Tissue Criteria (mg/kg dw)	Water Column Selenium Concentration (ug/L)
Hoopes Spring	13.6 (exceeded)	16.7 (exceeded)
Sage Creek	13.6 (exceeded)	16.7 (exceeded)
Crow Creek	12.5 (exceeded)	4.2 (exceeded)
Pole Canyon Creek	n/a (no fish)	n/a

Table 2 provides a summary of alternatives under consideration. The efforts for load reduction from panels D and E (194 acres) appears to be based on the need for selenium load reduction.

Table 2. Summary of Alternatives

Alternative	Mitigation	Adequacy/ Purpose
Alt 1 (NFA)	n/a	This alternative is not acceptable
Alt 2a	2000 GPM WTP	This is the current condition since 2017; This alternative is not acceptable.
Alt 2b	4000 GPM WTP	Strongly recommended: Improves surface water quality immediately (2025 startup considered reasonable)
Alt 2C – PRB	Permeable reactive Barrier – Groundwater mitigation for Pole Canyon ODA	Recommended: reduces loading to the system overall
Covers for Panels D & E: 3A: Dinwoody/Chert 3B: Capillary 3C: Enhanced Dinwoody 3D: Geomembrane 3E: Dinwoody Panel A	3A: Panels D, E 3B: Panels D, E 3C: Panels D, E 3D: Panels D, E 3E: Panel A	3A: minimal effort, 42% infiltration (not acceptable, high-risk option) 3B: includes lined drainage benches (less acceptable, high-risk option) 3C: **preferred alternative** with bentonite mixed with screen material; 3% infiltration, the recommendation is strongly supported 3D: lowest infiltration (0% infiltration) 3E: cover to address potential bird impacts

Water Treatment Alternatives

Source strongly supports the selection of alternative 2B over the other water treatment alternatives. Reasons for this support include reduced timelines for meeting target water quality and also reduced risk and uncertainty in meeting the targets. Source does not support the selection of no action (alternative 1) or alternative 2a because it does not meet appropriate timeline goals and adds uncertainty with meeting goals at all in future.

Groundwater Treatment Alternatives

Source supports the use of the PRB (Alternative 2c) to reduce loadings to groundwater and surface water. Source does not support the selection of alt 1 over alt 2c. This is because of the following reasons: timeline to reach goals and certainty of reaching goals.

Source Control Cover Alternatives

Source agrees with the Forest Service's analysis and preferred alternative for covers including 3C or 3D. it is not clear that 3C and 3D are equivalent in terms of effectiveness and risk reduction. Source believes the geomembrane may provide more protection, however the alternative 3C may be adequate if implemented carefully. Source does not support the other alternatives for cover design (1 / 3A / 3B). This is because 1) these cover alternatives do not adequately reduce the loadings of selenium to the receiving environment within an appropriate timeframe, and 2) these cover alternatives are less certain (include additional risks) for meeting mode predictions and reaching the CERCLA criteria.

Source's comments contribute to the comments on the proposed plan for community perspectives.

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