8.0 IDENTIFICATION OF PREFERRED REMOVAL ACTION

The detailed and comparative analysis highlights those implementability, effectiveness and cost considerations relevant to identifying a preferred group of removal actions for the Site. Although the source areas were analyzed individually, there is an interrelationship between the implementability and effectiveness of the alternatives for the different source areas from a Site-wide perspective. These relationships were considered in the identification of a preferred group of removal actions as briefly discussed below.

8.1 Primary Considerations

Within the Site, the relative importance of various source areas was characterized at both a qualitative and quantitative level. From all environmental aspects, the Pole Canyon external ODA was given the highest priority. The cross-valley fill/french drain disposal scenario present at Pole Canyon results in much higher loading of selenium to the groundwater and surface water pathways than for other settings. For example, the ridgetop setting of the A Panel external ODA is of far less environmental consequence than the valley-fill setting of the Pole Canyon external ODA. Correspondingly, actions to control selenium releases from the Pole Canyon ODA should be considered as a priority in terms of schedule and commitment of resources.

Prioritization of the Pole Canyon external ODA is relevant both in terms of overall effectiveness and implementability. The SI characterization and EECA analyses indicate that source control measures at the Pole Canyon ODA will have the greatest ability to reduce current concentrations of selenium in the Sage Valley shallow alluvial aquifer and the Wells Formation aquifer. Reducing selenium transport from the Pole Canyon external ODA to the Wells Formation will, correspondingly, provide the best long-term assurance that the Hoopes Spring expression of groundwater will have declining selenium concentrations.

In contrast, selenium concentrations in vegetation on the surface of the ODAs are already near the RAGs and do not pose a substantial risk. Modification of these conditions to achieve the RAGs and assure long-term effectiveness is important but not a priority from a short-term perspective.

From an implementability perspective, this means that concerns identified in the detailed analysis regarding materials availability should be fully considered when selecting a group of actions. Specifically, the limited local availability of organic amendments and topsoil cover, coupled with the short construction seasons and practical limitations on manpower/equipment resources, are important constraints. Consideration of these limitations is critical in the context of identifying and sequencing a preferred group of actions to be implemented Site-wide. The

potential short-term traffic safety consideration of hauling large amounts of materials from distant supply areas is also a factor.

Many of the alternatives evaluated would take several years or more to implement and several more years to become fully effective. This anticipated schedule for implementation is balanced on one end by availability of materials and on the other end by the need to achieve USFS multiple-use goals to the extent practical during and completely at the end of mining. Active mining/reclamation activities are anticipated for the next 15 to 20 years. During this period, actions to improve vegetative cover and reduce the long-term surface infiltration/leaching potential for the individual ODAs could be sequentially conducted without substantial ongoing exposure concerns.

Given the ultimate closure of the mine and the goal for full return of the Site to multiple uses, to the extent practical, the preferred response actions should not be dependent upon actions that require a high level of operation and maintenance. Correspondingly, actions that have a higher potential for long-term effectiveness and permanence are preferred.

In order to assure long-term effectiveness, monitoring will be an important near-term and long-term component of any group of removal actions implemented. In the near term it will be important to establish the effectiveness of major source control actions at the Pole Canyon external ODA. The presence of shallow and deep SI monitoring wells at the mouth of Pole Canyon will enable the timely evaluation of the effectiveness of removal actions at those locations. Continued monitoring of surface water, including seep expressions at the A, D, and E Panels, will provide data on the maturation of ongoing reclamation as well as future removal actions. Surface vegetation could be monitored for selenium content periodically until a removal action is demonstrated as being effective. Over the long term, monitoring of Hoopes Springs will provide an indication of the combined effects of actions at all source areas. This monitoring could readily be conducted as part of mine operations over the next 15 to 20 years and beyond to assure that the actions ultimately selected will be effective in both the near term and long term.

8.2 Preferred Group of Removal Actions

Consistent with the detailed and comparative analysis, the preferred removal actions are identified by source area. Table 8-1 provides a summary of the preferred response actions for the entire Site.

8.2.1 A Panel External ODA

In the context of the other source areas, the A Panel external ODA poses a relatively small near-term and long-term threat to human health and the environment. Given this condition,

Alternative 3 is preferred. Minor differences in expected performance for Alternative 2 and Alternative 4 are offset by the lack of locally available topsoil, the small benefit of seep treatment, and large cost differences.

The surface amendment and replanting components of Alternative 3 could be conducted over several seasons, as organic matter is available. Actions at Pole Canyon external ODA would take priority over amendment of the A Panel external ODA surface. In the near term, seep AS-2 should be fenced to eliminate livestock exposure and reduce any incidental wildlife exposure. Seep AS-2 would continue to be monitored for flow and water quality to evaluate the effectiveness of surface amendment on infiltration. If seep flow is still similar in volume and exceeds the RAGs five years after full amendment of Alternative 3, a chert barrier would be installed at AS-2 to permanently eliminate the potential for livestock and wildlife exposure. The haul road surface would be capped at the time of mine closure. Sediment in stormwater detention ponds would be excavated and relocated onsite (either to active mining areas or to the tailings pond, depending on timing), once the surface amendment and replanting was effective.

8.2.2 Pole Canyon External ODA

As noted, controlling the ongoing releases of selenium from the Pole Canyon external ODA is the highest priority for achieving Site-wide RAGs for surface water and groundwater. Alternative 3 is identified as the preferred action for the Pole Canyon external ODA because it provides a rapid reduction of selenium transport to these pathways through the isolation of the ODA from Pole Canyon Creek flows. Alternative 2 is of relatively limited effectiveness at considerably more cost and greater implementability uncertainty. Alternative 4 offers a slightly higher level of overall effectiveness through inclusion of a low-permeability cap; however, the minor benefits are offset by potential difficulties in obtaining the necessary materials and a large difference in cost.

Isolation of the Pole Canyon external ODA overburden from Pole Canyon Creek flows is expected to provide a large reduction in selenium transport to the alluvial groundwater system and Wells Formation aquifer. Inclusion of both the diversion and infiltration components will allow ongoing management of flows. The beneficial aspects of sending clean water to the Wells Formation upstream of the ODA can be balanced with seasonal demands for Pole Canyon Creek water downstream of the ODA (such as irrigation). This flexibility also minimizes the potential for any administrative hurdles to implementation (e.g., water rights). Run-on controls, amendment of the surface, and replanting, will provide further reductions in infiltration and resultant leaching of selenium from the overburden. Long-term O&M requirements for these actions are minimal.

The effectiveness of these removal actions in limiting selenium transport can be directly monitored for all transport pathways at existing monitoring wells GW-15 and GW-16. Ongoing monitoring for effectiveness will provide important early information regarding expected selenium concentration trends in groundwater discharged from the Wells Formation at Hoopes Spring.

Surface amendment and replanting with species that have a low affinity for selenium uptake provides long-term assurance that the ODA will be acceptable for unrestricted grazing. Removal of Pole Canyon Creek sediments, removal of stormwater basin sediments and capping of the haul road surface at the time of mine closure would address any remaining long-term exposure concerns.

It is recommended that Pole Canyon Creek diversion and infiltration components of Alternative 3 be accelerated as early actions to provide a rapid reduction in Site-wide selenium transport. If resources for amendment of the ODA surfaces are limited, the Pole Canyon ODA should be the highest priority.

8.2.3 D Panel Backfilled Pits and External ODA

Alternative 3 is identified as the preferred alternative for the D Panel backfilled pits and external ODA. Alternative 3 is viewed to have a similar level of overall long-term effectiveness as Alternative 2 and Alternative 4 at substantially less cost and with less uncertainty regarding the availability of the topsoil volumes necessary for implementation.

Run-on from adjacent hillsides can be controlled immediately. As for the A Panel, amendment of the surface and replanting can occur over time as the materials are locally available. During the interim, livestock and wildlife access to seeps DS-7 and DS-10 can be controlled through fencing. This will allow for ongoing monitoring at the seeps and evaluation of the effectiveness of the amendment and run-on controls in controlling seepage. At the time of mine closure, these seeps can be capped with chert. In addition, sediments would be removed from stormwater detention basins. Overall, the combination of these actions should assure achievement of the long-term goal of reestablishing all beneficial uses, including those linked to the groundwater and surface water resources.

8.2.4 E Panel External ODA

Alternative 3 is also identified as the preferred alternative for the southern portion of the E Panel external ODA. Given that the E Panel has only recently been reclaimed using current BMPs, and that there are additional reclamation activities planned for the backfilled pits, the immediate treatment of seeps ES-4 and ES-5 is not warranted. Correspondingly, the addition of a low-permeability cap under Alternative 4 is not recommended because of the large additional cost,

concerns about topsoil supplies, and the expected limited additional long-term benefits over Alternative 3.

As identified in the detailed and comparative analyses, the reclamation recently conducted at the E Panel using current BMPs will result in low selenium concentrations in vegetation. It is also expected that over the long term, seepage at ES-4 and ES-5 will improve as vegetation matures and run-on is controlled. The soil amendment of Alternative 3 provides additional assurance in terms of long-term effectiveness. In the near term, fencing of seep ES-4 and detention ponds EP-4 and EP-5 will limit access of livestock and wildlife. At the time of closure, ES-4, EP-4 and EP-5 will be capped consistent with the pilot action already implemented for ES-5.

As discussed for the A Panel and D Panel, these actions are of lower priority than those identified as preferred for the Pole Canyon external ODA.

8.2.5 Hoopes Spring

Alternative 2 is identified as the preferred alternative for Hoopes Spring. The contingent application of treatment under Alternative 2 is preferred over the more immediate treatment under Alternative 3 for several fundamental reasons that were as identified in the detailed and comparative analyses. The primary reasoning for preferring Alternative 2 is that source control actions, as described for the A Panel external ODA, Pole Canyon ODA, D Panel external ODA, and E Panel external ODA, are expected to provide a higher level of long-term effectiveness than active treatment of the Hoopes Spring flows. Controlling the release of selenium at the source is preferred to the perpetual operation of a large-scale conventional treatment facility. Construction and operation of the treatment facility prior to evaluating the effectiveness of source control actions would potentially unnecessarily change the landscape of Hoopes Spring and the surrounding area. Furthermore, given the large capital costs associated with the treatment facility, it would divert, and possibly inappropriately consume resources better applied to source control. However, treatability testing, including field-scale pilot programs, could be conducted at any time under Alternative 2. Initiation of treatability testing would provide the dual benefit of providing a basis for contingent full-scale design and removing some portion of the current Hoopes Spring loading.

Alternative 2 provides for the necessary level of monitoring at Hoopes Spring and downstream to better understand current chemical and biological conditions and to monitor trends in these conditions. The monitoring and lab toxicity studies will provide information needed to understand the relationship between water quality and partitioning of selenium in the aquatic environment. In combination with groundwater monitoring at Pole Canyon and at intermediate locations (e.g., GW18), adequate information will be available on which to base a decision regarding the need for contingent treatment under Alternative 2.

The comprehensive nature of the monitoring program, when coupled with the laboratory toxicity testing, will also provide additional assurance that the source controls and, if necessary, treatment removal actions will meet the RAGs. The development of a Site-specific standard for selenium for Hoopes Spring and downstream in Lower Sage Creek will provide a performance criterion by which the ultimate effectiveness of the selected remedy can be evaluated. The monitoring and Site-specific standard development will also provide important information related to additional mining activities occur within the Sage Creek and Crow Creek watersheds. Contingent treatment of Hoopes Spring will be available, as necessary, as part of Alternative 2 to mitigate any downstream impacts that result from the combined effects of Smoky Canyon mining and future mining on the Sage Creek and Crow Creek drainages.