Agencies' Comments on Draft Alternative 13M Evaluation Report and Related Documents

Prepared by USDA Forest Service

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AGENCIES' COMMENTS ON THE DRAFT ALTERNATIVE 13M EVALUATION REPORT AND SUPPORTING DOCUMENTS, HOLDEN MINE SITE, CHELAN COUNTY, WASHINGTON, DATED AUGUST 14, 2009

This document provides the Agencies' comments on Intalco's Draft Alternative 13M Evaluation Report (ERM and URS 2009a, referred to herein as the 13M Report), including its nine appendices. Additionally, this document includes the Agencies' comment on Intalco's supporting documents provided after the 13M Report was published.[1] To facilitate progress toward remedy selection, the Agencies are not requiring Intalco to revise the 13M Report or supporting documents. Rather, the Agencies' Alternative 13M comments should be read together with Intalco's 13M Report; the Agencies do not require Intalco to resubmit the 13M Report. These comments have the effect of modifying the 13M Report and are incorporated into the RI/FS for the Site.

The comments herein address the substantive portions of the 13M Report and do not necessarily address each point in the introductory summary section, titled Alternative 13M Summary. Comments on the main body of the report apply to the Alternative 13M Summary section as well. Similarly, comments made to the appendices and supporting documents have the effect of modifying the portions of the main body of the report that directly or indirectly reference or rely on material in the appendices.

Overall Assessment

The 13M Report was assessed in terms of the requirements listed in the March 11, 2008, letter to Intalco from the USDA Office of General Counsel (USDA OGC 2008) on behalf of the Agencies. These requirements represented items that the Agencies considered necessary for Intalco to address through proposed additional data collection and analysis, so that various remedy components that Intalco had proposed as part of Alternative 13 (David E Jackson & Associates et al. 2007) could be considered for inclusion in a selected remedy.

Some of the remedy components that now make up Alternative 13M are different from those that Intalco had proposed at the time of the March 11,

[1] 13M Report: Cost Estimates for Alternatives 11 and 13M (URS 2009f); Fall 2009 Additional Sampling Recommendations (URS 2009g); Draft Proposed Alternative Toxicity Reference Values Reports (ERM 2009b, ERM 2009c); Draft Tailings and Waste Rock Pile Cover Evaluation and Selection (ERM 2010a); Memorandum RE: Chemical Concentrations at Wells TP2-8 and TP2-11 (URS 2010a); and Draft Hydrogeology Technical Memorandum Addendum in Context of a Contingent Remedy (URS 2010d).

2008, letter as part of Alternative 13. Nonetheless, these requirements form a useful benchmark for evaluating the Alternative 13M remedy components. The requirements in the March 11, 2008, letter were grouped into eight categories that refer to different components of Intalco's proposed Alternative 13; each category is addressed separately below with respect to the information provided in the 13M Report.

1. Proposed Groundwater Collection Adjacent to Tailings

The requirements under this category pertained to Intalco's proposal to relocate Railroad Creek to the north and use the former creek channel to contain, collect, and convey groundwater to a treatment system downstream of Tailings Pile 3. By relying on collection of groundwater in the former creek channel and in a proposed collection pond east of Tailings Pile 3, the goal was to hydraulically prevent the transport of groundwater exceeding cleanup levels downgradient into Railroad Creek, without the need for groundwater barrier wall(s).

Alternative 13M is somewhat different from the approach that Intalco had proposed as part of Alternative 13 prior to the March 11, 2008, letter. Alternative 13M includes a barrier wall in conjunction with relocation of Railroad Creek in the vicinity of the Lower West Area and Tailings Pile 1 to achieve groundwater containment in this area, and relies on the former creek channel to collect impacted groundwater adjacent to part of Tailings Pile 2. Alternative 13M relies on natural attenuation instead of hydraulic capture in a collection pond to prevent transport of groundwater above cleanup levels to Railroad Creek downstream from Tailings Pile 3. Because of these differences, some of the previous Agency requirements in this category are not applicable to Alternative 13M. These differences are addressed in the following evaluation of Alternative 13M.

Information Needed to Consider Component for Inclusion in Selected Remedy

1. Hydrologic analysis of the new channel gradient to show geomorphic stability and that the channel will support habitat.

   The Agencies conclude that these elements of the groundwater collection remedial component have been adequately addressed for the purpose of remedy selection. If this component is included in the selected remedy, the details of stream relocation, in terms of stability, habitat impacts, and other factors would need to be more fully addressed during remedial design.

2. Elimination of ferricrete and flocculent formation in the new creek channel.

   The Agencies conclude that Intalco has adequately addressed the elimination of ferricrete and flocculent formation in the proposed relocated Railroad Creek channel for the purpose of remedy selection. Metals discharges into the new creek channel in the vicinity of where ferricrete and flocculent occur in the existing channel would be controlled through collection of seep and groundwater base flow into the former Railroad Creek channel and isolation of the new stream channel from impacted groundwater by locating it at a higher elevation than the existing channel. However, Intalco has not demonstrated that Alternative 13M will address flocculent formation downstream of the confluence of the proposed relocated segment and existing Railroad Creek channel in locations where groundwater with elevated concentrations of iron emanating from Tailings Piles 2 and 3 will continue to discharge to surface water.

3. Assessment of impacts on riparian corridor function (old growth, wildlife migration).

   The Agencies conclude that this element of the groundwater collection remedial component has been adequately addressed for the purpose of remedy selection.

4. Assessment of impacts on Holden Village (both the village proper and the new drain field).

   The Agencies conclude that this element of the groundwater collection remedial component has been adequately addressed for the purpose of remedy selection.

5. Analysis that shows the proposed alternative would accomplish containment (hydraulic isolation) of the contaminated plume. Intalco would need to demonstrate the following:

   - How gaining conditions would be maintained in the old channel concurrent with losing conditions in the new channel;

   - How the system would respond to seasonal and storm-related changes in hydrologic conditions; and

   - System efficiency in collection of both shallow and deep groundwater.

The Agencies conclude that, given the revised approach to groundwater collection proposed in Alternative 13M compared with Intalco's Alternative 13 proposal at the time of the Forest Service letter, the first two bullets have been adequately addressed for the groundwater collection remedy component. Regarding the third bullet, however, Alternative 13M does not include containment and collection of the entire contaminant plume, and would rely on natural attenuation as a remedial component to prevent groundwater impacted by Tailings Piles 2 and 3 from discharging to Railroad Creek. The Agencies conclude that Intalco has not demonstrated that natural attenuation would accomplish this objective and has not demonstrated that it would be a suitable alternative to physical containment or hydraulic isolation, collection, and treatment of contaminated groundwater.

6. Examples (case studies) of stream relocation that enabled effective use of the former channel for collection of contaminated groundwater, as part of cleanup at other sites.

   Such case studies were not provided in the 13M Report. Although Alternative 13M relies on the former channel for collection (and, therefore, hydraulic containment) of impacted groundwater to a lesser degree than the previous hybrid alternative, the lack of such information leaves some uncertainty as to the effectiveness and implementability of this component of Alternative 13M. This is a factor in the Agencies' evaluation of Alternative 13M.

7. Additional materials needed (e.g., riprap).

   The Agencies conclude that this element of the groundwater collection remedial component has been adequately addressed for the purpose of remedy selection. Quantities and sources of needed materials would have to be more fully addressed during remedial design.

8. Impacts on road system.

   The Agencies conclude that this element of the groundwater collection remedial component has been adequately addressed for the purpose of remedy selection. Impacts on the road system would need to be further addressed during remedial design.

9. Ability to accommodate potential future expansion and modification of the treatment system.

The Agencies conclude that this element of the groundwater collection remedial component has been adequately addressed for the purpose of remedy selection. The capacity, location, and provisions for future expansion and modification of the treatment system would need to be further addressed during remedial design.

Required Performance at Point of Compliance

Alternative 13M has not been shown to satisfy requirements for establishment of a conditional point of compliance for groundwater downgradient of Tailings Pile 3 as discussed in Section 6.2.2.1 of the Addendum to the Supplemental Feasibility Study (ASFS, Forest Service 2010). Surface water quality must meet applicable or relevant and appropriate requirements (ARARs) throughout Railroad Creek and in the Copper Creek Diversion following remedy implementation.

2. Groundwater and Seeps in Lower West Area (LWA)

The requirements under this category pertained to Intalco's Alternative 13 proposal to install a groundwater barrier wall in the Upper West Area to collect groundwater for treatment; groundwater below the barrier in the Lower West Area would have been addressed through natural attenuation before discharging to Railroad Creek.

Alternative 13M is significantly different from the approach that Intalco had proposed for Alternative 13. Alternative 13M includes a fully-penetrating barrier wall and groundwater collection system immediately adjacent to Railroad Creek in the Lower West Area, which is the same as Alternative 11. Because the Agencies already analyzed this component in the SFS, Intalco did not need to address the Agency requirements for this component.

3. Portal Drainage

The Agencies' requirements for this component pertained to Intalco's Alternative 13 proposal to use aboveground retention basins to equalize flow from the portal.

Alternative 13M includes installing hydraulic bulkheads and utilizing in-mine retention for flow equalization, if possible, instead of aboveground retention basins. In light of this change, the Agencies conclude that this remedial component has been adequately addressed for the purpose of remedy selection. If further investigation during remedial design shows that construction of an in-mine hydraulic bulkhead for equalization of portal flow is not practicable, the

remedy could be modified. Such a change may constitute a significant change to the selected remedy and would require documentation of the basis for the change.

4. Cleanup of Soils above Screening Values in the Mill Building and Ventilator Portal Surface Water Retention Area

The Agencies' requirements for these remedy components pertain to Intalco's Alternative 13 proposal to address soils in the mill building and detention pond areas.

Information Needed to Consider Component for Inclusion in Selected Remedy

The March 11, 2008, letter listed several actions that Intalco would need to take in order to evaluate approaches to soil cleanup in the mill building and detention pond area that did not include excavation, consolidation, and capping. The required actions, listed below, and the information obtained from them, are interrelated; therefore, the Agencies' evaluation is presented following the description of the actions:

1. Additional sampling and analysis to characterize soil materials in the Former Mill Building and Ventilator Portal Surface Water Retention Area.

2. Conduct studies to determine bioavailability of metals in the soil to terrestrial receptors.

3. Conduct a terrestrial ecological evaluation (TEE) that complies with EPA (1997) guidance and WAC 173-340-7493 to determine whether soils need to be removed or capped in place.

4. Monitor seeps and groundwater downgradient of the Ventilator Portal Surface Water Retention Area.

Intalco collected additional samples in the Ventilator Portal Surface Water Retention Area in 2008 and completed a TEE, which included studies to determine bioavailability of metals in the soil to terrestrial receptors. Under Alternative 13M, soil within the Ventilator Portal Surface Water Retention Area with concentrations above cleanup levels would be excavated to a depth of six feet, which is the conditional point of compliance (CPOC) for protection of terrestrial receptors. However, groundwater downgradient of this area has not been monitored except at Seep SP-26, and samples from SP-26 exceed proposed surface cleanup levels based on protection of surface water quality.

Thus, Intalco has not provided sufficient information to support selection of this component of Alternative 13M.

Materials at the Former Mill Building were not sampled because of safety concerns. Under Alternative 13M, Intalco proposed that the remaining tanks and steel superstructure would be removed and the area filled with excess waste rock generated during regrading of the West Waste Rock Pile, covered with a minimum of 6 inches of soil, and vegetated. Soil and residual materials with concentrations above potential cleanup levels for the protection of ecological receptors would either be removed or located below the CPOC of 6 feet (after covering with waste rock). However, Intalco has not demonstrated that the cover proposed for waste rock placed in the Former Mill Building area would satisfy the requirements for remedy selection. Specifically, Intalco has not shown that a 6-inch soil cover would meet the performance requirements for covers on limited-purpose landfills [WAC 173-350-400(3)] and the proposed waste rock cover would exceed terrestrial ecological risk-based cleanup levels. Therefore, the Agencies conclude that there is not adequate data to include this component of Alternative 13M in a selected remedy. The Agencies further note that materials designated as Dangerous Waste under WAC 173-303-070 must be removed and disposed of in a permitted facility. Adequate characterization of soil and other wastes in the Former Mill Building area would have to occur when demolition is accomplished and the area is safe to enter.

5. Tailings Pile Closure

The requirements of the March 11, 2008, letter for this component pertained to Intalco's Alternative 13 proposal to: (1) use a cap for the tailings piles that did not include a synthetic liner so as to meet the default requirements for closure of limited purpose landfills specified in WAC 173-350-400(3)(e)(ii); and (2) implement a regrading plan that did not include setbacks of all portions of the toes of the tailings piles from Railroad and Copper Creeks.

Information Needed to Consider Component for Inclusion in Selected Remedy

The March 11, 2008, letter listed the following requirements that closure of the tailings piles would have to address in order for this component to be considered in a selected remedy:

1. Selection of a final tailings pile cover would need to be based on engineering and ecological risk analysis that shows the closure would satisfy the requirements specified in WAC 173-350-400 and the Forest Plan Standards and Guidelines.

2. Selection of an alternative cap in accordance with WAC 173-350-400(3)(e)(i) would need to be based, in part, on a Terrestrial Ecological Evaluation (TEE) that complies with EPA guidance and WAC 173-340-7493.

3. Design of final tailings pile slopes would need to satisfy requirements of WAC 173-350-400(3)(g) and the Forest Plan Standards and Guidelines.

4. Selection of a regrading plan that does not include a setback from Railroad Creek and all along Copper Creek would need to be based on an analysis of geomorphic channel stability that shows the proposed approach will prevent future instability and release of tailings.

The Agencies conclude that the tailings pile cap proposed under Alternative 13M (6 inches of soil/gravel and wood slash on the top surfaces and 8- to 12-inches of soil/gravel placed on the side slopes) would not satisfy the state's presumptive cover requirements for limited-purpose landfills, and Intalco has not demonstrated that such a cover would satisfy either the performance requirements for landfill covers or the Forest Plan Standards and Guidelines. Intalco's proposed cover would not be protective of terrestrial organisms (criteria 1 and 2). The Agencies conclude that this component of Alternative 13M could not be included as part of a selected remedy.

Although the Agencies do not agree with all interpretations of Intalco's analysis (see comments on Appendix C, below), the geotechnical sensitivity analysis demonstrates that the side slope regrading proposed under Alternative 13M along Railroad Creek could be designed to satisfy requirements of WAC 173-350-400(3)(g) and the Forest Plan Standards and Guidelines, and could prevent future instability and release of tailings to surface water (criteria 3 and 4). The Agencies conclude that this element of the Alternative 13M approach to tailings pile closure could be considered as part of a selected remedy. Further stability analysis would be necessary as part of remedial design.

The Agencies do not consider that Intalco has adequately demonstrated that tailings release to Copper Creek would be prevented under Alternative 13M. Stability analysis indicates that tailings releases to Copper Creek are likely from Tailings Pile 2 under current conditions and, based on Intalco's Figure C-2-2, no regrading adjacent to Copper Creek is proposed under Alternative 13M.

6. Waste Rock Pile Closure

The requirements of the March 11, 2008, letter for this component pertain to Intalco's Alternative 13 proposal to address the main East and West Waste Rock Piles; and to address the Honeymoon Heights Waste Rock Piles through

methods other than removal and capping (the approach put forth in Alternative 11).

Under Alternative 13M, Intalco proposed capping the main waste rock piles with six inches of soil and gravel. Based on the information Intalco provided, the Agencies conclude that Intalco has not demonstrated that the Alternative 13M waste rock cover satisfies the requirements for remedy selection since it has not shown that a 6-inch cover for the East and West Waste Rock Piles would meet the closure requirements for limited-purpose landfills [WAC 173-350-400(3)].

Intalco also proposed in Alternative 13M that the Honeymoon Heights Waste Rock Piles would not be removed or capped. Instead, Intalco proposed that "monitored natural recovery" of Honeymoon Heights (regular inspections and periodic evaluations of whether additional actions would be required) would be implemented. The Agencies' March 11, 2008, letter addressed Honeymoon Heights as indicated below.

Information Needed to Consider Component for Inclusion in Selected Remedy

1. Prepare a map displaying an overlay of Riparian Reserves and the Honeymoon Heights Waste Rock Piles.

2. Sample and characterize material in waste rock piles.

3. Conduct studies to determine bioavailability of metals in the waste rock piles to terrestrial receptors.

4. Conduct terrestrial ecologic risk evaluation that complies with EPA (1997) guidance and WAC 173-340-7493 for all waste rock piles.

5. Conduct an engineering evaluation to determine practicability (and trade-offs) of safely accessing and relocating the Honeymoon Heights Waste Rock Piles.

6. Perform slope stability analysis on remaining waste rock piles in conformance with state landfill requirements (WAC 173-350-400) and the Forest Plan Standards and Guidelines.

The Agencies conclude that adequate information has been obtained regarding Honeymoon Heights Waste Rock Piles for remedial decision making, specifically:

- Mapping conducted by or in conjunction with the Forest Service indicates that Honeymoon Heights Waste Rock Piles are within riparian areas that are biologically important, and may be subject to protection under Section 404 of the Clean Water Act. Impacts of the remedy on wetlands would also be addressed under SEPA.

- A terrestrial ecologic risk evaluation, including sampling and characterization of the waste rock piles and studies to assess bioavailability of hazardous substances, concluded that the Honeymoon Heights Waste Rock Piles pose potential risk to some terrestrial ecological receptors.

- Sampling and characterization of the waste rock piles indicated that the waste rock piles pose a human health risk through direct contact, and institutional controls would be needed to protect recreational users of the area.

- Intalco's analysis of historical mine maps suggests that some potentially open stopes in the Honeymoon Heights area may extend close enough to the ground surface to make heavy construction activities in this area hazardous. The Agencies do not agree that Intalco has demonstrated this, as reflected in comments on Attachment B-1.

- Access for heavy equipment for removal or capping of the Honeymoon Heights Waste Rock Piles would cause short and long-term adverse impacts to existing habitat and lead to erosion and instability in the areas disturbed.

- Intalco's stability analysis for other waste rock piles indicates that the Honeymoon Heights Waste Rock Piles are likely unstable in their existing condition, and would be unstable in the event of an earthquake.

Intalco's approach under Alternative 13M would not adequately address the potential ecological risks associated with the Honeymoon Heights Waste Rock Piles. However, considering the practicability, and environmental tradeoffs (e.g., potential permanent habitat loss) of road building and other heavy construction, the Agencies conclude that addressing the Honeymoon Heights Waste Rock Piles through less-intrusive methods could be included in a selected remedy.

7. Treatment System Ponds

The requirements of the March 11, 2008, letter for this component pertain to Intalco's Alternative 13 proposal to install two water treatment facilities as opposed to the single treatment system under Alternative 11. Under Alternative 13M, two treatment facilities would be employed: one near the current lagoon

area and one downstream from Tailings Pile 3 on the south side of a relocated Railroad Creek.

Information Needed to Consider Component for Inclusion in Selected Remedy

1. Impacts on riparian corridor function (old growth, wildlife migration).

   The Agencies conclude that this element of the treatment system has been adequately addressed for the purpose of remedy selection.

2. Impacts on Holden Village.

   The Agencies conclude that this element of the treatment system has been adequately addressed for the purpose of remedy selection.

3. Impacts on road system.

   The Agencies conclude that this element of the treatment system has been adequately addressed for the purpose of remedy selection.

4. Ability to accommodate potential expansion and modification of the groundwater collection and/or treatment systems.

   The Agencies conclude that this element of the treatment system has been adequately addressed for the purpose of remedy selection, but reject a number of Intalco's assertions as noted in the detailed comments that follow. The expansion of the treatment system ponds to accommodate an increase in groundwater treatment volumes related to potential expansion of groundwater collection and/or potential modification of the Alternative 13M treatment system need to be addressed further as part of remedial design. For example, gradient limitations in the proposed East Water Treatment System area are a concern for potential expansion to accommodate potential increases in groundwater treatment volumes and/or potential modifications to optimize performance of the treatment system.

5. Ability to satisfy ARARs (e.g., the Ecology Permit Writer's Handbook).

   The Agencies conclude that this element of the treatment system has been adequately addressed for purposes of remedy selection.[2] The Agencies note that treatment system modeling results presented in Appendix H of the Alternative 13M Report indicate the treated water effluent will exceed potential cleanup levels for protection of surface water, and that further evaluations, such as the pilot tests now underway, will be needed as part of remedy design.

6. Stream channel stability and flood protection.

   The Agencies conclude that this element of the treatment system has been adequately addressed for the purpose of remedy selection but that Intalco has not adequately addressed how the treatment system proposed east of Tailings Pile 3 will be protected from flooding or what the consequences of flooding would be. Protection of the treatment system from flooding will need to be addressed during remedial design.

7. Wetlands impacts.

   The Agencies conclude that the impacts of this element of the treatment system have not been fully accounted for by Intalco. For the purpose of remedy selection, the Agencies conclude that the impacts of constructing the treatment facility east of Tailings Pile 3 will result in destruction of existing wetlands, and that this will need to be addressed under various ARARs (including mitigation required under Section 404 of the CWA and under SEPA), and NRDA. Mitigation under the CWA and SEPA will need to be addressed in RD, and the NRD compensation will be addressed separately. Intalco has also not evaluated the effects of discharge from the treatment facility into existing wetlands east of Tailings Pile 3.

8. Treatment System Performance

The requirements of the March 11, 2008, letter for this component pertain to Intalco's Alternative 13 proposal to install two water treatment plants incorporating low-energy technologies for alkalinity adjustment and settling, as opposed to the single treatment system put forth under Alternative 11.

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[2]Note this conclusion refers to the ability of two treatment facilities versus a single treatment facility to satisfy ARARs. However, Intalco has not presented information to support its proposal to construct unlined ponds as part of the groundwater treatment system. It is not clear that this would satisfy ARARs such as WAC 173-240-130(2)(t) or comply with state or local water quality management plans.

Information Needed to Consider Component for Inclusion in Selected Remedy

1. Case study information for multiple sites indicating that the proposed systems produce effluent of similar quality to that expected from Alternative 11, within the constraints of the Holden Mine Site (e.g., available hydraulic elevation gradient east of Tailings Pile 3).

   The case studies presented in Appendix H generally show similar treatment systems yielded higher effluent concentrations than Intalco predicts for the Alternative 13M treatment systems, and Intalco's predicted effluent concentrations exceed potential ARARs. Results of ongoing water treatability testing and, potentially, other studies are needed for treatment system design.

2. Ability to be expanded, modified, or augmented based on actual performance.

   Potential expansion and modification options for the groundwater collection and treatment systems will need to be addressed further as part of remedial design. For example, gradient limitations in the proposed East Water Treatment System area are a concern for potential expansion to accommodate potential increases in groundwater treatment volumes and/or potential modifications to optimize performance of the treatment system.

General Comments

1. General Comment: The Agencies note throughout the Alternative 13M Report (including its appendices) that Intalco uses language and tone showing bias in favor of Alternative 13M. The Agencies ignored this bias in accepting this report as part of the RI/FS package. The Agencies conducted their own analysis of alternatives in the ASFS and will rely on this analysis in making remedial decisions.

2. General Comment: The Agencies note throughout the Alternative 13M Report certain characterizations that, taken as a whole, may give the impression that certain remedial actions, cleanup requirements, or the cleanup decision process as a whole may be overly cautious or unnecessarily protective. For example, the characterization of certain soil ARARs or screening values as "conservative" (e.g., Section 1.7.3, Section 2.2.1.7, Table 2-1). The Agencies have not commented individually on all these types of characterizations where they do not affect the remedy

selection process, but note that the Agencies do not necessarily concur with such characterizations.

3. General Comment: Throughout the 13M Report, Intalco mentions additional data collection and analysis that was ongoing and not available at the time of the 13M Report, which would be pertinent to the remedy component evaluations and remedy selection. The Agencies believe adequate information does exist for remedy selection. The Agencies are proceeding with remedial decision making on the basis of existing data.

   Any additional relevant data that become available may be considered as part of the public review and comment phase on the Proposed Plan; could be considered during preparation of the Record of Decision (ROD); and/or the remedy could be modified later through a ROD Amendment or an Explanation of Significant Differences (ESD). Examples of ongoing data collection and analysis mentioned in the 13M Report are:

   - *Hydrogeologic field investigations to identify locations where groundwater discharges to Railroad Creek east of Tailings Pile 3.* The Agencies conclude that available data do not satisfactorily demonstrate that monitored natural attenuation is a suitable remedy component at the Site or that available data satisfactorily demonstrate that groundwater meets, or is likely to meet within a reasonable time frame, cleanup levels at a potential conditional point of compliance east of Tailings Pile 3. The Agencies will proceed with remedial decision making on the basis of these conclusions.

   - *Hydrogeologic field investigations to more fully characterize the nature and extent of the "eastern groundwater plume."* The Agencies conclude that such additional data are not necessary for remedy selection, but may be relevant to remedial design or for potential future modification of the selected remedy.

   - *Geotechnical fieldwork and analysis to further evaluate steeper waste rock pile side slope configurations.* Determination of final side slope configurations for the waste rock piles are not necessary for remedy selection and may be addressed as part of remedial design.

   - *Geotechnical fieldwork and analysis to further evaluate steeper tailings pile side slope configurations.* Determination of final side slope configurations for the tailings piles are not necessary for remedy selection and may be addressed as part of remedial design.

- *Development/refinement of site-specific, risk-based ecological indicator soil concentrations (for use in defining site-specific soil cleanup levels).* The Agencies have identified proposed soil cleanup levels in the ASFS and will use these as a basis for remedial decision making.

4. General Comment: The Agencies note that the description of Alternative 13M is not consistent between the main text of the 13M Report and some of the Appendices. Specifically, the characterization of what would happen under Alternative 13M if monitoring shows that the proposed natural attenuation remedy component for groundwater from Tailings Piles 2 and 3 is not effective or is inconsistent. For example, Figure E4-2 (Appendix E) suggests that installation of a barrier wall downstream of Tailings Pile 3 would be a "principal component" of a contingent action. Section E-4.2.3.4 (Appendix E) simply states that such a barrier wall "would be evaluated." Moreover, the main body of the text (e.g., Section 3.2.12), does not mention a contingent barrier wall at all, merely stating that unspecified contingent actions "would be evaluated." For the purpose of remedial decision making, the Agencies will proceed with the understanding that the description in the main body of the Alternative 13M Report, which was prepared more recently than Appendix E, provides Intalco's intended description of Alternative 13M.

5. General Comment: The Alternative 13M report does not present proposed cleanup levels (CULs) for all media and/or constituents of concern (COCs) that the Agencies consider relevant. For example, Table 2-1 does not present drinking water CULs for groundwater or surface water. This table also does not present terrestrial ecological risk-based CULs for soil, indicating that these values are still under development. In addition, the Agencies do not agree that Intalco has identified all of the CULs that are needed (e.g., the Agencies have identified CULs for copper and lead in soil for human exposure). Accordingly, the Agencies have performed their own analysis and have identified COCs and CULs for all relevant media and exposure pathways in the ASFS.

6. General Comment: Throughout the document, reference is made to "natural recovery" and "natural attenuation." The Agencies understand that natural recovery to typically refer to processes associated with marine or freshwater sediments and not usually to terrestrial soil materials, groundwater, or surface water as used in the Alternative 13M Report. It appears that the two terms are used interchangeably in the document and the Agencies assume that Intalco intended both to refer to the process of natural attenuation as defined under MTCA and CERCLA.

Both MTCA and CERCLA employ the concept of natural attenuation (e.g., WAC 173-340-370(7) and EPA [1999]). Under both regulatory frameworks, natural attenuation refers to a variety of physical, chemical or biological processes that, under favorable conditions, act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of hazardous substances in the environment. Under both sets of regulations, natural attenuation may be selected as a component of a cleanup action only in certain limited situations. A few of the considerations for the selection of natural attenuation as a remedy component are listed below:

- Regarding selection of natural attenuation as a cleanup component, CERCLA guidance (EPA 1999, page 3) indicates a preference for those processes that permanently degrade or destroy contaminants. Similarly, MTCA (WAC 173-340-370(7)(c)) requires evidence that degradation of contaminants is occurring at the Site.

- Both frameworks stress the application of practicable source control in conjunction with natural attenuation. MTCA (WAC 173-340-370(7)(a)) states that for natural attenuation to be selected at a site, source control (including removal and/or treatment of hazardous substances) must be conducted to the maximum extent practicable. Similarly, CERCLA guidance (EPA 1999, page 22) states that EPA expects source control measures to be implemented at most natural attenuation sites where practicable.

- EPA (1999) also provides a few general guidelines for use of monitored natural attenuation (MNA) as a remedial approach for inorganic contaminants. The key policy concerns are that the specific mechanisms responsible for attenuation of inorganic contaminants should be known at a particular site, and the stability of the process should be evaluated and shown to be protective under anticipated changes in site conditions. A number of documents (e.g., EPA 2007a, 2007b, and 2007c) address site characterization needs for assessment of monitored natural attenuation as a remedial component. For example, for copper, EPA (2007b) notes that:

  > *"Determination of the viability of copper remediation in ground water via monitored natural attenuation will depend upon proper assessment of contaminant loading to the aquifer and prevailing geochemistry and mineralogy within the contaminant plume and the down gradient zone prior to the point(s) of compliance. MNA may not be appropriate as a site remedy for copper contamination in acidic pH, highly oxidizing, and/or DOC-rich environments. The goal*

of site assessment is to demonstrate the process(es) controlling copper sequestration onto aquifer solids and the long-term stability of solid phase copper as a function of existing and anticipated ground-water chemistry."

The Agencies conclude that Intalco has not provided adequate information to demonstrate that Alternative 13M provides source control to the maximum extent practicable, to support selection of natural attenuation to address groundwater at Tailings Piles 2 and 3. Also, site characterization work has not adequately demonstrated that natural attenuation processes are occurring and would continue to occur.

7. General Comment: In several instances, when referring to cases where the TEE has identified HQs greater than one for particular receptors, the document states that, nonetheless, risks are considered to be low, unlikely, or minimal. For example, on Page 98, Section 3.2.10.9, the text states: "Although copper and molybdenum concentrations were above potential soil values established for the protection of plants and/or soil invertebrate communities, risks to plants and soil invertebrate communities are considered unlikely in this AOI." The Agencies reject general characterizations such as this.

8. General Comment: The Agencies do not agree that Alternative 13M satisfies the threshold requirements under CERCLA and MTCA and do not agree that Alternative 13M should be identified as the preferred alternative.

   Alternative 13M is not protective of the environment.

   - Alternative 13M allows impacted groundwater emanating from Tailings Piles 2 and 3 to continue to discharge untreated into Railroad Creek, and Intalco has not demonstrated that Alternative 13M is protective of aquatic organisms. Alternative 13M relies on natural attenuation, but Intalco has not shown that Alternative 13M meets the regulatory requirements for a remedy to rely on natural attenuation. Alternative 13M relies on a conditional point of compliance, but Intalco has not demonstrated that Alternative 13M will satisfy regulatory criteria for approval of a conditional point of compliance.

   - Alternative 13M is not protective of terrestrial organisms in several areas of the Holden Mine Site where soils or waste rock exceed terrestrial ecological risk-based cleanup levels, including Honeymoon Heights Waste Rock Piles, Downstream of Honeymoon Heights, Holden Village, the Lower West Area, and the Wind-Blown Tailings Area.

Though Alternative 13M would satisfy many potential ARARs, Alternative 13M would not satisfy all potential ARARS.

Alternative 13M does not satisfy potential chemical-specific ARARs for groundwater, may not satisfy potential chemical-specific ARARs for surface water, and may not satisfy potential chemical-specific ARARs and TBCs for sediment because Alternative 13M does not contain or collect and treat impacted groundwater emanating from Tailings Piles 2 and 3. Alternative 13M does not satisfy potential chemical-specific ARARs for soil, as it does not address soil contamination in some areas of the Holden Mine Site, including Honeymoon Heights Waste Rock Piles, Downslope of Honeymoon Heights, Holden Village, the Lower West Area, the Ballfield Area, and the Wind-Blown Tailings Area.

Alternative 13M would not satisfy all potential action- and location-specific ARARs. For example, Intalco has not presented information that shows that the Alternative 13M tailings pile covers will satisfy potential location-specific ARARs for prevention of the release of hazardous substances from tailings piles located within riparian reserves (Forest Service 1990). Additionally, Intalco has not presented information to support its Alternative 13M proposal to construct unlined ponds as part of the groundwater treatment system, and construction of unlined ponds would not satisfy potential action-specific ARARs.

The Agencies have conducted their own detailed analyses of Alternative 13M under CERCLA and MTCA in the ASFS. The Agencies will rely on the analyses presented in the ASFS during remedial decision making.

9. General Comment: In Sections 4 and 5, the Agencies do not agree with all of Intalco's comparisons of Alternatives 11 and 13M to CERCLA and MTCA selection criteria or to comparisons of the alternatives to each other that are presented in the document. The Agencies have conducted their own comparison of alternatives to selection criteria and to each other in the ASFS. The Agencies will rely on the comparisons presented in the ASFS during remedial decision making.

COMMENTS ON ALTERNATIVE 13M EVALUATION REPORT (MAIN TEXT)

This section provides comments on the main text of the report. Comments on each of the associated appendices to the report that have been submitted to the Agencies are provided in the sections that follow. Comments made to the main text of the report are understood to also apply to any appendices to which the

comment would also be relevant. Similarly, comments made to individual appendices are understood to also apply to relevant portions of the main text.

1. Page 1, Alternative 13M Summary: Strike the first sentence of the third paragraph "~~Based on the available information and results of the evaluations presented in this report, Alternative 13M is the preferred remedial alternative for the Site.~~" The Agencies will identify the preferred alternative in the Proposed Plan using information contained in the RI/FS.

2. Page 3, Alternative 13M Summary: The Agencies reject Intalco's modifications to the RAOs presented in the 13M Report. The RAOs stated in the SFS have been revised slightly as discussed in the ASFS.

3. Page 4, Alternative 13M Summary: The 13M Report states "Results of the baseline human health risk assessment (HHRA) and the supplemental human health risk evaluations presented in Appendix F show that PCOC concentrations in site soils, waste rock, and tailings are protective of human health under current and anticipated future land uses and construction activities." This statement is inaccurate and contradicts Intalco's proposed implementation of institutional controls to protect human health. PCOC concentrations exceed human health criteria in a number of areas, including the tailings piles, East and West Waste Rock Piles, Former Mill Building Area, Maintenance Yard, Lagoon, Ventilator Portal Surface Water Retention Area, and Honeymoon Heights Waste Rock Piles. Remedial actions, which may include institutional controls, are necessary to address all human health criteria exceedances.

4. Page 5, Alternative 13M Summary: Strike the third sentence of the third paragraph "~~Intalco and the natural resource Trustees are performing appropriate NRDA.~~"

5. Page 5, The last sentence is modified to read "Similarly, potential environmental impacts during construction would be mitigated to the extent possible through careful construction practices, good housekeeping, and advanced preparation of spill management <u>and</u> other contingency plans."

6. Page 10, Section 1.1: The last sentence of the first paragraph is modified to read: "The revised Draft Remedial Investigation Report (DRI) was submitted on 28 July 1999 (Dames and Moore, 1999), and was accepted as final by the Agencies, ~~with~~ subject to associated comment resolution documents, on 8 February 2002."

7. Page 10, Section 1.1: The third sentence of the second paragraph is modified to read "The DFFS evaluated eight site-wide remedial alternatives, including several subalternatives ~~that were developed and agreed upon by Intalco and the Agencies~~."

8. Page 10, Section 1.1: The fourth sentence of the second paragraph is stricken "~~The analyses and evaluations documented in the DFFS supported Intalco's selection of Alternative 3b as the preferred remedy for the Site.~~"

9. Page 10, Section 1.1: The last sentence of the third paragraph is modified to read "Both Alternatives 9 and 10 included additional remedial actions in the eastern portion of the Site than were included under Alternative 3b, the remedy initially proposed by Intalco, to address concerns related to groundwater associated with the three tailings piles."

10. Pages 10 – 11, Section 1.1: The fourth paragraph starting on page 10 is modified to read "In September 2007, the Agencies provided comments on the DFFS and ~~released~~ provided Intalco with the SFS and Final Draft Proposed Plan, which presented a new remedial alternative (Alternative 11) as the proposed remedy for the Site. Intalco responded to the Final Draft Proposed Plan with an October 2007 memorandum describing Alternative 13, which was developed in an effort to provide equal protection of human health and the environment as Alternative 11, but with improved technical feasibility and less cost compared to Alternative 11."

11. Page 11, Section 1.1: The first full paragraph is modified to read: "In an 11 March 2008 letter from the USDA Office of the General Counsel to Mr. Theodore Garrett, Intalco's outside counsel, the Agencies ~~requested~~ approved Intalco's request that it collect additional site data and analysis to support the consideration of alternative remediation components in the Proposed Plan (Appendix A). As ~~requested~~ approved in the 11 March 2008 letter, Intalco completed additional field investigation and data analysis tasks to further evaluate the following:"

12. Page 11, Section 1.1: The third sentence of the last paragraph is modified to read "Although Intalco ~~has moved expediently to~~ collected the additional field data and conducted additional analysis beyond the original scope of work, these activities are ongoing."

13. Page 12, Section 1.2: In the last sentence of the third paragraph the phrase "Conditional Use Permit" is modified to read "Special Use Permit."

14. Page 14, Section 1.4: The third sentence of the third bullet point on page 14 is modified to read "The tailings piles were constructed by Howe Sound Company under a permit ~~with~~ from the USDA Forest Service."

15. Page 14, Section 1.4, Third Bullet Point: The 13M report incorrectly states "[t]he tailings piles consist of approximately 8,500,000 cy of [tailings]." The RI indicates the estimated amount of tailings in the piles is approximately 8,500,000 tons.

16. Page 19, Section 1.5: The 13M Report states "...whereas shallow groundwater in the area of tailings pile 3 and the eastern portion of Tailings Pile 2 flows downward into deeper groundwater zones (model layers 2 and 3) and then beneath Railroad Creek and down valley (Figures 1-9 and 1-10)." Field data indicate that there is downward flow of groundwater below the eastern portion of Tailings Pile 2, below Tailings Pile 3, and east of Tailings Pile 3. While the groundwater model simulations also show downward flow in these areas, as it was calibrated to the field data, the Agencies have concerns with respect to the accuracy of the modeled vertical gradients compared to field measurements, as discussed later in comments in this document on Appendix E of the Alternative 13M Report. Intalco has not demonstrated that PCOC concentrations in groundwater do not exceed ARARs at a conditional point of compliance where groundwater discharges to surface water downstream of Tailings Pile 3. Thus, Intalco has not demonstrated that contaminated groundwater discharging from Tailings Piles 2 and 3 does not need to be contained, collected, or treated to satisfy ARARs.

17. Page 20, Section 1.6.1: The second and third sentences of the third paragraph are modified to read "Some sloughing of the west waste rock pile has occurred on the east side and the western half is held in place by deteriorating wooden retaining structures that are in need of repair. ~~Given the history of long term slope stability,~~ Stability analysis of the existing pile conditions was performed to verify the material strength properties assigned based on field and laboratory data."

18. Page 21, Section 1.6.2: Intalco has not provided references for the "historical records" referenced regarding geotechnical characterization of the tailings piles. These historical records, if relied on, will need to be provided to the Agencies for inclusion in the Administrative Record.

19. Sections 1.6.1 and 1.6.2: The 13M Report discussion of existing conditions for the waste rock and tailings piles appears to be biased towards highlighting the fact that the piles have not experienced a global failure since

being constructed, while seeming to downplay the surficial slumping, sloughing, and erosion that has occurred during their construction and over time following their construction. The writing mixes a combination of observations and Intalco's interpretations, without distinction, resulting in a misleading and biased presentation. The discussion only briefly mentions that factors of safety are generally unacceptable (i.e., the risk of failure is unacceptable) and large-scale failures are predicted to occur for the existing conditions during a design level earthquake.

20. Page 25, Section 1.7.2: The 13M Report states "Because Railroad Creek and Copper Creek abut the Site, a CPOC that is located within surface water at the point or points where groundwater flows into surface water may be established by Ecology." However, the Agencies note that Railroad and Copper Creeks are within the Site, they do not merely abut the Site.

    The Agencies provide the following clarification from the SFS: Under federal law, the point of compliance depends on the designated beneficial use of the surface water. As noted in Section 1.2.1.2 of the SFS, the designated beneficial uses of surface water in Railroad Creek [per WAC 173-201A-600] include (the use categories are shown in parentheses): aquatic life (salmonid spawning, rearing, migration, and core summer habitat), recreation (extraordinary primary contact), water supply (domestic, industrial, agricultural, and stock watering), and miscellaneous (wildlife habitat, harvesting, commerce and navigation, boating, and aesthetic values). In addition, because the Site is within a National Forest, and because Railroad Creek is a feeder stream to Lake Chelan, WAC 173-201A-600(1)(a) requires that Railroad Creek also "be protected for the designated uses of core summer salmonid habitat, and extraordinary primary contact recreation." Accordingly, cleanup levels for groundwater at the Site that enters Railroad Creek are based on protection of aquatic life.

    Generally, CERCLA and the NCP require that remedial actions attain non-zero MCLGs and MCLs in groundwater and surface water.[3] Under CERCLA, the preamble to the final National Contingency Plan (NCP) [55 FR 8753] states that groundwater remediation levels should generally be attained throughout the contaminated plume, or at and beyond the edge of the waste management area (WMA) when the waste is left in place (see also 53 FR 51426). Although the tailings and waste rock piles may be designated as

[3] CERCLA Section 121(d)(2)(A) and the NCP, 40 C.F.R. § 300.430(e)(2)(i)(B) & (C) and EPA's "Summary of Key Existing EPA CERCLA Policies for Groundwater Restoration", June 26, 2009, OSWER Directive 9283.1-33.

WMAs, there is no basis under federal law (other than the potential for an ARAR-waver based on technical impracticability) to allow groundwater to exceed cleanup levels downgradient of the WMAs. While EPA acknowledges an alternative point of compliance may also be protective of public health and the environment under "site-specific circumstances," the preamble to the proposed NCP also states "EPA's policy is to attain ARARs...so as to ensure protection at all points of potential exposure" [53 FR 51440]. Under CERCLA the alternative point of compliance for groundwater at this Site is based on the State of Washington's designated beneficial uses of the surface water, as set forth above. The points of potential exposure for the beneficial uses of surface water are at the groundwater-surface water interface.

Normally the point of compliance for groundwater under MTCA is throughout the Site, from the uppermost level of the saturated zone to the lowest depth that could potentially be affected. MTCA requires that groundwater cleanup levels be attained in all groundwater from the point of compliance to the outer boundary of the hazardous substance plume [WAC 173-340-720(8)]. MTCA allows a conditional point of compliance for groundwater for limited circumstances where it is not practicable to meet the cleanup level throughout a site within a reasonable restoration time frame, provided specified conditions are satisfied [see WAC 173-340-720(8)(c) and WAC 173-340-720(8)(d)(i)]."

21. Page 25, Section 1.7.2: Third sentence of last full paragraph, "However, concentrations in well pairs approximately 750 feet downgradient of Tailings Pile 3 have shown significant decreases in PCOC concentrations since 2001 and no longer exceed potential surface water criteria at wells DS-3S/D and DS-4S/D." The Agencies note that these favorable results must be viewed in light of the more recent findings that farther down valley, in monitoring well MW-9I, COC concentrations significantly exceed proposed cleanup levels for some COCs. The situation in this area is complex and is not adequately explained by existing data and analysis.

22. Page 27, Section 1.7.3: While soil screening values are generally conservative by definition and per MTCA [WAC 173-340-747(4)(a)] the fixed parameter three-phase partitioning model method used to obtain the soil concentrations protective of groundwater" provides default or fixed input parameters that are intended to be protective under most circumstances and conditions...," the Agencies take exception to the redundant phrase "conservative soil screening values" in the 13M Report. This phrase incorrectly suggests that these MTCA-based soil concentrations are more stringent than necessary to protect groundwater. Intalco had the

opportunity to use site-specific data to establish the soil concentrations protective of groundwater for the 13M Report, but did not.

In areas where groundwater containment is not provided, the lowest of the MTCA default soil concentrations for protection of groundwater and soil concentrations protective of human health and terrestrial receptors will be the cleanup levels used to evaluate and compare remedial alternatives at the feasibility level and for the Proposed Plan. Where groundwater containment is part of the remedy, soil cleanup levels would be based on protection of human health and terrestrial receptors, as discussed in the SFS.

23. Page 28, Section 1.7.4: Statements are made here and throughout the document that sediments in Railroad Creek and Lake Chelan (at the Lucerne Bar) comply with state Sediment Management Standards (SMS) (WAC 173-204) and, therefore, do not require further evaluation or remediation.[4] These statements are incorrect. The Agencies reject these assertions because the SMS does not provide criteria (chemical and/or bioassay) for freshwater sediments (see WAC 173-204-340 and 173-204-520(1)(d)). In addition, the Agencies reject assertions or implications in the document that Site sediments are adequately characterized and/or support conclusions that they pose acceptably low risk to aquatic organisms such that further characterization, cleanup, and/or monitoring are not required. The Agencies' assessment of sediment conditions at the Site and approach to sediment characterization, monitoring, and cleanup is presented in Sections 1.2.2.4 and Appendix H of the SFS, and Section 5.3.4 of the ASFS.

    The Alternative 13M report cites two documents (URS 2002 and URS 2003) as the bases for its conclusions that Lucerne Bar sediments comply with the SMS and do not warrant remediation, additional characterization, or monitoring. According to URS (2002), three samples were collected from Lucerne Bar in fall 2001 for bioassay testing. These tests were intended to address potential toxic effects from elevated levels of constituents of concern (e.g., zinc). Three bioassay tests were run on each sample: *Chironomus tentans* 10-day survival and growth (acute toxicity), Microtox porewater (acute toxicity), and *Hyallela azteca* 21-day survival and growth (chronic toxicity). However, because required test protocols were not

[4] Examples where such statements are made or implied in the Alternative 13M report include Sections 1.7.4, 1.7.4.1, and 1.7.4.2 (pages 28 and 29); Section 1.8.2 (page 31); Section 2.2.1.8 (page 54); Section 4.1.2 (page 103); Section 4.2.1.4 (page 117); Section 4.5.3.1 (page 138); Section 6.0 (page 173), and Table 1-5.

followed, all toxicity test results from this study were deemed invalid.[5] In fall 2002, URS collected three more samples from Lucerne Bar but only ran the *Chironomus tentans* 10-day survival and growth test for acute toxicity (URS 2003). These results did not indicate unacceptable toxic effects to *Chironomus.* However, the Agencies do not consider these results to be adequate for remedial decision making because they do not address chronic toxicity and may not be representative of current conditions at Lucerne Bar (which has been subjected to at least seven more years of potential contaminant inputs since the 2002 samples were collected).

The Alternative 13M report cites an Ecology study (Ecology 1997) as the basis for its assertions that Railroad Creek sediments comply with SMS and do not warrant remediation, additional characterization, or monitoring. The Ecology study evaluated potential toxic effects of elevated metals concentrations in creek sediments using two methods: (1) toxicity testing using *Hyallela azteca* and Microtox test organisms; and (2) quantitative analyses of benthic invertebrates in Railroad Creek, including taxa richness studies, community analysis, and functional feeding group analysis. The Alternative 13M report mentions only one of the study's findings, that sediment samples did not cause toxic effects to the *Hyallela* or Microtox test organisms.

However, the Alternative 13M report fails to note Ecology's qualification of this finding, that these laboratory tests would not detect certain potential adverse effects on benthic organisms such as the effects of iron precipitates on egg or gill respiration or the oxidation of iron reducing interstitial oxygen content in the sediments. More importantly, the Alternative 13M report ignores the results of Ecology's benthic invertebrate analyses. These analyses document a dramatic drop in benthic taxa and density below the tailing piles

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[5] As described in the URS data report (URS 2002): "Review of the three sediment bioassay reports . . . for the Fall 2001 sediment sampling performed at the Lucerne bar and Stehekin has identified variances from, and failure to follow, required procedures in each of the three test protocols. These variances indicate that test acceptability guidelines for all the Lake Chelan samples analyzed for each of the three bioassays were not met. Therefore, based on review of the data, it is apparent the tests and their results as performed are not suitable for use in meeting the objectives of the Draft SAP for the Fall 2001 sediment sampling."

This was noted by the Agencies in their review of URS (2002) and documented in a letter from Norm Day to Dave Jackson dated August 22, 2002: "The Agencies have determined that the tests are not of sufficient quality to inform cleanup decision-making. However, the qualified data do identify areas that have the potential to impact the benthic community."

relative to upstream stations, followed by slight recovery further downstream. The rich benthic invertebrate community upstream from the mine is reduced to an assemblage of a few metals-tolerant species below the mine. These data provide substantial evidence that discharges from the mine and tailings piles are impacting sediment dwelling organisms in the stream and form an important part of the Ecology study's overall conclusion that: ". . . the Holden site is having a devastating effect on the water quality and aquatic life of Railroad Creek."

24. Page 29, Sections 1.7.4.1 and 1.7.4.2: The 13M Report indicates Railroad Creek and Lake Chelan sediments are not considered for remediation at the Site. However, elimination of the adverse effect of ferricrete to aquatic life in Railroad Creek and monitoring sediment quality to determine whether any further action is needed to protect aquatic life and comply with ARARs is a remedial action objective for Site cleanup, as presented in the ASFS. Thus, the selected remedial alternative will need to address the aforementioned sediments.

25. Pages 29-30, Section 1.8.1: The third sentence of the first paragraph is modified to read "Since completion of the 1999 DRI, additional samples of surface and subsurface tailings and waste rock have been collected at the Site, and ~~at the Agencies' request,~~ a supplemental human health evaluation was conducted to assess current conditions and activities under Alternative 13M related to site tailings and waste rock."

26. Page 31, Section 1.8.2, Footnote 9: The Agencies have rejected the analysis cited by Intalco on the National Recommended Water Quality Criteria (NRWQC) as discussed in the SFS and supporting documents (USFWS 2004 and USFWS 2005).[6]

    Intalco's [ecological risk assessment] understates risks to aquatic life based on both empirical observations and comparison to EPA's NRWQC for aluminum, cadmium, copper, iron, and zinc, based on aquatic life protection. The Agencies note that review of available toxicological data by the United States Fish and Wildlife Service (USFWS) confirms that the 2002 NRWQC values are an appropriate basis for remediation to clean up surface water at

[6] Throughout the RI/FS process, the Agencies have used the acronym NWQC to refer to EPA's National Recommended Water Quality Criteria, whereas Intalco uses the acronym NRWQC. For the purpose of these comments, the Agencies have adopted Intalco's usage so as to avoid having to modify the acronym Intalco used in the Alternative 13M document sections being cited. While Intalco's usage is atypical, there is no substantive difference in the meaning of the two versions of the acronym.

the Site (USFWS 2004 and 2005). Additionally, MTCA specifically incorporates 1999 NRWQC as an MTCA requirement under WAC 173-340-730(3)(b)(i)(B).

Moreover, Footnote 9 is modified to state "Intalco has submitted technical documentation in the DFFS asserting ~~demonstrating~~ that the SWQC are based upon sensitive species that would not naturally inhabit Railroad or Copper Creeks and thus, are not relevant and appropriate to the Site. Intalco also submitted technical documentation in the DFFS ~~demonstrating~~ asserting that the NRWQC for Site PCOCs are outdated, and/or based upon species that do not inhabit Railroad Creek or Copper Creek and thus, the NRWQC are not relevant and appropriate to the Holden Mine Site (Hansen 2003a; Hansen 2003b; Hansen 2004b)." As discussed in Forest Service (2003 and 2007a) and USFWS (2007), sensitive organisms are considered surrogate species for those untested species found in natural waters. These surrogate species, although not found in Railroad Creek, represent the range of possible biological responses to contaminants.

27. Page 31, Section 1.8.2, Third Paragraph: The Agencies reject the ERA findings presented in the DRI and the DFFS that "*there is no risk to most animals, plants and soil biota throughout a majority of the Site and only a low potential risk to select plants, soil biota and wildlife in limited Site areas.*" The ERA needs to comply with the Terrestrial Ecological Evaluation Procedure in MTCA (WAC 173-340-7490 through -7494) and EPA Ecological Risk Assessment Guidance for Superfund (1997). This is addressed in the Agencies' comments on the DFFS (Forest Service 2007b).

28. Page 31, Section 1.8.2: The fourth paragraph is modified to read "In March 2008, the Agencies~~' requested that~~ and Intalco agreed that Intalco would update the ERA ~~be updated~~ to address the current MTCA regulations and to include a broader list of PCOCs and soil AOIs."

29. Page 39, Section 1.8.2.7: The 13M Report states "the grounds are maintained in a manner that is not intended, is not conducive, and is unlikely to support native wildlife populations." To the contrary, native wildlife are commonly observed browsing and making other use of habitat within the village proper; thus, Intalco's statement that the village is "not conducive and is unlikely to support native wildlife populations" is inaccurate.

30. Page 40, Section 1.8.2.8: The 13M Report states "[the ballfield] appears to have been constructed utilizing soil removed from a cut slope immediately north of the field." While portions of the ballfield may have been constructed from native soils, elevated concentrations of some hazardous

substance are present, possibly as a result of wind blown transport of tailings. Also, the DRI notes that waste rock may have been used in construction of the abandoned Honeymoon Heights access road and former bridge crossing, on the north side of Railroad Creek near the Forest Service campground and the ballfield.

31. Page 40, Section 1.8.2.8: Last sentence of second paragraph, "It is anticipated that the ballfield will remain in the current maintained state by the Holden Village and will not be returned back to the natural surrounding habitat." Only a small portion (~15 percent) of the ballfield is on patented land owned by Holden Village. The remainder of the ballfield area lies outside Holden's current Special Use Permit perimeter. Intalco should not assume that this area will not be returned to the surrounding natural habitat. The Forest Service has concerns about noxious weeds growing in this area and at some time will let the area return to native vegetation. The existing condition of the portion of the ballfield on National Forest System land is not a consideration in remedy selection.

32. Page 40, Section 1.9: The 13M Report states "[a]reas outside of the Holden Village and associated facilities are infrequently visited by occasional hikers and campers (in designated areas)." Intalco has not provided a basis for this characterization. Many people visit Holden Village, and people often enjoy exploring old mine sites. Many visitors take the Honeymoon Heights trail up to the 550 Level, and this hike is shown on Holden Village's published map of hikes in area.

33. Page 41, Section 1.9: The first sentence of the first bullet point is modified to read: "The Holden Village is operated as an interdenominational religious retreat under a ~~Conditional~~ Special Use Permit issued by the USDA Forest Service."

34. Page 43, Section 2.1: First and second RAOs, re: "alternative risk-based concentrations". The Agencies reject Intalco's restatement of the RAOs. Additionally, the Agencies reject Intalco's suggestion that risk-based cleanup levels can supersede ARARs, unless the ARARs specifically provide for a risk-based option. The Agencies discussed development of a site-specific standard for groundwater cleanup with Intalco several years ago and Intalco elected not to proceed.

35. Page 45, Section 2.2: The second sentence of the first paragraph is modified to read: "~~However,~~ Intalco may, in the future, ~~reserves the right~~ submit documentation supporting and requesting such waivers ~~if they are deemed necessary~~ based on remedy performance and site conditions."

36. Page 45, Section 2.2.1: Second sentence of first paragraph, "Potential cleanup levels were identified as the lowest potential chemical-specific ARAR for a given PCOC and media, the background concentration, or the analytical laboratory practical quantitation limit (PQL), whichever is greater." This approach is only acceptable if PQLs for sensitive analytical methods are used, as approved by the Agencies.

37. Page 45, Section 2.2.1.1: The second sentence of the first paragraph is modified to read: "Although site groundwater and surface water, including Railroad Creek, Copper Creek downstream of the Holden Village water structure, and Lake Chelan, are not public water systems, ~~the Agencies contend that the~~ federal MCLs are potentially relevant and appropriate requirements for these waters.

38. Page 46, Section 2.2.1.1: The 13M Report states "MCLGs are non-enforceable..." The Agencies note that non-zero MCLGs are potentially relevant and appropriate for groundwater at the Site.

39. Page 46, Section 2.2.1.1: The second sentence of the first full paragraph is modified to read: "~~The Agencies contend that t~~These non-enforceable goals are potentially relevant and appropriate to groundwater and surface water at the Site. Non-zero MCLGs for the PCOCs in site groundwater and surface water are equal to the MCLs."

40. Page 46, Section 2.2.1.2: The second sentence of the first paragraph is modified to read: "~~The Agencies contend that t~~Those state MCLs that are more stringent than federal primary MCLs are potentially relevant and appropriate to groundwater and surface water at the Site."

41. Page 47, Section 2.2.1.4: Footnote 15 is modified to read: "Although Intalco believes that a modification of the SWQC is not necessary at this time, Intalco has submitted technical documentation in the DFFS ~~demonstrating~~ <u>contending</u> that the SWQC are based upon sensitive species that would not naturally inhabit Railroad or Copper Creeks and thus, the potential justification for a modification to the SWQC (Hansen 2003a)."

42. Page 47, Section 2.2.1.4, Footnote 16: As previously stated in the Agencies' comments on the DFFS, under MTCA the 1999 NRWQC are potentially applicable to the Site [WAC 173-340-730(3)(b)(i)(B)], and the 2006 and 2007 NRWQC are potentially relevant and appropriate.

43. Page 47, Section 2.2.1.4: The last sentence of the third paragraph is modified to read: "~~While reserving objections, Intalco has agreed to~~

~~evaluate the SWQC as potentially applicable to surface water at the Site. As such, w~~Where hazardous substances in groundwater are likely to reach surface water, the SWQC are evaluated as potentially relevant and appropriate to groundwater at the Site."

44. Page 48, Section 2.2.1.4: The text indicates that a mixing zone for point source discharges "will be established." The substantive requirements for approval of a mixing zone are presented in WAC 173-201A-400. Intalco will need to accomplish further analysis/modeling during remedial design/remedial action to support the mixing zone decision process.

45. Page 48, Section 2.2.1.5: Footnote 17 is modified to read: "Intalco has submitted to the Agencies technical documentation in the DFFS ~~demonstrating~~ asserting that the NRWQC for Site PCOCs are outdated, and/or based upon species that do not inhabit Railroad Creek or Copper Creek and thus, the NRWQC are not relevant and appropriate to the Holden Mine Site (Hansen 2003a; Hansen 2003b; Hansen 2004b)."

46. Page 48, Section 2.2.1.5: The last two sentences of the first paragraph are modified to read: "~~While reserving objections, Intalco has agreed to evaluate the NRWQC as potentially relevant and appropriate to site surface water. As such, w~~Where hazardous substances in groundwater are likely to reach surface water, the NRWQC are evaluated as potentially relevant and appropriate to site groundwater."

47. Page 49, Section 2.2.1.6: The 13M Report states "[t]he NTR freshwater aquatic life criteria have not been adopted by the state of Washington and are not potentially applicable or relevant and appropriate." However, as previously stated in the Agencies' comments on the DFFS, MTCA has incorporated NTR values as potential cleanup levels for surface water [WAC 173-340-730(3)(b)(i)(C)].

48. Page 50, Section 2.2.1.7: Footnote 20 is modified to read: "Although the Chapter 173-201A WAC generally categorizes these water bodies as potential domestic water supply uses, there is no present or planned~~, or intended foreseeable~~ future use of these water bodies for drinking water as discussed above."

49. Page 52, Section 2.2.1.7: MTCA Method B soil requirements are potentially applicable to tailings and waste rock per the WAC 173-340-200 definition of "soil."

50. Page 52, Section 2.2.1.7, Footnote 24: Clarification – There are no soil concentrations established under federal laws or other applicable state law that need to be considered for establishing soil cleanup levels per MTCA Method B for the Site.

51. Page 52, Section 2.2.1.7, regarding Human Health Protection: WAC 173-340-740(3)(b)(iii) provides that where no federal or state health-based standard is available, the health-based MTCA cleanup level will be a concentration that protects human health as determined by evaluating pathways for groundwater, dermal contact, and the soil to vapor pathway. If the concentration that is protective of ecological receptors is more stringent, then it becomes the soil cleanup level.

52. Page 54, Section 2.2.1.8. The Agencies disagree with the characterization of Intalco's draft reports on Lucerne Bar sediments (URS 2002 and URS 2003) and Ecology's study on Railroad Creek (Ecology 2007) as "Agency-approved."

53. Page 58, Section 2.2.2.2 "Corrective Action Management Unit" bullet: CAMUs only apply at permitted dangerous waste treatment, storage or disposal facilities (TSDFs) at which the obligation to perform a RCRA "corrective action" is triggered. The CAMU concept is inapplicable at Holden, which is not a TSDF.

54. Page 58, Section 2.2.2.2 LDR bullet: The substantive requirements of the land disposal regulations (WAC 173-303-140), require meeting treatment standards prior to land disposal of dangerous waste. The substantive requirements for management of dangerous wastes would still apply on site. Any landfill or surface impoundment receiving dangerous waste within the Site would have to conform to the substantive standards of Chapter 173-303 WAC.

55. Page 59, Section 2.2.2.4: The first sentence of the first paragraph is modified to read: "The CWA regulates the discharge of pollutants from point sources into waters of the United States ~~which~~ and is administered by the USEPA under the NPDES permit program for federal land."

56. Page 59, Section 2.2.2.4: The first two sentences of the last paragraph are modified to read: "CERCLA 121(e) requires compliance with ~~that only the~~ substantive NPDES provisions but does not require the issuance of a permit ~~requirement be complied with~~ for on-site discharges. Substantive requirements include technology-based effluent controls based upon the best available technology (BAT) that is economically achievable, effluent limitations, monitoring, and compliance with SWQC, including establishment

of a mixing zone. Federal and state regulations require that NPDES effluent limitations ~~set forth in a NPDES permit~~ must be evaluated on a technology or water-quality basis."

57. Page 60, Section 2.2.2.4: First sentence of first full paragraph: "NPDES permit equivalency may establish water quality-based limitations that may include meeting potential surface water quality ARARs." This sentence is deleted because it is confusing.

58. Page 62, Section 2.2.2.7: The last sentence of the first partial paragraph is modified to read: "Since these discharges would occur on site, no permit would be required; however, ~~and only~~ substantive compliance with this potential ARAR would be required."

59. Page 62, Section 2.2.2.8: The last sentence of the first paragraph is modified to read: "Although a certification is not required for on-site CERCLA activities, substantive compliance with 401 Certification is required if a substantive federal permit requirement is identified as an ARAR."

60. Page 63, Section 2.2.2.10 Tailings and Waste Rock Piles: The text indicates tailings and waste rock piles "do not constitute landfills." The Agencies note that even though the tailings and waste rock piles were created prior to otherwise applicable solid waste regulations, they are still landfills in form and function. As a result, the limited-purpose landfill closure standards are potentially relevant and appropriate.

61. Page 62, Section 2.2.2.9: Add after the third sentence: "Note that the introductory paragraph to WAC 173-201A-410 defines "...short-term basis (e.g., actual periods of nonattainment would generally be limited to hours or days rather than weeks or months)..." Also, meeting the substantive requirements may require more than simply consultation with Ecology.

62. Pages 67-68, Section 2.2.4: The Agencies accepted Intalco's collection of site specific background soil data; therefore, the Washington Department of Ecology Background Soil Concentrations (Publication #94-115) is not a TBC. The Land and Resource Management Plan for Wenatchee National Forest, Executive Order 11990 - Protection of Wetlands, and Executive Order 11988 - Protection of Floodplains, are all potential ARARs, not potential TBCs. The Roadless Area Conservation Rule 2001 is also a potential ARAR. For a complete list of other potential ARARs and TBCs, see the SFS.

63. Page 69, Section 2.2.5.6: Intalco has indentified the "*Guidelines Developed by the Washington Department of Ecology Dam Safety Office and United*

States Committee on Large Dams" as a TBC in the Alternative 13M Evaluation Report and provided further discussions on this document in Appendix C, Attachment C-4. The Agencies have identified Chapter 173-175 WAC as a potential ARAR. WAC 173-175-050 notes that Ecology is to develop and maintain guidelines to help dam owners and project engineers in complying with dam safety-related requirements. The Agencies agree that guidelines developed by the Washington Department of Ecology Dam Safety Office (DSO) are a potential TBC based on DSO jurisdictional interpretations regarding the tailings piles at the Holden Mine Site. However, guidelines developed by a professional organization, such as the United States Committee on Large Dams (USCOLD) do not meet the requirements for potential TBCs, as defined by the Agencies in Section 2.3.1.3 of the SFS (and as stated by Intalco in the Alternative 13M Evaluation Report), because these guidelines were not issued by federal, state, or tribal governments. The Agencies recognize that use of the USCOLD guidelines for selecting seismic parameters for dam projects may be useful to identify engineering standards of practice for addressing seismic design criteria for the tailings and waste rock piles to meet the pertinent ARARs and TBCs requiring seismic stability (e.g., MM-3 of the LRMP and Washington State Solid Waste Handling Standards), but reject Intalco's characterization of these guidelines as TBCs.

64. Page 87, Section 3.2.7, Footnote 37: As previously discussed in the Agencies' Comments on the DFFS and in the SFS, the DFFS loading analysis models are flawed. The DFFS models do not represent metals *concentrations* at the point of compliance and are not an appropriate basis for remedy selection.

65. Page 88, Section 3.2.7: Last sentence of first partial paragraph, "If, after an extended period of monitoring, PCOC concentrations do not meet surface water ARARs at the established CPOC(s), contingent actions would be evaluated (see Section 3.2.12)." Intalco will have an opportunity to request a remedy modification if it demonstrates to the Agencies' satisfaction that groundwater baseflow into Railroad Creek does not exceed cleanup levels. The basis for such a determination will be a monitoring plan that satisfies MTCA requirements [e.g. WAC 173-340-410, and 173-340-720(9)].

66. Page 91, Section 3.2.9: Intalco has not provided sufficient detail regarding monitoring. Particularly, Intalco has not defined what will trigger evaluation of "contingent actions" or the time frame for proposed contingency monitoring. As stated in the Agencies' comments on the DFFS, while not requiring the development of specific detail, MTCA requires consideration of monitoring in the evaluation of alternative remedial actions. See WAC 173-

340-360(2)(a)(iv). The Agencies developed a Conceptual Monitoring Program that is presented in the SFS. Details of the monitoring plan for the Site will be determined during RD, subject to approval by the Agencies.

67. Page 94, Section 3.2.10.3: As noted in the 13M Report, materials remaining in the Former Mill Building have not been characterized. These materials will need to be characterized during RD/RA to determine the types of waste present (e.g., whether or not state designated Dangerous Waste or asbestos is present in the former mill building). Appropriate disposal of these materials will be determined after the materials have been characterized.

68. Page 96, Lower West Area-East, second paragraph and Page 97, Third paragraph: Where groundwater containment is part of the remedy, soil cleanup levels would be based on protection of human health and terrestrial receptors, as discussed in the SFS.

69. Page 98, Section 3.2.10.8: Most of the Ballfield Area is on Forest System Lands. The Agencies do not accept Intalco's characterization of risk to terrestrial receptors or the need to preserve existing use of this area. Cleanup of the Ballfield Area is further addressed in the ASFS

70. Page 98, Section 3.2.10.9: The first sentence of the second paragraph is modified to read: "Under Alternative 13M, a ~~significant~~ portion of the shallow soils <u>containing windblown tailings</u> located to the south of the Holden Village-Lucerne road will be removed and/or covered for construction of the realigned Railroad Creek channel (Figure 3-1 and Appendix D)."

71. Page 100, Section 3.2.11: Third to last sentence of first partial paragraph, "The available groundwater chemistry data and the CSM (Appendix E) suggest that natural attenuation mechanisms, including dispersion, advection, and surface water influx to the aquifer, combined with reductions in mass loading from the site source areas have resulted in lower concentrations of PCOCs in groundwater downgradient (east) of Tailings Pile 3." The Agencies view this as conjecture only. Reductions in concentration due to source depletion are not natural attenuation, as discussed in the SFS. Also, see Agency comments on Appendix E.

72. Page 101, Section 4.0: The second paragraph is modified to read: "There are a total of nine evaluation criteria under CERCLA. The first two criteria are referred to as "threshold criteria" because~~, in general,~~ a candidate alternative is required to meet them <u>for selection of a final remedy</u> ~~in order to support the statutory determinations and declarations that must be made~~

~~in the ROD. Failure to satisfy either of these criteria usually means an alternative is eliminated from further consideration; however, waivers of some requirements may be allowed under certain circumstances.~~ The two threshold criteria include:"

73. Page 101, Section 4.0: The eighth bullet point is modified to read: "~~Agency (Forest Service,~~ State ~~and USEPA)~~ acceptance; and

74. Page 102, Section 4.0: The first paragraph is modified to read: "Considerations related to ~~Agency~~ State and community acceptance are discussed in this section. The Agencies will evaluate and document ~~Agency~~ acceptance of the proposed remedial actions in the Proposed Plan and ROD and will evaluate and document community acceptance in the ROD primarily based on comments received from the public on the Proposed Plan."

75. Page 106, Section 4.1.3.2: Paragraph two states that the TEE showed that Honeymoon Heights Waste Rock Piles and areas downslope are unlikely to pose a risk to bird and mammal populations, although earlier text indicated that there was risk to insectivores in this area. The Agencies have determined that the Honeymoon Heights Waste Rock Piles contain concentrations of barium, copper, lead, mercury, molybdenum, silver, thallium, and zinc that exceed terrestrial ecological protection criteria, as do concentrations of aluminum, arsenic, barium, copper, mercury, selenium, silver, thallium, and zinc in soils downslope of these piles.

76. Page 107, Section 4.1.3.2: The Agencies disagree with Intalco's discussion of "fugitive" exotic species as an argument for not remediating the Honeymoon Heights Waste Rock Piles and areas downslope of Honeymoon Heights. This is an argument one could attempt to apply to virtually all ground-disturbing remedial actions and is no more of a problem in Honeymoon Heights than elsewhere at the Site. Rather, it might be less of a problem in Honeymoon Heights because weed sources are few and native pioneer species are present and continually revegetating areas disturbed by avalanches.

77. Page 109, Section 4.1.3.4: The Agencies note that if portions of the Wind-Blown Tailings Area are disturbed for construction of the remedy, or for logging or other activities in the future, it will be necessary to undertake removal, capping or other remedial activities at that time.

78. Page 111, Section 4.1.3.6: Last sentence of first paragraph, "Based on the existing and anticipated future land use, the Holden Village grounds are not

intended or maintained to support natural plant communities or wildlife populations and non-native ornamental plants and soil invertebrates are not considered terrestrial receptors of concern." The Agencies do not agree with this characterization of Holden Village; see comments to the TEE.

79. Page 112, Section 4.1.3.7: In the actual ballfield portion of this AOI, there is little native habitat as the area is largely covered by introduced species. The argument that a no-action approach in this area is appropriate in order to "avoid disturbance and clearing of the existing native habitat," is inappropriate.

80. Page 113, Section 4.2: The first sentence of the second paragraph is modified to read: "Compliance with potential chemical-specific, location-specific, and action specific ARARs is ~~usually~~ required for an alternative to be considered for selection as the preferred final remedy."

81. Page 113, Section 4.2: The third paragraph is modified to read: "Potential ARAR waivers, if necessary, would be addressed during the remedy selection process or following remedy implementation if the selected remedy does not perform as anticipated."

82. Page 114, Section 4.2.1.1: Last sentence of first partial paragraph, "Therefore, Alternatives 11 and 13M are expected to satisfy potential chemical-specific ARARs for surface water." The Agencies do not agree that it has been demonstrated that surface water ARARs will be met under Alternative 13M.

83. Page 114, Section 4.2.1.1: Evaluation of an ARAR waiver prior to implementation of a treatment system and potential modifications to meet ARARs, if necessary, would be premature. An ARAR waiver, if necessary, may be considered after the treatment system is up and running, including all necessary modifications to improve performance to the maximum extent practicable.

84. Page 118, Section 4.2.2.1: Intalco has not provided adequate information to demonstrate Alternative 13M would meet the requirements of WAC 173-340-370(7) for Ecology to consider natural attenuation appropriate. Specifically, Intalco has not demonstrated that Alternative 13M provides source control to the maximum extent practicable [WAC 173-340-370(7)(a)], and Intalco has not demonstrated that natural attenuation is occurring (see General Comment 6 above) and that natural biodegradation or chemical degradation will continue to occur at a reasonable rate at the Site [WAC

173-340-370(7)(c)]. Alternative 11 does meet the MTCA criteria for natural attenuation.

85. Page 121, first sentence: Replace "...is not considered relevant or appropriate..." with "...may not be practical or safe..."

86. Page 121, Section 4.2.2.3: The last sentence of the second paragraph is modified to read: "The treatment system performance and compliance with potential surface water ARARs will continue to be evaluated based on the results of the bench and pilot testing to be completed in 2009 and 2010 and during remedial design and remedial action."

87. Page 121, Section 4.2.2.3: First sentence of third paragraph, "The proposed narrative criteria, which protect the specific designated uses of all fresh waters (WAC 173-201A-600 and WAC 173-201A-602) in the State of Washington would be met by Alternatives 11 and 13M as the low energy treatment systems would improve water quality, designated water uses, and aesthetic values, and would protect human health." The Agencies note that "improve" is not the same as "meet," and the goal of remediation is to meet water quality criteria.

88. Page 122, Section 4.2.2.4: The first sentence of the first paragraph is modified to read: "As described in Section 2.2.4, portions of the 1990 LRMP and 1994 NWFP are potential ~~TBC~~ ARARs."

89. Page 123, Section 4.2.2.4: The first full paragraph is omitted. The Agencies note that the Honeymoon Heights Waste Rock Piles are on private land, but that portions of areas downslope of these waste rock pile may be on National Forest System land and within a designated Riparian Reserve where the LRMP and NWFP are potential ARARs (not TBCs as referred to by Intalco) for the purposes of cleanup.

    The LRMP and NWFP designation of Riparian Reserves does not apply to private land, but the ecological impacts/risks to the riparian environment still exist. Mapping conducted by or in conjunction with the Forest Service indicates that Honeymoon Heights Waste Rock Piles are within riparian areas that are biologically important and may be subject to special protection under the Clean Water Act.

90. Page 147, Section 4.6.7: Second sentence of first full paragraph, "The O&M requirements for Alternative 11 would likely be greater than for Alternative 13M, due to the longer water conveyance system and pumping/power requirements." This comment ignores the increased operation and

maintenance (O&M) that would result from operating two water treatment facilities compared to one. Intalco's evaluation may not fully reflect differences in O&M costs between Alternatives 11 and 13M (see also Comment 93 below).

91. Page 147, Section 4.6.8: The last sentence of the first paragraph is modified to read: "If bulkhead installation is determined to be infeasible, other methods of flow control, outside the mine, will need to be evaluated during remedial design."

92. Page 148, Section 4.7: First sentence of second paragraph, "The total cost of Alternative 13M is anticipated to be at least 40 percent lower than Alternative 11."

    The Agencies note that Intalco's general comments on the comparison of costs of Alternatives 11 and 13M were made prior to completion of Intalco's cost estimate. The cost estimates Intalco provided after completion of the Alternative 13M Report were neither clearly organized nor supported by explanatory text. Therefore, the Agencies have not attempted to address each comment on cost in the Alternative 13M Evaluation Report, and have provided their own cost analysis in the ASFS.

93. Page 148, Section 4.8: The title is modified to read: "4.8 ~~Agency~~ State Acceptance"

94. Page 149, Section 4.8: Consistent with General Comments 8 and 9, the State does not agree that Alternative 13M meets all requirements of WAC 173-340-360 and WAC 173-340-370, nor that it can be considered a permanent cleanup action under MTCA based on current information.

95. Page 150, Section 4.9: The first sentence of the second paragraph is modified to read: "The Proposed Location of the Realigned Railroad Creek Channel - Construction of the new Railroad Creek channel under Alternative 13M would result in construction-related noise and dust-generation near the Holden Village."

96. Pages 153-154, Section 5.2: The Agencies reiterate their previous comments with respect to Section 4.2. In particular, because Intalco has not demonstrated that Alternative 13M meets groundwater and surface water ARARs (specifically with respect to groundwater associated with Tailings Piles 2 and 3), Alternative 13M does not meet the MTCA threshold remedy selection requirements that a cleanup action comply with cleanup standards and comply with ARARs [WAC 173-340-360(2)(a)] (see Comment 16).

97. Pages 155-156, Section 5.3.1.1: A groundwater CPOC *may* be monitored within surface water, but any such monitoring must be "as close as technically possible to the point or points where groundwater flows into the surface water" [WAC 173-340-720(8)(d)(i)]. However, Ecology may require use of upland monitoring wells located between the surface water and the source of contamination to establish compliance where a conditional point of compliance has been established, WAC 173-340-720(8)(e)(i). The Agencies reserve the discretion to determine where monitoring of the groundwater CPOC should occur. This may mean monitoring groundwater in monitoring wells short of the groundwater/surface water interface, within benthic sediments immediately adjacent to the groundwater/surface water interface, and/or in piezometers screened slightly deeper than the benthic sediment.

98. Page 158, Section 5.4: Because Alternative 13M does not meet the threshold requirements for remedy selection under MTCA, the analysis of Alternative 13M should generally not be carried forward to an examination of MTCA's "other requirements," although the Agencies have done this in the ASFS for the sake of completeness (see Section 6.3 of the ASFS). Notwithstanding this shortcoming, and as stated in General Comments 8 and 9, the Agencies do not agree with all the comparisons of Alternatives 11 and 13M to MTCA's remedy selection criteria, including the requirement that the selected cleanup action use permanent solutions to the maximum extent practicable. The Agencies will rely instead on the comparisons presented in the ASFS. The reasons for this position include, but are not limited to, the following:

    a. The Agencies do not agree with Intalco's conclusion that Alternative 13M uses permanent solutions to the maximum extent practicable. Based on current information, Alternative 13M cannot be said to provide containment to the maximum extent practicable with respect to groundwater associated with Tailings Piles 2 and 3 (see Comment 16).

    b. Intalco has not demonstrated that the tailings pile and waste rock pile caps proposed under Alternative 13M would satisfy the performance standards of the State's requirements for limited purpose landfills. (*See* Overall Assessment comments under Comment 5: Tailings Pile Closure and Comment 6: Waste Rock Pile Closure.)

    c. "Monitored natural attenuation" as the sole remedy for soils in certain AOIs with PCOCs above potential terrestrial ecological risk-based levels (e.g., Honeymoon Heights) is not "permanent to the maximum extent practicable." The Agencies believe that other mitigating actions can be

taken (e.g., *in situ* treatment by lime addition), even where considerations of habitat disturbance may weigh against other active measures such as soil removal or capping.

99. Page 161, Section 5.5: Again, because Intalco has not provided adequate information to demonstrate Alternative 13M would meet the threshold requirements for remedy selection under MTCA, the analysis of Alternative 13M should not be carried forward to an examination of MTCA's "other requirements." Notwithstanding this shortcoming, and as stated in General Comments 8 and 9, the Agencies do not agree with all the comparisons of Alternatives 11 and 13M to MTCA's remedy selection criteria, including the requirement that the selected cleanup action provide for a reasonable restoration time frame. The Agencies will rely instead on the comparisons presented in the ASFS. Of note, WAC 173-340-360(4)(f) provides that extending the restoration time frame shall not be used as a substitute for active remedial measures when such actions are practicable. Thus, "natural attenuation" (as described in conjunction with Alternative 13M) may not be appropriate under MTCA with respect to groundwater associated with Tailings Piles 2 and 3.

100. Page 168, Section 5.7.1: Intalco has not demonstrated that the Alternative 13M actions associated with Tailings Piles 2 and 3 constitute AKART and groundwater containment to the maximum extent practicable.

101. Page 169, Section 5.7.4: Intalco has not demonstrated that certain Alternative 13M actions meet the standard of WAC 173-340-360(2)(f), which is that a cleanup action shall prevent or minimize present and future migration of hazardous substances in the environment. Specifically, these are actions associated with closure of the Tailings and Waste Rock Piles (where Intalco has not demonstrated how the proposed covers meet the performance standards for limited purpose landfill covers) and actions associated with Tailings Piles 2 and 3 groundwater.

102. Page 170, Section 5.7.5: Intalco has not demonstrated that the Alternative 13M actions associated with Tailings Piles 2 and 3 groundwater meet the standard of WAC 173-340-360(2)(g), which is that a cleanup action shall not primarily rely on dilution and dispersion unless the incremental costs of any active remedial measures over the costs of dilution and dispersion grossly exceed the incremental degree of benefits of active remedial measures over the benefits of dilution and dispersion.

103. Page 178, Section 6.0: The first sentence of the first full paragraph is modified to read: "The short term risks posed by Alternative 11 ~~risks~~ to the

local community, workers, and environment during the active construction seasons are greater than the risks posed by Alternative 13M, because implementation of Alternative 11 includes more handling of contaminated materials, more heavy construction activities, greater borrow soil and rock quarry requirements, and a longer construction duration than Alternative 13M."

APPENDIX A: AGENCIES' MARCH 11, 2008, LETTER REGARDING MODIFICATION OF THE 1998 AOC

Appendix A is a copy of the Agencies' March 11, 2008, letter (USDA OGC 2008).

APPENDIX B: DRAFT HONEYMOON HEIGHTS FOCUSED DRAINAGE ANALYSIS

The complete Appendix B has not yet been provided to the Agencies, but the Agencies believe there is sufficient information in the Administrative Record for the remedy selection process. The Agencies' comments on *Attachment B-1, Draft Honeymoon Heights Near-Surface Stope Mapping* (URS 2009a) are provided below.

B1. Intalco's Request to Perform Additional Work

Page 1, first paragraph, and page 2 first and second paragraphs: Work described in this document was not performed in response to the Agencies' request. The Agencies' March 11, 2008, letter approved Intalco's request to collect additional Site data and perform additional analyses to support the consideration of alternative remediation components proposed by Intalco.

B2. Crown Pillar Thickness

Page 1, fourth paragraph: Intalco asserts in both the RI (Dames and Moore 1999) and Attachment B-1 assert that the thickness of the crown pillars above stopes is on the order of 50 feet, but Intalco has not provided a specific citation for this information or say where it applies. It is not clear whether the thickness of crown pillars is 50 feet over all of the stopes or only a portion of them, and specifically whether this applies to stopes potentially located below or close to the Honeymoon Heights Waste Rock Piles. This is important because these waste rock piles are located near the portals of adits that extend away from the main ore body, and it is not clear that these portals are underlain by near-surface stopes.

B3. Location of Stopes Relative to Honeymoon Heights Waste Rock Piles

Intalco presents a number of Figures to support its contention that the Honeymoon Heights Waste Rock Piles are underlain by stopes at relatively shallow depths. The Agencies question this interpretation based on the following:

- Figures B1-2, B1-3, and B1-9 (plan views) do not show any stopes below the Honeymoon Heights Waste Rock Piles.

- Figure B1-4 (Cross section A-A') is not helpful in answering the questions on the location of stopes relative to waste rock piles, since A-A' is located upslope of the waste rock piles and both the stopes and the portals are projected into the plane of the section.

- Figure B1-5 (Cross section B-B') does not show any stopes below the portals.

- Figure B1-6 and B1-8 (oblique aerial views) do not show any stopes below the 1100-, 800-, 700-, and 550-level waste rock piles. It appears as if the 300-level waste rock pile could overlie or be close to a portion of the 550-level stope, but this cannot be said with certainty since: (a) it apparently contradicts information shown on Figure B1-2; and (b) no details of the oblique projection were provided. (A cross section perpendicular to the ground contours, through the waste rock pile would have been helpful in depicting the actual spatial relationship of conditions in this area.)

- Figure B1-7 (a cross sectional view projected from below ground) is not helpful since: (a) it appears to be oblique; (b) no details of the projection are provided; and (c) the waste rock piles are not shown. Also, Figures B1-7 and B1-6 appear to mislabel workings on the 2325-level; there is no 2325-level portal so far as the Agencies are aware.

B4. Feasibility of Accessing and Relocating Honeymoon Heights Waste Rock Piles

General Comment: Agencies Handout No. 6 (item no. 5) contemplated that Intalco would conduct an engineering evaluation to determine practicability and tradeoffs of safely accessing and relocating the Honeymoon Heights Waste Rock Piles. Intalco limited its evaluation of access to only consider the potential re-establishment of the historical access road and did not consider any alternative approaches.

Most of the historic road alignment is apparently not underlain by near-surface stopes, as indicated on Figures B1-2, B1-3, and B1-9. Intalco has not addressed feasibility of modifying the historical road alignment to avoid the limited areas that cross over stopes advanced from the 1000-level, which appear to be the only stopes that the road crosses (e.g. see Figure B1-3).

B5. Remedy for Honeymoon Heights Waste Rock Piles

General Comment: While Intalco has not adequately evaluated the risk of potential stope collapse, the Agencies have adequate information to assess short- and long-term adverse impacts to existing habitat, erosion, and instability of surficial soils, in order to select a remedy that will adequately address the Honeymoon Heights Waste Rock Piles.

APPENDIX C: DRAFT GEOTECHNICAL TECHNICAL MEMORANDUM

The Agencies' comments provided herein address information presented in *Holden Mine Alternative Remedy Components Evaluation, Appendix C: Draft Geotechnical Technical Memorandum* (URS 2009b). Reference to Appendix C in these comments refers collectively to the main appendix as well as its eight attachments.

Additionally, the Agencies reviewed the following slope stability model files provided by URS on behalf of Intalco:

April 8, 2009, iterations of existing conditions, Alternative 11, Alternative 13M, end of construction with Zone 4 under the starter dam, and end of construction without Zone 4 under the starter dam for Tailings Piles 1, 2, and 3 critical sections.

May 20, 2009, iterations of Alternative 11 and Alternative 13M post shaking analysis for Tailings Piles 1, 2, and 3 critical sections.

May 20, 2009, iterations of yield acceleration analysis for Alternative 11, Tailings Pile 1 critical section and Alternative 13M, Tailings Piles 1, 2, and 3 critical sections.

February 2009 iterations of existing conditions along stability section M-M' of Tailings Pile 2.

With the exception of the stability section M-M' files, which were requested by the Agencies after initial review of Attachments C1, C2, and C3, the stability

analysis files provided were selected by Intalco as representative analyses although these do not cover all of the iterations presented in Appendix C. Although requested, none of the deformation model (i.e., FLAC) files were provided for the Agencies' review, thus the Agencies are not able to comment on the adequacy or completeness of this analysis. While the Agencies believe the Administrative Record adequately supports the remedy selection process, questions on the modeling will need to be addressed if these results are relied on during remedial design.

Comments provided herein are not intended to be a comprehensive list of questions or issues to be addressed at the feasibility level throughout Appendix C. Rather, these comments highlight the Agencies' questions or concerns that Intalco will need to address during remedial design for the Agencies to accept the final design based on current analysis methods. Agency acceptance of the feasibility of specific proposed Alternative 13M remedial components for the purpose of remedy selection does not indicate Agency acceptance of related preliminary design aspects of Alternative 13M. For example, the Agencies accept the regrading of tailings piles and constructing a stabilizing buttress proposed in Alternative 13M as a remedial action alternative. However, the Agencies do not accept the proposed regraded slope and buttress configuration design proposed in Alternative 13M, due to unresolved questions as discussed herein.

The following comments regarding the interpretation of field and reported historical data, and details of the analytical techniques will need to be resolved during remedial design. These comments are organized into categories of areas of concern with respect to geotechnical issues that came out of the review of Appendix C. The categories/comments are generally presented in order of most critical to least critical as interpreted by the Agencies. The majority of these comments would affect both Alternative 11 and 13M similarly, with the exception of the condition of the starter dam, as described by Intalco, and the presence of overbank materials below the starter dam, which are only significant to the analysis of Alternative 13M.

C1. Presence of Liquefiable Soils Below the Tailings Pile Starter Dams

Intalco contends liquefiable soils, particularly overbank deposits (see also comment C3 regarding native, liquefiable soils), are not present below the tailings pile starter dams, which were used to contain the tailings at the very beginning of tailings pile construction. Intalco's argument is based on historical, pre-construction documents that state "*cleaning (sic) of logs, stumps, and duff to mineral soil on outside edge under toe dam*." Intalco interprets duff to include

both forest duff and overbank soil deposits, which have been observed in Intalco's borings and test pits to be up to approximately 4 feet thick and, in some cases, to extend below groundwater level. The overbank soil deposits were originally presented as a highly organic layer of soil, but further investigations led Intalco to reclassify the soil more generally as silty sand to sandy silt (i.e., mineral soil) with occasional organic materials. Intalco has provided conflicting interpretations of the overbank material as both duff in their interpretation of the historical construction documents and mineral soil in their interpretation of geotechnical exploration and sampling data.

Intalco also performed back analysis in an attempt to show that the overbank soils must have been removed from under the starter dam or the tailings piles would have failed in the end of construction condition based on their modeling assumptions. This analysis assumed conditions at the end of construction based on engineering judgment and historical documents, though photographs provided appear to indicate the piles may not have been built as steeply as described in historical documents and modeled in the back analysis. The starter dam did not appear to be exposed at the end of construction; which suggests that potential sloughing or erosion took place during construction. This analysis also assumed an undrained condition for the silty sand and sandy silt overbank soils at the end of construction (i.e., after up to 16 years of tailings deposition). Intalco did not investigate the possibility that the overbank soils may have exhibited drained behavior, which would result in an increase in back analyzed static stability. The Agencies believe Intalco's back analysis does not demonstrate the absence of liquefiable materials under the starter dam.

Excavations near the toe of Tailings Piles 1 and 3 (e.g., Tailings Pile 17, TP09-19, and TP09-20) and erosion repairs completed in 2006 did not reveal the starter dam, though Intalco's cross sectional interpretation indicates the toe dam is near the existing surface for Tailings Piles 1 and 3. Even if the starter dam is present in some areas, no field evidence supports Intalco's contention that liquefiable soils are absent under the starter dam.

Intalco performed sensitivity analysis which included liquefiable soils (see Comment C3 regarding liquefiable soils) below the starter dam, since their base case excluded liquefiable soils below the starter dam. This check indicated the analysis was highly sensitive to the presence of liquefiable soils below the starter dam. For the Tailings Piles 1 and 2 analysis, deformations were less than the 10 feet (i.e., the design criteria proposed for the maximum design earthquake [MDE[); however, for the Tailings Pile 3 analysis, deformations were greater than 10 feet.

Based on information currently available, the Agencies are not convinced that liquefiable soils, including overbank soils, are absent below the toe of the tailings piles (i.e., the potential location of a starter dam). The possibility of liquefiable soils below the toe of the tailings piles will need to be included in remedial design analysis, unless future field evidence conclusively demonstrates that liquefiable soils are not present anywhere along the toe of the piles.

C2. Groundwater Levels - Tailings Piles

Based on review of the geotechnical critical cross sections and available groundwater level data, the groundwater levels in the geotechnical analysis appeared to encompass the highest groundwater elevations measured in monitoring wells adjacent to the section. However, it appeared the analyzed groundwater elevation in the critical stability section for Tailings Pile 1 was approximately 8 feet lower and for Tailings Pile 3 approximately 3 feet lower than groundwater levels measured in other cross sections for these tailings piles. Additionally, downhole geophysical measurements near the crest of all of the tailings piles in the summer of 2008 (URS 2008) indicated that elevations of groundwater or saturated tailings were significantly higher than the groundwater elevations modeled.

The "critical" cross sections were chosen by Intalco based on stratigraphy, pile geometry (e.g., overall height), and static analysis of existing slope stability. This static analysis of existing conditions was relatively insensitive to groundwater levels, and critical sections were chosen based on interpreted critical stratigraphy and geometry for each pile. However, based on results presented in Appendix C, dynamic analysis will drive the geotechnical design of tailings pile closure. Dynamic analysis is sensitive to groundwater levels, which affect both effective stress parameters and the amount of tailings that could liquefy during an earthquake.

Intalco checked the degree of sensitivity with respect to groundwater levels by increasing the groundwater elevation analysis for Tailings Piles 1 and 2 by 2 feet. This analysis showed an increase in estimated deformations, though this was apparently not significant; the increase in deformations were less than one foot. This sensitivity analysis was not performed on Tailings Pile 3, as Intalco interpreted the water levels to be conservatively high in the base case. This interpretation may be reasonable for the Tailings Pile 3 critical section analyzed, but the critical section is near to and parallels the north end of the pile (i.e., runs approximately east-west) where groundwater levels are likely to be lowest. In order to apply this critical section to the remainder of Tailings Pile 3, elevated interior groundwater levels will need to be analyzed.

While the sensitivity analysis performed indicated that a 2-foot increase in groundwater elevation did not result in excessive deformations per the design criteria proposed, this analysis did not encompass the highest water levels measured in monitoring wells in Tailings Piles 1 and 3 or the groundwater levels indicated by the geophysical measurements. The effects of these groundwater data need to be addressed during remedial design.

C3. Thickness of Native, Liquefiable Soils

Intalco assumed the overbank deposits were the only potentially liquefiable, native soils. However, the upper alluvial soils could also potentially liquefy, as evidenced by low standard penetration test blow counts in native soils below the overbank soils (e.g., SB-09, SB-10, SB-11, TP1-1D, TP1-2D, and TP2-1D) and CPT data, which appears to be from below the overbank soils (see Zone 4 discussion below). Intalco performed sensitivity analysis on the thickness of overbank soils, looking at a maximum thickness of 4 feet. The deformation estimates did not appear sensitive to increasing the thickness of native liquefiable soils from 2 feet to 4 feet; however, when increasing the thickness of the native liquefiable soils was coupled with increasing groundwater levels (see above Groundwater Levels comments) the results became more sensitive.

These data suggest that the susceptibility of native soils below the tailings piles to liquefaction will need to be addressed as part of remedial design. Analysis of a native liquefiable layer thicker than 4 feet should be accomplished as part of remedial design, and regraded slope angles and/or buttress design adjusted to achieve acceptable factors of safety and deformations.

C4. Zone 4

Zone 4, in Intalco's interpretation of CPT data, includes both weak tailings and overbank soils (and potentially loose alluvial soils). For CPT explorations, no soil samples are retrieved; only the measurements from the CPT probe are used to interpret soil conditions and classify soil. To obtain physical samples, for example to distinguish tailings from overbank soil from underlying alluvial soils, an adjacent soil boring is necessary. Comparing the paired CPT and soil boring explorations CPT-7 to SB-3 (URS 2008), the Zone 4 interpretation in CPT-7 extends approximately 4 feet below the bottom of the overbank-alluvium contact observed in SB-3. These observations indicate some portion of the alluvial soils near the overbank-alluvium contact may be potentially liquefiable. This may not have been apparent in the boring due to the sampling interval used, whereas the CPT provided near-continuous measurements. Thus, as previously discussed (see Thickness of Native, Liquefiable Soils comments), there

is evidence that the thickness of potentially liquefiable native soils may be greater than that modeled and checked with sensitivity analysis by Intalco.

The static soil properties of Zone 4 were estimated from CPT empirical correlations because there was very limited lab strength data for Zone 4 materials. The Zone 4 soil in the models only represented Intalco's interpreted thickness of the overbank materials reported to range from 1 to 3 feet in Appendix C. However, Intalco's Zone 4 interpretations from CPT data indicate a thickness of soft/weak soils at the base of the tailings piles up to approximately 12 feet thick. Thus, portions of CPT interpreted Zone 4 (weak tailings and potentially loose alluvial soils) were excluded from the models. Estimated deformations would likely have been higher had the increased thickness been modeled, and this will need to be addressed during remedial design.

The dynamic properties of Zone 4 were based on the properties of tailings measured from cyclic direct simple shear (DSS) testing. Only one sample (SB-3 at 114') is interpreted by Intalco to have been native, overbank soil; however, the data and interpretations have not clearly indicated this sample was overbank soil. In the current post-earthquake stability and dynamic deformation analysis, the cyclic resistance to liquefaction curve and liquefied shear strengths are modeled the same for the saturated tailings and overbank soils. However, the saturated tailings are also modeled using a dilation model (see Dilation Model comments below) that was not applied to the overbank soils, reportedly due to the limited lab data available.

The potentially liquefiable, native soils (i.e., native Zone 4 soils) will need to be better characterized regarding susceptibility to liquefaction and residual strength during remedial design, as opposed to treating them the same as saturated tailings.

C5. Dilation Model

Intalco modeled the pre- and post-liquefaction dilative behavior of tailings (i.e., pore pressure decrease and resulting shear strength increase) based on post-liquefaction test data. However, monotonic DSS and triaxial test data of samples not subjected to cyclic stresses and liquefaction show the tailings are actually contractive (i.e., pore pressures increase and strength decrease with strain) up to strains of approximately 10 percent. This initial contractive response with increasing shear strain would decrease soil strength and promote liquefaction, as opposed to the dilation model being implemented, which increases liquefaction resistance.

The Agencies do not believe it is appropriate to model the pre-liquefaction contractive/dilative behavior based on post-liquefaction dilative behavior, as doing so will unconservatively increase the modeled resistance to liquefaction. The contractive/dilative soil behavior modeled before triggering of liquefaction will need to be based on soil behavior prior to liquefaction or analysis demonstrating the sensitivity of the modeled deformations to the pre-liquefaction contractive/dilative behavior will need to be provided during remedial design.

While it is clear how Intalco modeled pore pressure dissipation using the dilation model, it is unclear how the post-liquefaction strength gain was modeled using Intalco's dilation model. The Agencies' understanding of the deformation modeling is that once a soil liquefies, this material is assigned a constant, liquefied shear strength equal to the estimated post liquefaction, residual shear strength. This shear strength is estimated from laboratory tests and empirical correlations with field data. Because the liquefied strength is constant, it is independent of pore pressures and effective stresses. Thus, for dilation to result in an increase in strength simply through a decrease in pore pressure, a frictional component must be involved. The method Intalco used was not clearly defined, and no frictional, residual strength data or estimates were presented or discussed in Appendix C.

Further clarification on how strength gain due to dilation with increasing straining of liquefied soils will need to be provided during remedial design for the Agencies to accept the use of these methods for final design of the tailings pile slopes. A sensitivity analysis that eliminates the dilation model would be useful for determining the significance of dilation and determining the importance of clarifying these technical details.

C6. Dilation and Liquefied Shear Strength

Intalco modeled the dilative behavior of tailings with increasing shear strain based on observations of dilative behavior in post-cyclic tests (see Dilation Model comments above). Intalco's dilation model did not appear compatible with their interpretation of the liquefied shear strength of tailings, which were estimated from the same lab test data. Intalco defined the liquefied soil strength at a shear strain of 10 percent from specimens previously cycled to liquefaction. At a shear strain of 10 percent dilation is already occurring and contributing to the shear strength. Thus, the liquefied strength includes the strength gain due to dilation up to 10 percent shear strain. Additionally, the dilation model adjusts pore pressures to increase strength within the initial 10 percent of shear strain experienced by soil in the deformation models. This, in effect, unconservatively doubles up the dilative behavior and resulting strength gain in the deformation

models. The compatibility of the dilation model and liquefied shear strength will need to be addressed during remedial design.

C7. FLAC Modulus, Damping, and Dilation

Intalco indicated material damping occurred in the dynamic modeling via plastic deformation using the Mohr-Coulomb failure criteria. As discussed in Holden project meetings, a constant modulus would be used and the aforementioned damping relied upon, as opposed to using a hysteretic damping and modulus reduction curve model. Intalco indicated references would be provided to demonstrate the applicability of this method of analysis to dynamic FLAC deformation modeling. These references have yet to be provided to the Agencies.

Additionally, it is unclear how a model that relies on plastic yielding/straining for cyclic damping also uses plastic yielding to dissipate pore pressures through the dilation modeling during cyclic loading before and after triggering of liquefaction. The dilation modeling based on plastic strains before liquefaction seems like it could create a modeled cyclic resistance to liquefaction that is in addition to the resistance to liquefaction from cyclic loading from laboratory tests.

The deformation modeling techniques need to be further clarified in order for the Agencies to accept Intalco's reliance on these techniques during remedial design.

C8. Subduction Record

Intalco indicated that a low amplitude but long duration subduction event would be analyzed to determine if such an event is critical to seismic stability, but the results of this analysis were not presented. The subduction record, scaled to match to design spectrum, should be checked as part of remedial design.

C9. Sensitivity Analysis of Tailings Properties

Intalco performed sensitivity analysis with respect to the tailings frictional strength properties for Zones 1, 2, and 3, and cohesion for Zone 1A. The sensitivity analysis assumed the heavily relied on CPT empirical friction angle correlations were accurate, and Intalco performed sensitivity analysis with respect to the statistics of the data set. Thus, the sensitivity analysis did not account for potential error in the CPT correlations themselves and may not have covered the range of potential strength properties. While the sensitivity analysis of tailings strength properties did not appear complete, the later sensitivity

analysis with respect to tailings pile deformation modeling indicated predicted deformations were relatively insensitive to the strength properties of the unsaturated tailings.

C10. Degree and Thickness of Cementation in Outer Slope of Tailings Piles (Zone 1A)

The degree of cementation in the outer slope, referred to by Intalco as Zone 1A, was estimated from back analysis. However, the back analysis was based on assumed end of construction conditions, which may not have been representative of actual construction conditions (e.g., photographs provided by Intalco appeared to indicate the piles may not have been built as steeply as reported and modeled by Intalco and the starter dam did not appear to be exposed at the end of construction. This suggests that potential sloughing or erosion likely took place during construction). Also, the effect of time elapsed since construction on the development of cementation due to oxidation of the tailings would not necessarily be reflected in analysis using end of construction conditions.

Zone 1A was generally assumed to have a 20-foot lateral thickness in the Appendix C analysis. Field investigations from spring 2009 indicated uncemented, native derived fill was present at the crest of Tailings Piles 2 and 3. At the crest of Tailings Pile 1 cemented tailings approximately 4 to 5 feet thick parallel to the existing slope was observed (note the crest has the greatest exposure to weathering and therefore may have the thickest cemented tailings). Samples of Zone 1A tailings were acquired during spring 2009 fieldwork, but the results of lab testing and updates to analyses were not included in Appendix C.

Intalco performed sensitivity analysis with respect to tailings properties, which included reducing the cementation of Zone 1A to that estimated for Zone 1. This effectively removed Zone 1A, except for a slightly higher friction angle, and the analysis indicated the deformations were not sensitive to this change. This is expected, as the proposed Alternative 13M tailings pile configurations would involve removing most of Zone 1A during slope regrading. However, Intalco commented in Appendix C that spring 2009 fieldwork was being performed to better characterize the outer shell and mentioned the possibility of designing for steeper slopes during remedial design. This would likely be the result of relying more on tailings cementation.

In order to justify steeper slopes through reliance on cementation, Intalco will need to provide a more complete assessment of the cemented tailings strength properties (i.e., appropriate laboratory and/or *in situ* testing), field evidence of the thickness of cemented material analyzed, characterization of variability in

thickness, and a revised cover design for the regraded tailings pile slopes that satisfies ARARs (e.g., geotechnical stability, ecological requirements, etc.).

C11. Starter Dam

There is no field evidence regarding the condition and location of the starter dam. However, unless Intalco proves there are no liquefiable materials below the starter dam, the condition and location of the starter dam are not likely to be significant to geotechnical stability of the tailings piles.

C12. Alternative 13M Toe Berm Space Requirements

The Agencies note Intalco has conceptually demonstrated the need for a buttress or toe berm in order for 2H:1V tailings pile slopes to be stable under ARAR-driven seismic conditions. However, the proposed toe berm geometries for Alternative 13M along Section B-B' of Tailings Pile 1 and Section G-G' of Tailings Pile 3 do not account for the limited space available around portions of the tailings piles. Although this was not addressed in Intalco's comparison of Alternatives 11 and 13M, the Agencies believe this can be more fully considered as part of remedial design and is not necessary for remedy selection.

Intalco has proposed relocating Railroad Creek at the location of Section B-B,' whereas Railroad Creek remains in its existing channel adjacent to Tailings Pile 1 west of Section B-B'. Where Railroad Creek remains in its existing channel there does not appear to be enough space to construct the toe berm proposed by Intalco, using the approach shown at Section B-B', or the proposed groundwater barrier wall adjacent to Tailings Pile 1. Along this reach it appears that Intalco would need to extend the creek relocation further upstream, or the Alternatives 11 and 13M regrading and toe berms would be the same.

At Section G-G' the Alternative 13M toe berm includes an extended compacted alluvium toe that appears to extend into the existing wetland east of Tailings Pile 3. However, along the majority of the perimeter of Tailings Pile 3 in Alternative 13M there will be a conveyance trench in the existing (proposed to be abandoned) Railroad Creek channel with the relocated Railroad Creek to the north. The presence of the conveyance trench and relocated Railroad Creek conflict with the space required for the compacted alluvium portion of the toe berm. This would likely require Railroad Creek to be relocated farther north than proposed by Intalco, relocating the toe of the tailings pile slope as contemplated for Alternative 11, or, potentially, modification of the toe berm along the north side of Tailings Pile 3.

C13. Compacted Fill Properties

The properties used to model the compacted tailings and alluvium appear high. These properties should be verified with tests and checked with sensitivity analysis during remedial design.

C14. Groundwater Levels - Waste Rock Piles

Intalco used a groundwater level of 3 feet above the waste rock-native contact for the waste rock pile analysis. This was an estimated groundwater level and was not compared to the water levels measured in vibrating wire transducers installed during the summer of 2008 (transducer data not yet provided). Measured groundwater levels should be used for remedial design. Design should include sensitivity analysis to assess the effect of extreme groundwater levels, since design will likely be accomplished before very much water level data has been obtained.

C15. Railroad Creek Relocation

The impacts of blasting the new creek channel in proximity to Tailings Pile 2 as part of the effort to relocate Railroad Creek must be considered during remedial design.

C16. Deformation Analyses for Waste Rock Piles

Intalco notes on Page 2 of Attachment C3, "It was also determined and agreed upon with the Agencies during Geotechnical Progress Meeting No. 4, that the conditions of the waste rock piles were such that, provided their exterior slopes were flattened to 2 horizontal to 1 vertical (2H:1V), they did not warrant the completion of detailed deformation analyses." The Agencies clarify that based on the preliminary, simplified deformation analysis presented at the time of that meeting, the Agencies agreed that FLAC analyses were not warranted, but that simple deformation analyses are necessary to demonstrate seismic stability of proposed waste rock pile slopes.

APPENDIX D: DRAFT PROPOSED RAILROAD CREEK REALIGNMENT TECHNICAL MEMORANDUM

The Agencies' comments provided herein address information presented in *Holden Mine Alternative Remedy Components Evaluation, Appendix D: Draft Proposed Railroad Creek Realignment Technical Memorandum* (URS 2009c).

Comments provided herein are not intended to be a comprehensive list of questions or issues to be addressed at the feasibility level throughout Appendix D. Rather, these comments highlight questions or concerns the Agencies have that Intalco will need to address during remedial design in order for the Agencies to accept the final design based on current analysis methods. Thus, Agency acceptance of the feasibility of Railroad Creek realignment proposed in Alternative 13M does not indicate Agency acceptance of all related preliminary design aspects of Alternative 13M.

None of the Agencies' geomorphologic concerns are believed to be fatal flaws that would result in rejecting the proposed relocation of Railroad Creek as a possible remedy component during remedy selection.

The following comments are organized into categories of areas of concern with respect to geomorphologic issues that came out of the review of Appendix D. The categories/comments are presented in order of most to least critical, as interpreted by the Agencies.

D1. Elevated Copper Creek Extension - Debris Accumulation

Section D-5.0: From the profile, plan, and details for lower Copper Creek, it appears that the new creek channel will be significantly higher than the surrounding existing ground surface and will be configured like an elevated aqueduct but on a fill berm instead of a structure. The proposed sediment cleanout area makes sense given this configuration, but the open channel perched on a berm may be susceptible to failure from debris accumulation, leading to overtopping and erosion of the berm. Additional evaluations will need to be made as part of remedial design to determine if there are adjustments to this configuration that could further reduce the possibility and consequences of failure.

D2. Copper Creek Extension and Railroad Creek Floodplain

Section D-5.0: From the profile, plan, and details for lower Copper Creek, it appears that the new, elevated Copper Creek channel would effectively dam up a large portion of the Railroad Creek floodplain during high flow events that inundate the floodplain. The consequences of flooding given the proposed configuration do not appear to have been addressed at the feasibility level and will need to be addressed during remedial design.

D3. Fish and Wildlife High Flow Criteria

Table D2-1, Footnote d; Table D5-1; and Section D-2.2.3 cite Oregon Department of Fish and Wildlife Fish Passage Criteria. While these may be useful for comparison, remedial design will need to rely on Washington State criteria for fish passage. Examples include the Washington hydraulic code and regulations (e.g., WAC 220-110-070), as well as aquatic habitat design guidelines for fish passage and stream habitat restoration guidelines prepared by the Washington Department of Fish and Wildlife, US Fish and Wildlife Service, and Washington State Department of Ecology.

D4. Sediment Transport Capacity Field Measurements

Section D-3.0: Field-measured sediment gradations inform the estimate of sediment transport capacity. Pebble counts provide good information about the surface sediment gradation. Gravel bed streams often form an armor layer of coarser gravel and cobbles at the surface. Using pebble counts tends to result in a coarser sediment size distribution compared to the results of a bulk volume sample including sediment below the bar surface. When evaluating sediment loads, bulk volume samples tend to give a better representation of the sediment transported by the stream. Pebble counts are standard practice and generally appropriate. The effect of using surface sediment size distributions in the sediment transport evaluation will need to be evaluated and addressed as part of remedial design (e.g., does this approach tend to under-predict the sediment transport load?).

D5. Sediment Transport Evaluation

Section D-3.0: The discussion of the Meyer-Peter and Mueller equation indicates the results are approximate and suitable solely for guidance in determining sediment gradation. The sediment transport evaluation seems to focus on determining appropriate design of the restored stream bed grain size distribution. This is appropriate, but not complete. A critical question is whether the new channel will have the ability to transport the sediment load delivered from upstream without either sediment accumulation or scour that would compromise its ability to meet performance objectives. It seems the sediment transport analysis could be readily applied to this question. There is some discussion on this in Section D-5.2.2 in which the sediment transport analysis is applied to addressing sediment transport capacity through the reach. The upstream sediment load will need to be addressed as part of remedial design.

D6. Impermeable Liners

Section D-5.0: Impermeable liners under stream channels increase the risks of performance failure. The text in Section D-4.2.1 describing the alternatives describes the proposed layer as "low permeability material." The graphic details on Figure D5-6 identify this feature as "Impermeable Liner." Whether or not a liner is necessary will need to be determined as part of remedial design. If a liner is necessary, the Agencies believe a cement- or bentonite-amended soil layer, or other clay-like material is superior to a plastic or geotextile liner, as riprap placement would be less likely to puncture a clay liner.

D7. Flow Cutoff Walls

Section D-5.0: The Agencies agree the flow cutoff walls proposed to be located within the riprap below the new Railroad Creek channel are a good idea. The relative size of the streambed gravel in comparison to the riprap under it will need to be addressed as part of remedial design. Methods used in soil filter design should be considered to prevent the stream gravel from being lost into the voids between the riprap and leaving the riprap exposed in the new channel.

APPENDIX E: DRAFT HYDROGEOLOGY TECHNICAL MEMORANDUM

The Agencies' comments provided herein address information presented in *Holden Mine Alternative Remedy Components Evaluation, Appendix E: Draft Hydrogeology Technical Memorandum* (URS 2009d). Additionally, the Agencies reviewed groundwater modeling files provided by URS for each of the five groundwater models developed, described later in these comments.

Comments provided herein are not intended to be a comprehensive list of questions or issues regarding the feasibility investigations and analysis presented in Appendix E. Rather, these comment highlight the Agencies' questions or concerns that Intalco will need to address during remedial design for the Agencies to accept the final design based on current analysis methods. Thus, Agency acceptance of the feasibility of proposed Alternative 13M remedial components does not indicate Agency acceptance of all related preliminary design aspects of Alternative 13M.

URS developed and presented the results of five groundwater models in Appendix E:

- Regional model;
- High-flow existing conditions;

- Low-flow existing conditions;
- High-flow conditions for the proposed Alternative 13M remedy; and
- Low-flow conditions for the proposed Alternative 13M remedy.

The regional model extended into the upper reaches of the watershed surrounding the Site in an attempt to develop a large-scale model of the Railroad Creek watershed. The latter four models were smaller-scale models (referred to as "telescoped models") focused on groundwater flow in the vicinity and downstream of Holden Mine Site contaminant sources (e.g., Lower West Area; East and West Waste Rock Piles; Tailings Piles 1, 2, and 3).

Based on the Agencies' review, the regional groundwater model was ultimately unsuccessful given the constraints of the modeling performed. However, the regional model was not significant to developing the telescoped models of existing conditions or the Alternative 13M models and, thus, revision of this model is not necessary for assessment of Alternative 13M.

The four telescoped models provide reasonable approximations of groundwater flow conditions in the vicinity of the Site features (i.e., west of the eastern boundary of Tailings Pile 3 to include the Lower West Area) and appear adequate to evaluate remedy components west of Copper Creek. However, the Agencies have concerns regarding use of the models for predicting both the fate and quantity of groundwater originating from the Tailings Piles 2 and 3 areas that flows to the east. Intalco suggests that the groundwater sampling and modeling indicate impacted groundwater above proposed cleanup levels is not discharging to Railroad Creek and natural attenuation of impacted groundwater is occurring before discharging to Railroad Creek downstream of Tailings Pile 3. The Agencies do not agree that natural attenuation and protectiveness of Railroad Creek has been demonstrated by the available field data and groundwater modeling.

The following comments are organized into categories of areas of concern with respect to hydrogeologic issues that came out of the review of Appendix E. The categories/comments are presented in order of generally the most to least critical as interpreted by the Agencies.

E1. Natural Attenuation

Intalco presents data from the DS-3 and DS-4 well pairs as evidence that *"the concentrations decline substantially with distance from the source area"* and also states that the absence of detectable concentrations in DS-9S and DS-9D indicate that natural attenuation is occurring. While Intalco later indicates that concentrations of PCOCs measured in DS-9I exceed potential ARARs for

cadmium, copper, zinc, aluminum, and iron, Intalco fails to address these data as indicating natural attenuation may not be occurring along some preferential pathways. Intalco only surmises that groundwater exceeding potential ARARs is not discharging to Railroad Creek at an unspecified location east of the tailings piles. Further, Intalco conjectures, based on DS-10 data, that the contaminated groundwater in the preferential pathway is either naturally attenuated or discharges to Railroad Creek upstream of DS-10 (at an unknown concentration).

Intalco has not demonstrated that natural attenuation of contaminated groundwater east of Copper Creek is preventing, or will prevent, the discharge of groundwater with COC concentrations above potential ARARs to surface waters.

Along with other requirements (e.g., source control to the maximum extent practicable), Ecology expects that natural attenuation of hazardous substances may be appropriate at sites where there is evidence that natural biodegradation or chemical degradation is occurring and will continue to occur at a reasonable rate at the site [WAC 173-340-370(7)(c)]. The Alternative 13M Report does not provide any analysis to address this expectation.

E2. Particle Tracking

Page E3-10, Section E-3.3.4: The particle tracking analysis for both the low and high flow cases presented by Intalco, as well as additional checks performed by the Agencies, indicate a large component of groundwater flows to the eastern boundary of the model in an area north of Railroad Creek. This preferential groundwater flow pattern likely occurs because the lowest heads along the eastern boundary of the model are assigned to this area north of Railroad Creek. However, this area is topographically higher than Railroad Creek, and there is no field evidence to support the lowest hydraulic heads being located north of Railroad Creek. On the basis of available information, the Agencies consider it more likely that the Railroad Creek channel represents the area with the lowest hydraulic heads, and the current model representation of the area east of Tailings Pile 3 is inaccurate.

E3. Modeled Hydraulic Gradients East of Copper Creek

Page E3-10, Section E-3.3.3.4: Intalco has not demonstrated the model computed hydraulic gradients show a pattern similar to observed hydraulic gradients. The model calibration indicates a geographic bias of vertical gradients with vertical gradients east of Copper Creek underestimated by a factor of approximately five, on average, for the low-flow condition.

Vertical gradients are largely unknown for the high-flow condition, as there is only a single observed vertical gradient value for the entire model domain.

An important area of uncertainty related to the vertical gradients east of Copper Creek is the distribution of high permeability zones in the alluvial hydrogeologic unit downgradient of Tailings Pile 3. While these high-permeability deposits are required to generate downward flow of groundwater in the model to match the groundwater conditions observed in the field, there are no field data to support these interpreted high permeability deposits.

E4. Treatment Pond Leakage

Page E5-5, Section E-5.2: The Alternative 13M model predicts a 0.15 cfs loss during low flow. However, the under-predicted vertical gradients likely bias groundwater flow paths to the shallow portion of the aquifer, suggesting that pond leakage may be significantly greater than predicted by the model.

The Alternative 13M model predicts a net inflow of 0.35 cfs under high flow conditions; however, there are no high-flow vertical gradient observation points to evaluate this prediction.

In order to rely on the groundwater models for predicting treatment pond leakage/inflow, additional field data would be necessary to validate or modify and recalibrate the groundwater with respect to gradients observed in the field. These data and analysis would need to be collected and performed as part of remedial design to support the estimate of treatment pond leakage/inflow.

E5. Barrier Wall and Collection Trench Design West of Copper Creek

The groundwater models should be used to perform sensitivity analysis of the barrier wall and collection trench system (e.g., varying barrier wall permeability) and estimate the effectiveness of the system at containing and collecting contaminated groundwater relative to existing conditions during remedial design. The Agencies note that Intalco's cost estimates include different sections of soil-cement and soil-bentonite barrier wall based on structural considerations; remedial design will need to be address materials selection based on performance requirements to adequately contain impacted groundwater.

E6. Collection Trench Design East of Copper Creek

If the evaluation of the depth and the length of the collection trench east of Copper Creek will rely on model predictions as part of remedial design, this

assessment will need to address the measured versus predicted vertical gradients east of Copper Creek. Similarly, any re-evaluation of groundwater flow rates into and out of the collection ponds done using the model will need to address model under-prediction of vertical gradients.

E7. Comparisons of Portal Drainage and Surface Water

Page E2-15, Section E-2.3.8.1, first full bullet at the top of page: Intalco indicates water quality at RC-2 appears to be a function of the portal drainage. However, the spring "flush" that drives the increase in metals concentrations at the portal drainage also results in metals increases in seeps that have been measured along Railroad Creek. Elevated concentrations of aluminum, cadmium, copper, and zinc have been measured at the seeps along the tailings piles, indicating that groundwater is a source of these metals. Thus, it is misleading to speak of a decrease in concentrations from P-5 and RC-2 and would be more appropriate to compare RC-4 (upstream of the tailings and downstream of P-5) to RC-2. Based on this comparison, aluminum and zinc increases or remain the same between RC-4 and RC-2; cadmium and copper are similar or decrease between RC-4 and RC-2.

E8. Groundwater Heads Above Ground Surface in Model

Page E3-9, Section E-3.3.3.3: The discussion of model head calibration focuses on head targets and does not address the many model cells where groundwater is calculated to be above the ground surface. The areas where heads are calculated above ground surface and their effect on remedy evaluations should be addressed if the model will be relied upon for remedial design.

E9. Tailings Pile Infiltration

Section E 5.1.5: The 30 percent reduction in infiltration through the tailings piles is based on an estimated cover permeability of 1 $x10^{-4}$ cm/sec used in the HELP model (Attachment E6). This permeability seems low for the proposed soil cover (described variously as silty sand or soil/gravel) and will need to be verified during remedial design.

E10. Sludge Landfills and HELP Modeling

Figure 4E4-1: Remedial components 5 and 17 describe construction of landfills on top of the tailing piles for disposal of contaminated sediments (soils) and water treatment sludge. If these landfills will require under- and over-liner systems, these liners should be integrated into the HELP model evaluation during

remedial design. Intalco has not adequately addressed the question of whether geomembranes will be required for liners or covers to satisfy ARARs.

E11. Baseflow Discharge

Page E2-3, Section E-2.2.2.2: Linking minimum discharge during low-flow conditions to stream baseflow discharge is misleading since baseflow discharge can vary seasonally.

E12. Hydrostratigraphic Units from Pumping Tests

Table E2-3: The subdivisions based on hydrostratigraphic units from the pumping tests are misleading. The pumping wells were all completed in the alluvium, but, in some cases, the observation wells are screened in a different hydrostratigraphic unit.

The Cooper-Jacob method assumes a homogenous aquifer; therefore, it may not be valid to estimate the hydraulic conductivity for a well completed in an entirely different hydrostratigraphic unit. For example, the hydraulic conductivity estimates from the slug tests conducted in TP1-1D are different than the hydraulic conductivity estimated based on the pumping test. The rationale for selecting hydraulic conductivity values and assigning hydraulic conductivity values to model cells would need to be verified if the groundwater models are used to support remedial design.

E13. Modeled Copper Creek - Railroad Creek Connection

Copper Creek is not connected to Railroad Creek in the modeled remedial scenarios. Although the absence of a connection may not significantly impact model results, the connection should be modeled to maintain accuracy of the model representations, if the models will be used during remedial design.

E14. Hydraulic Conductivities from Field Tests

Attachment E1, Table 1: The hydraulic conductivities based on the pumping wells are less than the hydraulic conductivity from the observation wells. This implies the formation is very heterogeneous and/or that the analytical method was misapplied.

The estimates of hydraulic conductivity are higher for the pumping test than the corresponding slug tests for DS-6D, DS-6S, and DS-7S. This inconsistency suggests the estimates of hydraulic conductivity may be unreliable, and this would need to be addressed as part of remedial design.

The aquifer thickness for DS-6S, DS-7S, and DS-6D used in the pumping test is the not the same value as used in the slug tests. This inconsistency suggests the estimates of hydraulic conductivity may be unreliable, and this would need to be addressed as part of remedial design.

APPENDIX F: DRAFT SUPPLEMENTAL HUMAN HEALTH EVALUATION FOR THE TAILINGS AND WASTE ROCK PILES

The Agencies have the following general comments on *Holden Mine Alternative Remedy Components Evaluation, Appendix F: Draft Supplemental Human Health Risk Evaluation for Tailings and Waste Rock Piles* (URS 2009e). Additional comments are provided in a letter from Ecology (2010c) and included as Attachment 1 to this document.

F1. Intalco's Request to Perform Additional Work

General Comment: There are several instances where Intalco suggests that data collected in 2008 were requested by the Agencies. The Agencies' March 11, 2008, letter approved Intalco's request to collect additional Site data and perform additional analyses to support the consideration of alternative remediation components proposed by Intalco.

F2. Characterization Language

General Comment: The Agencies note numerous instances in this Appendix where Intalco has used certain characterizations that, individually or taken as a whole, may give the impression that certain remedial actions, cleanup requirements, or the cleanup decision process as a whole may be overly cautious or unnecessarily protective. For example, the characterization of hazardous substance concentrations in the tailings as "limited exceedances of MTCA cleanup levels" or identification of hazardous substances that exceed CULs as "potential" constituents of concern (e.g., see Section 1.0). The Agencies have not commented individually on all of these types of characterizations where they do not affect the remedy selection process, but note that the Agencies do not necessarily concur with such characterizations.

F3. Depth of Characterization with Respect to Existing and Proposed Grades

Intalco evaluated concentrations of hazardous substances in the tailings and waste rock piles based on samples collected at depths less than 16 feet, and more than two-thirds of these samples were collected at depths of 2 feet or less.

Since it appears that no deeper data are available, Intalco has no basis for asserting that concentrations of hazardous substances in these samples are representative of concentrations at greater depths. The Agencies note that hazardous substance concentrations at depth may differ since there has been less oxidation of sulfide minerals than near the surface. Also, the lower portions of the tailings and waste rock piles are likely zones where hazardous substances have accumulated following near-surface leaching, as discussed in Appendix E of the DFFS.

The Agencies note that regrading the slopes of the tailings and waste rock piles to nominal 2H:1V (as contemplated in URS 2009b) will expose materials that currently are as much as 80 feet or more below the existing surfaces of these waste piles (actual depths vary depending on proximity to the existing toe of slope, pile height, and existing slope angle). As a result, the concentrations of hazardous substances that construction workers and, potentially, that long-term maintenance workers would be exposed to, may be different than the concentrations used in Intalco's analyses. Intalco's discussion of conditions above the point of compliance depth for soils should refer to the final ground surface that will result from the remedial action.

F4. Exposure Depth and Human Health Exceedances

The Agencies reject Intalco's assertion in section F-1.1 that samples deeper than six inches did not need to be considered in the DRI risk assessment because there was no reasonably foreseeable exposure at this depth. The Agencies reject Intalco's assertion that "the tailings piles were eliminated as an area of concern for potential human health risks... through the Draft Final Feasibility study (DFFS)(URS 2004) *and subsequent analyses by Intalco and the Agencies*" (italics added). The Agencies noted in comments on the DFFS (Forest Service 2007b) that hazardous substances in the tailings exceeded human health criteria for soil ingestion and dermal contact, and identified these hazardous substances in Table 3 of the SFS.

F5. Errata

Table F2-2 does not provide the information described in the second paragraph of Section F-2.1.12. It appears that the correct table was omitted.

F6. Site Specific Background Data

Table F2-3 does not include the correct background values for arsenic, barium and zinc. Ecology's published regional background concentrations are not applicable where site specific background data are available. As a result, arsenic

is omitted form Intalco's discussion of hazardous substances above screening levels in the tailings piles. Also, the table does not include any arsenic data for the waste rock piles.

F7. Settling Pond Exposures

The Agencies are puzzled by Intalco's statement in the fourth paragraph of Section F-3.0 that long-term maintenance workers may be exposed to hazardous substances during "excavation of the contaminants of the settling pond." Intalco is suggesting that sludge accumulating in the treatment facility settling ponds may be hazardous; this contradicts Intalco's suggestion in Appendix H that the ponds will not need to be lined because they do not contain any hazardous substances. Also there are contradictory statements in this paragraph about the potential for maintenance workers to be exposed to hazardous substances related to maintenance of the East and West Waster Rock Pile covers.

F8. Maintenance Worker Exposures to Tailings and Waste Rock

The Agencies do not accept Intalco's suggestion in section F-5.0 that maintenance workers are only likely to be exposed to surface materials, or that this potential exposure can "conservatively" be represented by samples taken from the top two feet of existing tailings and waste rock surfaces.

APPENDIX G: DRAFT TERRESTRIAL ECOLOGICAL EVALUATION REPORT

The Agencies' provided comments addressing information presented in the *Draft Terrestrial Ecological Evaluation Report* (draft TEE, ERM 2009b)[7] in a letter transmitted to Intalco on May 4, 2009 (Attachment 2 to this document) and discussed these comments with Intalco representatives in a July 29, 2009 teleconference. That letter requested modification to the draft TEE, which Intalco has not done. The draft TEE comments in the attached May 4, 2009 letter shall be construed to modify the draft TEE so that the draft TEE, along with these comments, is part of the FS. Resubmittal of the draft TEE is not needed for the purpose of remedy selection. Intalco has also submitted revised toxicity reference values (TRVs) and ecological indicator soil concentrations (EISCs), as discussed in later comments. The Agencies have used the data Intalco collected

[7] Note the draft TEE is referred to as Appendix G only in the 13M Report (ERM and URS 2009a). The draft TEE was prepared as a completely separate document with its own set of appendices, not to be confused with the 13M Report appendices.

for the draft TEE along with acceptable TRVs to develop proposed soil cleanup levels that are protective of terrestrial receptors, as presented in the ASFS.

APPENDIX H: DRAFT WATER TREATMENT SYSTEM PERFORMANCE EVALUATIONS REPORT

The Agencies' comments provided herein address information presented in the *Draft Water Treatment System Evaluations Report* (ERM and URS 2009b).[8]

Comments provided herein are not intended to be a comprehensive list of questions or issues to be addressed at the feasibility level throughout Appendix H, but highlight questions or concerns of the Agencies that Intalco will need to address during remedial design in order for the Agencies to accept the final design based on current analysis methods. Thus, Agency acceptance of the feasibility of some proposed Alternative 13M water treatment system remedial components does not indicate Agency acceptance of all related preliminary design aspects, if the Agencies selected these components in the Record of Decision for the Site.

None of the Agencies' concerns are believed to be fatal flaws that would result in rejecting the proposed water treatment systems as possible remedy components during remedy selection.

The following comments are organized into categories of areas of concern with respect to issues that came out of the review of Appendix H. The categories/comments are generally presented in order of most to least critical as interpreted by the Agencies.

H1. Compliance with ARARs

While treatment system modeling predicts a significant decrease in PCOC metal concentrations, final concentrations for cadmium, copper, and zinc still exceed water quality criteria. The Agencies understand that water treatment system pilot testing is underway to provide data to better predict treatment system performance. Measures to optimize performance of the treatment system and meet potential ARARs will need to be evaluated as part of remedial design.

[8] Note the Draft Water Treatment System Performance Evaluations Report is only referred to as Appendix H in the 13M Report (ERM and URS 2009). The Draft Water Treatment System Performance Evaluations Report was prepared as a completely separate document with its own set of appendices, not to be confused with the 13M Report appendices.

The Agencies reject Intalco's assertions that some potential approaches to optimization are not practicable because of electric power requirements, as Intalco has not presented any analysis of the power required for different approaches or the feasibility of supplying different amounts of electrical power at the Site.

H2. Biotic Ligand Model

Section 8.2: The Biotic Ligand Model (BLM) is a potential ARAR and will need to be addressed as part of determining cleanup levels at the Holden Mine Site. Comparisons of copper concentrations in treatment system effluent to potential ARARs will need to address the BLM for remedial design.

H3. Treatment System Effluent Evaluations

Table 8-1: Predicted effluent concentrations of cadmium, copper, and zinc from the West Area Treatment System exceed the potential ARARs by factors of approximately 10 to over 100 and should not be discharged to Railroad Creek. The Two-Stage Blended Treatment configuration, which provides secondary treatment for West Area Treatment System effluent, is predicted to significantly decrease concentrations of cadmium, copper, and zinc and is the preferred configuration of the Alternative 13M treatment systems modeled, but is not the system Intalco described in the main Alternative 13M text or included in its cost estimate. While the Two-Stage Blended Treatment configuration still results in predicted concentrations of cadmium, copper, and zinc above potential ARARs, this treatment configuration is predicted to be the most efficient at removing PCOCs from collected and treated groundwater and should be the basis for final design and optimization during remedial action.

H4. Settlement Pond Leakage

Page 26, second paragraph: Intalco estimated that a net loss of water from the ponds to groundwater will occur during low-flow conditions. Intalco should address the point of compliance and discharge criteria for the net loss to groundwater as part of commenting on the Proposed Plan.

H5. Adsorption of Cadmium, Copper, and Zinc

Section 6.1.3.1, second paragraph (and other sections): Intalco indicated that hydrous iron oxide precipitates are responsible for much of the adsorption of PCOC metals. Iron precipitates can occlude other metals but since cadmium, copper, and zinc have a positive charge in solution, they will not be strongly adsorbed because the iron oxide surface also has a positive charge. Methods to

improve adsorption of cadmium, copper, and zinc, which by Intalco's current predictions will exceed potential ARARs in effluent concentrations, will need to be addressed as part of remedial design.

H6. Engineered Wetland

Page 10, first paragraph; Page 13; Page 71, first full paragraph: A constructed wetland is specified for "opportunistic" polishing for additional solids removal from East Area Treatment System Pond effluent. The stability of the precipitated metal hydroxides (i.e., solids) released to the environment will need to be addressed as part of remedial design.

Additionally, Intalco has not clearly explained why differing technologies were proposed for treating the East and West Area Treatment System Pond effluents. For the West Area Treatment System the settling pond effluent is proposed to be filtered using sand media filters, while "opportunistic" polishing in a constructed wetland is proposed for the East Area Treatment System Pond effluent. Intalco indicated that the requirements and methods for filtering/polishing settling pond effluents for proposed treatment systems will be further addressed based on bench and pilot testing. These evaluations will need to be completed in a manner acceptable to the Agencies as part of remedial design.

Intalco also appears to be planning for use of a mixing zone for effluent discharged from the treatment facility east of Tailings Pile 3. Under Washington law, a mixing zone is not available for discharges from groundwater into surface water. Although Intalco has not addressed this directly, the proposed use of wetlands as part of the treatment (polishing step) appears to be a discharge to ground that would subsequently seep into Railroad Creek. Intalco should address this as part of its public comments on the Proposed Plan.

H7. Aquafix Mixing

Page 17, second bullet: It is not clear whether there is sufficient hydraulic gradient (i.e. topographic slope) in the East Area to meet the Aquafix manufacturer's recommendations. This will need to be addressed as part of remedial design.

H8. In-Line Neutralization System

Page 18, second bullet: It is not clear whether a contact time of approximately 30 seconds with the in-line neutralization system (ILS) components will be sufficient for winter conditions at Holden. Additionally, it is not clear whether

enough head would be available to operate an ILS system in the East Area. These items will need to be addressed as part of remedial design.

H9. Rate Constants and Lime Concentration

Section 6.1.2.3, Kinetics Literature Review: It is not clear if the cited studies use excess lime or stoichiometric concentration. If a significant excess of lime is present, reaction rate constants will be pseudo-first order and generally higher than if lime was present at or near stoichiometric concentration. The current proposed lime concentration is near stoichiometric concentration (i.e., only 10 percent above stoichiometric concentration). The reaction rate constants used for remedial design need to be appropriate for the proposed amount of lime addition.

H10. Temperature Effects on Reaction Rates

Intalco states that temperature impacts are not expected to be significant because water temperature only varies from 3 degrees to 12 degrees C. However, in general, chemical reaction rates exhibit a two-fold change for every 10 degree C change in temperature. A more detailed assessment of the effects of temperature on the rate of reaction and the impacts thereof on the treatment systems for the Holden Mine will need to be addressed during remedial design.

H11. Settling Pond Sizing

Page 9, third bullet from bottom: The pond length to width ratio is specified as 2 length (L):1 width (W). The Holden Mine Water Treatability Testing Draft Work Plan (MWH 2009) states that "An aspect ratio in the range of 3:1 to 5:1 (L:W) is common." A pond aspect ratio of 2:1 (L:W) seems low and may increase the potential for short circuiting. This will need to be addressed during remedial design.

H12. pH Adjustment

Page 65, last bullet: Increasing pH is specified as a system modification to improve performance. Remedial design needs to address the potential for resolubilization of aluminum at higher pH. Additionally, while pH adjustments may be desirable to improve metals removal performance, the effluent pH will need to meet the National Pollution Discharge Elimination System (NPDES) criteria. Intalco has not addressed this but may need to as part of optimizing performance of the water treatment system after startup

H13. Surface Water Temperatures

Page 22, first bullet: Intalco states that water temperatures at Holden are not expected to be as low as 3 to 4 degrees Celsius (in contrast to other statements related to reaction rates). However, October 2008 monitoring data for Railroad Creek show a temperature range of 3.3 to 4.5 degrees Celsius (URS 2008). Water temperatures used in remedial design will need to be supported with representative Site data.

H14. Settling Pond Bypassing and Inflow Channels

Page 11, sixth bullet, and Figure 3-4: Intalco specifies bypass channels/piping around each pond to allow for sludge removal. However, Figure 3-4 does not seem to indicate enough gates/weirs to completely isolate each individual pond to allow for water drainage and solids removal. Additionally, there are no gates/weirs shown on the conveyance channel to direct flow into the ponds. Remedial design will need to address how flow will be directed into the ponds and how the ponds will be bypassed for cleaning.

H15. Settling Pond Drainage

Page 13, Section 3.3.3: Intalco indicates the settling ponds will be taken off-line and allowed to drain for sludge removal but does not indicate how the ponds will be drained without risk of loss of contents (5 percent solids is a very thin fluid). This will need to be addressed during remedial design.

H16. Operations and Maintenance

Page 12, Section 3.3.2: Regular and routine operation and maintenance inspections are discussed in this section. The plan for staffing the treatment system and overseeing system operation and maintenance will need to be addressed during remedial design.

H17. Lime Impurities

Page 59, last paragraph: A purity of 94 percent was used for pebble quicklime in the AMD Treat calculations. Remedial design should address what impurities may be present in chemicals added during treatment and how the presence and amount of these impurities will affect treatment system performance and required maintenance.

H18. Errata:

- Page 10, first bullet, and Figures 3-1 and 3-2: It is not clear how many collection trenches are proposed to be constructed in the Lower West Area and along Tailings Pile 1. The text specifies one trench, but Figures 3-1 and 3-2 indicate two parallel trenches, according to how these features are defined in the figure legend. This will need to be clarified during remedial design.

- Page 63, second paragraph: The first sentence should read, "Particles with settling rates *greater* than the treatment system overflow rate..."

- Page 63, second paragraph: It appears that the East and West Area overflow rates have been reversed in the text. The East Area overflow rate should be 8 gpd/ft^2 and the West Area overflow rate should be 21 gpd/ft^2.

APPENDIX I: PRELIMINARY ECOLOGICAL INDICATOR SOIL CONCENTRATIONS

The Agencies understand that the EISCs Intalco provided in Appendix I could be used to establish soil CULs. However, Appendix I did not address all potential constituents of concern or all AOIs. Subsequent to completion of Appendix I, Intalco submitted new TRVs. The Agencies have commented separately on the new TRVs in the following section. The Agencies used the MTCA formula, and acceptable TRVs to calculate proposed soil CULs for the Site, as described in the ASFS and Ecology (2010a). These values will be used for remedy selection.

Additional specific comments are provided in the memorandum from Ecology (2010a), included as Attachment 3 to this document.

DRAFT PROPOSED ALTERNATIVE TOXICITY REFERENCE VALUES REPORTS

The Agencies believe that the application of appropriate alternative toxicity reference values (TRVs) will enhance the cleanup process and appreciate the effort spent on developing alternative TRVs for use at the Holden Mine Site. However, as detailed in the comments below, the Agencies do not agree with all of Intalco's alternative TRVs. The Agencies have the following general comments on the TRVs proposed by Intalco in the Draft Proposed Alternative Toxicity Reference Values Reports (ERM 2009b and 2009c).

Additional specific comments are provided in the memorandum from Ecology (2010b), included as Attachment 4 to this document.

TRV1. Aluminum Alternative TRVs

Alternative TRVs were proposed for aluminum for plants and small mammals. The Agencies appreciate Intalco's acceptance that aluminum is a constituent of concern although it was not identified as such in the draft TEE (ERM 2009a).

TRV2. Aluminum Alternative TRVs for Plants

Intalco's proposed alternative plant TRV for aluminum is 125 mg/kg dry weight (DW) based on a study by Raynal et al. (1990). The origin of this value is unclear since Table 1 of Raynal et al. (1990) shows that 20 percent biomass reductions in red spruce occur at foliar aluminum concentrations ranging from 70 to 250 mg/kg DW. In addition, ERM (2009b) cites Kabata-Pendias (2001) showing that biomass reductions associated with aluminum accumulation in grasses occur at tissue concentrations ranging from 50 to 3,410 mg/kg DW. Macnicol and Beckett (1985) show that upper critical tissue levels range from 20 to 280 mg/kg DW for crop species including grasses and forbs. Since MTCA requires that alternative TRVs obtained from a literature survey shall represent the lowest relevant LOAEL found in the literature survey, a lower plant alternative TRV for aluminum would be appropriate to protect a wider variety of plant taxa. Therefore, the Agencies will use the larger value of a plant tissue TRV of 70 mg/kg DW (corresponding to the lowest site-specific EISC) or the Site-specific background concentration, to derive a soil cleanup level for aluminum that is protective of plants.

TRV3. Plant Tissue Benchmark for Zinc

The origin of the proposed plant tissue benchmark for zinc of 176 mg/kg DW is unclear. Figure 2 of Andrade et al. (2009) shows zinc concentrations in leaves, stems, and roots of jack bean grown in soil at four zinc concentrations (0, 100, 300, and 900 mg/kg), both with and without inoculation with arbuscular mycorrhizal fungi. However, the report does not provide a table of tissue concentrations. Therefore, the Agencies do not accept the proposed plant tissue benchmark for zinc and, therefore, considered both the default MTCA soil concentration of 86 mg/kg and the EPA eco-SSL concentration of 120 mg/kg, to derive soil cleanup levels.

TRV4. Basis for Alternative TRVs for Soil Invertebrates

The proposed alternative TRVs for soil invertebrates for copper and lead are based on studies in which critical body residues (CBRs) were developed for earthworms. Although earthworms are not expected to be present at most AOIs, the Agencies understand that published information on CBRs for other

terrestrial invertebrate taxa is limited. Since earthworms are generally considered a sensitive soil toxicity test species, the Agencies consider Intalco's selection of earthworm CBRs as a surrogate species for other invertebrates to be protective of other terrestrial invertebrate taxa.

TRV5. Alternative TRV for Copper in Invertebrates

The proposed alternate invertebrate TRV for copper (61 mg/kg DW tissue) is based on a laboratory study by Burgos et al. (2005) in which the earthworms (*Lumbricus rubellus*) were exposed to artificial soil spiked with various concentrations of copper for 21 days. At the highest soil copper concentration (200 mg/kg DW) survival was depressed, growth was not adversely affected, and effects on reproduction were equivocal. Ma (2005) also evaluated the effect of copper on *L. rubellus* in the laboratory by exposing worms to two natural soils spiked with varying levels of copper for 28 days. Ma (2005) determined the CBR for survival to be 60 mg/kg DW, which corresponds well with the Burgos et al. (2005) results. However, Ma (2005) determined the CBR for reproduction to be 40 mg/kg DW. Since reproduction appears to be a more sensitive endpoint, it is more appropriate to use the 40 mg/kg DW value from Ma (2005) as the alternative copper TRV for soil invertebrates. Therefore, the Agencies will use the tissue-based copper TRV of 40 mg/kg DW to derive soil cleanup levels protective of soil invertebrates.

TRV6. Alternative TRV for Lead in Invertebrates

The proposed alternative TRV for lead in invertebrates (120 mg/kg DW) is based on a laboratory study by Inouye et al. (2006) in which earthworms (*Eisenia fetida)* were exposed to natural soil spiked with various concentrations of lead. Survival at 28 days was not affected at any soil lead concentration. However, reproduction (assessed as the number of cocoons at 56 days) declined at tissue lead concentrations greater than 41.9 mg/kg wet weight (WW). This value was used to derive the proposed alternative TRV of 120 mg/kg DW tissue by assuming the earthworm moisture content was 65 percent (EPA 1993). There are two problems with this proposed alternative TRV. First, the dry weight conversion is incorrect. EPA (1993) lists the moisture content of earthworms as 84 percent not 65 percent. Second, Inouye et al. (2006) provide an alternate measure of reproduction (i.e., the number of juveniles at 56 days) which is a more sensitive endpoint than the number of cocoons. Inouye et al. (2006) removed all adult worms from the test chambers at 28 days for determination of survival and tissue lead burdens. Test containers were then returned to growth chambers for an additional 28 days after which the number of cocoons and juvenile worms were determined. There were approximately 2.5 times more juveniles than cocoons in the control treatment suggesting that most cocoons

hatched during the 56-day test period (17.8 cocoons versus 45.2 juveniles). Since most of the cocoons appear to have hatched at 56 days, the number of juveniles is a better measure of reproduction. Inouye et al. (2006) showed a significant and consistent decline in the number of juveniles at 56 days beginning at a lead tissue concentration of 14.1 mg/kg WW (converted to 88 mg/kg DW assuming a moisture content of 84 percent). The Agencies will use a tissue-based lead TRV of 88 mg/kg DW to derive soil cleanup levels protective of soil invertebrates.

TRV7. Alternative TRV for Copper in Small Mammals

The proposed small mammal alternative TRV for copper (136 mg/kg) comes from a study by Lecyk et al. (1980) in which mice were exposed to varying concentrations of copper sulfate in food and the effects on reproduction noted. This study is included in the EPA ecological soil screening levels document for copper (EPA 2007d). A review of EPA's mammalian toxicity data for reproduction, growth, and mortality endpoints where only studies that contained both NOAEL and LOAEL data were considered, shows that the proposed alternative TRV of 136 mg/kg is close to the midpoint of the rank-ordered dataset. This dataset contains 31 observations with LOAELs ranging from 6.79 to 47,500 mg/kg/d. MTCA requires that alternative TRVs obtained from a literature survey shall represent the lowest relevant LOAEL found in the literature survey. Since the proposed alternative TRV does not appear to represent the lowest relevant LOAEL, it is unacceptable to the Agencies and the Agencies will use the MTCA default wildlife TRVs to derive soil cleanup levels for copper.

TRV8. Errata/Omissions

Several inconsistencies were noted in hazard quotient tables (Tables A, B, and C, Attachment B (ERM 2009b) and Table 6-1 and 6-2 (ERM 2009c)). For example:

a. Attachment B, Table B, copper, Tailings Pile 3 (ERM 2009c) – the RME tissue concentrations should be 52 mg/kg (see ERM (2009a) Appendix B, Table B18) not 2.1 mg/kg.
b. Attachment B, Table C, shrew, aluminum (ERM 2009c) – HQ for downslope of Honeymoon Heights Waste Rock Piles should be 3.27 not 0.8.
c. Table 6-1 (ERM 2009b) – $HQ_{alt\ tissue}$ should be 0.1, not blank. In addition, rationale for displaying $HQ_{alt\ tissue}$ values is unclear.
d. Table 6-4 (ERM 2009b) – RME_{tissue} for Tailings Pile 3 should be 4 mg/kg, not 52 mg/kg.
e. A general comment on all of the HQ tables is that they do not indicate when a metal was not detected in samples from an AOI. This is relevant

information for making remedial decisions and should have been included in footnotes to indicate when metals were not detected.

INTALCO'S COST ESTIMATES FOR ALTERNATIVES 11 AND 13M

The Agencies' comments provided herein address information presented in Intalco's cost estimate files for Alternatives 11 and 13M that were provided via e-mail on September 4, 2009 (URS 2009f).

Intalco provided the following electronic cost estimate files for the Agencies' review.[9]

- Alt 13M Cost Estimate - 2009 09 04.xls
- Alt 13M Costs Backup - 2009 09 04.xls
- Alt 13M O&M Costs - 2009 09 04.xls
- Agency Alt 11 Costs Backup - 2009 09 04.xls
- Agency Alt 11 O&M Costs - 2009 09 04.xls

The Agencies note there are several instances where Intalco has not explained its assumptions (e.g., CST3 and CST7); has used certain assumptions inconsistently for Alternatives 11 and 13M when there is no reason they should be considered differently (e.g., see comments CST5 and CST14); or has made apparently unreasonable assumptions (e.g., see comments CST10 and CST15). The Agencies have not performed a detailed review of all aspects of Intalco's cost estimates but, instead, focused on elements of Alternative 11 where there are significant differences between Intalco's and the Agencies' estimates, and where there are significant differences between Intalco's estimates for

[9] All files are Intalco's cost estimate files as named by Intalco. For example, "Agency Alt 11" in the file name does not indicate that the file represents the Agencies' cost estimate. In fact, Intalco modified the cost estimate for Alternative 11 originally provided by the Agencies in 2007, based on Intalco's interpretation of Alternative 11 and the newly available information from Intalco's 2008 and 2009 efforts. As Intalco's interpretation of Alternative 11 based on the new information does not match that of the Agencies, the Agencies have prepared their own cost estimates which are presented in Appendix A of the ASFS.

Alternatives 11 and 13M. Some of the differences between the Agencies' and Intalco's estimates are discussed further in Appendix A.

CST1. Units Costs Adjustment

Intalco has inconsistently used the regional (Spokane) unit costs adjustment to national base prices taken from the Means cost estimating guides for some cost elements, and eliminated it other instances. The Agencies believe that a local adjustment for costs derived from national indices should be used consistently. Such use is consistent with published guidelines (Means 2005, etc.), particularly where other elements of the cost estimate specifically address local adjustments to regional prices to consider the remote location of the Site.

CST2. Proposed Quarry Location

Intalco's estimates generally refer to a proposed quarry location at Tenmile Creek, for both Alternatives 11 and 13M. The Agencies note that these costs would need to be adjusted in the event an alternative quarry location is selected as proposed by the Agencies (Lightning Ridge).

CST3. Treatment System Flow Rates

It is unclear where the flow rates used in Intalco's cost estimates came from and, thus, it is unclear if treatment system costs dependent on flow rates were appropriately estimated/scaled from Intalco's previous cost estimate referenced in the cost backup spreadsheets. The Agencies note that flow rates presented in Appendix H (URS 2009f) are based on a preliminary version of the URS groundwater model, and have based the Agencies' estimates on the completed groundwater model, as discussed in Appendices A and D of the ASFS.

CST4. Treatment Pond Site Preparation and Excavation

Intalco's estimates for both Alternatives 11 and 13M include excavation for Site preparation in addition to the excavation for the treatment ponds. The Alternative 13M estimate includes a note "excavation to flatten area before ponds go in," which increases the excavation costs by approximately $390,000. Intalco's estimate of Alternative 11 includes additional excavation for a hillside cut that increases the excavation costs by approximately $240,000. It is unclear what this additional excavation is based on or why it is required before the ponds are excavated. The Alternative 13M treatment facilities sites are located in an area that is essentially flat, and the Alternative 11 treatment facility is located so that the main axis of the system follows existing contours as depicted in Appendix F of the SFS.

CST5. Treatment System Pond Lining

Alternative 13M does not include the cost for lining the treatment ponds, which results in a $656,000 savings over Intalco's estimate for Alternative 11. This represents an example of Intalco's frequent practice of using inconsistent assumptions for costs of similar elements of Alternatives 11 and 13M. The result of this is an apparent lower cost for Alternative 13M that does not take into account real differences in performance compared to another alternative. While omitting pond lining reduces the cost of Alternative 13M, it is not clear that this would satisfy ARARs such as WAC 173-240-130(2)(t) or comply with state or local water quality management plans, as discussed in the ASFS. If Intalco does not believe that pond linings are required, the same assumption should apply to its estimates for both Alternatives 11 and 13M.

CST6. Alternative 13M Sludge Management

It appears that no cost for pumping sludge to a landfill was included for Alternative 13M. Instead, the Alternative 13M cost estimate indicates that treatment ponds will be taken off-line to allow the sludge to consolidate to the degree that it can be excavated and trucked to the landfill. Sludge consolidation is enabled by the absence of a treatment pond liner, allowing water to drain through the base of the pond and into the groundwater. Intalco has not provided any information to demonstrate that there is sufficient time (i.e., in a single summer season) to drain the sludge to achieve the 37 percent solids content Intalco specified as necessary to be able to truck the sludge to the landfill. While Intalco's proposed Alternative 13M sludge management approach may appear to cost less than its estimate for Alternative 11, it is not clear that using unlined treatment ponds and allowing treated water to infiltrate into the groundwater would satisfy ARARs or, as noted above, why Intalco did not use the same approach for both Alternatives 11 and 13M.

CST7. Alternative 11 Sludge Management

Intalco's cost estimate for Alternative 11 refers to a sludge decant pond, but does not explain what this is. It is unclear if Intalco's cost estimate for Alternative 11 includes costs for transferring sludge from the treatment system to the decant ponds or from the decant ponds to the landfill.

CST8. Costs Based on 2005 or 2007 Dollars

The Alternatives 11 and 13M cost backup worksheets indicate that costs are in 2005 dollars. However, the costs from the backup worksheets are entered in the cost column for 2007 dollars on the summary worksheet. It is not clear

whether these summary costs are actually in 2005 or 2007 dollars. Intalco has not explained how it derived the factor used for converting 2005 costs to 2007 dollars.

CST9. Lime Quantity

The source of the lime quantity used in Intalco's estimate for Alternative 11 is not identified.

CST10. Treatment System Equipment Replacement

Intalco assumed an annual cost of $10,000 for Alternative 13M equipment upkeep and does not include any treatment equipment replacement. This is unrealistic since the treatment system will need to operate for hundreds of years, as discussed in the SFS. Intalco did not explain why periodic costs for equipment and infrastructure replacement were not included in Intalco's Alternative 11 and 13M cost estimates. The SFS included an estimate of $1.05 million (net present value) for this cost item for Alternative 11.

CST11. Regulatory Review and Oversight of Treatment System Operation

Intalco did not include costs in Alternatives 11 and 13M for regulatory review and oversight of treatment system operation.

CST12. Tailings Regrading Volumes

It is unclear how Intalco estimated the regrading volumes for their cost estimates from the information provided in the costs backup spreadsheets. The Agencies checked the estimated volumes in the cost estimates based on Intalco's slope stability cross sections and shear key excavation lengths in the costs backup data. The volumes estimated from Intalco's slope stability sections were up to about 75 percent higher or lower than Intalco used for different tailings piles and alternatives.

CST13. Tailings Pile 1 Barrier Wall Setback

Based on a note in Intalco's cost backup, the slope regrading costs for Alternatives 13M and 11 should be the same for Tailings Pile 1, due to setback requirements for barrier wall installation in both alternatives. However, Intalco's costs do not appear to reflect this, and the corresponding Alternative 11 costs for Tailings Pile 1 are approximately 90 percent ($190,000) higher than for 13M.

CST14. Tailings Pile Toe Berm Materials

To improve tailings pile stability, Intalco's Alternative 13M proposes a combination of rock and compacted tailings for a toe berm, whereas Intalco's Alternative 11 toe berm was assumed to be composed only of quarry rock. The unit cost of quarry rock is estimated to be approximately six times more expensive than compacted tailings. Intalco's estimated cost savings of Alternative 13M over Alternative 11 with respect to toe berm materials and construction are thus exaggerated, since the same approach could have been used for both alternatives.

CST15. Tailings Double Handling and Compaction

Intalco's estimate for Alternative 13M tailings pile berm compaction unit costs include haul from Tailings Piles 1 and 3 to the toe berm locations and compaction; while the tailings pile slope regrading unit costs also include haul to the top of Tailings Piles 1 and 3 and compaction. The apparent double handling and compaction costs in the Alternative 13M cost estimate are approximately $1M.

CST16. Compacted Alluvium in Tailings Pile 3 Toe Berm

Alternative 13M costs do not appear to include the compacted alluvium portion of the toe berm Intalco included for geotechnical stability along section G-G' at Tailings Pile 3 (URS 2009b).

CST17. Tailings Pile 3 Toe Berm

There does not appear to be enough room for the compacted alluvium portion of the Alternative 13M toe berm along the majority of Tailings Pile 3 due to the proposed alignment of the relocated Railroad Creek. Thus, Tailings Pile 3 toe berm costs are likely underestimated, as more rock fill and/or compacted tailings will likely be necessary to stabilize the pile where there is insufficient space to use a compacted alluvium portion of the toe berm.

CST18. Geomembrane Cost Differences

Intalco used significantly different unit prices for the landfill geomembranes in Alternatives 11 and 13M with no justification for the cost differences. Among other differences, the Agencies note Intalco's estimate for Alternative 11 was based on an 80 mil HDPE liner, whereas the cost for Alternative 13M was for a 60 mil HDPE liner.

FALL 2009 ADDITIONAL SAMPLING RECOMMENDATIONS

The Fall 2009 Additional Sampling Recommendations memorandum (URS 2009g) consists of a sampling plan covering the sampling and analysis of groundwater and surface water samples in paired well points and staff gages along Railroad Creek downstream from Tailings Pile 3. The memorandum also covers the redevelopment and collection of groundwater samples from monitoring wells at Tailings Piles 2 and 3 that had not been sampled since 1991 or 1995. As stated in the memorandum, a primary purpose of the sampling was to obtain data to support the reliance of Alternative 13M on natural attenuation of groundwater from Tailings Piles 2 and 3.

The memorandum was transmitted to the Forest Service via e-mail after business hours on October 13, 2009. The schedule in the sampling plan indicated that fieldwork had begun a week earlier, on October 7, 2009, and was scheduled to be completed by October 16, 2009. This timing did not give the Agencies an opportunity for meaningful input to the proposed data collection, and does not meet the requirements of paragraphs 38 and 41 of the AOC. The AOC requires written approval by the Remedial Project Manager before additional data collection.

Intalco's sampling memorandum also presented water level and chemistry data for well points, staff gages, and monitoring wells that were sampled during the spring and summer of 2009. At that time, Intalco had not submitted these data in any other document as far as the Agencies are aware, although these data are clearly relevant to Intalco's assertion that there is no risk to surface water quality related to groundwater above proposed CULs downstream of the tailings piles. Additional comments are noted below.

ASR-1. More Hydrogeological Information Needed Downstream of Tailings Pile 3

The Railroad Creek losing/gaining data downstream of Tailings Pile 3 indicates that the groundwater/surface water interaction is hydrogeologically more complex than previously described by Intalco. The data provided confirm that significantly more information is needed to show that a remedy that does not include containment/collection of all impacted groundwater emanating from Tailings Piles 2 and 3 (e.g., Intalco's proposed Alternative 13M) is protective of aquatic organisms.

ASR-2. Conditions at North Versus South Edge of Railroad Creek

Data from SG-2 (the only location where gaining/losing conditions are measured on both the north and south edge of Railroad Creek adjacent to a tailings pile) indicate that the south bank is gaining while the north bank is losing. The rest of the staff gages adjacent to the tailings piles are all on the north side of Railroad Creek and, thus, may not reflect the conditions at the south bank adjacent to the tailings piles or farther downstream. These data indicate that Intalco may not rely on data collected on one side of the creek to draw conclusions as to whether the same gaining or losing conditions are present on the opposite bank or below the bottom of the creek bed.

DRAFT TAILINGS AND WASTE ROCK PILE COVER EVALUATION AND SELECTION

These comments address the *Draft Tailings and Waste Rock Pile Cover Evaluation and Selection* (Cover Report, ERM 2010a). Comments provided herein highlight questions or concerns of the Agencies based on the current document, but are not intended to be a comprehensive list of questions or issues that will need to be addressed during remedial design.

The Cover Report (ERM 2010a) discusses Intalco's most recent recommended cover configuration of 12 inches of soil or a hybrid of soil and amended tailings totaling 12 inches thick, which is different from the cover proposed under Intalco's Alternative 13M (ERM and URS 2009a). The Agencies have commented on the Alternative 13M cover earlier in this document, and have evaluated it as part of Alternative 13M in the ASFS (Forest Service 2010).

As detailed previously in this comment document, the Agencies have numerous comments/questions/concerns regarding the data, analyses, and/or conclusions provided in Intalco's reports preceding and cited in the Cover Report. The following Agencies comments on the Cover Report focus only on new information provided in the Cover Report.

CVR-1. Intalco's Request to Perform Additional Work

There are several instances in the Cover Report where Intalco suggests that additional data collection and evaluations accomplished in 2008 and 2009 were requested by the Agencies. This is incorrect. The Agencies' March 11, 2008, letter (USDA OGC 2008) approved Intalco's request to collect additional Site data and perform additional analyses to support the consideration of alternative remediation components proposed by Intalco.

CVR-2. Performance Objectives and Potential ARARs

The Agencies note that the performance objectives identified in the Cover Report are those identified by Intalco not the Agencies. Intalco's potential ARARs-based performance objectives are focused on the state limited purpose landfill requirements (WAC 173-350-400). As previously stated, the final cover for tailings and waste rock piles also needs to satisfy the requirements of the Forest Plan Standards and Guidelines and other potential ARARs. The Agencies expectations for performance objectives for caps over hazardous substances are presented in Appendix C of the ASFS.

CVR-3. Honeymoon Heights Waste Rock Piles

It is unclear why Intalco omitted the Honeymoon Heights Waste Rock Piles from the Cover Report. The Honeymoon Heights Waste Rock Piles characteristics are similar to the East and West Waste Rock Piles, and information related to covers for the East and West Waste Rock Piles may also be applicable to the Honeymoon Heights Waste Rock Piles.

CVR-4. Human Health Risk

Intalco's assessment of human health risk with respect to its recommended tailings and waste rock pile covers does not account for metals concentrations that exceed MTCA human health-based soil criteria for the protection of groundwater (see ASFS Table 3). Thus, Intalco has not demonstrated that its recommended cover satisfies ARARs for protection of human health.

CVR-5. Ecological Risk

The Cover Report identifies hazard quotients (HQs) greater than 1 for plants on the tailings piles, and for plants and invertebrates on the East and West Waste Rock Piles. This indicates that Intalco has identified metals concentrations exceeding risk-based concentrations protective of these ecological receptors. However, Intalco conjectures that the "weight of available evidence" indicates ecological impacts due to metals concentrations exceeding risk-based protection of ecological receptors are either unlikely, will be minimal, or "might have some potential contributing effect" (although the latter is not explained). The Cover Report also incorrectly indicates that the tailings and waste rock piles pose no risk to wildlife (see Table 14 of the ASFS).

As shown in Table 14 of the ASFS, metals concentrations in the tailings piles and waste rock piles exceed risk based concentrations for the protection of plants,

invertebrates, and wildlife. Intalco has not demonstrated their recommended cover will be protective of plants, invertebrates, and wildlife.

CVR-6. Minimize Infiltration

The Cover Report indicates closure of the tailings piles and the main East and West Waste Rock Piles are expected to reduce infiltration via surface regrading and drainage features. Intalco provided a Hydraulic Evaluation of Landfill Performance (HELP) model for a *different* proposed cover as part of the 13M Report, Appendix E (URS 2009d). However, no further HELP modeling was presented for the new cover recommendations presented in the Cover Report. During final cover design Intalco will need to demonstrate that the cover prevents or minimizes infiltration to prevent generation of significant quantities of groundwater with concentrations of hazardous substances above proposed cleanup levels, which would require collection and treatment. See comments in the previous section (e.g., General Comments on 13M Report) of this comments document related to collection and treatment of groundwater.

CVR-7. Deep-Rooted Plants

The Cover Report appears to focus on identifying native grasses and forbs with shallow root structures in order to demonstrate a 12-inch soil cover would be capable of sustaining native vegetation. The Cover Report also indicates that with a 12-inch soil cover, deeper-rooted plants (e.g., trees and shrubs) will be exposed to tailings and waste rock with metals concentrations above risk-based protection levels for plants. Although Intalco contends that natural recovery would not be prohibited over time, this would not satisfy ARARs or the RAOs for the Site.

Intalco has not demonstrated the recommended 12-inch cover would be protective of native vegetation (including deep-rooted plants), or enable establishment of the indigenous eastside mixed conifer forest habitat at the Site within a reasonable restoration time frame.

CVR-8. Residual PCOCs

Intalco's reference to "residual PCOC concentrations" in the Cover Report is unclear. Intalco has not proposed any cleanup action for the tailings and waste rock such that there would be residual metals concentrations different from the current concentrations in the mine waste, e.g. after treatment. Intalco's use of "residual" seems to imply metals concentrations in the tailings and waste rock are not significant, an unsupported assertion that the Agencies reject. As identified by Intalco in the Cover Report, and summarized in Tables 3 and 14 of

the ASFS, metals concentrations in the tailings and waste rock exceed risk-based levels for the protection of both human health and terrestrial ecological receptors.

CVR-9. Current Conditions

The Cover Report states "data and recent observations of the tailings piles (Appendix A) show that deeper rooted plants are re-establishing under current conditions" and "the significant number of native shrubs and trees currently on the tailings piles suggest that deeper-rooted shrubs and trees would also establish on the tailings piles over time." However, re-establishment of vegetation does not indicate the absence of risk to environmental receptors. The Cover Report also notes the "plants appear healthy and show indications of recent growth" on the tailings piles, but this does not indicate the absence of risk to other types of plants, soil invertebrates, or wildlife.

Intalco's overly general statements do not fully address potential terrestrial ecological risk, a reasonable restoration time frame, or the varied current conditions across the tops of the tailings piles and waste rock piles. The current conditions on the tailings piles are not acceptable for final cover habitat, as indicated by Intalco's recent data collection (i.e. 18 or more years since interim and experimental actions were undertaken on the tailings piles).

CVR-10. Burrowing Depths – Mammals and Invertebrates

While the Cover Report indicates the tailings piles and East and West Waste Rock Piles pose no risk to mammals and minimal risk to soil invertebrates, Table 14 of the ASFS shows metals concentrations in the tailings piles and waste rock piles exceed risk based concentrations for the protection of invertebrates and wildlife. The Cover Report does not address burrowing depths of mammals and invertebrates with respect to the cover thickness (see Appendix C of the ASFS). Numerous species inhabiting the eastside mixed conifer habitat within and/or adjacent to the Holden Mine Site have burrowing depths greater than 12 inches, indicating Intalco's recommended cover may not prevent exposure to metals concentrations exceeding risk-based levels and, thus, may not be protective of terrestrial ecological receptors. Intalco has not demonstrated their recommended cover will be protective of invertebrates and wildlife.

CVR-11. Wildlife Foraging

Intalco's footnote on page A-10, Footnote 17 states that "A 12-inch cover is unlikely to mitigate exposures of deeper-rooted shrubs and trees to underlying tailings and waste rock substrate. However, the findings of the draft TEE

concluded that if root systems were to contact underlying tailings/waste rock, these exposures pose no risk to herbivorous wildlife populations (ERM 2009)." Comments on Intalco's TEE have been previously discussed and are attached to this document (Attachment 2).

CVR-12. Precedent Documents/Sites in WA

Intalco cites four studies in the Cover Report as precedent for Agency acceptance of 12 inch covers in the state of Washington. The Agencies do not necessarily accept these studies as relevant or appropriate, since Intalco has not addressed whether the proposed RAOS or the constituents of concern for these sites are relevant to the Holden Mine Site.

While Intalco indicates the cited "case studies are consistent with the recommended 12-inch cover," the Agencies brief review of these case studies found inconsistencies between the cited case studies, the Cover Report presentation of the case studies, and the Holden Mine Site.

Intalco describes Azurite Mine as having a 12-inch soil cover in the Cover Report text, but shows the total cover thickness was 24 inches in Table A-5. The 24-inch thick cover was confirmed through review of the cited Azurite Mine Action Memorandum (Forest Service 2009a).

Intalco cites Beth Lake Prospect's 8-inch soil cover as a precedent for Holden Mine. However, this cover was for a time-critical removal action focused on eliminating human health risk for one waste rock pile that had significant public use, and may not have been a final cover. Also this is a site where hazardous substance concentrations were substantially similar to background (Forest Service 2009b).

Intalco cites a 12-inch cover for the Longshot Mine. Review of the engineering evaluation/cost analysis (EECA) for the site indicated a 12-inch cover was proposed as a *possible* option if mine waste was relocated to an on-site repository and *if* design analyses indicated this would satisfy the state limited purpose landfill performance standards (WAC 173-350-400); a limited purpose landfill presumptive cover was proposed as a second option. Instead, the recommended alternative proposed placing mine waste in an open mine stope for containment, covering the mine waste with soil, and placing cable netting over the partially filled stope to prevent public access (MSE 2008).

Oriole Mine – The proposed cleanup action for this site included a 12-inch soil cover for human health and eco-risk. The Administrative Record for this site

shows that further investigations are needed into whether a more elaborate water balance cover is needed depending on tests for leachability of metals.

Overall, Intalco's purported summary of relevant and appropriate precedents for similar sites in Washington is incomplete, and does not adequately inform decision-making for selection of a remedy for the Site, which is discussed in the ASFS.

CVR-13. Mine Waste Re-Vegetation Studies

The Cover Report cites multiple mine reclamation studies related to re-vegetation investigations. These studies describe the effects of varying soil cover thicknesses and combinations of soil amendments at other mine reclamation sites, and highlight the importance of designing a cover with an optimal combination of materials, thickness, and amendments based on site specific conditions.

Intalco has provided an informative summary of multiple considerations that will need to be addressed and optimized during remedial design. However, the cited studies do not demonstrate that Intalco's recommended 12-inch cover adequately addresses risk to human health and terrestrial ecological receptors and achieves Site remedial action objectives as suggested by Intalco.

CVR-14. Holden Mine Studies

The Cover Report cites multiple studies investigating re-vegetation experiments on the Holden Mine tailings piles. Most of the cited studies focused on varying soil amendments and their effects on re-vegetation efforts and were not focused on design of optimal covers for the Holden Mine tailings piles.

One study (Scherer and Everett 1998) investigated reforestation with experimental cover configurations and various amendments. Intalco cites the results of the Scherer and Everett (1998) study as "indicating that a 12-inch cover produced more favorable results than amended tailings alone" and showing "increased survival rates in test plots with a 12-inch cover." These characterizations of the Scherer and Everett (1998) study results are misleading. The 12-inch soil cover Intalco refers to is actually clustered layers of log pieces, tree fall, branches, and forest litter over 4 inches of gravel over 12 inches of local forest topsoil over 12 inches of pit run gravel over 18 inches of lime amended tailings (Scherer and Everett 1998; personal communication with N. Day, August

2009).[10] This same study also mentions "relatively poor growth for Douglas-fir is of concern, since the species is a prominent component of the adjacent forest [...] by the fourth season, Sitka alder was the only member of the tree seedlings used here that had produced reproductive structures [...] the application of the concept of soil islands as sites for dispersal onto the tailings is hampered by the infertility/toxicity of the tailings material." Thus, Scherer and Everett (1998) does not appear to support Intalco's recommended cover as suggested in the Cover Report.

CVR-15. Soil Attribute Studies

The Cover Report provides an informative summary of studies on the effects of different soil attribute variables on re-vegetation of tailings and waste rock piles. The information provided indicates grain size, substrate compaction, soil pH, and total organic content all influence plant growth. However, the relative influence of each of these factors has not been addressed for the Holden Mine Site in the Cover Report, and will need to be addressed during remedial design.

CVR-16. Supporting Language

The Cover Report uses language such as plant survival, mitigation and/or reduction of exposure, and not prohibiting natural recovery to support Intalco's recommended cover. While Intalco's statements with such language may be true, Intalco has not demonstrated the recommended cover is an optimal cover design for Site conditions, meets potential ARARs, and is protective of human health and terrestrial ecological receptors.

CVR-17. Majority of Root System in Top 12 Inches

The Cover Report states the "majority of the root systems/"feeder roots" of native grasses and forbs occur within the top 12 inches of soil" and provides a range of selected native grass and forbs with maximum or minimum root depths ranging from 6 inches to 52 inches. While the Cover Report statement may be true that the majority of the root system of native grasses and forbs exists within the top 12 inches, Intalco has not demonstrated the recommended cover will be protective of plants, including the grasses and forbs identified as well as trees

[10] Note Scherer and Everett (1998) appear to show the 12-inch pit run gravel layer in Figure 2 though it is not described in their text. USFS review of the contract and construction drawings (personal communication with N. Day, August 2009) for the vegetated islands indicated the soil islands of the Scherer and Everett (1998) study were constructed as described in this comment document.

and shrubs with deeper root systems that are part of the eastside mixed conifer habitat.

CVR-18. Restorative Plants

The Cover Report references Dodson and Peterson (2009) as a restoration study in eastside mixed conifer forest habitat of the Lake Chelan Drainage following the Deer Point fire. Intalco presumes the seed mix used in the Dodson and Peterson (2009) study exemplifies restorative native vegetation relevant to the Holden tailings and waste rock piles. As noted in the Cover Report, the seed mix is prescribed operationally for some low elevation areas. Dodson and Peterson (2009) indicate the low elevation areas are open ponderosa pine forest type, while mixed conifer was present at the middle to high elevation sites where wheat seeding treatments (not the seed mix referred to in the Cover Report) are operationally prescribed. Additionally, the Dodson and Peterson (2009) study investigated various treatments for erosion control/soil stabilization to aid in the natural recovery of habitat affect by wildfires. While information yielded from the Dodson and Peterson (2009) study may be useful, the study does not represent the conditions of the Holden Mine tailings and waste rock piles.

CVR-19. Remediation Levels (MTCA Language)

The Cover Report refers to remediation levels in the context of MTCA on Page A-4. A remediation level defines the concentration of a hazardous substance above or below which a particular cleanup action component (e.g., soil treatment or containment) will be used [WAC 173-340-355(2)]. Remediation levels are not the same as cleanup levels, which define concentrations above which the contaminated medium must be remediated.

CVR-20. Windblown Tailings Area Observations

On Page A-10 the Cover Report indicates that Intalco infers that shrubs and trees would re-establish on the tailings and waste rock piles with a 12-inch cover, based on observations of eastside mixed conifer forest associated plants being observed in the windblown tailings area. The purported connection that Intalco makes between an established eastside mixed conifer forest habitat impacted with near surface accumulations of windblown tailings and the goal of re-establishing similar habitat over the piles of mine waste using a 12-inch soil cover is unsupported.

CVR-21. Creation of Soil Conditions for Eastside Mixed Conifer Forest Habitat

The Cover Report states "native vegetation observed growing within the experimental re-vegetation test plots atop the tailings piles at the Site suggest that, over time, the root systems of native grasses and forbs are anticipated to create soil conditions favorable for the re-establishment of native shrubs and trees characteristic of EMCF habitat." Intalco has not explained their reasoning for suggesting/anticipating re-vegetation with native grasses and forbs will create soil conditions favorable for re-establishing eastside mixed conifer habitat.

CVR-22. Re-Colonization by Deeper-Rooted Shrubs and Trees

Intalco's assertion in footnotes 6 and 24 that "given the draft TEE finding of no risks to herbivorous wildlife at the tailings/waste rock piles, subsequent re-colonization by deeper-rooted shrubs and trees would be a supported natural by-product of initial re-vegetation of the soil cover" is unsupported. See the Agencies' comments on the draft TEE presented previously in this document. Regardless of Intalco's characterization of potential risk to wildlife, Intalco has not adequately supported its conclusion that re-colonization by deeper-rooted shrubs and tress would be an acceptable by-product of re-vegetating a soil cover.

CVR-23. Geotechnical Analyses of Cover

The Cover Report indicates that analyses show that the soil cover would behave like the underlying tailings and waste rock under seismic conditions and experience minor deformations. However, the geotechnical analyses did not include deformation analyses of the cover; rather, Intalco assumed that the soil cover would behave like the underlying tailings and waste rock (URS 2009b). Additionally, current geotechnical analyses do not address erosion of the soil cover, as indicated in the Cover Report. The *Draft Geotechnical Technical Memorandum* (URS 2009b) indicates that erosion control will be considered during remedial design.

CVR-24. Errata

- On Page 6 Intalco references the USFS Holden Mine Site Cleanup website as supporting a statement regarding plant root depths of native grasses and forbs. This appears to be in error as the USFS Holden Mine Site Cleanup website does not discuss native plant root depths, and, when the statement is repeated on Page A-20, the reference is changed to USFS Fire Effects Information System.

- Table A-8: Data references Zabowski and Everett (1997) but appears to be based on Kramer et al. (1998).

DRAFT TEE SUMMARY MEMO (ERM 2010B)

This January 2010 document, "Terrestrial Ecological Evaluations Summary, Holden Mine Site, Chelan County, Washington" prepared by ERM, is a summary of information presented in previous documents, e.g. the draft TEE (ERM 2008 and ERM 2009a), and the two alternative TRV memos, (ERM 2008b) and ERM (2009c). This document does not present any new information, and also does not address previous Agency comments on the draft TEE or related Intalco documents that were previously submitted. Accordingly, the previous Agency comments presented above on Intalco's TEE and related documents also are applicable to ERM (2010b).

CHEMICAL CONCENTRATIONS AT WELLS TP2-8 AND TP2-11

The Agencies have the following general comment on Intalco's February 10, 2010 Memorandum RE: Chemical Concentrations at Wells TP2-8 and TP2-11 (URS 2010a).

The Agencies disagree with Intalco's position that groundwater samples from monitoring wells screened within the tailings piles (e.g., TP2-8B and TP2-11B) should not be included in calculations to determine representative hazardous substance concentrations in groundwater impacted by the tailings piles. The presence of water in these wells and available pressure transducer data indicates the tailings in these locations were saturated at the time of sampling. There was sufficient water in the well for Intalco to collect a water sample. The water in the saturated tailings is present below the ground surface and as far as can be determined is hydraulically connected to groundwater in the underlying alluvial aquifer. Therefore, the water sampled in these wells is groundwater. The Agencies note that the tailings are the source of hazardous substances in groundwater. Analytical results for samples from wells TP2-8B and TP2-11B should be included in statistical calculations of hazardous substance concentrations in groundwater impacted by the tailings piles.

HYDROGEOLOGY TECHNICAL MEMORANDUM ADDENDUM / CONTINGENT REMEDY

The Agencies have the following initial comments on Intalco's February 24, 2010 Draft Hydrogeology Technical Memorandum Addendum in Context of a Contingent Remedy (URS 2010d). The Agencies may later supplement these comments based on additional review of the information provided.

HTM-1 Downgradient Plume is Inadequately Characterized

The existing data very clearly indicate that impacted groundwater originating from the TP-2 and TP-3 source area discharges into surface water at Railroad Creek above proposed cleanup levels.

The Agencies believe that the groundwater contaminant plume downgradient (to the east) of Tailings Pile 3 is not adequately characterized to support selection of monitored natural attenuation as part of the remedy. Additional information would be needed to adequately delineate both shallow and deeper groundwater contamination and to demonstrate the mechanism by which natural attenuation is occurring.

Intalco identifies water quality data from the well points as being suitable for screening but says that it should not be compared to potential chemical-specific ARARs. The Agencies agree that properly constructed monitoring wells may produce more repeatable water quality results over time, but also believe the well point samples provide a useful indication of groundwater quality as it discharges into Railroad Creek (e.g. SG-9-WP and SG-10-WP). The MTCA specifically allows for use of filtered groundwater samples for compliance monitoring where a properly constructed monitoring well is not able to provide low turbidity water samples [WAC 173-340-720(9)(b)].

The extent of groundwater with hazardous substances above proposed cleanup levels has not been delineated. Additional information, for example, in the form of an expanded monitoring well network, would be needed to delineate both shallow and deeper groundwater contamination downgradient of Tailings Pile 3. A gap of approximately 2.6 miles exists between monitoring wells bounding the plume (DS-9 and DS-10)(Figure 3-13). The shallow groundwater plume is documented to extend approximately 2.8 miles downgradient of TP-3, as far as temporary well point SG-20-WP (Table 3-7, Figure 3-2). The extent of the plume in deeper groundwater is also unknown (Figure 3-13). Additional wells to delineate the plume (horizontally and vertically) may be needed after definition of the areas where groundwater enters Railroad Creek downstream of Tailings

Piles 2 and 3. Well locations could be selected on an iterative basis using the groundwater model to identify gaps in coverage.

Many of the figures interpolate concentrations between sampling stations (Figure 3-12a&b, 4-2a&b, 4-2c, 4-3a&b, 4-4a&b, 4-5a&b). Given the complexity of the Site, it is inappropriate to interpolate linear trends between stations that are separated by thousands of feet or miles. Site characteristics that provide potential to cause variability in Railroad Creek concentrations include seeps, groundwater inputs and losses, chemical reactions causing precipitation, intermittent creek inputs, etc.

Wells should also be located downgradient of DS-9, where shallow impacted groundwater has been sampled, and extend as far downstream as needed to delineate the plume (Figure 6-1). Additional work is also needed to assess the mechanism by which natural attenuation is occurring (see subsequent comments).

HTM-2 Cleanup Action Needs to Address Existing Surface Water Impacts

Elevated surface water concentrations of hazardous substances are observed at the furthest downstream Railroad Creek station RC-3, approximately 8 miles downgradient of TP-3 (Table 3-5 and Figure 13-12a). RC-3 surface water concentrations are greater than the upgradient surface water station RC-6 and exceed surface water criteria for cadmium, copper, and zinc. Intalco's proposed approach would delay for at least ten years cleanup of surface water impacted by groundwater containing hazardous substances released from Tailings Piles 2 and 3.

HTM-3 Points of Compliance

Throughout the memo, justification of the Alternative 13M remedy without the Tailings Piles 2 and 3 groundwater barrier wall and collection system (i.e., the contingency) repeatedly relies on compliance being based on surface water concentration measurements in Railroad Creek. This approach fails to sufficiently recognize exposure pathways to aquatic life (including fish spawning and the benthic community). Upwelling groundwater must meet surface water ARARs at or before it reaches surface water, not only after discharge and mixing.

The MTCA requires a cleanup action include all practical methods of treatment (AKART) prior to approving a conditional point of compliance [WAC 173-340-720(8)(c)].

Under MTCA, the conditional point of compliance must be as close as practicable to the source of hazardous substances [WAC 173-340-720(8)(c)], and no farther away from the source than within surface water as close as technically possible to the point(s) where groundwater flows into the surface water [WAC 173-340-720(8)(d)(i)]. In gaining reaches, the point of compliance at the furthest, might be at the groundwater-surface water interface within the pore water, however as a practical matter Ecology may require compliance monitoring within wells [WAC 173-340-720(8)(e)(i) and WAC 173-340-720(9)(a)]. Samples collected from the bottom of the river channel, as Intalco proposes do not meet this requirement.

Points of compliance should also be established for the groundwater contaminant plume that is not upwelling and continues to migrate through the subsurface.

HTM-4 Groundwater to Surface Water Discharges

Intalco states that in-stream samples indicate that groundwater inputs do not result in a significant effect to surface water quality. There are several problems with this interpretation:

a) There are several locations downgradient of the tailings piles and within the Railroad Creek channel where shallow groundwater contains hazardous substances at concentrations that significantly exceed surface water criteria (Table 3-7). In addition, vertical gradient information indicates that gaining reaches are interspersed throughout the downstream study area where impacted groundwater discharges into surface water. These vertical gradients change seasonally (Figures 3-10a and 3-10b). Surface water exceeds surface water criteria in locations that coincide with contaminated shallow groundwater (Tables 3-5 and 3-7).

b) Intalco's conclusion uses a dilution approach, but Intalco has not fully addressed the MTCA requirements [WAC 173-340-360(2)(g), WAC 173-340-370(6), WAC 173-340-720(8)(d), WAC 173-340-730(6)].

c) Groundwater discharges must also be protective of the benthic community, which Intalco has not addressed. The NRDA analyses prepared by the Agencies (Stratus Consulting 2005) showed significant impacts to the benthic communities in Railroad Creek.

d) Groundwater quantity discharging to surface water and contaminant inputs have not been quantified sufficiently. See subsequent comments on the mass loading analysis.

e) Intalco's analysis of gaining and losing reaches is based on relatively flat gradients (i.e., differences in water levels between paired well points and stream gages that are typically separated by 7 to 40 feet. However, Intalco reports its water level measurements are only accurate to +/-0.25 feet. Much of the data in Table 3-4 is within the uncertainty of the measurements as stated on Page 3-9. A note should be added to the table explaining this, but more important, Intalco should reconsider its approach to provide better accuracy.

HTM-5 Attenuation

Intalco asserts that impacted groundwater will naturally attenuate due to advection and dispersion before discharging into Railroad Creek to the east of Tailings Pile 3. This approach appears to rely entirely on dilution of contaminants.

Ecology expects that natural attenuation of hazardous substances may be appropriate at sites where there is evidence that natural biodegradation or chemical degradation is occurring and will continue to occur at a reasonable rate [WAC 173-340-370(7)(c)]. Results and discussion should be presented to show multiple lines of evidence that support natural attenuation of hazardous substances (primarily metals) at the Site. The information contained in the memorandum does not constitute an adequate demonstration. In addition, there is not sufficient evidence showing that natural attenuation of the groundwater plume would occur within an acceptable timeframe. Finally, some pre-agreed upon form of an attenuation demonstration, including acceptable statistical analyses of results, should accompany the attenuation argument. The scope of the simple regression analysis presented in the Intalco memo is by itself inadequate.

HTM-6 Regression Analysis (Section 3.2.4, Figures 3-15a through 3-15g)

Intalco concludes that the regression analysis presented indicates natural attenuation is occurring. The Agencies have concerns with the regression analysis conclusions for several reasons:

a) The analysis is limited to 5 well cluster locations and does not provide rationale for selection (or elimination) of available well locations and data sets.

b) Some wells and some constituents appear to show trends, but not all wells or all constituents. Insufficient data have been collected to provide reliable

trend plots. Most of the plots that appear to have reasonable coefficients of determination are driven by two clusters of data. For the DS-3 and DS-4 wells it seems there was a drop in concentrations when comparing 2001 data to the recent data, rather than a trend downward. Furthermore, some of the data may be considered outliers if sufficient data were available for a longer term trend analysis (for example, the cadmium concentration in DS-1 for 1997).

c) No discussion or analysis of the source area concentrations was provided.

d) The question has been raised as to whether variability in precipitation has caused fluctuations in groundwater concentrations that are not explained by natural attenuation.

Regression analysis can be an acceptable line of evidence for supporting natural attenuation; however, results should be accompanied by other evaluation methods (see natural attenuation comments). In addition, future regression analyses should be performed on a pre-agreed upon set of wells and data.

HTM-7 Mass Loading Analysis (Section 4.0)

Intalco presents a mass loading analysis and concludes that inputs to surface water from groundwater flowing beneath the Tailings Piles 2 and 3 source area do not present a significant load to Railroad Creek. This analysis is used to support Intalco's recommendation for monitored natural attenuation downgradient of Copper Creek. This section leaves the Agencies with several questions and concerns. The analysis does indicate that source control in the LWA and Tailings Pile 1 areas will reduce mass loading to Railroad Creek to some extent. However, the Agencies cannot rely on the conclusions drawn from this analysis regarding the effectiveness of the remedy options east of Copper Creek (i.e., the contingency vs. monitored natural attenuation) without first addressing the following data gaps and concerns:

a) Appendix A of the 2007 SFS presents a detailed critique of previous mass loading analyses prepared by Intalco. The limitations of mass loading analyses to remedy selection are equally a problem with the 2009 analysis.

b) The mass loading analysis makes numerous simplifying assumptions about load inputs and reduction factors and does not account for groundwater contributions and losses, seeps, intermittent creeks, precipitation of constituents, etc. For example, several in-stream surface water sample locations measured contaminants at concentrations significantly higher than predicted. In addition, calculated surface water loads increase in reaches

downgradient of the tailings piles (e.g., RC-2 to RC-14) (Figure 4-5a and 4-5b). The data indicate that shallow groundwater in these reaches is impacted by the upwelling contaminant plume (Tables 3-5 and 3-7, Figures 3-10a and 3-10b). This information indicates the model has not accounted for all inputs downgradient of the Tailings Pile 1 and LWA remedy area and, therefore, cannot be used to evaluate the effectiveness of individual remedy components as proposed by Intalco.

c) Contributions from the tailings pile source area were reduced over time by applying a time-trend loading ratio. The Agencies have previously commented that source depletion is not an acceptable form of natural attenuation (for example, see footnote no. 4 in the SFS). Intalco has not provided any description of natural geochemical mass reduction processes occurring at the site, how they were verified, or how this loading ratio was estimated. These factors should be eliminated from the loading analyses, unless it can be demonstrated which geochemical processes are occurring at the site and at what rates. Peer-reviewed, published studies at sites with similar conditions may also be relevant.

d) The Agencies have identified lead as a constituent of concern in surface water and in groundwater discharging to surface water; however, this document (URS 2010d) only presents data for aluminum, cadmium, copper, iron, and zinc. An evaluation of surface water quality or of the groundwater-to-surface-water pathway that does not include lead is incomplete.

HTM-8 East Area Treatment System (Section 2.1.5)

Intalco has not presented information to support its proposal to construct unlined ponds as part of the groundwater treatment system. It is not clear that unlined ponds would satisfy ARARs such as WAC 173-240-130(2)(t) or comply with state or local water quality management plans.

HTM-9 2009 Water Quality Results (Section 3.2.4)

a) 2009 Surface Water Stations: It is not clear whether RC-3, RC-10, and RC-15 are located in gaining or losing reaches. Locations for RC-3 and RC-15 are not included in the figures.

b) 2009 Seeps: The Agencies are concerned that Alternative 13M does not include a plan to capture and treat seeps in the vicinity of Tailings Piles 2 and 3 if they continue to flow following the remedial action. Seeps from this area exceed surface water criteria (Table 3-8). In addition, several of these seeps also have significant flow rates (Table 3-1c). This information is not

mentioned within Intalco's memo. An evaluation of how flow rates are expected to be affected once the engineered cap and stormwater diversions are in place was not provided.

HTM-10 Conceptual Site Model (Section 3.2.5)

a) 2nd paragraph: The shallow groundwater contours and pathway are depicted in Figures 3-7a&b and 3-16 seem reasonable. However, deeper groundwater contours (Figure 3-8a) do not necessarily travel flow in the same direction. Additional deep wells may be needed after better definition of where groundwater enters Railroad Creek downstream of Tailings Piles 2 and 3. Intalco concludes that deeper groundwater is also attenuating. See earlier comments on natural attenuation.

b) 2009 Groundwater Monitoring Wells: The piezometric contours shown on Figure 3-16 indicate groundwater flow is more complex than indicated by the simple colored arrow on the figure. The colors suggest shallow groundwater becomes intermediate in depth and then shallow again, and this is not supported by sufficient well data for analysis of vertical gradients. Although Intalco conjectures that thinning of the alluvial layer, and/or shallow bedrock would tend to reverse gradients, this is not adequately supported by groundwater monitoring. Complexity of the hydrogeology in this area is further indicated by Intalco's statement that DS-3S/D, DS-4DD, and DS-4S/D are downgradient of the tailings piles, but DS-9I is further east of these wells and is much more impacted.

c) Intalco states that the losing condition of Tenmile Creek may form a partial or complete hydraulic barrier to down valley groundwater movement. It is not clear what the basis is for inferring that Tenmile Creek is always in a losing condition. It is not a reasonable hydrogeologic assumption that Tenmile Creek forms a complete barrier.

HTM-11 Timing of a Contingency Decision (Section 4.7)

Contingent remedies in and of themselves are not common, as Intalco's own literature review confirms. Alternative 14 (Forest Service 2010) includes a fully penetrating barrier wall. Allowing this wall to be modified or eliminated at a later date based on additional data and information is a demonstration of the Agencies willingness to work with Intalco. Moving forward, the Agencies are interested in exploring what specific parameters, monitoring locations, frequency, and statistical validation of apparent trends, will be necessary for decisions on implementing the contingent remedy.

That said, Intalco's literature survey came across as misleading due to the confusion of two very different concepts – the time period to implement a remedy (which would include remedial design and construction) and a reasonable restoration time frame (the period of time before the site is expected to achieve compliance with cleanup levels). For example, remedial design and construction may take place over 5 years, but the restoration time frame might be 25 or 30 years. Intalco's comparison of the remedy implementation time at Holden Mine with restoration times at other sites blurs the distinction between the two and is not relevant. At other sites, the adequacy of the remedy is evaluated in 5-year cycles through the 5-year review process, and the Agencies do not see a reason to deviate from that for this Site.

After the ROD, any decision to modify the remedy will need to be based on pre-established criteria, agreed upon by both Agencies and Intalco. The justification for modification of the remedy could include, but would not necessarily be limited to, the following:

a) Delineation of the groundwater plume to the east;

b) Clearly defined points of compliance that are able to be monitored, (along with the methods for monitoring, constituents, and frequency);

c) Collection of data that allows for evaluation of cleanup criteria at the appropriate points of compliance;

d) Appropriate data validation (including statistical) that demonstrates acceptable quality of the data for the intended decision; and

e) Demonstration that monitored natural attenuation is protective.

HTM-12 Methods

a) Cadmium method detection limits often exceed the surface water criteria.

b) The Agencies do not agree with Intalco's assertion in Section 3.2.4 that the results from filtered samples collected from the well points are unsuitable for comparison to ARARs, even on a screening-level basis. WAC 173-340-720(9)(b) addresses conditions (e.g., high turbidity) under which it may be appropriate to use filtered results for compliance monitoring.

HTM-13 Effects of Construction on Water Quality (Section 4.5)

Section 4.5. This section is confusing and appears to be at odds with some of the material presented in Appendix E of the DFFS (Analysis and Prediction of Long-Term Attenuation of Metals Loadings, Holden Mine by SRK). Section 4.5 evaluates the effects of regrading the side slopes of the tailings piles (e.g., under Alternative 13M) on water quality. Specifically, the February 24, 2010 memo discusses whether such regrading would cause a "spike" in COC concentrations in groundwater discharging to Railroad Creek and concludes that no such spike would be expected. This conclusion appears to be inconsistent with some of the analyses presented in Appendix E of the DFFS.

Appendix E describes a scenario in which oxidation of freshly deposited tailings in the unsaturated zone, along with infiltration of groundwater, has created "acid fronts" within the tailings piles that have migrated downward through the tailings. When an acid front reaches the water table, typically near the base of the tailings, COCs mobilized by the acidic conditions are released into the groundwater. The rate of downward migration of an acid front is controlled by the ability of oxygen to diffuse into the tailings. The diffusion rate, in turn, depends on the grain size of the tailings and the depth of the front from the tailings surface. A front migrates rapidly through coarser grained material (such as along the margins of the tailings piles) and more slowly through fine-grained tailings (such as in the interior of the piles). A front also migrates more rapidly initially when it is close to the tailings surface, and slows progressively as it migrates deeper.

The modeling presented in the DFFS Appendix E predicts that some acid fronts have already broken through to the water table in areas where tailings are coarse and/or thin (such as along the margins of the tailings piles) while fronts in other areas are predicted break through during the next several decades. The modeling also predicts that acid fronts in some portions of the tailings piles, where the tailings are thick and fine-grained, may not break through for centuries (see Appendix E, Figure 14). The modeling predicts that acid front breakthrough from different areas within Tailings Piles 2 and 3 will cause the loading rates of COCs to groundwater to vary over the next 50 to 80 years before entering a centuries-long period of stability or slow decline. There is sufficient uncertainty in the model predictions that it is not clear whether loading rates would be expected to increase or decrease in the near term. Also, although the predicted overall long term loading rate trend is downward, it is not clear whether loading peaks over the next several decades associated with Tailings Piles 2 and 3 would involve higher or lower loading rates than under current conditions.

Section 4.5 of the February 24, 2010 memo acknowledges that regrading the side slopes of the tailings piles would expose unoxidized sulfide minerals. The text further implies that surface water runoff and shallow interflow might be impacted from contact with this material but that the runoff and interflow would be addressed through BMPs and unspecified drainage controls along the toe of the regraded slopes. However, neither Section 4.5 nor Appendix E addresses the development of acid fronts beneath these newly exposed areas, the rate these fronts would migrate downward until reaching the water table, or the potential impact of this on groundwater and surface water quality.

Section 4.5, page 4-8, first full paragraph, second sentence. This sentence states that Appendix E of the DFFS concludes that releases of COCs from the tailings piles would decrease over time as leaching progresses. Although predicted trends for many COCs over centuries to millennia are downward overall, loading rates for COCs over the next 50 – 80 years are not predicted to exhibit a simple downward trend but instead are predicted to vary. Given the uncertainty over where current conditions fall on the loading curves (see Appendix E, Figure 14), it not possible to say whether releases from the tailings piles are currently in an increasing phase or a decreasing phase.

Section 4.5, first full paragraph on page 4-8, last two sentences. These sentences state that Appendix E of the DFFS (the SRK analysis) explicitly considered the effects of regrading the tailings piles and that the regrading would not affect the leaching of COCs. These statements are misleading because the "regrading" scenario evaluated in Appendix E involves simply grading the top surfaces of the tailings piles (to achieve a 3% slope overall); it did not evaluate the regrading the side slopes of the tailings piles, which would involve depths of excavation of several tens of feet to achieve more stable slope configurations as implied by the context of the rest of Section 4.5.

Section 4.5, first and last paragraphs. These paragraphs state that, although regrading the tailings pile side slopes would not cause spikes in COC loading or water quality, other work conducted within and adjacent to Railroad Creek would result in short-term impacts to surface water and groundwater. The mechanisms and duration of such impacts are not adequately explained.

In summary, the Agencies do not accept Intalco's conclusions that regrading the tailings pile slopes will not cause a short-term increase in the concentration of hazardous substances in groundwater below and adjacent to the tailings piles.

HTM-14 Contingent Remedy Evaluation Period (Section 4.6)

Section 4.6, page 4-11, second full paragraph. The Agencies believe that the groundwater travel time presented in this section may be significantly overestimated for the following reasons:

- The travel time estimate presented in Section 4.6 assumes that the effects of Alternative 13M components (i.e., regrading and installation of tailings pile cover) will not be apparent until groundwater travels from the west site of Tailings Pile 2 to SG-10 (a distance of 4,550 feet). Section 4.6 estimates this travel time to be 2 to 10 years based on a travel distance of 4,550 feet. However, the Agencies note that the relevant travel distance may be significantly shorter than this. First, it would not be necessary for effects to be observed at SG-10 before evidence of the effectiveness of the remedy to be evident. Wells at the eastern margin of Tailings Pile 3 are roughly 1,800 feet closer to the tailings pile sources than SG-10, and observed changes in groundwater quality would be expected to be evident there significantly sooner than Intalco suggests.

- Backward particle tracking using URS's calibrated groundwater model suggests that groundwater immediately east of Tailings Pile 3 is derived primarily from recharge near the center of Tailings Pile 3 and the eastern portion of Tailings Pile 2 (not from the extreme western portion of Tailings Pile 2 as assumed in the calculations in Section 4.6). If the URS model is correct, this would reduce the relevant travel distance by roughly 1,000 feet. Estimates from particle tracking suggest travel times from Tailings Piles 2 and 3 to wells east of Tailings Pile 3 would be on the order of 1 to 3 years.

- The travel time estimate presented in Section 4.6 is based on an assumed hydraulic conductivity range for the alluvial aquifer of 30 to 100 ft/day; this range is derived from URS' groundwater model. However, aquifer tests conducted in the alluvial aquifer suggest a higher range with average values of 73 to 180 feet per day (see Table E2-3 from the Alternative 13M Report). Using the same assumptions for hydraulic gradient and effective porosity as Section 4.6, these higher values would yield an effective groundwater velocity roughly twice as fast.

In summary, the Agencies do not accept Intalco's conclusion that a period of 2 to 10 years would be required to evaluate the effect of the remedy on groundwater quality downgradient of Tailings Piles 2 and 3.

HTM-15 Additional Specific Comments

a) Page 2-4, Section 2.2: Alternative 13M would protect Railroad Creek from contamination sources in the Portal discharge, Lower West Area and Tailing Pile 1. Tailings Piles 2 and 3 will continue to impact groundwater that flows into Railroad Creek downgradient of the realigned reach following implementation of Alternative 13M. Also, ARARs are concentration-based, but the crux of Intalco's argument that it would meet AKART is loading-based.

a) Page 3-8, Section 3.2.3, Vertical Gradients: Intalco notes an upward gradient was observed between wells DS-9I and DS-9D. The data in Table 3-3 indicates an upward gradient was observed in June and July and a downward gradient was observed in October.

b) Page 3-9, Section 3.2.3, Groundwater-Surface Water Interface: The gaining condition at SG-9 in June and July is within the range of uncertainty (±0.25). Thus, as suggested regarding SG-3 in the next paragraph, SG-9 may have been slightly gaining or losing in June and July 2009.

c) Page 3-11, Section 3.2.4: The third complete sentence on the page states "During this spring sampling event, potential ARAR exceedances included cadmium, copper and zinc at all sampled stations downstream of the portal drainage discharge (i.e., RC-4, RC-2, RC-10 and RC-3) and aluminum at RC-2." This phrasing ignores other sources of contamination that discharge into Railroad Creek upstream of the portal drainage.

d) Page 3-15, Section 3.2.5: The Agencies disagree with the last sentence of second paragraph. While the three wells, NRC-3D. DS-4DD, and DS-9D, are screened just above the bedrock contact, it is difficult to say whether they are interconnected such that attenuation is demonstrated when comparing the results. The distances between the wells and the variability in the subsurface geology make it difficult to say whether the screens are sampling the same geologic unit.

e) Page 3-15 to 3-16, Section 3.2.5, Third paragraph: The Agencies note that Railroad Creek *was marginally* gaining to gaining in both July and October 2009. Ten Mile Creek is another factor impacting groundwater and surface water conditions in Railroad Creek downstream of SG-9 and SG-10. The influx of clean water from the Ten Mile Creek drainage would result in dilution of any contaminants entering Railroad Creek.

f) Page 3-16, Section 3.2.5: In bullet #4, the text refers to the model predictions east of Tailings Pile 3. The Agencies note that this area is close to the boundary of the model and the model would not provide a reliable prediction for groundwater flow in the area.

g) Page 4-3, Section 4.2: The memorandum states that "Tailings Pile 1 contributes significantly more aluminum and iron than Tailings Piles 2 and 3 combined." This statement is based on the loading analysis which is limited to the section of Railroad Creek along the Site. Fieldwork in 2008 and 2009 has shown that contamination from the Site continues to impact Railroad Creek further downstream than the loading analysis studied.

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ATTACHMENT 1
ECOLOGY'S REVIEW OF APPENDIX F (DRAFT SUPPLEMENTAL HUMAN HEALTH RISK EVALUATION) OF THE 13M REPORT FOR THE HOLDEN MINE SITE

WASHINGTON STATE Department of Ecology

MEMORANDUM

Date: January 27, 2010

To: Norm Day, Holden Mine Project Manager

From: Valerie Bound, Toxics Cleanup Program Section Manager

Subject: Appendix F – Draft Supplemental Human Health Risk Evaluation

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Thank you for the opportunity to review the July 10, 2009 Draft Supplemental Human Health Risk Evaluation (HHRE) for the Tailings and Waste Rock Piles by URS. This document is found in Appendix F of the Alternative Remedy Components Evaluation. The overall approach to the HHRE appears to be reasonable and thorough; however, Ecology does have a few comments that should be addressed.

1. Section 2 – Evaluation for selecting potential contaminants of concern (PCOCs): Soil analytical results from the tailings and waste rock piles were screened against standard MTCA B soil cleanup levels to determine which contaminants should be retained as PCOCs and evaluated further. The MTCA B soil cleanup level calculations accounted for the ingestion exposure pathway only. Dermal absorption and inhalation of windblown dust are also complete exposure pathways and should be included in cleanup level calculations using MTCA and other modeling techniques. It may be reasonable to assume that the dermal absorption pathway is insignificant; however, Ecology will require additional justification of this assumption.

2. Section 3, FigureF3-1 – Conceptual Site Model: Refer also to Section 2 comment. Without additional information as to why URS assumes the dermal absorption and inhalation pathways to be minor or insignificant, Ecology disagrees and considers them to be complete and significant exposure pathway.

3. Section 4 – Remediation Levels:
    a. Ecology cannot consider the Holden Village and surroundings area to be an industrial area. Therefore, only MTCA Method B methods for unrestricted land use should be used or referenced when calculating modified cleanup levels (or remediation levels) for the reasonable maximum exposure scenarios. However, for maintenance and construction worker, it is reasonable to use some of the Method C default values for adult workers within the Method B calculations (ex. average body weight, exposure duration, averaging time, dermal surface area).
    b. For recreational exposure calculations, the exposure frequency (EF) should be increased to 0.36 (based on 6 months of exposed soil, 6 months of snow cover, and 5 days per week of exposure). The MTCA default EF is 1. URS had proposed an EF of 0.28 (based on 5 months of exposed soil, 7 months of snow cover, and 5 days per week of exposure). For maintenance workers, an EF of 0.36 should also be used. Maintenance

workers will likely be living in the Holden Village area. For construction workers, the EF should be 0.41, based on Intalco's own cost estimate workbook (6 days per week, or 150 days per year).

c. For maintenance workers, the default soil ingestion rate of 200 mg/d should be used.
d. For lead, the blood-lead modeling methods may be a reasonable approach to estimating exposure; however, MTCA Method B methods (similar to those used for copper) should also be compared to soil results. Again, Ecology will require justification for recommendations of remediation level selections.
e. Table F4-1: Please update exposure parameters based on Ecology's comments.

4. Section 5 – Comparison of Remediation Levels with Site Concentrations: The calculated remediation levels are compared to the UCL95 statistic only. All three MTCA statistical comparisons used in Section 2 [and found in WAC 173-340-740(7)(d)]) should be used for this evaluation.

ATTACHMENT 2
AGENCY COMMENTS ON THE MARCH 2009 DRAFT TERRESTRIAL ECOLOGICAL EVALUATION (TEE) REPORT FOR HOLDEN MINE

Agency Comments on the March 2009 Draft Terrestrial Ecological Evaluation (TEE) Report for Holden Mine

INTRODUCTION

The Agencies consider the March 2009 Draft TEE and the previously submitted TEE Data Report (ERM, November 2008) to provide considerable information that has advanced understanding of conditions at the Site and which will upon completion be a useful part of remedy selection. However, the Draft TEE contains a number of areas where the risk assessment approach is not consistent with regulatory requirements, includes some notable errors, and data or calculations presented in ways that are not readily able to be checked for omissions or errors. As a result, the Agencies provide the following comments and requested changes so the document may be used for the purpose of selecting remedial alternative components.

EXPOSURE PATHWAYS

1. Ecology considers both the food ingestion and incidental soil ingestion pathways in the wildlife exposure model, described in Table 749-4, which must be used to establish cleanup levels for wildlife receptors. Consideration of only the food ingestion pathway is valuable in determining the utility of remedial alternatives, which prevent soil ingestion but does not further the primary goal of the TEE, which should be to establish protective cleanup levels.

2. For all AOIs, statements are made that the Conceptual Site Model includes amphibians/reptiles. Figure 7.2 only displays pathways for insectivorous and herbivorous reptiles. Carnivorous snakes, for instance, are not included, and neither are amphibians. The text or the table should be corrected for consistency sake, and to avoid implications that any modeling for these guilds or groups was conducted. These guilds and groups should also be clearly identified in the uncertainty analysis.

SCREENING OF PCOCS

3. The background screening process to select potential constituents of concern (PCOCs) is flawed in several aspects. U.S. EPA recommends that all chemicals with concentrations above risk-based levels should be retained in the baseline risk assessment and that background issues be addressed in risk characterization.[1] This is contrary to text contained in Section 7.2 of the

[1] Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Site. Office of Emergency and Remedial Response, Washington D.C. [Appendix B – Policy Considerations for the Application of Background Data in Risk Assessment and Remedy Selection]. OSWER 9285.7-07P

draft TEE Report that states that U.S. EPA guidance allows for the elimination of chemicals from further quantitative evaluation. MTCA does not contain any specific language on how to conduct background screening from multiple matrices at a site. Therefore, the background screening process used in the Draft TEE Report does not appear to have a regulatory basis of application. The background screening process should be modified as described below in order to more appropriately address exposure and risk.

a. Intalco screened metals in soil and used that result to determine whether the same metals are also PCOCs for tissue samples. If the metal was not identified as a PCOC in soil, Intalco did not identify it as a PCOC in tissues. This process ignores significant differences in metal concentrations in tissue samples between the background areas and various AOIs, and also does not address the effect of differing soil pH on the potential bioavailability and toxicity of the metals (discussed below in comment 3.b.). For example, aluminum is not identified as a PCOC in Tailings Pile 1 (TP-1) based on a comparison of aluminum concentrations in soil at TP-1 and Ecology's published background concentration. However, the TEE Appendix B data show the aluminum exposure point concentrations (EPCs) for conifer tissues are 290 ppm for TP-1 but only 27 ppm for the associated background area. Clearly, aluminum is elevated above background in conifer tissue samples from TP-1. This also was observed for other constituents in plant and invertebrate tissues. Metals in each media should be compared to background independent of whether they are soil PCOCs for each area.

b. WAC 173-340-709(2) states, "For purposes of defining background concentrations, samples shall be collected from areas that have the same basic characteristics as the medium of concern at the site, have not been influenced by releases from the site, and, in the case of natural background concentrations, have not been influenced by releases from other localized human activities." Most of the AOIs do not have the same basic soil characteristics as the background areas, due to a depressed soil pH, which affects the bioavailability of many of the metals. Table 12-5 of the Draft TEE Report lists the median pH values for the AOIs and background areas. The median soil pH for the Eastside Mixed Conifer background is 6.32, whereas the median soil pH for the associated AOIs ranges from 3.73 to 6.27. Typically, low pH was observed in the tailings piles and waste rock piles that have little vegetation. Although other factors such as particle gradation and moisture may contribute to poor plant cover in some areas, lack of vegetation in low pH areas may also be an indicator of phytotoxicity compared to areas with more neutral pH such as Holden Village and the Ballfield Wilderness Boundary Area. The Eastside Riparian Wetland median background soil pH is 6.75, whereas the median soil pH of associated AOIs ranges from 4.06 to 5.82. Comparisons should not be made for AOIs with soil pH appreciably different from background since pH affects bioavailability of metals.

   Metals cannot be excluded as PCOCs where the background comparison criteria are invalid to make those determinations. For example, Intalco erroneously excluded aluminum as a PCOC for all AOIs by comparison to the published background soil concentration even though MTCA's Ecological Indicator Soil Concentration (EISC) for plant toxicity (50 mg/kg)

is based on the soluble form of aluminum and not the total concentration measured by Intalco. The distinction between total and soluble aluminum is crucial, as discussed in U.S. EPA's Eco-SSL for aluminum.[2]

EPA indicates pH provides an indirect but reliable approach for assessing whether soluble aluminum could be present (EPA 2003; OSWER Directive 9285.7-60). The soils samples used by Intalco to calculate natural background for aluminum had pH greater than 5.5, thus these samples do not provide a reasonable basis for determining whether aluminum in soils is a PCOC. Aluminum should be considered as a PCOC where pH is < 5.5, since EPA's Eco SSL indicates it is the soluble form of aluminum that causes plant toxicity (not the total metals concentration measured by Intalco). Soil pH should also be considered in the identification of other metals as PCOCs in soil.

c. Risks to wildlife were not evaluated for those metals that were not identified by the TEE as PCOCs in soil, as previously noted. The Agencies' concern is that this approach appears to have screened out metals whose concentrations in invertebrates or plants could drive risk to wildlife via the ingestion pathway and would result in HQs above 1. Using the example of aluminum described above, the Agencies calculated an HQ of 137 for a weasel from ingestion of aluminum in food spreadsheets provided in the files in Appendix E.1 of the draft TEE, (see following table). This value is calculated in Column S, Table 7-17, "Summary_FoodOnly" tab when the values for aluminum in Column B of all tabs of Table 7-4 are set to "Yes" (identifying the metal as a PCOC). When incidental ingestion of soil is also considered, the combined HQ increases to 733 (hidden Column C of Table 7-13, "Summary" tab).

[2] Aluminum in soil is typically unavailable for biological uptake. However, as the soil pH drops from neutral to acidic conditions, the bioavailability of aluminum increase to a point where it may become toxic. Therefore, rather than using the total soil concentration-based approach for developing an EcoSSL, U.S. EPA used an alternative approach where aluminum's potential toxicity is evaluated using soil pH. The criterion is set at soil pH of below 5.5 at which point aluminum is considered a potential ecological contaminant of concern. The technical basis for this criterion is that the soluble and toxic forms of aluminum are only present in soil under soil pH values of less than 5.5. U.S. EPA's EcoSSL for aluminum is available online at http://www.epa.gov/ecotox/ecossl/.

AOI	HQ for weasel–aluminum (food only)	HQ for weasel–thallium (food only)
Tailings Pile 3 (TP3)	137	5
Tailings Pile 1 (TP1)	133	5
Tailings Pile 2 (TP2)	76	5
Area of Wind-blown Tailings (WBT)	74	2
Holden Village (HV)	56	1
Lower West Area - East (LWA & East)	40	0
Lower West Area - West (LWA & West)	31	0
West Waste Rock Pile (WWRP)	23	1
Honeymoon Heights Waste Rock Piles (HHWRP)	23	0
East Waste Rock Pile (EWRP)	20	1
Areas Downslope of Honeymoon Heights Waste Rock Piles (DSHHWRP)	15	1
Ballfield/Wilderness Boundary Area (BFWBA)	9	0

The preceding table also shows another example (thallium) where HQs exceed 1 for a metal that was screened-out. Thallium was apparently erroneously screened out as a PCOC in soil because Intalco compared its RME in soil to the MTCA EISC of 1 mg/kg; however, this EISC is based only on protection of plants. In Section 8.2, Intalco reported using a thallium TRV of 0.074 mg/kg for assessing risk to mammals based on ORNL, because MTCA does not present EISCs for thallium that are protective of invertebrates or wildlife. MTCA also requires a literature-based value for soil invertebrate TRVs that are not included in Table 749-3, but it appears Intalco did not address this.

Intalco should recalculate risks to wildlife.

d. Barium in TP-1 provides another example of how the background screening process is flawed in assessing PCOCs for different media within an AOI, and this is carried through the AOI-specific risk evaluation. For example, Figure 11.1-1 shows the site-specific risk summary for TP-1. Barium was identified as a PCOC in surface soil, but not in conifer tissues. Therefore, the risk for the mule deer in the conifer category only accounts for exposure from soil ingestion. This background screening process creates a less than transparent framework for the TEE. A preferable process would be to identify a metal as a PCOC for an AOI if it exceeds background in any matrix and then base the risk estimates on the cumulative dose from all matrices. A background comparison could then be made during risk characterization to show the incremental risk above background for the cumulative exposure. This alternative approach simplifies the presentation and interpretation of the risk estimates, and will enhance the Agencies' ability to assess remedial options.

Intalco should recalculate risks to wildlife.

e. Finally, the use of Ecology's[3] Yakima Basin soil background values is not compatible with use of the site-specific natural background data collected by Intalco. Neither MTCA nor the EPA guidance intended that different background values be used to find the maximum possible value to selectively exclude constituents as PCOCs. Intalco collected site-specific background data so that these data would form the basis of background screening (i.e., to distinguish site-related concentrations from non-site-related concentrations [WAC 173-340-709(1)], based on comparison of samples that "have the have the same basic characteristics as the medium of concern at the site" [WAC 173-340-709(2)]. Intalco should rely on the collected site-specific background values (and modify the draft TEE accordingly).

4. Arsenic is identified as a PCOC in waste rock although it was not detected in any waste rock samples; similarly, mercury and thallium are identified as having soil background exposure concentrations although they were not detected. Intalco should provide a table listing all constituents for all AOIs (including BGR and BGMC) that had calculated exposure point concentrations based solely on non-detects.

IDENTIFICATION OF CLEANUP LEVELS

5. Protective, numeric cleanup levels need to be clearly presented in the document for each class of ecological receptors. These cleanup levels along with the supporting data provided in the TEE will be used to select remediation alternatives considering the net environmental benefit of the alternative for each area of the Holden mine site. While calculations of HQs and comparisons to background levels are useful in evaluating remediation action alternatives, cleanup levels protective of plants, soil biota, and wildlife receptors need to be established. Under MTCA, cleanup levels can be established using HQ=1 and natural background levels or values from Table 749-3 (or other protective EISC values). Using this approach, it appears that the areal extent of contamination exceeding cleanup levels to be delineated will be quite large and will include the area of wind-blown tailings. The nature and extent of the contamination exceeding protective cleanup levels need to be clearly defined in the document.

   Potentially higher cleanup levels could be established by using quantitative site-specific field studies as specified in WAC 173-340-7493 (3) (e) or through bioassays. Many areas might be eliminated from further consideration if quantitative field studies or bioassay had been used to establish cleanup levels. Intalco should consider the use of bioassays to definitively assess the toxicity of the wind-blown tailings.

[3] Ecology. 1994. Natural Background Soil Metals Concentration in Washington State. Pub. No. 94-115.

The qualitative field studies that were performed for the TEE do not appear to meet the requirements for setting cleanup levels for either the plant or soil biota communities although they may be considered during remedy section. Information from the qualitative field studies may be used to set cleanup levels only to the extent that it meets the aforementioned MTCA requirements.

6. Cleanup levels are needed for areas that were excluded from the TEE based on prescriptive remedies of removing or capping impacted soils to satisfy WAC 173-340-7491(1)(a and b). The TEE should note that lateral extent of removal and capping in these AOIs will be based on compliance samples at the time of remediation that show concentrations of all PCOCs in remaining soils are below cleanup levels. Furthermore, the TEE should identify the basis used to develop cleanup levels for those AOIs where prescriptive remedies will be implemented, but where biota data were not collected (e.g., Mill, SWRA).

RISK CHARACTERIZATION

7. There is considerable uncertainty in reaching a risk conclusion for plants in cases where HQs are above 1. A significant number of metals have HQs above 1 suggesting potential phytotoxic affects. Some HQs were very high, such as an HQ of 201 for zinc in the LWA East AOI. Intalco's argument that phytotoxic affects are unlikely to occur is based on field observations that the plant communities in AOIs with HQs above 1 do not appear to be adversely affected by the metals, but this is not necessarily a reliable basis for concluding there is not an impact.

    a. The MTCA indicator soil concentrations used to calculate the HQs for plants typically have growth/yield as a toxic endpoint. A reduction in overall growth/yield of perhaps 30 percent could be considered ecologically significant, but it would be difficult to observe that level of effect during the type of episodic field reconnaissance accomplished by Intalco. Intalco attributes the conspicuously limited vegetation on tailings and waste rock piles to characteristics of gradation, total organic carbon, and moisture, but these do not preclude chemical effects.

    b. The use of critical plant tissue levels provides an added line of evidence for evaluating phytotoxic effects of metals at Holden Mine. In addition to many studies reporting critical plant tissue levels for individual metals in various plant species, a number of review papers provide broadly applicable levels.[4] Many of the critical plant tissue studies focus on

[4] Davis, R.D., P.H.T. Beckett, and E. Wollan 1978. Critical levels of twenty potentially toxic elements in young spring barley. Plant and Soil 49: 395-408; Chang A.C., T.C. Granato, and A.L. Page 1992. A methodology for establishing phytoxicity criteria for chromium, copper, nickel, and zinc in agricultural land application of municipal sewage sludge. Journal of Environmental Quality 21: 521-536; Macinol, R.D., and P.H.T. Beckett 1985. Critical tissue concentrations of potentially toxic elements. Plant and Soil 85: 107-129; Kabata-Pendias, A. and H. Pendias 1984. Trace Elements in Soils

agronomic crops, and some of these studies deal with grasses (e.g., barley, wheat, corn) and other species that are suitable surrogates for species at Holden Mine. In addition, some studies are available on native plant species such as coniferous and broadleaf trees that would also serve as suitable surrogates for shrub and tree species at Holden Mine.[5]

8. Intalco should add the use of critical tissue levels as an additional line of evidence to evaluate potential phytotoxic affects of metals. This approach could also eliminate some potential concerns with comparing background soil concentrations to soils in AOIs with significantly different pH values.[6]

9. Calculated HQs indicate that metals cause a risk to soil invertebrates in several AOIs. Several invertebrate HQs are greater than 20 (e.g., copper in HHWRP, DSHHWRP, LWA East, EWRP, and WWRP AOIs). In addition, lead, molybdenum, selenium, and silver HQs exceeded 1 in the LWA East AOI. MTCA does not provide soil invertebrate ISCs for aluminum, barium, molybdenum, silver, or thallium.

10. Intalco used a field survey of invertebrate communities as a line of evidence to suggest that it is unlikely that invertebrates at the site are being adversely affected by metals in soils. This line of evidence, although relevant, is not thoroughly convincing. Although information on critical tissue levels for invertebrates is likely to be fairly limited, Intalco should do a literature search to see whether such information is available. This search should be prioritized on those metals presenting the greatest uncertainties.

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and Plants. CRC Press. Boca Raton, Florida; Beckett, P.H.T. and R.D. Davis 1977. Upper critical levels of toxic elements in Plants. New Phytol. 79:95-106.

[5] Kelly, J.M., M. Schaedle, F.C. Thornton, and J.D. Joslin 1990. Sensitivity of tree seedlings to aluminum: II. Red oak, sugar maple, and European beech. J. Environ. Qual. 19: 172-179; Raynal, D.J., J.D. Joslin, F.C. Thornton, M. Schaedle, and G.S. Henderson 1990. Sensitivity of tree seedlings to aluminum: III. Red spruce and loblolly pine. J. Environ. Qual. 19: 180-187.

[6] MTCA plant ISCs for metals were either set at natural background or the soil screening benchmarks for phytotoxicity provided by Oak Ridge National Laboratory (ORNL, see Efroymson, R.A., et al., 1997. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision. ES/ER/TM-85/R3). ORNL compiled relevant data and rank ordered the lowest observed adverse effect (LOAEL) data from studies conducted in the laboratory, field, and greenhouse. The benchmarks were typically the 20th percentile of the rank ordered LOAEL data and the predominant endpoint was growth/yield. The phytoxicity studies typically applied the metal in a bioavailable form to soil and then grew plants in the soil for a prescribed period of time. The pH of the test soil was noted in the ORNL data summary, when available, and ranged from 3 to 8 for the Holden Mine PCOCs. Although it would be anticipated that tests run on soils with a lower pH would have the lower LOAEL, a review of the ORNL data shows this was not usually the case. Again, the use of critical tissue levels for plants provides a relatively straight forward method to assess the phytotoxic potential of the metals.

EFFECTS TO INDIVIDUALS VERSUS POPULATIONS

11. Ecology defines significant adverse population-level effects as "effects that impair reproduction, growth or survival" of an individual. Text was presented throughout the TEE indicating that these adverse effects on individuals do not constitute population-level effects. These statements are contrary to Ecology's definition and must be removed from the document.

12. In several cases, potential effects within an AOI are dismissed because the size of the habitat is small. Size of habitat patches is far less important ecologically than the quality, connectivity, and location of the patches. Very small habitat patches (e.g., watering holes, mineral licks, snag patches, etc.) can be much more important than the surrounding habitat depending on their character and function. Some habitat patches draw use from a much larger surrounding area, and are critical to the function of the larger area. Size should not be used as a rationale for dismissing potential effects without a discussion of the quality, location, and function of the patch in the context of the larger area, particularly given that the Site is located in the Railroad Creek riparian corridor, which provides habitat connectivity throughout the Railroad Creek valley. Small patches along that corridor may be very important ecologically. Please revise the report accordingly.

13. Throughout the TEE, many references are made regarding effects to individuals versus effects to populations. Effects to individuals should not be dismissed just because there is no discernable effect at the population level since some populations are very large (common species, e.g., the population of mule deer in Eastern Washington). It depends on how rare the species in question is, particularly as to the rarity within Railroad Creek valley, as this area is isolated from other "subpopulations" by the lake, glaciers/deep or persistent snows, rocky peaks, and a lack of vegetation at upper elevations. No inventory has been performed, so we do not know which species are present or how rare they are. The importance of the loss of or exposure of any individuals or group of individuals is difficult to assess if the population level is unknown. The report should be revised, therefore, to identify potential effects to individuals at the site and relate the potential effects to the subpopulations in similar connected habitat within the Railroad Creek valley.

14. Additionally, for Threatened or Endangered Species, assessments are conducted at the individual level to determine potential effects (also see other comments on T&E species). If an action adversely affects an individual or group of individuals, then a potential "take" of the species would occur. Take can result from effects to both habitat suitability and prey availability as these factors influence basic life functions such as feeding, protection from predation, and reproduction. Again, the point is that species assessments should be conducted at the individual level, and the draft report should be revised to address this.

15. Many species (including American Robins) are covered under the Migratory Bird Treaty Act (MBTA) and associated Executive Order. "Take" is defined differently under MBTA. It generally focuses on direct harm to individual birds or bird populations. Harm would include direct lethal

toxic effects or toxic effects that prevent reproduction. Potential "harm" should be described and not dismissed because an entire population is not exterminated. Under the MBTA, Executive Order 13186 (2001), and the associated MOU with the U.S. Fish and Wildlife Service, "effects would be described by the amount of habitat impacted, and, where practicable, projects would be mitigated to reduce the potential for unintentional take." The draft TEE report should be revised to address this issue.

16. Under the National Forest Management Act (NFMA) impacts to wildlife species are assessed via potential changes in populations, not extinctions of populations. As with MTBA, changes in habitat are usually used as a proxy for population changes where it is not possible to assess actual changes in populations. Any modeling, such as TEE analysis, that indicated some individuals of a population would be affected could also be used, and the draft report should be revised to address this issue.

FIELD STUDIES AND SPECIES/HABITAT CHARACTERIZATION

17. The TEE notes that the surveys conducted were cursory walk-through surveys where no plant keying was conducted. This type of survey tends to result in recording dominant species and overlooking cryptic, less common, non-blooming, or seasonally absent species, as well as non-vascular species such as mosses, lichen, and fungi. Many of these less noticeable species are highly sensitive to environmental contamination (e.g., lichen). The "cursory" survey approach was adequate for the intended purpose of identifying the general type and abundance of vegetation at each AOI, but was not anticipated to be used to compare the biodiversity (see "taxa richness" comments page 97) or structural complexity of each AOI. All statements regarding comparisons of species richness/taxa richness must be qualified by the limitations of the survey method.

18. Also, comparing AOIs by relative structural complexity of the plant community is complicated by the disturbance history of the site. Some AOIs have been disturbed by flood, fire, and avalanche; some by mining and/or Holden Village operational activities; and some by multiple causes. There may also be differences in structural complexity that are the result of phytotoxic effects. Because there are so many potential contributing factors, and no direct measures of structural complexity were made, the draft TEE should be revised to state that it is very difficult to rationally assign the differences to disturbance effects (whatever the source) or potential toxicity effects.

19. Page 5 (and elsewhere). Mallory Lenz is quoted numerous times as saying "no threatened or endangered species have been observed at the Holden Mine Site (pers. comm., M. Lenz, Forest Service). On its own, the statement is misleading. While it is true that she personally has not seen a T&E species on the site itself, others have reported T&E species in the immediate vicinity, and suitable habitat for T&E species is present at the Site. Spotted owls are documented just down valley of the Site, and are likely to move through the mine-impacted area. The Site is

potential habitat for spotted owls, lynx, gray wolves, and grizzly bears, and the species are potentially present. The habitat could be occupied at any time, and under ESA the Forest Service analyzes the habitat as occupied unless adequate protocol surveys indicate otherwise. Please revise the text throughout the report accordingly.

20. Page 5. The statement regarding designated critical habitat is misleading. While it is true that there is Designated Critical Habitat for several species in Chelan County, there is none in Railroad Creek valley or at the Site, and Designated Critical Habitat is not a concern in this evaluation.

21. Page 49. (Following another iteration of Mallory Lenz's quote discussed above) there is a statement that "existing plant cover is considered unlikely to provide the necessary refuge habitat to support either resident spotted owls or lynx." While the tailings do not provide "refuge" cover, they do provide for some prey production (particularly snowshoe hare and some smaller animals) and the cover limitations actually aid prey acquisition by the predator. Although the tailings do not offer nesting/denning habitat for the predators, they do offer foraging habitat for predators in close proximity to suitable reproductive habitat elsewhere at the Site. Please revise the text accordingly.

22. It would also be helpful to include a figure that shows the AOIs and the background sampling areas on one map so that relative size could at least be assessed visually. Figure 5-3 shows the AOIs and 1998 background sampling locations but does not specifically delineate the sampled area. Figure 5-3 also refers to Figure 3-B, which was to show the sample locations but is either missing or mislabeled and should be labeled Figure 5-4. Figure 5-4 shows the background sampling locations and in an inset shows their location relative to the AOIs, but doesn't specifically delineate the sample locations.

23. On page 63, the statement that "No small mammal burrows were observed at the east or west waste rock piles during the 2008 field investigation" is somewhat misleading. Small mammals (e.g., pika, Douglas squirrel) were observed moving in and out of gaps in the larger rocks (M. Lenz, July 2009), and some of these gaps may have been burrows. Please revise the text to reflect that small mammals were observed, and that presence of burrows was not investigated.

24. On page 69, the statement that "these waste rock piles are considered to provide marginal refuge/forage habitat and are unlikely to support native mammal populations" continues to build on the notion that no mammals use the waste rock piles. Small mammals were observed using the larger material at the sides and toes of the piles within a few minutes of arrival on each visit. In fact, the waste rock piles are functioning as artificial talus slopes, key habitat for the pika. If the area supports native mammals, it supports at least part of a "native mammal population." Please revise the text accordingly.

25. On page 80, regarding the characterization of the area downslope of the Honeymoon Heights waste rock piles, it is true that the AOI is unlikely to support wildlife populations (or individuals)

characteristic of mid- to late successional eastside riparian wetland habitat and that is because it is in an avalanche chute. It will likely be in a perpetual state of early succession, as are other areas of eastside riparian wetland habitat that are subject to continual disturbance processes such as flood and avalanche. However, its shrubby nature makes it good foraging and hiding habitat for many species. Early successional riparian wetland habitats are important habitats specifically because the disturbance process continually renews the vegetation, which is capable of continual regeneration because of its well watered riparian location. Many species of wildlife (both herbivores and their associated predators) are attracted to these relatively small areas within larger forested landscapes because of the relatively higher productivity of potential forage. In fact, the wolverine, a wildlife species of concern, actually forages for avalanche kill in these types of areas. Wolverines have been reported at the Site. Please revise the text to reflect the importance of this habitat. The footnote that an avalanche chute (or flood zone) background area may be a more representative point of reference is appreciated.

26. On page 97, what is the purpose of the average number of plant taxa/location metric? The implication is that this is intended to be a representation of taxa richness per unit effort, and that it would be used to facilitate richness comparisons among AOIs. However, the highest value (contrary to the statement on page 98, paragraph 2, line 2) happens to be for Tailings Pile 3, where only one location was sampled. This seems unrealistic given that the tailings are poorly vegetated in comparison to virtually any of the other AOIs. To be a reasonable representation of actual species richness, the total area sampled per AOI needs to be included in the metric. The draft TEE report should be revised to address this issue.

27. Additionally, when comparing the Background Mixed Conifer with the wind-blown tailings, one can see that the number of taxa observed was similar, but the average number of taxa/location was well over twice as high for the background area, even though the sampling effort was lower (fewer samples). This finding is in direct conflict with the statement on page 61 that "this AOI (WBT) supports an eastside mixed conifer forest habitat similar to that observed at the background area." The bottom line is that even though there were more sample locations in the WBT than the Mixed Conifer Background Area, the sampling intensity/effort was lower because the WBT is so large an area. In order to make adequate comparisons between AOIs, the level of sampling effort per AOI needs to be standardized, perhaps by ensuring that the number of samples per acre of the AOI is included in the measure. The draft TEE report should be revised to address this issue.

28. Page 103. It should be noted in the uncertainty analysis (perhaps in Section 12.1.4) that vegetation was not randomly sampled and that tissue samples were collected from a "best guess" at plant species most likely to be foraged upon by wildlife. The potential for presence of hyperaccumulators that are browsed upon by wildlife still exists and should be noted as a part of the uncertainty analysis.

29. Page 107. Section 12.3.2 states that "the TRVs are based on earthworms that were not observed at the Site and are not considered to occur at AOIs." Earthworms were observed in

the Wind-blown Tailings Area and in Holden Village by Mallory Lenz and Dana Houkal during the July 7-10, 2008, field reconnaissance. The draft TEE report should be revised to reflect this.

30. Page 107. Regarding amphibians, there is a quote in Section 12.3.3 from Johnson and O'Neil (2001) stating that "eastside mixed conifer forests play a supportive (but not essential) role in species maintenance and viability." The next paragraph in the same reference states that "within Eastside Mixed Conifer Forests, the moister cedar hemlock and grand fir habitat types support the richest amphibian communities because of the damp climate and greater abundance of aquatic habitats." This second statement is clearly more representative of site conditions at Holden, and virtually all of the Eastside Mixed Conifer habitat at the Site is close to water, making it much more important to the species than forested habitats located at a greater distance from water. The draft TEE report should be revised to reflect this.

31. Further in the same paragraph in the TEE is the statement, "At higher elevations, temperatures are generally too cold and the breeding season too short to support diverse amphibian communities in this habitat (Johnson and O'Neil 2001)." This statement applies to elevations higher than Holden where lodgepole pine and subalpine fir dominate the vegetation. At Holden, subalpine fir and lodgepole are two of many conifer species present at the Site. Holden is actually located at a middle elevation that supports wetter habitat than the lower elevations, and warmer habitat than the higher elevations, and supports some of the best amphibian habitat within the drainage. The Washington Gap Analysis (Dvornich et al., 1997) and other relevant amphibian texts (e.g., Leonard et al., 1993) show that Holden offers core habitat for numerous amphibian species, and is well within the habitat limits of both low elevation species, and species such as the Cascades Frog that inhabit higher elevations. The draft TEE report should be revised to reflect this.

32. These same arguments also apply to reptiles, and Holden is not too high an elevation or too cold a forest type to support reptiles. At least three snake and two lizard species could be expected at the Site. The draft TEE report should be revised to address this.

33. Additionally, the Johnson and O'Neil reference describes regional habitat types within the Pacific Northwest, and displays habitat at a very large landscape scale. The intent of the book is not to diminish the value of the habitat at the local level, but rather is intended to aid identification of habitats most likely to support various assemblages of wildlife. The fact is that various reptiles and amphibians are present at Holden and their habitat should be protected. The relative rarity of some of these species makes it more important to protect them, not less important. Please revise the text accordingly.

34. Page 108. The statements on page 107 are intended to support the reasoning that the mixed conifer habitat is not essential to maintenance and viability of amphibian and reptile species, and therefore, the lack of quantitative TEEs for these species is not a data gap. As noted above, the habitat is occupied and, therefore, is of local value, particularly as much of the Chelan Ranger District is drier and amphibians are even rarer in other portions of the district.

Additionally, extrapolations between homeotherms (the birds and mammals) and the poikilotherms (reptiles and amphibians) are, as noted, "tenuous and cautioned" but there is also a problem in extrapolating between terrestrial species, and amphibian species that are both terrestrial and aquatic. The combined effects of both types of exposures could be cumulative, synergistic, or compensatory. Additionally, amphibian diets are generally different than most mammals or birds, except for the insectivores, which generally have the highest mammalian HQs. Given these various uncertainties, it does not seem reasonable to use the mammal and bird findings to conclude that there is little to no impact to reptiles and amphibians in either the mixed conifer forests or their immediately adjacent associated riparian areas. It seems more reasonable to conclude that there is a data gap resulting from the lack of amphibian toxicity data, and the complexity of analyzing impacts to species that have multiple exposures at different life stages. Please modify the text to indicate insufficient toxicity and exposure information on amphibians and reptiles is considered a data gap for both mixed conifer and riparian habitats. Also delete both sentences beginning with "Nonetheless, AOI-specific quantitative TEE analyses..."

35. Page 115. The conclusions regarding amphibians and reptiles are repeated, and again the argument was made that the habitat is too cold and breeding season too short, and that habitat at the site was "supportive" but not essential. In this case, both habitat types were included in the conclusion and this is clearly not the case for riparian habitat, and as described above, should also not be concluded for mixed conifer habitats at this elevation that are in such close proximity to water. Please revise this conclusion in a manner consistent with revisions based on other similar comments.

REMEDY SELECTION

36. The introduction to the Draft TEE states, "The TEE was completed to supplement the Site record concerning remediation components proposed by Intalco for consideration by the Agencies..." The MTCA [WAC 173-340-7490(1)(b)] states that information collected during a TEE "shall be used in developing and evaluating cleanup action alternatives and in selecting a cleanup action" and the Agencies intend the results of the TEE to be used for evaluating and selection of remedy components, regardless of whether they were proposed by Intalco or the Agencies. The Agencies expect Intalco to address deficiencies noted in these comments so that the final TEE can be used for this purpose.

37. As noted in Comments 14, 15, and 16, evaluation of adverse impacts at the individual level, or use of the amount of impacted habitat as a surrogate measure of impacts to individuals of various species of concern, would give a metric for comparing alternatives, including a no action alternative where potential toxic effects persist. Dismissing potential loss of individuals of a population would not be an appropriate project evaluation approach under any of the above laws. The document should be revised to note that these potential ARARs would be considered during remedy selection.

APPARENT ERRORS/OMISSIONS

38. There are a number of apparent errors or omissions in the document as indicated by the following examples. Intalco should correct these errors prior to re-examining the risk calculations, and then provide an updated HQ tabulation for all receptors in all AOIs

- Barium was removed as a PCOC in some tailings piles and waste rock piles based on the statement in Tables C-2, C-8, C-13, C-14, C-29, and C-31 that "RME < Yakima BTV." The Yakima background concentration was listed as 500 mg/kg. The referenced Ecology document, "Natural Background Soil Metals Concentrations in Washington State," does not contain a Yakima background concentration for barium (although it does contain a Spokane area background of 254 mg/kg). This needs to be checked for all soil AOIs.

- In Table C-1, mercury is incorrectly eliminated as a PCOC for TP-1 (0 to 1 foot bgs) on the basis that "RME < EISC." The listed RME for mercury is 0.35 mg/kg, while the listed MTCA EISC is 0.1 mg/kg.

- In Table C-13, selenium is incorrectly eliminated as a PCOC for TP-3 (0 to 1 foot bgs) on the basis that "RME < Yakima BTV." The referenced Ecology document, "Natural Background Soil Metals Concentrations in Washington State," does not contain a Yakima background concentration for selenium. Selenium is eliminated as a PCOC because it passes the WRS and Quantile tests.

- In Table C-14, selenium is incorrectly eliminated as a PCOC for TP-3 (0 to 6 feet bgs) on the basis that "RME < Yakima BTV." The referenced Ecology document, "Natural Background Soil Metals Concentrations in Washington State," does not contain a Yakima background concentration for selenium. Selenium is eliminated as a PCOC because it passes the WRS and Quantile tests.

- In Table C-29, thallium is incorrectly eliminated as a PCOC for West Waste Rock Pile (0 to 6 feet bgs) on the basis that "RME < BTV." The listed BTV is higher than background. However, thallium is eliminated as a PCOC because its concentration is less than the EISC.

- Appendix D. According to Tables 8-3 through 8-6, the final BAF should be the median BAF. However, there are several instances in Appendix D where this is not the case (e.g., Tailings Piles 1, 2, 3 Flat (TPF), molybdenum, final BAF is 0.05, while the median BAF is 3.9). Please correct these inconsistencies. Also, once Appendix D is updated, the values in Tables 8-3 through 8-6 and risk calculations in Appendix E should be updated.

- Appendix E.1; Worksheets 7-7 in the various risk tables. These tables present inconsistent values for soil ingestion rates for wildlife receptors with many values listed as “NA.” Table 8-2 lists specific soil ingestion rates for each receptor, which should be used in Worksheets

7-7. Please ensure that the measured and modeled HQs for wildlife receptors include the proper soil ingestion rates.

39. The Summary of Risk Estimate Tables do not always satisfy simple hand check calculations, and the Risk Estimate Summary Matrix figures (e.g., Figure 11-1.1) do not entirely agree with the Summary of Risk Estimate Tables (e.g., Tables 11.1-3 through 11.1-5) or the text (Section 11.1.4), as indicated by these examples:

    - For TP-1, the shallow- and deep-rooted plant EPC values for zinc are shown as 161 and 4,563 mg/kg, respectively. Dividing these values by the EISC of 86 from Table 7-2 produces HQ values of 1.9 and 53, respectively; whereas Table 11.1-3 shows the HQ for shallow- and deep-rooted plants on TP-1 to be 1.9 and 2, respectively (these values match the values in the CD file TEE_Risk Calc_TP1). Also, the HQ value for zinc shown on Figure 11.1-1 is shown as 91, which does not agree with either the table or the hand check.

    - Table 11.1-3 (and the CD file noted above) shows the HQ for barium on TP-1 is 1.1 for both shallow- and deep-rooted plants; whereas the text and Figure 11.1-1 only show a HQ above 1 for barium for shallow soils. Same problem for molybdenum, the table and CD show HQ = 15 for both shallow- and deep-rooted plants, and copper HQ = 3.0 for both shallow- and deep-rooted plants, whereas the text and figure only show an HQ greater than 1 for shallow-rooted plants for these two metals.

    - For Tailings Pile 2, the EPC for soil invertebrates for zinc is shown in Table 11.1-2 to be 362. Dividing that by the EISC value of 200 (from MTCA, since Table 7-2 only shows the lowest EISC which in this case is for plants) produces an HQ of 1.8, whereas Table 11.1-6 shows a value of 1.4.

    It is somewhat awkward doing these kinds of checks since it is sometimes not clear from the tables which EISC or TRV value was used by Intalco for the risk calculation. For example Table 7-2 and all the tables in Appendix C only show the lowest EISC (e.g., 50 mg/kg for copper for soil biota; whereas a copper value of 100 mg/kg is needed to calculate risk to shallow- and deep-rooted plants).

    Intalco should provide a spreadsheet workbook formatted as a single table for each AOI that shows the EPC value for each metal, all the EISC or TRV values (e.g., plants, soil invertebrates, and wildlife) for each metal, and appropriate background values (MCBG or RBG) for each metal. This will enable the Agencies to make simple comparisons to assess relevant CPOCs and HQ values for each metal for each AOI.

40. The draft TEE text has numerous generalities that might be interpreted to infer acceptance by the Agencies of unsupported qualitative statements by Intalco. For example in Section 11.1 Intalco says:

"Final land uses considered for the tailings piles include: waste water treatment plant sludge disposal site; and emergency evacuation gathering site for Holden Village. As discussed with the Agencies, objectives for habitat and biota with regard to the tailings piles should be compatible with the final land use for these AOIs."

This is problematic because it implies that the Agencies concur with the two limited land use objectives that are listed; and because post-remediation land use as forest habitat (which is very much an Agencies objective) is not included in the list. The TEE should not specify any final land use, which can more properly be addressed in the Feasibility Study.

A second example in the same section is Intalco's conjecture for the tailings piles:

"Existing habitat is considered adequate to provide cover for movement by wildlife."

The Agencies do not necessarily concur with Intalco's assertions of this sort even where the Agencies have not specifically taken exception to each instance of such assertions or implied opinions.

Intalco should remove unsupported assertions and implied opinions from the final TEE report.

41. Section 7.3.1, pg 28. Although most metals are not considered to be volatile (mercury being one exception), potential exposure through inhalation of fugitive dust is considered a complete exposure pathway for wildlife. Please provide justification for not including this pathway in the quantitative exposure and risk evaluation.

42. Appendix E.1; Table 7-8. Please justify the use of the MTCA TRVs for arsenic V (rather than arsenic III) and inorganic mercury (rather than organic mercury). This could be done in footnotes to Table 7-8.

43. The TEE does not provide a rationale for separating the tailings and waste rock piles into multiple sub-units each with its own set of PCOCs and EPCs; and in some instances Intalco found it convenient to group all the tailings data. Intalco should present an acceptable basis for such splitting, or present a single set of PCOCs, EPCs, and HQ values for the tailings piles (not including the Wind-blown Tailings area), and a single set of PCOCs, EPCs, and HQ values for the waste rock piles.

44. Section 7.2, Paragraph 3 of the TEE states that WAC 173-340-703(2)(d) allows chemicals to be screened from further consideration if their concentrations do not exceed background. The TEE's characterization of this section of the MTCA regulation is incomplete. Section 307 also indicates that any elimination is subject to approval by Ecology and lists comparison to background as only one of several factors that must be evaluated in order to eliminate a chemical from further consideration. Other factors that must be considered include the toxicological characteristics of the hazardous substance relative to its concentration, its

tendency to persist in the environment, its mobility in the environment, the thoroughness of testing for the substance, and its frequency of detection. This section of the TEE should address these other factors listed in the regulation.

45. It is not clear whether Intalco accomplished a literature survey to identify toxicity values not shown in MTCA Table 749-3 and 749-5 [e.g., soil biota values for aluminum, or wildlife values for aluminum andsilver (mammals); other than by checking the EPA Eco-SSLs and ORNL data. Intalco should accomplish a literature survey to identify toxicity values where required, and modify the Section 8.2 text.

46. Errata:

- Table 7-2; add EISC and background soil values for arsenic.

- Section 3.2; add mercury to the list of metals elevated with respect to background and the MTCA EISCs.

J:\jobs\476914\revised TEE comments 5.4.9.doc

ATTACHMENT 3
ECOLOGY'S REVIEW OF APPENDIX I (PRELIMINARY ECOLOGICAL INDICATOR SOIL CONCENTRATIONS) OF THE 13M REPORT FOR THE HOLDEN MINE SITE

Memorandum

WASHINGTON STATE DEPARTMENT OF ECOLOGY

Date: 1/22/2010

TO: Norm Day, Holden Mine Project Manager
US Forest Service

FROM: Valerie Bound, Section Manager –Toxics Cleanup Program
Central Regional Office, Yakima

In consultation with key Toxics Cleanup Program staff

David Sternberg, Ecotoxicologist
Policy and Technical Support Unit

Laura Klasner, Project Engineer
Central Regional Office, Yakima

SUBJECT: Review of Appendix I (Preliminary Ecological Indicator Soil Concentrations) of the 13M Report for the Holden Mine Site

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This memo reflects Ecology's official comments on Appendix I. Appendix I is located within the 13M Alternative Report prepared by URS. Ecology appreciates the opportunity to review and comment.

Overall, Ecology is supportive of the general approach used to determine ecological indicator soil concentrations (EISCs) for the Holden Mine Site in Chelan County, WA. The approach is consistent with the previously submitted Site-Specific Terrestrial Ecological Evaluation (TEE) (ERM, March 2009).

Determining hazard quotient (HQ) based soil concentrations using the provided equations is acceptable. However, the specific area use factors (AUFs) used in the equation were not provided. AUFs must be approved in advance by Ecology on a case by case basis.

Although the EISCs presented could have been used to establish soil cleanup levels, that was not done. Also, not all potential constituents of concern or all areas of interest were addressed.

Ecology recognizes that many of the EISCs proposed in Appendix I are based on outdated toxicity references values (TRVs). Subsequent to completion of Appendix I, ERM submitted two additional reports proposing new TRVs. Please see Ecology's memo that comments specifically on the new proposed TRVs.

ATTACHMENT 4
ECOLOGY'S REVIEW OF NEW TOXICITY REFERENCE VALUES (TRVS) FOR COPPER, THALLIUM, ALUMINUM, LEAD, MERCURY, MOLYBDENUM, AND ZINC FOR THE HOLDEN MINE SITE, AS PROPOSED BY ERM IN TWO SUBMITTALS

Memorandum

Date: 2/3/2010

TO: Norm Day, Holden Mine Project Manager
US Forest Service

FROM: Valerie Bound, Section Manager –Toxics Cleanup Program
Central Regional Office, Yakima

In consultation with key Toxics Cleanup Program staff

David Sternberg, Ecotoxicologist
Policy and Technical Support Unit

Laura Klasner, Project Engineer
Central Regional Office, Yakima

SUBJECT: Review of new Toxicity Reference Values (TRVs) for Copper, Thallium, Aluminum, Lead, Mercury, Molybdenum, and Zinc for the Holden Mine Site, as proposed by ERM in 2 submittals

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This memo reflects Ecology's official comments on the documents referenced below. We appreciate the opportunity to review and comment.

- September 2009. Draft Proposed Alternative Toxicity Reference Values for Copper, Thallium, and Aluminum in Support of the Holden Mine Site Terrestrial Ecological Evaluations. ERM. (including toxicity studies referenced)
- November 2009. Draft Proposed Alternative Toxicity Reference Values for Lead, Mercury, Molybdenum, and Zinc in Support of the Holden Mine Site Terrestrial Ecological Evaluations. ERM. (including toxicity studies referenced)

Toxicity Reference Values Used to Calculate Cleanup Levels

Ecology has accepted the majority of the proposed alternative TRVs submitted by ERM for Intalco. However, there are a few notable exceptions (Table 1). ERM proposed alternative plant TRVs for aluminum (*Al*), copper (*Cu*), mercury (*Hg*), molybdenum (*Mo*), lead (*Pb*), thallium (*Tl*), and zinc (*Zn*). Alternative TRVs for *Cu* and *Pb* were also proposed for invertebrates inhabiting the site. In addition, ERM proposed alternative small mammalian wildlife TRVs for *Al, Cu, and Tl*. Ecology concurs with the use of the alternative plant TRVs for *Cu, Hg, Mo, Pb* and *Tl*. However, there was not enough information presented in the Draft Proposed Alternative TRV document (November, 2009) to justify the use of the alternative plant TRV for *Zn*. Also, Ecology has

determined an alternative TRV (70 mg/kg DW) for plants is more appropriate than ERM proposed alternative for *Al*. Similarly, Ecology has determined that ERM's alternative invertebrate TRVs for *Cu* and *Pb* should not be accepted, given that peer-reviewed literature suggesting a TRV of 40 mg/kg/ DW *Cu* is more appropriate for the protection of earthworms (Ma, 2005). Also, an alternative invertebrate TRV of 88 mg/kg DW *Pb* must be used in the calculation of the EISCs for the site based on additional literature (Inouye et al., 2006). A determination was made that the proposed mammalian TRV for *Cu* did not represent the lowest observed adverse effect level (LOAEL) required by MTCA. MTCA TRVs were used to calculate EISCs for the shrew, vole, and robin.

Based on TRVs accepted and approved by Ecology, soil cleanup levels (CULs) have been developed for the protection of terrestrial organisms at the Holden Mine Site. Please see Tables 1 and 2 for accepted and approved terrestrial TRVs and CULs. Final CULs will be determined using these terrestrial CULs, human health CULs, and site-specific background information.

Ecologically Protective Cleanup Levels

Cleanup levels presented in Table 2 of this memo were calculated/selected using procedures consistent with the site-specific Terrestrial Ecological Evaluation (TEE) methods specified in WAC 173-340-7493. The following ecologically protective cleanup levels are based on conditions which currently exist at the Holden Mine site. The cleanup levels have not been changed to reflect natural background concentrations of metals at the site and are not necessarily protective of human health. The selected cleanup levels are protective of the range of potential ecological receptors identified by the resource agencies associated with Holden Mine. Specifically, cleanup levels were chosen that are protective of voles, shrews, hares, robins, deer, and grouse as well as soil invertebrates and plant species. A single cleanup level is provided for each of the nine areas of interest (AOIs) comprising the Holden Mine site. The lowest value determined to be protective of each of species/group was selected as the cleanup level for the area. Where site-specific values were available and evaluated at the site, site-specific cleanup levels were calculated using Ecology's Wildlife Exposure Model for predators (*Equation 1*) and herbivores (*Equation 2*). Cleanup levels that are protective of plants and soil invertebrates found on the site were determined using a combination of values provided in MTCA [Table 749-3, Ecological Indicator Soil Concentrations (EISCs)] and EPA Ecological Soil Screening Level (ECO-SSL) documents. Where site-specific information was available, soil cleanup levels were calculated for invertebrates and plants using the equation provided below (*Equation 3*).

MTCA Wildlife EISC formulas:

Equation 1

$$EISC_{ay} = TRV_{ay}/[(FIR_a \times P_a \times BAF_y)+(SIR_a \times RGAF_y)]$$

Equation 2

$EISC_{ay} = TRV_{ay}/[(FIR_a \times P_a \times K_{Plant})+(SIR_a \times RGAF_y)]$

Plant & Invertebrate EISC formula using tissue-based TRVs

Equation 3
$EISC_{plant\ or\ Invert.} = TRV_{tissue}/BAF_y$

$EISC_{ay}$ = ecological indicator soil concentrations for receptor a & chemical y (mg/kg)

TRV_{ay} = toxicity reference value for receptor a & chemical y (mg/kg/d)

FIR_a = food ingestion rate for receptor a (kg DW/kg BW/d)

P_a = proportion of contaminated food in diet for receptor a (unitless)

BAF_y = bioaccumulation factor for chemical y
different BAF (e.g., K_{plant}) are available for different tissue types (unitless)

SIR_a = soil ingestion rate for receptor a (kg DW/kg BW/d)

$RGAF_y$ = gut absorption factor for chemical y in soil (unitless); assumed to be 1

Procedure for Selection of Ecologically Protective Cleanup Levels

In developing the soil CULs, Ecology relied on the following:

- November 2007. Model Toxics Control Act (MTCA) Statute and Regulation (Chapters 173-340-7490 through 173-340-7494). Ecology Publication No. 94-06.
- EPA's website on Ecological Screening Levels, http://www.epa.gov/ecotox/ecossl/, including the referenced chemical-specific publications

The following hierarchy of criteria was used for selecting cleanup levels within each ecological category (plant, soil invertebrate, or wildlife):

a. Site-Specific EISC: If a site-specific EISC was calculated based on field sampling, this value was considered the most reliable value and selected as a cleanup level.
b. EPA ECO-SSL: Ecology will likely incorporate these values into a future rule, given that they represent a wider body of more recent data than MTCA EISCs. If no site-specific EISC was calculated, then EPA ECO-SSLs (for plants and soil invertebrates only) were the preferred default cleanup level. Because EPA uses

a different wildlife exposure model than MTCA, EPA ECO-SSL values were not used as default wildlife cleanup level.

c. MTCA EISCs: MTCA EISCs were used only in cases where site-specific EISCs or EPA ECO-SSLs were not available.

Once the data was narrowed down to three cleanup levels [one cleanup level protective of each of the three ecological categories (plants, soil invertebrates, and wildlife)], the lowest of the three values was selected as the final risk-based cleanup level protective of terrestrial ecological receptors. Footnotes on Table 2 summarize the origin of the cleanup levels.

Table 1. Approved TRVs

Constituents of Concern (mg/kg)	Proposed plant tissue-based TRVs (mg/kg tissue)(a)	Approved plant tissue-based TRVs (mg/kg tissue)	Proposed soil invertebrate tissue-based TRVs (mg/kg tissue)(a)	Approved soil invertebrate tissue-based TRVs (mg/kg tissue)	Proposed small mammal dose-based TRVs (mg/kg body wt/d)(a)	Approved small mammal dose-based TRVs (mg/kg body wt/d)
Aluminum	125	70			100	100
Arsenic						
Barium						
Cadmium						
Chromium						
Copper	16	16	61	40	136	used MTCA values instead
Lead	35	35	120	88		
Mercury	0.29	0.29			--	
Molybdenum	2.33	2.33			--	
Selenium						
Silver						
Thallium	11	11			0.074	0.074
Zinc	176	used MTCA values instead				

(a) TRVs from the following two reports: September 2009. Draft Proposed Alternative Toxicity Reference Values for Copper, Thallium, and Aluminum in Support of the Holden Mine Site Terrestrial Ecological Evaluations. ERM. & November 2009. Draft Proposed Alternative Toxicity Reference Values for Lead, Mercury, Molybdenum, and Zinc in Support of the Holden Mine Site Terrestrial Ecological Evaluations. ERM.

Table 2. Approved Ecologically Protective Cleanup Levels for the Holden Mine Site

Metal	Tailings Piles	Honeymoon Heights	East & West Waste Rock Piles	Wind-blown Tailings Area	Downslope Honeymoon Heights	Holden Village	Wilderness Boundary/ Ballfield	Lower West Area - West	Lower West Area - East
Aluminum	**4369**	**69**	**69**	**4666**	**4822**	**4571**	**4600**	**4767**	**4694**
Arsenic	**(18)[a]**	**(18)[a]**	**(18)[a]**	**(18)[a]**	**(18)[a]**	**(18)[a]**	**(18)[a]**	**(18)[a]**	**(18)[a]**
Barium	**(330)[b]**	**102**	**102**	**232**	**106**	**131**	**227**	**49**	**122**
Cadmium	**5.5**	**14**	**14**	**9**	**13.5**	**16**	**8**	**5**	**12**
Chromium	**29**	**29**	**29**	**(42)[c]**	**29**	**29**	**29**	**29**	**29**
Copper	**85**	**46**	**46**	**85**	**288**	**112**	**46**	**24**	**39**
Lead	**161**	**118**	**118**	**139**	**201**	**124**	**201**	**201**	**121**
Mercury	**(0.1)[d]**	**(0.1)[d]**	**(0.1)[d]**	**(0.1)[d]**	**(0.1)[d]**	**(0.1)[d]**	**(0.1)[d]**	**(0.1)[d]**	**(0.1)[d]**
Molybdenum	**18.6**	**2.3**	**2.3**	**6.0**	**5.5**	**0.7**	**0.3**	**0.8**	**1.2**
Selenium	**(0.5)[a]**	**0.31**	**0.31**	**(0.5)[a]**	**(0.5)[a]**	**(0.5)[a]**	**0.44**	**(0.5)[a]**	**(0.5)[a]**
Silver	**18.5**	**3.9**	**3.9**	**11.9**	**3.9**	**3.9**	**16.5**	**3.9**	**8.5**
Thallium	**0.02**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**
Zinc	**(120)[b]**	**(120)[b]**	**(120)[b]**	**(120)[b]**	**(120)[b]**	**(120)[b]**	**(120)[b]**	**(120)[b]**	**(120)[b]**

Footnotes:

( ) Parentheses indicate the cleanup level is based on a regulatory value. All other values are based on site specific information.

a Acceptable use of EPA ECO-SSL plant value.

b Acceptable use of EPA ECO-SSL invertebrate value.

c MTCA plant EISC.

d MTCA invertebrate EISC.

e MTCA wildlife EISC.

***** Soil invertebrate values are not available. Therefore, it is unknown whether the final EISC values are protective of soil invertebrates.