

FIVE-YEAR REVIEW REPORT
KENNECOTT NORTH ZONE SUPERFUND SITE

APPENDIX I: COMPLETE TECHNICAL ASSESSMENT

OPERABLE UNIT TECHNICAL ASSESSMENT

OU8 Waste Water Treatment Plant and Sludge Ponds

QUESTION A: Is the remedy functioning as intended by the decision documents?

Yes. The remedy is functioning as intended by the decision documents. However, further action by Kennecott, EPA and UDEQ is necessary to support the long-term protectiveness of the remedy (see Question C).

Remedy elements identified in the decision documents (1996 Action Memorandum and 2002 ROD) are summarized below. An assessment of remedy element functionality is also provided. Under Question C, elements that would maintain the protectiveness of the remedy (that were not included in the September 2002 ROD) are discussed.

1. Removal of WWTP and former Sludge Ponds and covered wastes

The response action was implemented in accordance with the 1996 Action Memorandum. Condition of the footprints for the WWTP and Sludge Ponds B, C and C+ at the time of the April 4, 2013 site inspection demonstrated that the surface soils were predominantly stable and well-vegetated. Recent pipeline construction projects across the footprints of the WWTP and Sludge Pond B caused for the reestablishment of covers and the surfaces are in various stages of revegetation. As noted by review of the post removal data, some soils exceed the Sites' unrestricted land use standard for arsenic (50 mg/kg). Therefore, some of the areas that have had removal actions were backfilled during the initial response work (in some cases with tailings). The depth of cover material (soil, tailings) was approximately 18 inches at the time of response action. After the pipeline projects, Kennecott re-established covers pursuant to the work plans for the Former Sludge Pond B and MAP Pipeline projects. Previous inspections of the footprints that comprise OU8 did not observe soil migration or exposure issues.

2. Groundwater monitoring as required to assess effectiveness of source control measures

The response action was implemented in accordance with the 1996 Action Memorandum. Source control measures implemented during the response action predominantly included the removal of soils, sludge and dike material that had elevated concentrations of arsenic, lead, and selenium, and were also found to be leachable. Groundwater monitoring at OU8 is included in the remedy requirements of OU23.

3. Provision of Maps Documenting Waste Left in Place

The response action was partially implemented in accordance with the September 2002 ROD. Maps were originally produced, but as land ownership did not change, the maps were retained by the current land owner (Kennecott). Kennecott is currently incorporating existing data into its "Contaminated Sites Registry" database and revising existing maps of known waste left in place. See Question C (for OU8) for further information.

QUESTION B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

No. The exposure assumptions are currently not valid. However, the toxicity data, cleanup levels and remedial action objectives used at the time of the remedy selection are still valid.

Exposure Assumptions and Toxicity Data

Cleanup levels set for this site were presented in the September 2002 ROD. These cleanup numbers were derived in the document entitled *Preliminary Remediation Goals for Addressing Risks to Human Health from Exposure to Chemicals in Kennecott Soil* (prepared by EPA, December 1999). Because these documents were developed prior to EPA's RAGS Part F (2009), the exposure assumptions for the inhalation exposure pathway were conducted differently. The exposure metric that was used in the ROD and the PRG document used inhalation concentrations that were based on Ingestion rate and Body weight (mg/kg-day). The updated methodology found in EPA's RAGS part F uses the concentration of chemical in the air, with the exposure metric of $\mu\text{g}/\text{m}^3$. While there is no significant change in cleanup levels, it is important to present the most current methodology that is used for the inhalation pathway. As noted below under Cleanup Levels, EPA and DERR are in the process of re-affirming the risk-based cleanup levels for various land uses at the OUs of the Sites under a decision document.

Human Health

Changes in Exposure Pathways: The September 2002 ROD set cleanup concentrations for arsenic, cadmium, lead and selenium for developed and undeveloped industrial lands. It also established the adequacy of concentrations for these same metals for open space and recreational levels. Lastly, the September 2002 ROD established unrestricted land use standards for arsenic and lead.

However, the September 2002 ROD did not establish residential land use standards for arsenic, cadmium, lead and selenium (it is anticipated that protective concentrations of arsenic and lead would likely drive future response work). Because of their proximity to industrial areas and transportation corridors, OU8 is unlikely to be converted to residential land use in the future. Future response work would have to comply with the unrestricted land use standards for arsenic and lead (unless developed for industrial, recreational or agricultural land use), unless OU-specific residential land use levels were to be established.

Changes in Toxicity, and Other Contaminant Characteristics: There have been no changes in toxicity factors or characteristics for the COCs (including arsenic, cadmium, lead and selenium) that were used to develop cleanup levels.

Changes in Risk Assessment Methods: EPA's Risk Assessment Guidance for Superfund Part F was finalized in 2009. The exposure metric that was used prior to RAGS Part 4 for inhalation concentrations were based on Ingestion rate and Body weight (mg/kg-day). The updated methodology found in EPA's RAGS part F uses the concentration of chemicals in the air, with the exposure metric of $\mu\text{g}/\text{m}^3$.

Expected Progress Toward Meeting RAOs: Past removal actions were effective to achieve cleanup goals to an industrial land use standard. Via such, the RAOs were attained. Inspection

and maintenance requirements for applied covers (soil or engineered caps) were not addressed under the September 2002 ROD. Please refer to Question C for more information.

During the removal actions, two Ponds (Pond A and D) were converted to wetland use. The elimination or containment of soils in the footprints of Sludge Pond A (now Pond 7) and Sludge Pond D (now Pond 6) was part of the response work for OU8, but ongoing monitoring is part of the remedy for OU22. Monitoring of groundwater to assess metals concentrations is part of the remedy for OU23.

Ecological Assessment: As noted above, potential ecological concerns due to release of metals into the down gradient wetland habitats is addressed under OU22. Furthermore, as noted under OU19, there is a generalized risk from palatable plants, which can uptake selenium and pass it on to herbivores via ingestion. Therefore, reclamation activities in OU19 should not use seeds of such plants. Control of plant species (during reclamation actions through the screening of seed mixtures) is warranted for OU8.

Cleanup Levels

ARAR-Based Cleanup Levels: Site cleanup levels are risk-based concentrations. *Risk-Based Cleanup Levels (Surface Soils/Mine Waste):* Risk-based cleanup levels were identified in the September 2002 ROD for various land uses, as well as subsequent documents related to remedial design. The risk-based cleanup levels for arsenic, cadmium, lead and selenium (for industrial/commercial, agricultural and recreational land uses) are summarized in Table J-2 (Appendix J). As it pertains to each specific COC,

- Arsenic – The standards listed in Table J-2 are generally still adequate to ensure protectiveness for public health and the environment. No arsenic cleanup level was established for residential land use from a risk assessment. For residential or more protective concentration, EPA selected a default unrestricted land use standard of 50 mg/kg from a risk management perspective.
- Cadmium – The standards listed in Table J-2 are generally still adequate to ensure protectiveness for public health and the environment. No cadmium cleanup level was established for residential land use from a risk assessment.
- Lead – The standards listed in Table J-2 are generally still adequate to ensure protectiveness for public health and the environment. No lead cleanup level was established for residential land use from a risk assessment. For residential or more protective concentration, EPA selected a default unrestricted land use standard of 500 mg/kg from a default risk assessment value.
- Selenium - The standards listed in Table J-2 are generally still adequate to ensure protectiveness for public health and the environment. No selenium cleanup level was established for residential land use from a risk assessment.

Other ARARs

Further response actions (as it pertains to site soils) were not required under the September 2002 ROD (unless redevelopment proposals are submitted, or as may be required under the

remedy for OU22). EPA acknowledged that chemical-specific closure standards as a state ARAR (specifically UAC R315-101) were neither applicable or relevant and appropriate because risk-based standards already existed.

All ARARs will be evaluated for the Sites in a decision document scheduled for June 2015. For a listing of existing ARARs please refer to the September 2002 ROD.

QUESTION C: Has any other information come to light that could call into question the protectiveness of the remedy?

Yes. The 2002 ROD did not require mapping, work plans, ICs, annual inspections and reports. Post-removal data document concentrations of arsenic that exceed the unrestricted land use standard of 50 mg/kg. An IC is needed to ensure soils exceeding the site unrestricted land use standards are managed in the future. The 2002 ROD did not require maintenance for soil covers or engineered caps; an O&M plan needs to require such. Though not specifically required under the 2002 ROD, an IC is also needed to restrict the use of seeds of plants capable of up-taking selenium during revegetation actions. When the September 2006 AOC is closed, a site wide management plan is needed to address the management of waste left in place and encountered waste which may be discovered in the future. A decision document will address these issues and is scheduled for completion by June 2015.

No Required Inspections or Reports: DERR has performed informal inspections periodically while on site observing other response work implemented by Kennecott. Generally, the facility footprints in OU8 are stable. Formal inspection reports (by Kennecott and/or UDEQ) would provide more information during future FYRs to support protectiveness determinations.. Inspection reporting of the ongoing groundwater monitoring actions will be covered under OU23.

No Site-Specific Work Plan and Response Work Oversight Required: Though not specifically required under the September 2002 ROD, DERR has coordinated with Kennecott to review and accept project-specific soil management work plans and to provide oversight during ongoing response work. Response work continues to generally be governed by the requirements of the September 1996 AOC work plan, but some site-specific site conditions have necessitated changes from the listed response steps. The provision of project-specific work plans should be required (for example, to characterize borrow areas), so the Agencies can verify compliance with and evaluate deviations from the Sites' governing documents (i.e., AOC work plans, operation, maintenance and replacement (OM&R) plans, etc.).

No Institutional Controls, No Maps Denoting Soils Above Sites' Land Use Standards: The footprint of OU8 has remained in ownership by Kennecott (or its predecessors) since processing facilities were first constructed on the northern boundary of the Oquirrh Mountains. OU8 is surrounded by transportation corridors and the current processing and waste management facilities of Kennecott. Land use is unlikely to change in the short term. However, after mine closure, land use could change though it may stay industrial/commercial because of OU8's proximity to established transportation corridors. Because some arsenic concentrations exceed the Sites' unrestricted land use standard (50 mg/kg), further soil management actions may be

necessitated, but currently no land use controls are in place to require such and maps denoting the locations of elevated arsenic are pending.

It is understood that Kennecott is currently engaged with EPA and DERR to develop site wide management plans for known waste left in place and unknown waste in place that may be encountered in the future. These two O&M plans are being developed as part of the ongoing negotiations to render a federal consent decree for the Sites. The two O&M plans will cover soil management requirements for OU8, and maps associated with both plans will document where soils exist above the Sites' land use standards and where environmental covenants filed by Kennecott are applicable. These two O&M plans are intended for completion as part of a decision document. The environmental covenants (once issued) will act as a proprietary institutional control that the State of Utah will be granted enforcement authority under (if necessary). The covenants will allow Kennecott to notify subsequent property owners of land use restrictions and requirements for further response work if the land associated with OU8 is to be redeveloped.

Furthermore, an IC is necessary to ensure that the seeds of plants capable of up-taking selenium are not used during revegetation efforts in the area of OU8.

Maintenance of Established Covers or Engineered Caps for Removed and Reclaimed Facilities:

Outside of the general requirements of the June 1996 AOC work plan, the maintenance of post removal reclamation soil covers or engineered caps has not be memorialized in a work plan yet. Pending site wide management plans for known waste left in place and future encountered waste (as introduced above under the discussion about institutional controls) could be modified to include maintenance requirements for established soil covers, asphalt covers and engineered covers. OU8.

Closeout of Sept. 1996 AOC and Requirement for the Submission of Work Plans In the Future:

Under the pending site wide consent decree the September 1996 Administrative Order on Consent will be closed. Closeout of the 1996 AOC will render the requirement for Kennecott to submit site specific work plans for response actions obsolete. Site specific work plans (in compliance with the general work specified under the pending site wide management plans for waste left in place and future encountered waste) are needed to ensure soils exceeding site specific land use standards are managed until soil/sediment metals concentrations at a site attain the applicable unrestricted land use concentrations.

OU9 Magna Soils

QUESTION A: Is the remedy functioning as intended by the decision documents?

Yes. The remedy is functioning as intended by the decision documents.

No action was selected under the decision document (2002 ROD). Under Question C, the concern about soils potentially exceeding the unrestricted land use standard for arsenic and lead is described further.

QUESTION B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

No. The exposure assumptions are currently not valid. However, the toxicity data, cleanup levels and remedial action objectives used at the time of the remedy selection are still valid.

Exposure Assumptions and Toxicity Data

Cleanup levels set for this site were presented in the September 2002 ROD. These cleanup numbers were derived in the document entitled *Preliminary Remediation Goals for Addressing Risks to Human Health from Exposure to Chemicals in Kennecott Soil* (prepared by EPA, December 1999). Because these documents were developed prior to EPA's RAGS Part F (2009), the exposure assumptions for the inhalation exposure pathway were conducted differently. The exposure metric that was used in the ROD and the PRG document used inhalation concentrations that were based on Ingestion rate and Body weight (mg/kg-day). The updated methodology found in EPA's RAGS part F uses the concentration of chemicals in the air, with the exposure metric of $\mu\text{g}/\text{m}^3$. While there is no significant change in cleanup levels, it is important to present the most current methodology that is used for the Inhalation pathway. As noted below under Cleanup levels, EPA and DERR are in the process of re-affirming the risk-based cleanup levels for various land uses at the OUs of the Sites under a decision document.

Human Health

Changes in Exposure Pathways: The September 2002 ROD set cleanup concentrations for arsenic, cadmium, lead and selenium for developed and undeveloped industrial lands. It also established the adequacy of concentrations for these same metals for open space and recreational levels. Lastly, the September 2002 ROD established unrestricted land use standards for arsenic and lead.

However, the September 2002 ROD did not establish residential land use standards for arsenic, cadmium, lead and selenium (it is anticipated that protective concentrations of arsenic and lead would likely drive future response work). Future response work might have to comply with the unrestricted land use standards for arsenic and lead (unless developed for industrial, recreational or agricultural land use), unless OU-specific residential land use levels were to be established.

Changes in Toxicity, and Other Contaminant Characteristics: There have been no changes in toxicity factors or characteristics for the COCs (including arsenic, cadmium, lead and selenium) that were used to develop cleanup levels.

Changes in Risk Assessment Methods: EPA's Risk Assessment Guidance for Superfund Part F was finalized in 2009. The exposure metric that was used prior to RAGS Part 4 for inhalation concentrations was based on Ingestion rate and Body weight (mg/kg-day). The updated methodology found in EPA's RAGS part F uses the concentration of chemicals in the air, with the exposure metric of $\mu\text{g}/\text{m}^3$.

Expected Progress Toward Meeting RAOs: RAOs were not selected under the September 2002 ROD because no remedy was found necessary. Therefore attainment of RAOs is unnecessary.

Ecological Assessment: No ecological concerns were noted in the September 2002 ROD.

Cleanup Levels

ARAR-Based Cleanup Levels: No action was required by EPA to address soils in Magna. Therefore, no ARAR-based cleanup levels were acknowledged in the September 2002 ROD.

Risk-Based Cleanup Levels (Surface Soils/Mine Waste): A range of typical residential action levels were used for comparison to sampled soils in OU9. The noted concentration ranges for arsenic and lead range from default conservative values to the Sites' maximum allowable residential land use standards (arsenic - 50 mg/kg to 100 mg/kg and lead – 400 mg/kg to 1,200 mg/kg). No site-specific residential risk assessment was performed for OU9.

Review of existing cleanup levels and re-affirmation of their applicability will be documented in a decision document scheduled for June 2015.

Other ARARs

Further response actions (as it pertains to site soils) were not required under the September 2002 ROD (unless redevelopment proposals are submitted, or as may be required under the remedy for OU22). As such, no ARARs were listed specifically for OU9.

All ARARs will be evaluated for the Sites during the preparation of a decision document.

QUESTION C: Has any other information come to light that could call into question the protectiveness of the remedy?

Yes. As noted above, the September 2002 ROD did not require further action for OU9. However, the September 2002 ROD did not explain that the Sites' unrestricted land use standard for arsenic (50 mg/kg) was exceeded in three locations and for lead (500 mg/kg) in two locations (as assessed from reviewing the 1990 and 1994 studies). Concentrations of arsenic above the unrestricted land use standard ranged from 58 to 186 mg/kg. Concentrations of lead above the unrestricted land use standard ranged from 500 to 540 mg/kg. These reported analytical results from both the 1990 and 1994 studies are from the limited laboratory derived data sets.

Review of the 1994 BOR/EPA study determined that the principal data set was derived from XRF analysis of the samples collected. Ten percent of the samples were segregated for analysis by both XRF and lab methods for total metals to assess the accuracy of the XRF instrument. The reported quantity of samples (noted above) derived from the September 2002 ROD could not be verified, nor could the statistics presented in table 3.2 of the September 2002 ROD and replicated in Table 2-A of Appendix E.

It was determined that EPA's original decision was premised on using area averaging as a tool to assess the potential risk of the few exceedances of the unrestricted land use standards for arsenic and lead. However, this approach should have been explained further in the decision document, especially since this review determined that one of the principal data sets used for the decision was XRF data (which historically is considered screening level data). It is recommended that EPA and UDEQ explain further (in a decision document) the few exceedances of the unrestricted land use standards, in context to the potential for human health risk in a residential setting.

OU13 Smelter and Acid Plants, OU14 Refinery, and OU15 Mills and Tailings Pond

QUESTION A: Is the remedy functioning as intended by the decision documents?

Yes. The remedy is functioning as intended by the decision documents. However, further action by Kennecott, EPA and UDEQ is necessary to support the long-term protectiveness of the remedy (see Question C).

Remedy elements identified in the decision documents (1996 Action Memo and 2002 ROD) are summarized below. An assessment of remedy element functionality is also provided. Under Question C, elements that would maintain the protectiveness of the remedy (that were not included in the September 2002 ROD) are discussed.

1. Removal of Decommissioned Facilities (OU13, 14 and 15)

The response actions have been implemented in accordance with the 1996 Action Memorandum. During the site inspection, the condition of the footprint areas appeared stable and well covered. Installed covers appeared intact, but for a few locations. Soils underlying the active facilities and under the covers at the remediated facility footprints can exceed the Sites' unrestrictive land use standards for arsenic and lead, and the industrial land use standards for arsenic, lead and selenium (predominantly). On average, the depth of cover over these soils when first applied was 18 inches; there were few signs of erosion. Most of the covers were stable and well vegetated. Ongoing soil management around the active facilities is implemented in response to small construction projects intruding into the underlying soils with elevated COCs. Previously installed covers in these areas were observed to have been re-established.

At OU15, operating facilities were intact, stable and no releases were observed. Operating facilities consist of the Power Plant, pipelines, roads, Magna Process Water ponds, rail corridors. Demolition and cleanup work performed from 2007 to 2009 at the Magna Mill and Bonneville Crusher facilities has yet to be reported. The footprints of both facilities have been reclaimed. As determined during the inspections, the soil covers placed over the footprints of the decommissioned facilities (Bonneville Crusher & Grinder mill, Magna Mill, Arthur Mill) are stable and intact, though success of revegetation efforts is limited. Some associated infrastructure for these mills are either still in use, abandoned, or in the process of being removed (i.e. Copperton Rail lines), reporting on the ongoing work is pending. Intrusions into the surfaces at OU15 due to small projects have been re-established pursuant to the agreed upon procedures (which are drawn from the requirements of the 1996 AOC work plan).

At OU14 the engineered caps constructed over the historic Precious Metals Plant and the EP footprints were predominantly intact. At the Refinery EP footprint, the engineered cap showed signs of vehicle traffic on the surface, exemplified by an approximate 6-inch impression left by a vehicle tire. Both footprints also had a noted intrusion which was the result of the ongoing OU23 remedial investigation (RI) update. As part of the OU23 RI update, Kennecott installed lysimeters through the caps at both footprints and into the underlying contaminated soils. The lysimeters are intended to be permanent for the time being while the RI update for OU23 is completed. The average depth of the caps was

approximately 18 inches at the time of response action. Subsequent follow-up determined that the installed cap extends to approximately the centerline of the surface water drain located along the southern boundary of the EP footprint. Intrusions into the surfaces at OU14 due to small projects have been re-established pursuant to the agreed upon procedures (which are drawn from the requirements of the 1996 AOC work plan). Recent small project area locations were inspected and found to have had the original covers replaced and stable.

At OU13 previous facilities that were demolished, characterized and received removal actions were covered (as required under the work plan) and now either are used to support ongoing operations or as open space. Open space areas appear stable, vegetation success continues to be affected by the active operations at OU13. Some of the active facilities are constructed on the footprints of the removed facilities. Applied covers appeared to be intact except for one area. The cover placed over the Black Rock Tailings Pond has been eroded in a few locations, and slag was observed (from a distance) on the surface. The tailings pond's perimeter is fenced (thus access is controlled to areas where the cover has been eroded) and the footprint is used to support operations at the Smelter. Intrusions into the surfaces at OU13 due to small projects have been re-established pursuant to the agreed upon procedures (which are drawn from the requirements of the 1996 AOC work plan). Recent small project area locations were inspected and found to have had the original covers replaced and stable.

2. Groundwater monitoring as required to assess effectiveness of source control measures (OU13 and OU14)

The response action was implemented in accordance with the 1996 Action Memorandum. Source control measures implemented during the response action predominantly included the removal of soils that had elevated concentrations of arsenic, lead, and selenium, and were also found to be leachable. Engineered caps (utilizing clay and drainage blankets) were installed over the footprints of the Refinery's Electrolytic Pond and the historic Precious Metals Plant to reduce potential infiltration and leaching of buried soils with leachable arsenic and selenium. Groundwater monitoring of the selenium plume at OU14 and groundwater monitoring at OU13 are included in the remedy requirements of OU23.

3. Provision of Maps Documenting Waste Left in Place (OU13, 14 and 15)

The response action was partially implemented in accordance with the September 2002 ROD. Maps were originally produced, but as land ownership did not change, the maps were retained by the current land owner (Kennecott). Kennecott is currently incorporating existing data into its "Contaminated Sites Registry" database and revising existing maps of known waste left in place.

4. Future CERCLA Response Action at the Acid Farm and historic Precious Metals Plant and Refinery Tank House (OU13 and OU14)

The response actions implemented by Kennecott in response to the 1991 stipulated consent decree issued by the Utah Division of Solid and Hazardous Waste (DSHW), under

RCRA, were ceased per agreement between Kennecott and the DSHW because the requirements of the stipulated consent decree had been attained. In 2009, a new release was determined to have taken place from the Acid Tank Farm Loading Station. The Utah Division of Water Quality (DWQ), under the Utah GWPP, required corrective action under the Groundwater Protection Permit issued for the Smelter Facility. Based on characterization data, the DWQ and the Division of Environmental Response and Remediation (DERR) agreed that under CERCLA, groundwater conditions in the immediately down gradient wetland area (OU22 – Garfield Wetlands) should be monitored where surface water quality can be influenced by groundwater. As noted by DWQ (February 19, 2013 memo, Appendix D,) the corrective action implemented by Kennecott has been effective. Annual monitoring data for the down gradient wetland habitat are covered under OU22.

The response actions implemented by Kennecott to remove and cap soils from the footprint of the historic Precious Metals Plant remain protective. To date, soils still requiring removal action exist under the Refinery's Tank House because the Refinery is still operational. Mine closure is not in the immediate future, so implementation of response actions is still pending.

5. Operate the Arthur Step-back Repository as a CAMU (OU15)

Kennecott operates and maintains the Arthur Step-back Repository pursuant to the requirements of the 199s North Facilities Soils and Waste Water Treatment Plant Work Plan. Kennecott is currently developing an O&M work plan for the continued operation of the Arthur Step-Back Repository as a CAMU for the ongoing CERCLA response actions pursued by them at decommissioned facilities. Maintenance of caps and annual reporting of leachate management activities are intended to be covered. Currently the Repository is operated under the terms of the September 1996 AOC work plan.

QUESTION B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

No. The exposure assumptions are currently not valid. However, the toxicity data, cleanup levels and remedial action objectives used at the time of the remedy selection are still valid.

Exposure Assumptions and Toxicity Data

Cleanup levels set for this site were presented in the September 2002 ROD. These cleanup numbers were derived in the document entitled *Preliminary Remediation Goals for Addressing Risks to Human Health from Exposure to Chemicals in Kennecott Soil* (prepared by EPA, December 1999). Because these documents were developed prior to EPA's RAGS Part F (2009), the exposure assumptions for the inhalation exposure pathway were conducted differently. The exposure metric that was used in the ROD and the PRG document used inhalation concentrations that were based on Ingestion rate and Body weight (mg/kg-day). The updated methodology found in EPA's RAGS part F uses the concentration of chemicals in the air, with the exposure metric of $\mu\text{g}/\text{m}^3$. While there is no significant change in cleanup levels, it is important to present the most current methodology used for the inhalation pathway. As noted below

under Cleanup Levels, EPA and DERR are in the process of re-affirming the risk-based cleanup levels for various land uses at the OUs of the Sites under a decision document.

Human Health

Changes in Exposure Pathways: The September 2002 ROD set cleanup concentrations for arsenic, cadmium, lead and selenium for developed and undeveloped industrial lands. It also established the adequacy of concentrations for these same metals for open space and recreational levels. Lastly, the September 2002 ROD established unrestricted land use standards for arsenic and lead.

However, the September 2002 ROD did not establish residential land use standards for arsenic, cadmium, lead and selenium (though it is anticipated that protective concentrations of arsenic and lead would likely drive future response work). Because of their proximity to industrial areas and transportation corridors, OUs 13, 14 and 15 are unlikely to be converted to residential land use in the future. Future response work would have to comply with the unrestricted land use standards for arsenic and lead (unless developed for industrial, recreational or agricultural land use), unless OU-specific residential land use levels were to be established.

Changes in Toxicity, and Other Contaminant Characteristics: There have been no changes in toxicity factors or characteristics for the COCs that were used to develop cleanup levels.

Changes in Risk Assessment Methods: EPA's Risk Assessment Guidance for Superfund Part F was finalized in 2009. The exposure metric that was used prior to RAGS Part 4 for inhalation concentrations was based on Ingestion rate and Body weight (mg/kg-day). The updated methodology found in EPA's RAGS part F uses the concentration of chemicals in the air, with the exposure metric of ug/m³.

Expected Progress Toward Meeting RAOs: Previous removal actions were effective to achieve industrial land use standards. The RAOs were attained for facilities that have been decommissioned and removed.

Periodic ongoing response actions continue to support the attainment of the RAOs as facilities at the Smelter, Refinery, Mills and Waste Management Operations become available for demolition and their footprints are characterized. Migration of groundwater with elevated selenium and/or arsenic from OU13, 14, and 15, is addressed as part of the remedy for OU23. Potential migration of soil or water with elevated concentrations of the COCs into down gradient sensitive environments is addressed as part of the remedy for OU22. Provision of maps and development of institutional controls (which will attain the fourth RAO) are still pending; see Question C.

Ecological Assessment: As noted above, potential ecological concerns from the migration of soil or water from OU13, 14 and 15 into sensitive down gradient environments is addressed as part of the remedy for OU22.

Cleanup Levels

ARAR-Based Cleanup Levels: Site cleanup levels are risk-based concentrations. *Risk-Based Cleanup Levels (Surface Soils/Mine Waste):* Risk-based cleanup levels were identified in the September 2002 ROD for various land uses, as well as subsequent documents related to

remedial design. The risk-based cleanup levels for arsenic, cadmium, lead and selenium (for industrial/commercial, agricultural and recreational land uses) are summarized in Table J-2 (Appendix J). As it pertains to each specific COC,

- Arsenic – The standards listed in Table J-2 are generally still adequate to ensure protectiveness for public health and the environment. No arsenic cleanup level was established for residential land use from a risk assessment. For residential or more protective concentrations, EPA selected a default unrestricted land use standard of 50 mg/kg from a risk management perspective.
- Cadmium – The standards listed in Table J-2 are generally still adequate to ensure protectiveness for public health and the environment. No cadmium cleanup level was established for residential land use from a risk assessment.
- Lead – The standards listed in Table J-2 are generally still adequate to ensure protectiveness for public health and the environment. No lead cleanup level was established for residential land use from a risk assessment. For residential or more protective concentrations, EPA selected a default unrestricted land use standard of 500 mg/kg from a default risk assessment value.
- Selenium - The standards listed in Table J-2 are generally still adequate to ensure protectiveness for public health and the environment. No selenium cleanup level was established for residential land use from a risk assessment.

Other ARARs

One of the remedial elements includes the demolition and removal of decommissioned facilities, and the characterization (and removal if necessary) of soils in the footprints of the facilities. Under the September 2002 ROD, EPA listed certain state ARARs for future response work when facilities are decommissioned or the mine shuts down. The listed state ARARs pertain to the control of fugitive emissions under the Utah Air Conservation Regulations and the generation, transport and disposal of hazardous waste under the Utah Hazardous Waste Regulations. Some of the noted citations are inaccurate or out of date.

All ARARs will be evaluated for the Sites in a decision document scheduled for June 2015.

QUESTION C: Has any other information come to light that could call into question the protectiveness of the remedy?

Yes. The 2002 ROD did not require mapping, work plans, ICs, annual inspections and reports. Post-removal data document concentrations of arsenic and lead exceed the unrestricted land use standard of 50 mg/kg and 500 mg/kg, respectively, and the industrial land use standard for selenium of 13,972 mg/kg. An IC is needed to protect all potential future in areas where soils exceed the site unrestricted land use standards. An IC is also needed to restrict the use of seeds of plants capable of up-taking selenium during revegetation actions. The 2002 ROD did not require maintenance for soil covers or engineered caps; an O&M plan needs to require such. The 2002 ROD did not discuss how active operations and waste management operations could be managed under existing State of Utah permits (as contemplated by the 1995 MOU) as a means to prevent re-introduction of COCs. When the September 1996 AOC is closed the Arthur Step-back Repository at OU15 needs to be reauthorized and an O&M plan needs to be approved for continued use. Also, a site wide management plan is needed to

address the management of waste left in place and encountered waste which may be discovered in the future. A decision document will address these issues and is scheduled for completion in June 2015.

No Required Inspections and Reporting: DERR has performed informal inspections periodically while on site observing other response work implemented by Kennecott. Generally, the facility footprints in OU13, 14 and 15 are stable. Formal inspection reports (by Kennecott and/or UDEQ) would provide more information during future FYRs to support protectiveness determinations. Inspection reporting of the ongoing groundwater monitoring actions will be covered under OU23.

No Site-Specific Work Plan and Response Work Oversight Required: Though not specifically required under the September 2002 ROD, DERR has coordinated with Kennecott to review and accept project-specific soil management work plans and to provide oversight during ongoing response work. Response work continues to generally be governed by the requirements of the September 1996 AOC work plan, but some site-specific site conditions have necessitated changes from the listed response steps. The provision of project-specific work plans should be required (for example, to characterize borrow areas), so the Agencies can verify compliance with the Sites' governing documents (i.e., AOC work plans, OM&R plans, etc.) and evaluate deviations from the Sites' governing documents.

No Institutional Controls, No Maps Denoting Soils Above Sites' Land Use Standards: The footprints of OU13, 14 and 15 have remained in ownership by Kennecott (or its predecessors) since processing facilities were first constructed on the northern boundary of the Oquirrh Mountains. Land use is unlikely to change in the short term. However, after mine closure, land use could change, though it may stay industrial/commercial because of OU13, 14 and 15's proximity to established transportation corridors and active process waste management facilities. Because some arsenic and lead concentrations exceed the Sites' unrestricted land use standards (50 mg/kg and 500 mg/kg, respectively) and selenium can exceed the Sites' industrial land use standard (13,972 mg/kg), further soil management actions may be necessitated. However, currently no land use controls are in place to require such actions and maps denoting the locations of elevated COCs are pending.

It is understood that Kennecott is currently engaged with EPA and DERR to develop site wide management plans for known waste left in place and unknown waste in place that may be encountered in the future. These two O&M plans are being developed as part of the ongoing negotiations to render a federal consent decree for the Sites. The two O&M plans will cover soil management requirements for OU13, 14 and 15, and maps associated with both plans will document where soils exist above the Sites' land use standards and where environmental covenants filed by Kennecott are applicable. These two O&M plans are anticipated to be completed as part of a decision document. The environmental covenants (once issued) will act as a proprietary institutional control under which the State of Utah will be granted enforcement authority (if necessary). The covenants will allow Kennecott to notify subsequent property owners of land use restrictions and requirements for further response work if the land associated with OU13, 14 or 15 is to be redeveloped.

Furthermore, an IC is necessary to ensure that the seeds of plants capable of up-taking selenium are not used during revegetation efforts in the area of OU13, 14, and 15.

Maintenance of Established Covers or Engineered Caps for Removed and Reclaimed Facilities: Outside of the general requirements of the September 1996 AOC work plan, the maintenance of post removal reclamation soil covers or engineered caps has not been memorialized in a work plan yet. Pending site wide management plans for known waste left in place and future encountered waste (as introduced above under the discussion about institutional controls) could be modified to include maintenance requirements for established soil covers, impervious material covers and engineered covers.

No Re-authorization Mechanism or Performance Standards for the Arthur Step-back Repository (OU15): Once the pending federal consent decree is rendered, the 1996 AOC and North Facilities Soil and Wastes Water Treatment Plant Work Plan will be closed out. The September 2002 ROD does not re-authorize the use of the Arthur Step-back Repository as a CERCLA CAMU once the 1996 AOC is closed out. Furthermore, specific performance standards to protect groundwater are not listed in the 1996 AOC work plan or the September 2002 ROD, nor were annual reporting requirements established. To address these issues, Kennecott is negotiating an O&M plan to re-authorize the Arthur Step-back Repository as a CERCLA CAMU and to establish groundwater protection performance standards for the repository. The Arthur Step-back Repository O&M plan is being developed as part of the ongoing negotiations to render a federal consent decree.

No Requirement to Maintain Compliance with State Permits: Under a broader context of site management, the Agencies and Kennecott rendered an agreement that the State of Utah would regulate the active mining operations using its groundwater authorities to ensure there was not an ongoing introduction of COCs. Some remedies for the North Zone operable units call out state permits as an ARAR and require Kennecott to be in compliance, but generally speaking this is not uniform across the whole site. The Agencies need to complete an assessment to determine if Kennecott's compliance with all state permits regulating operations and waste management strategies address CERCLA interests, and potentially list these management criteria in a decision document.

Kennecott's compliance with the requirements of:

- OU13: GWPP permit (#UGW350008), DAQ permit (Title V Operating Permit #3500030002 and Approval Orders #DAQE-AN103460049-11 and #DAQE-AN103460052-13);
- OU14: DAQ permit (Title V Operating Permit #3500030002 and Approval Orders #DAQE-AN103460049-11 and #DAQE-AN103460052-13), and;
- OU15: GWPP permit (#UGW350011 and #350015); DAQ's approval orders and permits (Title V Operating Permit # 3500346002 and Approval Order AN105720026-11); UPDES permits for outfalls associated with the Magna Tailings Impoundments (#UT0000051); and DOGM reclamation requirements (Bonds #M0350002 and #M0350015).

could ensure the successfulness of CERCLA response actions that have been completed and/or are ongoing around permitted facilities. These permits regulate the release of contaminants into the surrounding environments in the Kennecott North Zone, which if elevated, could impact down gradient/wind sensitive habitats and areas where CERCLA response actions are being

pursued. This FYR included an assessment of Kennecott's compliance with the permits issued by the State of Utah (see Appendix H). Non-compliance incidents could cause CERCLA response actions to be unsuccessful at OU19, 13, 14, 15, 22 and 23. Once assessed by the Agencies, a decision document should be used to clarify the applicability of permits (including and in addition to the Utah Groundwater Protection Program's permit) issued by the State of Utah for Kennecott's operational and waste management facilities.

OU19 Smelter Fallout

QUESTION A: Is the remedy functioning as intended by the decision documents?

Yes. The remedy is functioning as intended by the decision documents. However, further action by Kennecott, EPA and UDEQ is necessary to support the long-term protectiveness of the remedy (see Question C).

Remedy elements identified in the decision document (2002 ROD) are summarized below. An assessment of remedy element functionality is also provided. Under Question C, elements that would maintain the protectiveness of the remedy (that were not included in the September 2002 ROD) are discussed.

1. Prevent the use of palatable plants with a capacity to uptake selenium from site soils

The response action was and continues to be implemented in accordance with the September 2002 ROD. As reported in an email dated March 27, 2013 (Appendix D) Kennecott has not and does not use seed mixtures that contain species of palatable plants that can uptake selenium during reclamation activity. However, an institutional control to memorialize the seed restriction would assist with the long term protectiveness of the selected remedy.

2. Provision of maps documenting waste left in place

The response action was partially implemented in accordance with the September 2002 ROD. Maps were originally produced, but as land ownership did not change, the maps were retained by the current land owner (Kennecott). Kennecott is currently incorporating existing data into its "Contaminated Sites Registry" database and revising existing maps of known waste left in place.

3. Segregate known locations in the canyons with concentrations of COCs that could pose a threat and schedule for appropriate response action

The response action was partially implemented in accordance with the September 2002 ROD. Maps were originally produced as part of distinguishing areas requiring future response work, but as land ownership did not change, the maps were retained by the current land owner (Kennecott). Kennecott is currently incorporating existing data into its "Contaminated Sites Registry" database and revising existing maps of known waste left in place. Furthermore, soil management plans were not specifically required (though at times Kennecott has coordinated with UDEQ and EPA to develop site specific response action work plans). A specific requirement for such would assist to ensure soils in

exceedance of the Sites unrestricted land use standards are managed appropriately in the future.

4. Excavated material from canyons hauled off site must comply with unrestricted land use standards and hauled on site must comply with applicable land use standards for the Sites'

Kennecott continues to comply with this requirement. There has been no excavation of borrow material for use off site from the canyons. The one proposed sand and gravel operation by Monroc did not complete an agreement with Kennecott for use of the Black Rock Canyon area. An institutional control to memorialize this soil management strategy would assist with ensuring this requirement is implemented in the future.

As for on-site use, borrow material is screened during CERCLA response actions pursuant to site-specific work plans. To date, no excavation of borrow material for use on site from Black Rock Canyon has transpired. Some borrow material from Kessler Canyon was excavated during the Section 17 Pipeline project. This material was sampled pursuant to the soil management plan for this project. Most recently, material has been excavated from the same borrow location in Kessler Canyon for soil cover at the Smelter Landfill site. As noted above, Little Valley was used as a source of borrow material along its lower southern slope near the mouth of the canyon. A June 2013 accepted characterization work plan will direct further characterizations at the Little Valley borrow source areas.

QUESTION B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

No. The exposure assumptions are currently not valid. However, the toxicity data, cleanup levels and remedial action objectives used at the time of the remedy selection are still valid.

Exposure Assumptions and Toxicity Data

Cleanup levels set for this site were presented in the September 2002 ROD. These cleanup numbers were derived in the document entitled *Preliminary Remediation Goals for Addressing Risks to Human Health from Exposure to Chemicals in Kennecott Soil* (prepared by EPA, December 1999). Because these documents were developed prior to EPA's RAGS Part F (2009), the exposure assumptions for the inhalation exposure pathway were conducted differently. The exposure metric that was used in the ROD and the PRG document used inhalation concentrations that were based on Ingestion rate and Body weight (mg/kg-day). The updated methodology found in EPA's RAGS part F uses the concentration of chemicals in the air, with the exposure metric of $\mu\text{g}/\text{m}^3$. While there is no significant change in cleanup levels, it is important to present the most current methodology for the inhalation pathway. As noted below under Cleanup Levels, EPA and DERR are in the process of re-affirming the human health risk-based cleanup levels for various land uses at the OUs under a decision document.

Human Health

Changes in Exposure Pathways: The September 2002 ROD set cleanup concentrations for arsenic, cadmium, lead and selenium for developed and undeveloped industrial lands. It also

established the adequacy of concentrations for these same metals for open space and recreational levels. Lastly, the September 2002 ROD established unrestricted land use standards for arsenic and lead.

However, the September 2002 ROD did not establish residential land use standards for arsenic, cadmium, lead and selenium (though it is anticipated that protective concentrations of arsenic and lead would likely drive future response work). Because areas included in OU19 are located behind Kennecott's active processing facilities, the canyon areas in OU19 are unlikely to be redeveloped until mining operations cease. Because of existing land use standards, future residential development (though limited by canyon-specific parameters) would have to comply with the unrestricted land use standards for arsenic and lead, unless an OU-specific residential land use level were to be established for the applicable COCs.

Furthermore, the recreational standard noted in Table J-2 (Appendix J) was premised on recreationalists using ATVs during their recreational activity. Dependent on future proposed recreational activity by future property owners or local governments, the exposure pathway for the current recreational standard may need to be re-evaluated. For further information on these two issues, see Question C.

Changes in Toxicity, and Other Contaminant Characteristics: There have been no changes in toxicity factors or characteristics for the COCs (including arsenic, cadmium, lead and selenium) that were used to develop cleanup levels.

Changes in Risk Assessment Methods: EPA's Risk Assessment Guidance for Superfund Part F was finalized in 2009. The exposure metric that was used prior to RAGS Part 4 for inhalation concentrations were based on Ingestion rate and Body weight (mg/kg-day). The updated methodology found in EPA's RAGS part F uses the concentration of chemicals in the air, with the exposure metric of $\mu\text{g}/\text{m}^3$.

Expected Progress Toward Meeting RAOs: Previous response actions were effective to achieve the RAOs in part (as noted under Questions A). Provision of maps and development of institutional controls (which will attain the second and third RAOs) are still pending; see Questions C.

Ecological Assessment: Exposure assessment methodology, toxicity characteristics and exposure pathways have remained the same in Little Valley, Kessler and Black Rock canyons (as well as the other canyons investigated, Coon and Harkers). The principal risk is still represented by herbivorous mammals and birds that forage on palatable plants with the capacity to uptake selenium. Control of such plant species is still warranted versus destruction (via removal action) of the limited habitat represented in these canyon locations.

Cleanup Levels

ARAR-Based Cleanup Levels: Site cleanup levels are risk-based concentrations for human health. *Risk-Based Cleanup Levels (Surface Soils/Mine Waste):* Risk-based cleanup levels were identified in the September 2002 ROD for various land uses, as well as subsequent documents related to remedial design (for human health). The risk-based cleanup levels for arsenic,

cadmium, lead and selenium (for industrial/commercial, agricultural and recreational land uses) are summarized in Table J-2 (Appendix J). As it pertains to each specific COC,

- Arsenic – The standards listed in Table J-2 are generally still adequate to ensure protectiveness for public health and the environment. No arsenic cleanup level was established for residential land use from a risk assessment. For residential land use the Sites’ default unrestricted land use standard of 50 mg/kg is currently applicable and protective.
- Cadmium – The standards listed in Table J-2 are generally still adequate to ensure protectiveness for public health and the environment. No cadmium cleanup level was established for residential land use from a risk assessment.
- Lead – The standards listed in Table J-2 are generally still adequate to ensure protectiveness for public health and the environment. No lead cleanup level was established for residential land use from a risk assessment. For residential land use the Sites’ default unrestricted land use standard of 500 mg/kg is currently applicable and protective.
- Selenium - The standards listed in Table J-2 are generally still adequate to ensure protectiveness for public health and the environment. No selenium cleanup level was established for residential land use from a risk assessment.

From an ecological perspective, no cleanup action levels were established under the September 2002 ROD. Ecological risks (as noted above) did not out-weigh the damage removal action would have caused to the recovering habitats in the canyons.

Other ARARs

No specific ARARs were listed as it pertains to the selected remedy for OU19.

All ARARs will be evaluated in a decision document scheduled for June 2015.

QUESTION C: Has any other information come to light that could call into question the protectiveness of the remedy?

Yes. As noted above, the September 2002 ROD did not require annual inspections and reporting, submission of work plans for future response work (if necessary) to address site specific conditions, provision of oversight during future response work, ICs and FYRs for areas where soils exceed an unrestricted land use standard. Post-removal data document arsenic and lead concentrations that exceed the Sites’ unrestricted land use standard of 50 mg/kg and 500 mg/kg (respectively). As it pertains to redevelopment for residential land use, OU19 does not have a residential land use standard. Therefore, currently residential development has to comply with the unrestricted land use standards for the Sites. As it pertains to recreational use, a limited exposure pathway was assessed, an IC is needed to protect all potential recreational users and other users that would necessitate COC concentrations comply with unrestricted land use standards. An IC is also needed to restrict the use of seeds of plants capable of up-taking selenium during revegetation actions.

No Required Inspections and Reporting: DERR has performed informal inspections periodically while on site observing other response work implemented by Kennecott. Generally, the canyons

that comprise OU19 appeared stable, though some erosional activity was observed in upper Kessler and Black Rock canyons. Formal inspection of the canyon areas and reports from such would provide more information for future FYRs to support protectiveness determinations.

No Site-Specific Work Plan and Response Work Oversight Required: Though not specifically required under the September 2002 ROD, DERR has coordinated with Kennecott to review and accept project-specific soil management work plans and to provide oversight during ongoing response work. Response work continues to generally be governed by the requirements of the September 1996 AOC work plan, but some site-specific site conditions have necessitated changes from the listed response steps. The provision of project-specific work plans should be required (for example, to characterize borrow areas), so the Agencies can verify compliance with the Sites' governing documents (i.e., AOC work plans, OM&R plans, etc.) and evaluate deviations from the Sites' governing documents.

No Institutional Controls, No Maps Denoting Soils Above Sites' Land Use Standards: The footprint of OU19 has remained in ownership by Kennecott (or its predecessors) since processing facilities were first constructed on the northern boundary of the Oquirrh Mountains. OU19 has been used for open space and buffer to the processing operations on the north end. Land use is unlikely to change in the short and long term until mining and processing operations cease. It is however noted that land use could change. Review of existing soil data determined that the Sites' unrestricted land use standards are exceeded in various locations within OU19. Dependent upon future land use scenarios, soils may require management if the Sites' unrestricted land use standards have to be attained. Furthermore, future recreational land use applications may not be consistent with the exposure pathways modeled during the assessment of the Sites' recreational land use standard. As such, future recreational land use may necessitate a re-assessment of the Sites' recreational land use standard. No institutional controls are in place to require soil management to ensure compliance with the unrestricted land use standards or to ensure recreational land use applications are consistent with the modeled exposure pathway. Furthermore, an IC is needed to ensure that plants which can accumulate selenium are not used during revegetation efforts in the future.

No maps of the areas exceeding the Sites unrestricted land use standards have been provided to date. It is understood that Kennecott is currently engaged with EPA and DERR to develop site wide soil management plans for known waste left in place and unknown waste that may be encountered in the future. These two O&M plans are being developed as part of the ongoing negotiations to render a federal consent decree for the Sites. The two O&M plans will cover soil management requirements for OU19, and maps associated with both plans will document where soils exist above the Sites' land use standards and where environmental covenants filed by Kennecott are applicable. The two O&M plans should also specify that the seeds of plants capable of accumulating selenium are not used during revegetation efforts. These two O&M plans are anticipated to be completed as part of a decision document. The environmental covenants (once issued) will act as a proprietary institutional control under which the State of Utah will be granted enforcement authority (if necessary). The covenants will allow Kennecott to notify subsequent property owners of land use restrictions and requirements for further response work if the land associated with OU19 is to be redeveloped.

OU22 Great Salt Lake, Shoreline Wetlands and OU23 North End Groundwater

QUESTION A: Is the remedy functioning as intended by the decision documents?

No. It is not known whether the remedies for OU22 and OU23 are functioning as intended by the 2002 ROD. The groundwater system (OU23) in the Kennecott North Zone has an upward gradient, which allows for groundwater to express at the surface in the ponds of the Garfield Wetlands (OU22). Groundwater with elevated concentrations of selenium and arsenic emanating from under OU13 and OU14 does express at the surface in/near the ponds of the Garfield Wetlands. The selected remedy for OU23 (monitored natural attenuation) was premised on a clear understanding of the horizontal and vertical extent of the groundwater with elevated selenium and arsenic. Ongoing monitoring of the groundwater system has called into question the previous assumptions, conceptual site model, and conclusions of the 2000 remedial investigation (RI).

The fate and transport of selenium in the Garfield Wetlands has been characterized for some time, without clear conclusions. It was assumed at remedy selection that macroinvertebrate dietary pathway for the avian species which make use of the Garfield Wetlands for forage and nesting was the principle pathway of exposure. The monitoring to date has not demonstrated a clear pattern (along this pathway) between the sediment, water column and macroinvertebrate tissue data sets, nor has it frequently required monitoring of selenium concentrations in the applicable end point for the receptors, bird eggs.

As of late, arsenic concentrations in the water column data set in the Garfield Wetlands have demonstrated exceedances of the State of Utah water quality criteria for aquatic wildlife. Arsenic was not previously determined to be a COC for OU22.

UDEQ and EPA have concluded that the remedial investigation conclusions and selected active and passive remedial components need to be re-assessed. As it pertains to OU22, the methods to protect the end receptors, the avian species foraging and nesting in the habitat, needs to be clarified from a perspective of performance standards (for all applicable COCs) and monitoring requirements. As it pertains to OU23, the prevention of extracting and consuming groundwater with elevated COCs, effectiveness of monitored natural attenuation versus active extraction, and the active collection of groundwater (at springs and seeps) and containment in the process water circuit requires further assessment (planned under a focused feasibility study).

UDEQ and EPA have also concluded an institutional control is necessary to prevent access to the underlying aquifer. Concentrations of selenium in the groundwater do exceed the State of Utah drinking water standard.

QUESTION B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

No. It is currently unknown if the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy selection are still valid. From an ecological concern, UDEQ and EPA are re-evaluating these topics; see Question C for more information. From a human health concern, it is clear from the monitoring data that concentration of selenium in the groundwater of the aquifer system do exceed the State of Utah drinking water standard. See Question C for more information.

QUESTION C: Has any other information come to light that could call into question the protectiveness of the remedy?

Yes. EPA, UDEQ, and Kennecott have decided to re-focus and combine the selected remedies for OU22 and OU23 to enhance the protectiveness of the selected remedy imparts to the avian receptors that use the Garfield Wetlands for nesting and foraging habitat during the breeding season and to the surrounding public living in adjacent communities. To select effective remedial elements that will ensure groundwater and surface water will not lead to inappropriate exposures, EPA, UDEQ, and Kennecott decided to implement a number of studies which in part have been completed. One remaining study to be completed is a focused feasibility study for OU23 to assess some potential further active response action.

Based upon the results of these studies, it is anticipated that under a decision document, the EPA and UDEQ will clarify the selected remedy for OU22 and OU23. The clarified remedy will cause for the direct monitoring of both COCs at appropriate end points to ensure exposure risks do not arise. As it pertains to selenium, it is anticipated that the monitoring will focus on the periodic assessment of a statistical representation of bird eggs co-located with samples of other media. Such data will then allow for a better assessment of the transport of selenium in the dietary food web and assess more frequently if bird egg concentrations are reaching levels of concern. As it pertains to arsenic, the understanding of arsenic's potential to have a detrimental effect on the avian receptors is less clear. It is anticipated that the arsenic assessment will result in the support of reasonable performance standard to ensure detrimental effects do not arise. As it pertains to OU23, it is anticipated that a drilling restriction, ongoing monitoring of the selenium and arsenic plumes emanating from OU13 and OU14, and potential further source control work will result.

Once a decision document is completed, the overall protectiveness of the combined remedy for OU22 and OU23 will be re-evaluated. A five-year review addendum will be completed by June 2015. It is anticipated that five-year reviews will continue, since selenium and arsenic concentrations in the groundwater plumes emanating from OU13 and OU14 are not expected to reduce below concentrations that allow for unrestricted use or unrestricted exposure for some time.