6.0 Summary and Conclusions

In 1990, a RI/FS and ROD were completed for MMTS OUs I and II. A RI was completed for OU III in 1998 and subsequent interim action performed. This report presents the results of the interim remedial action and completes the remedial investigation/feasibility study process. Information presented in this RI Addendum/FFS for OU III of MMTS is summarized in the following sections.

6.1 Physical Site Characteristics

- The hydrostratigraphic units associated with OU III are the alluvial aquifer, which is underlain by the Dakota Sandstone aquitard and the Burro Canyon sandstone aquifer.
- The alluvial aquifer continues to be contaminated because of past Millsite activities. The primary sources of contamination (the tailings piles) have been removed. Alluvial aquifer material downgradient of the Millsite remains as a residual source of contamination to ground water. The vadose zone is not a significant contributor to ground water contamination. Selenium concentrations have increased in surface and ground water since remediation of the Millsite was completed. The increased selenium levels are most likely due to weathering of bedrock exposed during remediation and subsequent release of naturally occurring selenium, and, due to naturally occurring off-site sources north of the Millsite.
- The alluvial aquifer is currently not used for drinking water, irrigation, or livestock watering. Montezuma Creek is used for irrigation and livestock watering. The city of Monticello uses Burro Canyon ground water for nondomestic and domestic purposes.
- The Mancos Shale and Dakota Sandstone aquitards where present, and the upward vertical hydraulic gradient between the Burro Canyon aquifer and the alluvial aquifer where these aquitards are absent, protect the Burro Canyon aquifer from contamination from the alluvial aquifer.
- Montezuma Creek and the alluvial aquifer are hydraulically interconnected; the alluvial aquifer both discharges to and accepts recharge from Montezuma Creek. On the Millsite, the alluvial aquifer discharges significantly to Montezuma Creek. Ground water flow from the Millsite is approximately 11 gpm. Montezuma Creek is a predominantly losing stream from the eastern boundary of the Millsite to approximately 1 mile downstream. East of that point a strong gaining stream condition results due to pinching out of the alluvial aquifer because of bedrock control and discharge from the Burro Canyon Fm.
- Contaminants of concern for OU III are arsenic, manganese, molybdenum, nitrate, selenium, uranium (and uranium isotopes), vanadium, gross alpha, and gross beta. In surface water, nitrate and selenium are the only contaminants that exceed Utah surface water standards. Contaminants in the alluvial aquifer have migrated off the Millsite in levels that exceed their respective PRGs.
- Uranium has migrated the farthest; its contamination extends approximately 1 mile to the east of the Millsite. The distribution of uranium in the alluvial aquifer is consistent with column test results that indicated that uranium is the most mobile contaminant.

- The PRB is effective in reducing contaminant concentrations in the alluvial aquifer. Its longevity is likely to be at least 15 yr from the time of installation. EPA and DOE are undertaking further studies to evaluate its performance and longevity.

6.2 Ground Water Modeling

- Ground water modeling predicts that uranium concentrations in ground water will decrease to less than 30 µg/L in 42 yr from October 2002, independent of treatment by the PRB.
- The uranium plume will move beyond the PRB by 2015. Rapid restoration of ground water quality on the Millsite is achieved by inflows from lateral sources. These inflows are ultimately captured by the wetlands and creek on the Millsite and are conveyed from the study area principally as surface flow.
- The uranium plume downgradient of the Millsite is attenuated by dilution resulting from discharge of Burro Canyon Fm. ground water to the alluvial aquifer and by discharge of the alluvial aquifer to Montezuma Creek. These processes occur in the narrow reach of Montezuma Creek where the upper bedrock is the Burro Canyon Fm.

6.3 Risk Assessment

6.3.1 Human Health

- Site-specific exposure factors were developed by DOE, EPA, and UDEQ based on existing and anticipated future land use scenarios. Exposures were determined using both RME and CT exposure parameters.
- Under the current scenario (agricultural/recreational use), added cancer risks do not exceed EPA's risk range of 10^{-6} to 10^{-4}, do not produce an HI greater than 1 (the numerical indicator of transition between acceptable and unacceptable risks), and result in an EDE of 5.5 mrem/yr, which is less than the 25 mrem/yr benchmark.
- Based on the unlikely assumption that the contaminated alluvial aquifer will be used for drinking water, noncancer risks produce an HI greater than 1, and cancer risks are within EPA's risk range. Potential future consumption of alluvial ground water is the most significant contributor to total human health risks.

6.3.2 Ecological Risks

- Because of uncertainties associated with selenium concentration trends in surface water and ground water and the development of habitat at Wetland 3, future risks to ecological receptors from exposure to selenium cannot be evaluated at this time.
- For COCs other than selenium, the decreases in COC concentrations in surface water, ground water, soil, and sediment should result in concentration decreases for those same constituents in biotic media. Therefore, it is assumed that risks to the ecological receptors identified in 1998 associated with all ecological COCs except selenium have been reduced by remedial action and that the conclusions reached in the 1998 ERA remain valid (i.e., no significant ecological risks).

- Given that the best habitat for the spotted bat and southwestern willow flycatcher is in an area where concentrations of selenium in the creek average between 5.1 and 7.0 µg/L and hot-spot remediation of contaminated soil and sediment has occurred, it is likely that the overly conservative exposure parameters balance any possible increase in selenium exposure from terrestrial invertebrate ingestion. It is unlikely that these receptors are currently at significant risk from selenium.
- A biomonitoring plan will be developed to address potential uncertainties with regard to the ecological health of wetlands on the Millsite due to selenium. Specific sampling goals and design will be in the OU III Proposed Plan and ROD. Results of the data collection effort dictated by the post-remedial monitoring plan will be evaluated before the next CERCLA 5-year review scheduled for February 2007 so that determination may be made of the protectiveness of the remedy to the environment.

6.4 Feasibility Study

- The four remedial alternatives carried through the detailed analysis are

  1. No Further Action with Institutional Controls
  2. Monitored Natural Attenuation with Institutional Controls
  3. Permeable Reactive Barrier with Monitored Natural Attenuation and Institutional Controls
  4. Enhanced Permeable Reactive Barrier with Monitored Natural Attenuation and Institutional Controls

  The institutional controls in each alternative are the OU III ground water use restriction that was implemented in 1999 and the quitclaim deed for the Millsite. Two enhancement options to improve the capture and treatment efficiency of the permeable reactive barrier were evaluated under Alternative 4.

- Each alternative can meet site RAOs within the established remediation time frame. The estimated time to attain RAOs does not vary significantly among the alternatives. The estimated remediation time frames (since October 2002) are 42 yr for Alternatives 1 and 2, 40 yr for Alternative 3, and 39 and 38 yr for Alternative 4 Options 1 and 2, respectively.

- The alternatives are equally protective of human health throughout the estimated remediation time frame. This result is achieved through institutional controls that restrict use of contaminated ground water at OU III.

- Compared to Alternatives 3 and 4, Alternative 2 is capable of achieving RAOs without additional technical or administrative requirements, and without reliance on the PRB. Otherwise, Alternatives 2, 3, and 4 are similar in satisfying the criteria evaluated in the detailed analysis (state and community acceptance excluded).

- An advantage of Alternative 4 is to potentially reduce the remediation time by 4 or 5 years.

End of current text