ATTACHMENT D

SUMMARY OF ACTINIDE MIGRATION EVALUATION MEETINGS

The Actinide Migration Evaluation (AME) projects were established by DOE in 1996 to investigate and model ^{239,240}Pu, ^{241}Am, and uranium transport in the site environment. Periodic technical and public meetings have been a way for Kaiser-Hill (K-H) and the various scientists who specialize in the study of actinide movement in the environment to report on the progress of their findings at Rocky Flats. The specific projects that are currently underway are

- Watershed erosion and sediment transport modeling
- Air transport modeling
- Biological impact on actinide mobility
- Pathway analysis
- Updating the data quality objectives for the AME project
- Uranium geochemical modeling
- Colloidal transport and aggregation experiments
- Sampling process waste lines for plutonium, americium, and uranium oxidation states
- Installation and sampling groundwater aseptic wells
- High Resolution Inductively-Coupled Plasma/Mass Spectrometry (ICP/MS) analysis of RFETS groundwater and surface water samples
- Soil aggregation/disaggregation studies by Colorado School of Mines (funded by U.S. Environmental Protection Agency (EPA).

A *Risk Assessment Corporation (RAC)* representative attended the AME meetings beginning with the meeting on November 19, 1998, at the Arvada City Hall. The group meets about every 6-8 weeks. As we began the project, there were four reports from K-H and Rocky Mountain Remediation Services (RMRS) that were currently available about the work:

RMRS. 1998. Loading Analysis for the Actinide Migration Studies at the Rocky Flats Environmental Technology Site. Rev. 0. RF/RMRS-98-277. UN. September. (Available surface water discharge and actinide activity data from site monitoring programs during the 1990s were compiled to compute actinide loads on a storm-specific and annual basis. The analysis was done for Woman Creek, Walnut Creek and the South Interceptor Ditch [SID] drainage basins, which is part of the Woman Creek watershed).

RMRS. 1998. Actinide Content and Aggregate Size Analyses for Surface Soil in the Walnut Creek and Woman Creek Watersheds at the Rocky Flats Environmental Technology Site. Rev. 1. RF/RMRS-98-281.UN. September. (Reports ^{239,240}Pu, and ^{241}Am activity in surface soil sampled in Fiscal Year 1998 from the Walnut and Woman Creek watersheds. Particle size distribution of the soil and sediment samples were done at the Colorado School of Mines. Data will be used as source of actinides

to streams via storm water runoff and to calibrate the Watershed Erosion Prediction Project [WEPP] model to estimate soil erosion and associated actinide transport).

RMRS. 1998. Conceptual Model for Actinide Migration Studies at the Rocky Flats Environmental Technology Site. No number on cover. October.

RMRS. 1998. Preliminary Report on Soil Erosion/Surface Water Sediment Transport Modeling for the Actinide Migration Study at the Rocky Flats Environmental Technology Site. Fiscal Year 1998. RF/RMRS-98-285.UN. November. (Provides preliminary modeling results that will be used for calibrating the soil erosion and surface water transport modeling effort for the Rocky Flats watersheds. This report describes results for the SID watershed, which drains into Pond C-2).

At the November 19, 1998 meeting, there were two major topics: (1) soil erosion and sediment transport modeling Fiscal Year 1999 work (a summary of the November 1998 report above) reported by Win Chromec and Ken Spitze, and (2) Air Modeling Fiscal Year 1999 work that will be done by Radian International reported by Martha Hyder and Arney Srackangast. Radian International is just beginning the current air modeling work and will focus on "improving estimates of airborne actinide migration and deposition in the conceptual model," (paper three above) "preparing a modeling tool to use in evaluating various emission scenarios, and providing preliminary air pathway dose estimates." They plan to do this by reviewing published studies of contaminated soils resuspension to determine resuspension mechanisms, and then to identify resuspension models to use in estimating emissions of actinides from contaminated soils into the air.

The January 21, 1999 AME meeting focused on studies of plutonium migration at the Rocky Flats site. Dr. Greg Chopin from the University of Florida described his work with the use of oxidation state actinide analogs to observe effects of geochemical processes over long time periods. He and his colleagues have studied old uranium and thorium locations around the world to find analogs for plutonium, (e.g., Th^{4+} for Pu^{4+}, and U^{4+} for Pu^{4+}). The main message is that natural analog sites provide valuable information on actinide chemistry and fate and transport; to date these studies show very little movement of plutonium over long time periods. Their studies indicate that Rocky Flats plutonium is insoluble but they emphasize that solubility studies are complex. At that same meeting, Mike Murrell and Chris Brink from Los Alamos National Laboratory (LANL) explained how they are tracing uranium migration at the Rocky Flats solar ponds using refined analytical techniques in ion counting to follow the transport of uranium and to differentiate between "Rocky Flats" uranium and "natural" uranium.

At the April 29, 1999 AME meetings, researchers described progress on collecting borehole samples from the South Interceptor Ditch, runoff samples from a buffer zone area near Walnut Creek, and water samples from Pond B-5 discharge that will be used for suspended solid fractionation experiments. Jim Ranville from the Colorado School of Mines, described his work on soil aggregation at Rocky Flats and how it might affect solubility. Mary Neu from LANL then described results of current experiments done on characterizing plutonium in samples from the 903 Area. Using powerful, state-of-the-art analytical techniques, she and her colleagues have demonstrated that plutonium from under the asphalt pad at the 903 Area is insoluble PuO_2. The plutonium/americium ratio also indicates insoluble plutonium. These new results provide solid proof for what many have assumed all along¾that plutonium in the soil at Rocky Flats is insoluble PuO_2, and thus may not get into the groundwater.

These studies are exciting and very relevant to the current soil project because they help to characterize the chemical and physical form of plutonium at the Rocky Flats site. The AME research that is underway has helped to define the potentially significant pathways and we still see inhalation as the major pathway for this work. Recent work at LANL indicates that the plutonium from soil samples under the 903 Pad is insoluble PuO_2. While results from some of the AME studies indicate that this insoluble form of plutonium may not enter groundwater, we are examining a conservative calculation to address the question of whether or not the pathway can be ruled out of the current analysis. We understand the importance of groundwater and surface water pathways in the long term, and include the groundwater pathway in one of our scenarios. We do recognize, however, that our assessment of the groundwater pathway is limited by the complexity of the pathway.

On October 4, 1999, the AME meeting covered the following topics: an update of the site conceptual model by Chris Dayton; a summary of experimental results obtained to date by the Colorado School of Mines and by Texas A&M, Galveston; results of the FY99 atmospheric dispersion and deposition by Martha Hyder of Radian International; biological mobility of environmental plutonium by Ward Whicker of Colorado State University and an update on the 903 Pad remediation project by Steve Paris of RMRS. The characterization of the 903 Pad is complete and a remediation strategy is being developed.

A study by the Colorado School of Mines that is investigating the effect of environmental redox potential on the solubility of plutonium shows that under moderately reducing environments while the soil is fairly saturated, there is less plutonium found in the <0.45 μ size fraction than in oxidizing environments. Americium's association with a particular size fraction seems to independent of the redox potential.

To evaluate the biological mobility of environmental plutonium, a draft "white paper" by Dr. Kathryn Higley of Oregon Sate University and Dr. Ward Whicker of Colorado State University, titled "Biological Mobility of Environmental Plutonium," was distributed. Dr. Whicker described the results of their study and the report is available through the Citizen's Advisory Board. Plutonium is not a biologically essential nutrient, nor an analog of a biologically essential nutrient. Much of the plutonium measured in plant material comes from atmospheric deposition onto the leaf surface.