SMC April 24 Conference Call Presentation to the NRC of a Proposal to Utilize a Modified EPA Method 1312 for Kd Determination

Shieldalloy Metallurgical Corporation (SMC) proposes to use a modified EPA Method 1312 (U.S. EPA, 1990), commonly known as Synthetic Precipitation Leaching Procedure (SPLP), for the determination of distribution coefficients (Kd) for radionuclides between Storage Yard materials (slag and baghouse dust) and infiltrating rainwater. The following general reasons are given for selection of the SPLP for the leaching evaluations:

- The SPLP evaluates the potential for leaching of metals into ground and surface waters
- The SPLP provides a realistic assessment of metals mobility under field conditions
- The SPLP is the appropriate method for evaluating fate and transport of metals in a waste disposal facility that excludes municipal solid wastes.
- The SPLP focuses on leaching of metals from materials rather than adsorption of nuclides from the surface of the materials, as is the case in the spiked ASTM D-4319 method.

Additional justification for use of the SPLP method, rather than the ASTM D-4319 method of Kd determination (ASTM, 1993), is provided in the "Clarifications" section at the end of this document.

Proposed Test Procedures

- The EPA test method normally includes an 18-hour leach period with tumbling of solids and contact solution in a reaction chamber
- SMC will initially conduct an investigation into the optimum leach period by leaching 3 samples each of slag and baghouse dust for up to 14 days (or longer, if necessary). Interim results at 24 hours, 3 days, 7 days, and 14 days will be evaluated to assess attainment of steady-state, as determined by asymptotic approach to, or achievement of, a limiting value.
- These interim times are identical to those specified in ASTM Method D-4319 (ASTM, 1993)
- Site rainwater will be used for the contact solution as an additional measure to improve the experimental assessment of the potential leachate chemistry
- The initial investigation will also evaluate the effect of particle size on the leach rate by testing 3 particle sizes of slag: ground sample (12 mesh), 1-inch diameter, and 4-inch diameter. The baghouse dust samples used for the initial investigation will not be downsized.
- For the initial tests, elemental analyses will be performed for U, Th, and Ra; pH and Eh will be monitored, and Ca, Al, Mg, and Si will be analyzed to assist with the determination of the optimum leach time for the radionuclides.
- The slag samples with larger particle sizes (1-inch and 4-inch) will be tumbled 3 times/day for 5 minutes, for a total of 15 minutes of daily tumbling, in order to avoid the potential for mechanical erosion, abrasion, or other physical degradation of the solids. It should be noted

that the amount of agitation will not affect the equilibrium liquid concentrations, although it may affect the kinetics and hence the time necessary to reach equilibrium. This, however, is outweighed by the effect of mechanical degradation that would result from continuous tumbling.

- The ground slag and baghouse dust will initially be tumbled for the standard 18-hour period. The ground slag samples and the baghouse dust will then be tumbled for two hours per day for the remaining duration of the test procedure.
- From the results of the initial investigation on 3 samples each of slag and baghouse dust, the time necessary to achieve steady-state and the radionuclides that are quantitatively leached will be determined for use in conducting tests on additional samples.
- An additional set of 14 samples of each material will then be subjected to the modified SPLP, described above, with leach times set as determined during the initial investigation. The result will be leachability data for a total of 17 samples of slag and 17 samples of baghouse dust.
- Only radionuclides that leach into solution in quantifiable amounts during the initial investigation will be analyzed during the subsequent testing. No further analyses will be performed for Ca, Al, Mg and Si.
- The subsequent tests on slag will be performed on only the 4-inch particle sizes, with leach times determined based on the initial test results for the four-inch particle size.
- The SPLP results from the 4-inch tests will be used as input to the Kd determinations for slag, even though the mean particle size in the storage yard is one foot or more.
- The objective of the initial investigation on the 3 different particle sizes is to confirm the expectation that the apparent Kd decreases with decrease in particle size as a means of demonstrating that the use of too small of a particle size leads to unrealistic results for leach and dose modeling, and that the use of the 4-inch particle size is still conservative, considering the actual size of the slag pieces in the Storage Yard.

Sample Collection

- The slag piles and the baghouse dust piles in the Storage Yard will be divided into 17 approximately equal-dimension sectors and the GPS coordinates for the approximate center of each sector will be determined.

- Samples of slag or dust will be collected from that location unless accessibility or other safety issues make that location unsuitable. In that case, the sample from that sector will be collected as close as possible to the centerpoint of the sector, with the GPS coordinates of the actual collection location recorded.

- For the baghouse dust stockpiles, samples will be collected from a depth of at least one foot below the surface of the pile, in order to avoid the inclusion of weathered materials in the samples.

- For the slag stockpiles, surface weathering is not as important because of the physical form of the material (i.e., large-diameter rocks), the necessarily large volumes that will be collected for

each sample, and the significantly higher radionuclide content in slag. While the radionuclide content of the slag may have varied to some degree over the years based on expected variabilities in feed material concentration, the chemical process for ferrocolumbium production did not change from the 1950's until the day production ceased in the late 1990s. Therefore, the leachability of samples from 17 systematic sampling locations at or near the surface of the slag pile is deemed representative of the pile in its entirety.

- To ensure the samples of slag are in fact representative of the higher-activity ferrocolumbium slag (and not a stray piece of ferrovanadium or columbium slag), only those samples that exhibit contact exposure rates in excess of two (2) mR per hour will be used for the analysis. The contact exposure rates for each of the samples sent to the laboratory will be recorded on the collection log.

Clarifications

Tumbling:

- The experimental objectives include determining the change in apparent Kd with increase in particle size
- For the 1-inch and 4-inch slag pieces, it is necessary to avoid abrasion/mechanical erosion and creation of additional surface area for reactivity that might result from continuous tumbling
- The large pieces will have large pore spaces at closest packing
- Non-uniformity (concentration gradients) of the contact solution is unlikely for the large particles; tumbling is probably unnecessary, but some agitation will provide a level of assurance.
- The baghouse dust and ground slag require longer tumbling due to the fine pore spaces and the space above the solids occupied only by the contact solution; mixing of pore solution and this "head space" solution is necessary

RESRAD Model Kd:

- A Kd is required by the RESRAD Model; this Kd is intended for equilibrium sorption/desorption in contaminated sediments, not kinetically-controlled leaching of metals from a source, as is the case for the materials in the Storage yard.
- The objective for dose modeling is to simulate rate-controlled leaching, realistically, yet conservatively, not equilibration of the entire solid mass
- ASTM D-4319 (ASTM, 1993) is intended for sorption/desorption on soil, not rate-controlled reactivity or leaching; the extremely large surface area with the small particle sizes, providing more surface area for reactivity, is unrealistic.

References

ASTM, 1993 (Reapproved 2001). Standard Test Method for Distribution Ratios by the Short-Term Batch Method D 4319-93.