

1. What Questions Were Asked of the Peer Reviewers?

In order to provide a more complete analysis, and in accordance with EPA policy, we presented the two new studies for formal, independent peer review. The three peer reviewers selected for this process are national experts with significant technical expertise in hazardous waste leaching, have no prior association with these studies, and have no perceived or actual conflict with any impact of the study results. The members of the peer review panel were tasked with evaluating the adequacy of the experimental design, conduct, and conclusions of the two studies. The peer review panel also provided information on how the studies can be used to provide a framework to determine whether additional protective measures are required to prevent loss of mercury to the environment from the treatment and co-disposal of mercury-bearing wastes in landfills.

Additionally, the members of the peer review panel were asked if additional studies were warranted for other factors that impact solubility (e.g., liquid/solid ratio, redox conditions, leachate composition) or affect ability to leach (such as use of macroencapsulation).

2. What Did the Peer Reviewers Say About the Study of the Treatment of Mercury Surrogate Wastes?

Two of the peer reviewers stated that the experimental design was appropriate for the study. One reviewer, however, said the design did not follow the Data Quality Objectives (DQOs) process, and argued that there is little relationship between the objectives and the design. We disagree with this reviewer, however. EPA has developed the DQOs process as the Agency's recommended planning process when environmental data are used to select between two opposing conditions, such as achieving or not achieving a numerical standard.¹⁶ The DQOs process is used to develop qualitative and quantitative statements of the overall level of uncertainty that a decision-maker is willing to accept in results or decisions derived from environmental data, *i.e.*, Data Quality Objectives. The DQOs process entails a seven step systematic procedure for defining the criteria that a data collection design should satisfy, including when to collect samples, where to collect samples, the tolerable level of decision error for the study, and

how many samples to collect, balancing risk and cost in an acceptable manner. When this process is not directly applicable (*i.e.*, the experimental objective is estimation, research, or any other objective that does not select between two distinct conditions), the Agency recommends the use of a systematic planning method for defining performance criteria.¹⁷ For this research project, a systematic planning method was used. The project planning process used and the planning documents development were guided and overseen by EPA/ORD staff, and the Quality Assurance Project Plan (QAPP) was reviewed and approved by an EPA/ORD quality assurance expert. EPA believes that the project objectives and criteria were logical, given the intended end-use of the data, well-defined, and achievable.

The three reviewers all stated that the study was conducted properly. The three reviewers also stated that the studies met the objectives of: (1) Evaluating the ability of alternative treatment technologies to achieve a goal of 0.025 mg/L or less for the stabilization of mercury over a range of pH levels from 2 to 12; and, (2) to compare constant pH leaching protocol results to standard TCLP results. Two of the reviewers evaluated the ability of each treatment technology to meet the treatment goal, and concluded that the ability of each technology to meet the treatment goal in the constant pH leaching was pH-dependent.

The reviewers suggested additional studies to fill in specific data gaps. One reviewer noted that additional extractions up to at least pH 12.5 are needed to supplement the report. While we agree evaluation of a broader range could be helpful, we do not believe that additional studies are cost effective, because only a small fraction of hazardous waste landfills have been observed to have leachates above pH 12. In cases where disposal is proposed at or above pH 12.5, additional data for such conditions may be necessary to establish that treatment is effective for the expected disposal conditions. (See section II.F of today's notice for a discussion of pH levels in hazardous waste landfills.)

Another reviewer suggested that two or more actual wastes (rather than surrogates) containing over 260 mg/kg of mercury be subjected to stabilization and leaching by the TCLP as well as by the constant pH protocols. EPA agrees that using actual wastes, rather than surrogates, for treatability tests can be desirable. However, in many cases

during the history of establishing treatment standards in the BDAT program, EPA has used surrogates in lieu of actual wastes, whenever representative "hard-to-treat" wastes were not readily obtainable. Specifically, in the case of characteristic wastes, which can be extremely variable, using a surrogate allows us to evaluate a "hard-to-treat" waste. Using a "hard-to-treat" waste is useful if the ultimate treatment results will be used for other forms of that waste, which in the case of a characteristic waste like D009, is likely the case. In the studies discussed in this notice, where we were trying to determine how these forms of mercury would respond to treatment and determine how the treated waste forms would react to various pH environments, we are comfortable that using surrogate wastes did not diminish the value of the studies.

3. What Did the Peer Reviewers Say About the Elemental Mercury Study?

One of the peer reviewers agreed that the experimental design was appropriate for the study. Another reviewer said that a statement of acceptable errors should have been included (e.g., a treatment technology must be effective on 90% of wastes with a 90% confidence). Without such a statement, he said, it is difficult to decide when a technology provides adequate treatment. EPA believes that a statement of acceptable errors as constructed by the reviewer was not appropriate. The objective of the study was to determine how these forms of mercury would respond to treatment and to determine how the treated waste forms would behave in various pH environments.

Another reviewer also said the experimental design was generally appropriate; however, it failed to confirm that concentrations of elemental mercury in the treated wastes were at the values reported by the vendors. He added that the recoveries (*i.e.*, measure of total mercury present) for treated elemental mercury wastes submitted by Vendors A and C are so low that they cast doubt on the results of the leach tests. We disagree. The analysis of mercury content of the treatment residuals and that of the leachates are two distinct analyses. The low recoveries for the treated elemental mercury wastes were a result of the difficulty in digesting the solid waste form to dissolve the mercury and make it available for analysis; as a result, waste loadings reported by the vendors could not be verified. Regarding the leach tests, all spike recovery measurements of the leachates achieved

¹⁶ See EPA/600/R-96/055; Guidance for the Data Quality Objectives Process. <http://www.epa.gov/quality/qs-docs/g4-final.pdf>

¹⁷ Ibid.