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PUBLIC MEETING ON WASTE LEACHING
Session II - Modeling and Risk Assessment

Inorganic Modeling Issues and Problems - David Brown

David Brown, EPA/ORD, was scheduled to discuss issues and problems associated with modeling the leaching behavior of inorganic constituents. Mr. Brown could not be present, and his presentation was read by David Friedman, EPA/ORD. The text of that presentation is provided here, in its entirety.

The TCLP or other associated tests are a critical part of implementing some very important regulations that impact many people and many industries as well as the public at large. Because of that there is a great need for setting such methods right. Perhaps too great a need. I wonder if any such tests could be devised to adequately carry such a large load. My own answer to that question is: "Probably not." Considering the specifics of the many hundreds of combinations of waste materials possible, and the many hundreds of potential ideas that might be concocted to defeat any specific test over time, we would indeed be asking a lot from any possible TCLP substitute that might be devised. The waste chemistries are simply too specific and vary too widely to expect to find the test design that 'fits them all' in a satisfyingly defensible way. Having arrived at that conclusion in my own mind, my thinking has strayed toward looking for a set of waste-specific tests, or for finding some other means of satisfying the basic need that incorporates some facility for dealing with the diversity that various wastes now, and in the future, might present.

To develop, test, and adequately apply a sufficiently diverse set of waste category- specific tests to the problem in such a way as to result in a fully defensible position would appear to be a very difficult charge. A charge that might well be outside the realm of do-ability considering time and resource constraints, and the need to extend the battery of tests as new wastes come along and old ones diminish over time. Maintenance of the system of tests so assembled would also be a continuing struggle to assure that proficiency was retained over time in the face of changing waste streams and combinations thereof. Because these difficulties all lead to hands-on efforts in the laboratory in one way or another, I would regard this as a brute force kind of approach with high, long term effort and frequent adjustments involved. For those who might disagree, I offer the following challenge: Give me the complete set of specifications on your metals waste and the test you would apply to it, and 24 hours, and I will put on my waste generator's cap and find a way to defeat it.

If we are to deal with so much diversity in the most efficient way, it seems to me need to put our computers to work on this problem. Rather than devising endless tests and continually revising them to fit a endless stream of new waste combinations, can't we find a way to catalogue what we know about chemistry in our machines and let them do the work? Here, I am suggesting that we do our testing with a model. Then, to adjust our test, or to look at its outcomes, we end up pushing buttons and letting the machines do the work. This too is an admittedly difficult

undertaking on the front end. I am not suggesting that all the computer models or the data to drive them are available now, or that I necessarily know anyone smart enough to build them all quickly. What I am suggesting is that it might be an approach with some healthy long term benefits for all concerned. There would also be some side benefits, as discussed in the next bullet.

For sometime now, we have sidestepped the issue of dealing with interactions among mixed wastes in waste management units (WMU). The simple reason for that is that we don't know what combination of stuff is actually in the WMUs that we seek to model with methodologies like HWIR99. This is also why we can have less than great confidence in the applicability of any particular test on a single waste stream when it will actually be disposed in a mixture capable of many complicating' reactions not reflected in the test. This lack of important information is at the heart of some of the uncertainty in the HWIR99 methodology, as well as the the performance of any test (or model substitute) that we might seek to concoct. It is also the area where I think we might best apply some effort. Until we do, we are quite simply attempting to deal with an unknown in a very pragmatic way. How, for instance, do we design a test or modeling protocol that works for an unknown mixture? How do we validate such a test? I can't answer those questions, but would like to challenge those who can.

That brings me to the bottom line. I say we think about developing models to perform the necessary tests on the computer. To do that, we need detailed data on the waste composition, and we also need detailed data on the how those wastes are actually mixed in the WMU. If we have both those things, we could start making real progress toward developing the sort of predictive models that I am suggesting we develop over time. Once developed, such tools could be easily adjusted to fit changing conditions and waste mixture combinations by simply pushing some buttons, at least in the long haul. The data required to do what I suggest does not exist, and that it might take an act of Congress AND a prodigious amount of effort and expense to get it.) All true of course. Even so, it does seem we are working with an unknown problem until we put the facts on the table. We won't get there until we start, and now seems a good time to do that. If not, we will likely find ourselves asking these same questions a few years form now.

So what I suggest is that we put some thought toward gathering the necessary facts rather than fighting the unknowns any further. We then use those facts in combination with what we know about chemistry, and put some expert systems together that will do the testing for us. It isn't something I would suggest is easy, but it does seem like something reasonable to do because of the long term benefit to be gained, both from the testing perspective and for reducing uncertainty in our risk assessment methodologies. For metals, we have some reasonable starting points available in the variety of metal speciation models and databases that already exist. For organics we have some pretty smart organic chemists around to deal with the reactions. For the metal / organic combinations we have some complexation constants on hand, and know how to get more. There is also a developing field of software design expertise to draw from in developing the sort of expert systems methodologies that would help to make the approach I am suggesting more self-sustaining over time.

How do we do all this? I suggest we start with a three-way partnership agreement between the EPA, the regulated community, and the academic / consulting research community. The EPA and waste generators would work together to help put the needed data on the table (even if it has to be only for a series of well-thought scenarios), and the EPA and outside research community would combine forces to build the modeling tools. All would share in the mutual benefits, that I think could be many. EPA gets a major, and recurring, problem solved, uncertainty of its methods are reduced and public acceptance is increased. The regulated community gets more fair and equitable regulations. The scientific community takes a step forward, and nobody has to stir test tubes.