2011 World of Coal Ash (WOCA) Conference – May 9-12, 2011 in Denver, CO, USA
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Summary of the EPA's Leaching Environmental Assessment Framework (LEAF) and the Implications for Coal Ash Impoundments and Beneficial Use in Mine Reclamation

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Introduction

In its proposed ruling, the U.S. Environmental Protection Agency (EPA) provides a summary of recent EPA research on the tests for constituents leaching from coal combustion residuals (CCRs). This research was conducted under the guidance of the EPA's Office of Research and Development (ORD) to identify appropriate leach testing methods (including LEAF) that can be used to assess existing leaching under known or proposed CCR management conditions. Evaluation of LEAF by the Electric Power Research Institute (EPRI) indicates that LEAF noted several potential advantages and drawbacks over single-point batch tests such as the Toxicity Characteristic Leaching Procedure (TCLP SW-846, Method 1311) and the Synthetic Precipitation Leaching Procedure (SPLP SW-846 Method 1312).

What is the LEAF Protocol?

LEAF is an organized collection of four different laboratory test methods designed to identify the leaching characteristics of a wide range of CCRs. LEAF requires the collection of considerably more data than standard single-point batch leaching tests such as the TCLP and the SPLP. The additional testing and data are intended to provide a more robust dataset that can be used to evaluate CCRs over a wider range of pH and site-specific conditions.

EPA Considerations

- Addresses concerns of the EPA Science Advisory Board, can provide a better technical basis for risk assessment.
- Allows assessment of materials for beneficial reuse.
- Can provide a better technical basis for evaluating treatment effectiveness. (See Validation of Test Method in the LEAF)

Potential Advantages of LEAF

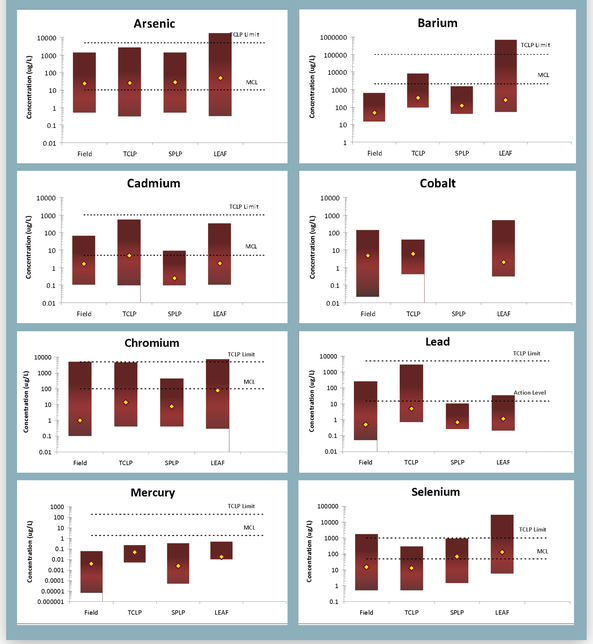
- Provides a more robust dataset for evaluating CCRs over a wide range of conditions. (See EPRI Comments)
- Testing can be tailored to address site-specific conditions, such as a limited pH range for cementitious materials.

Drawbacks and Disadvantages of LEAF

- Primary concern is the inappropriate use of the large volume of data provided by the LEAF protocol. (See EPRI Comments)
- Lack of field validation to guide the site-specific application.
- Increased range of pH that may not be representative of actual site conditions and potential for regulators to use worst-case results.
- Limited number of laboratories able to perform the testing and concern over repeatability and cost.
- Can impact the use of safe and effective beneficial reuse methods while the use and reliability of the LEAF protocol is fully investigated and calibrated.
- Proper interpretation requires special knowledge of geochemistry and an understanding of interrelated issues that may impact environmental systems.

Information from EPRI Technical Review

Figure 6-4
Range in Leachate Concentrations for Field Leachate, TCLP, SPLP, and LEAF Procedures. The diamond in the bar represents themedian value.



Implications for Coal Ash Reuse

- Results can vary significantly from TCLP and SPLP results depending on pH and material properties. Which method is correct for the different ranges of pH and the wide variety of materials?
- How and where will LEAF be applied? Only for structural fills or is it applicable to other unencapsulated uses?
- The time required for test validation and the phase-in period is unclear. Could it be applied retroactively to previously approved or closed CCR sites?
- How will potential conflicts with TCLP and SPLP test results be addressed? Will a failing result using the LEAF protocol supersede a passing result using other SW-846 test methods?
- Will different results for leachability obtained using the LEAF protocol call into question uses of coal ash that were previously considered beneficial (i.e. roadway embankments and mine reclamation with lime additives)?

References

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KEYWORDS: beneficial reuse, mine reclamation, leachability, structural fill for coal ash

ABSTRACT:

In its proposed ruling, the U.S. Environmental Protection Agency (EPA) provides a summary of recent EPA research on the tests for constituents leaching from coal combustion residuals (CCRs). This research was conducted in cooperation with the Electric Power Research Institute (EPRI) , the utility industry and various agencies working under the guidance of the EPA's Office of Research and Development (ORD). The focus of the EPA research and LEAF was to identify appropriate leach testing methods that can be used to assess existing leaching under known or proposed CCR management conditions. Followup evaluation of LEAF by an EPRI team of scientists indicates that the LEAF offers several advantages, and a few drawbacks over single-point batch tests such as the Toxicity Characteristic Leaching Procedure (TCLP) and the Synthetic Precipitation Leaching Procedure (SPLP). Advantages include having a more robust data set for make leaching evaluations, and drawbacks include a lack of commercial labs setup to run the procedures and the lack of a interlab study to evaluate reproducibility. This paper will not evaluate the accuracy of laboratory testing protocol, but primarily focus on the use and potential impact of LEAF as leachability evaluations are made on existing coal ash impoundments and proposed mine reclamation projects.

The proposed use and potential impact of LEAF that will be considered in this paper and presentation include general recommendations and guidelines to address the following:

- Since LEAF is a relatively new test method and virtually no commercial labs are familiar with the protocols how will it be made available to electric power utility industry?
- What are the range of concentrations of pH that will be used for different types of flyash and subsurface conditions?
- How will the LEAF test results be compared to previously completed TCLP and/or SPLP tests for specific projects and/or site conditions?
- In consideration of the lack of data comparing laboratory to field conditions with CCRs in the United States, how will the data from LEAF be used for evaluating metals concentrations beneath coal ash impoundments and mine reclamation projects?
- Since the transition between previously established TCLP and SPLP tests, and the new LEAF test results is still in process, how should test reports and professional opinions of reliability be reported?
- What are the site specific conditions that need to be considered for coal ash impoundment and proposed mine reclamation projects when using LEAF or other leach testing procedures?

Submitted for consideration in the 2011 World of Coal Ash Conference, May 9-12, 2011.