MANAGEMENT OF COAL ASH DISPOSAL AND HOUSEHOLD TRASH – Do they need to be Different?

Lisa JN Bradley, PhD, DABT, AECOM Environment

INTRODUCTION

There is currently much activity in Washington centered around the management of the disposal of coal combustion products (CCPs) or coal ash. Proposals for disposal have been put forward both on the regulatory and legislative fronts. In the public discussion of CCPs, news stories have raised concerns, as in the following:

“While barring the EPA from regulating coal ash, the legislation would allow states to treat the ash as municipal waste, placing it in the same category as household garbage and cleaning chemicals, wastewater and construction debris.”

[The Tennessean, July 14, 2011]

What is the story behind these stories?

Regulatory Background

In May 2010, the U.S. Environmental Protection Agency (USEPA) put forward two co-proposals for regulating the management of coal ash disposal. One proposed to manage coal ash as a "special" waste under RCRA Subtitle C (regulations for hazardous waste management), and one proposed to manage coal ash as a solid waste under Subtitle D, the subtitle under which municipal solid waste (MSW) is managed.

One aspect of these proposals that is important to understand is that engineering controls required by each for the construction of a landfill for coal ash disposal are the same, and are the same as required for MSW landfills under RCRA Subtitle D.

Legislative Background

On the legislative front, several bills are moving through the U.S. House of Representatives that address coal ash. The most prominent is HR 2273, the “Coal Residuals Reuse and Management Act,” which was approved by a 35-12 bipartisan vote in the Energy and Commerce Committee on July 13, 2011. This bill would prevent the USEPA from regulating coal ash disposal as a “hazardous waste” under RCRA Subtitle C while simultaneously directing states to enact enforceable permit programs modeled after successful municipal solid waste programs, under RCRA Subtitle D.

The Issue

The news stories are correct – one of USEPA’s regulatory options would require management of coal ash disposal under RCRA Subtitle D, the same regulations that apply to MSW. The question is: Do the physical and chemical properties of coal ash necessitate disposal regulations that are stricter than those for MSW? Or stated differently: If MSW landfills are successfully managed under Subtitle D of RCRA, are there differences between MSW and CCPs that warrant a Subtitle C regulation?

CCP disposal site.

Municipal waste.
Technical Background

A major consideration in the regulatory discussion is the potential risk posed by leachate from CCP landfills and impoundments and its impact on the environment. CCP impoundments and landfills are typically monofills that are fairly consistent in composition compared with the much more numerous and ubiquitous Subtitle D MSW landfills, which can receive a variety of wastes and are successfully regulated as nonhazardous waste under RCRA.

Leachates from these two types of landfills are also very different, with CCP leachate containing a relatively consistent set of inorganic constituents, while MSW landfill leachate can consist of a wide variety and heterogeneous mixture of inorganic and organic constituents. However, the relative risks of the leachates can be compared using risk-based screening methods.

The Electric Power Research Institute (EPRI) is an independent, non-profit company performing research and development for the benefit of the public. EPRI conducted a human health and ecological risk-based comparison of leachate from MSW landfills to leachate from CCP landfills and impoundments. Leachate is the liquid that drains or “leaches” from a landfill and is generated by infiltration of precipitation and/or the percolation of precipitation through the disposal site. Leachate was chosen as the metric for comparison in the evaluation because leachate is characteristic of the disposal site and its specific contents, and its potential for impact on the environment is independent of the geology or geography of the disposal site. Therefore, a comparison of leachates from MSW and CCP landfills/impoundments allows a direct comparison of their respective contents, and the behavior of the contents in terms of leachate formation.

The comparison was conducted in the following manner: Data sets representative of each type of leachate were located and a selection process identified the leachate data set used for the evaluation; risk-based comparison levels were identified from government sources to be used to evaluate comparative risk for both human health and ecological scenarios; risk-based screening was conducted using the leachate data sets and human health and ecological screening levels; and the results were evaluated and summarized. Details of this evaluation can be found in “Comparison of Risks for Leachate from Coal Combustion Product Landfills and Impoundments with Risks for Leachate from Subtitle D Municipal Solid Waste Landfill Facilities,” Report No. 1020555 available at www.epri.com.

Data Sets

MSW leachate data were obtained from the USEPA’s LEACH 2000 database. After evaluating each source of components for this database, leachate data for over 200 constituents from a total of 121 MSW landfills were used. These data have been assumed to be representative of the more than 3000 MSW landfills in the United States.

CCP leachate data were queried from EPRI’s Combustion Product Information (CPIinfo) database which contains analytical results from solid composition, laboratory leaching, and field leachate testing performed by EPRI since 1985. Results compiled for this study reflect database contents as of October 2010. They represent 47 inorganic constituents from 30 CCP management units and are considered representative of CCP management units in the United States.

Summary statistics (minimum, maximum, and 50th and 90th percentile concentrations) were calculated for each constituent in each data set.

Risk-Based Comparison Levels

The leachate data available for MSW landfills and CCP landfills and impoundments are liquid concentrations. Therefore, risk-based comparison levels appropriate for liquid media concentrations were identified for both the human health and the ecological evaluations.

For human health evaluations, USEPA provides screening levels that are used in both state and federal regulatory programs (USEPA, 2010, version from May 2010; available at [http://www.epa.gov/region09/superfund/prg/index.html]). The only screening levels provided for liquid media are for tap water, so they were used here for comparison. However, it is important to note that it is unrealistic to assume that either type of leachate, MSW or CCP, would be the source of tap water or drinking water.

For the ecological evaluations, screening levels for freshwater surface water were compiled from federal sources. Chronic ambient water quality criteria (AWQC) were used as well as freshwater screening levels from USEPA Regions 3, 4, and 5. The lowest value available for each constituent from these sources was conservatively selected as the ecological risk-based screening level for the leachate evaluation. Ecological comparison levels are generally based on conservative endpoints and sensitive ecological effects data and the assumption that aquatic receptors (e.g., fish, invertebrates) are directly exposed to constituents in surface water. However, note that aquatic receptors are not in direct contact with either type of leachate.

Risk-Based Comparison

A cumulative risk-based screening method was used in conjunction with human health and ecological risk-based comparison levels to develop estimates of comparative risks between the MSW and CCP leachate datasets, as detailed in the EPRI report.

Risk is a function of the concentration of a constituent in an environmental medium, the level of exposure to that medium, and the estimate of toxicity of the constituent:

\[ \text{Risk} = \text{Concentration} \times \text{Exposure} \times \text{Toxicity} \]

Given a target risk level, a screening level concentration of a constituent in an environmental medium can be calculated:

\[ \text{Screening Level Concentration} = \frac{\text{Target Risk Level}}{\text{Exposure} \times \text{Toxicity}} \]

One can compare a measured environmental concentration to a screening level by a simple ratio to determine if the environmental concentration is above or below the screening level:

\[ \text{Ratio} = \frac{\text{Concentration}}{\text{Screening Level Concentration}} \]

In the evaluation, relative risks were developed by calculating the ratio of the leachate concentration for each constituent to its comparison level for both the human health and the ecological evaluations:

- For noncarcinogens and for the ecological screen, the target risk level is a ratio of 1 (called a hazard quotient), thus the resulting ratio is equivalent to a hazard quotient.
- For carcinogens, the resulting ratio was multiplied by the target risk of 1x10^-6 used in the calculation of the USEPA screening level to develop a relative risk level.

Relative Risk = \[
\frac{\text{Concentration}}{\text{Screening Level Concentration}} \times \frac{\text{Target Risk Level}}{\text{Exposure} \times \text{Toxicity}}
\]
So, we are asking the question: Are the leachate concentrations above or below the risk-based screening level, and what is that ratio? Knowing the target risk level that the screening level is based on, we can use the ratio to estimate a relative risk level associated with that constituent.

The relative risk results for each type of leachate are summed—for human health, noncancer and cancer results are summed separately.

**Results**

*Table 1* summarizes the results. Note that the magnitude of the results in the first two lines of the table is not as important as the ratio of the results between the MSW and CCP data. These ratios are provided in the second two lines of the table.

As shown, the relative risks based on the human health evaluation are essentially the same for the CCP and MSW leachates, with the MSW leachate risks slightly lower at the 50th percentile concentration level, and slightly higher at the 90th percentile concentration level. The relative ecological risks are higher for MSW leachate than for CCP leachate. These results are discussed in detail in the EPRI report.

### Summary

Based on the results of this risk-based comparison, it can be concluded that the relative health risks associated with leachates from MSW landfills and CCP management units are similar. One striking difference is that there is only one carcinogen that is a risk driver for the CCP leachate, while MSW leachate risk drivers comprise over 30 potential carcinogens, including volatile organic compounds, semivolatile organic compounds, PCBs, dioxins and furans and pesticides. Thus, the engineering controls used to successfully manage MSW landfills and their contents and the generated leachate can be applied to CCP management units and protect the environment.

In addition to leachate management for MWS landfills, operating criteria are provided under Subtitle D for disease vector control (e.g., rodents, flies, mosquitoes, and other insects, that can transmit diseases to humans) and explosive gases control – controls that are not necessary for a CCP monofill that does not attract disease vectors and does not generate explosive gases. These differences are summarized in *Table 2*.

Thus, EPA’s proposed Subtitle D rule for CCP disposal and legislation currently under consideration in Congress would indeed “allow states to treat the ash as municipal waste, placing it in the same category as household garbage and cleaning chemicals, wastewater and construction debris.” Even though it is household garbage, the disposal of municipal solid waste is very tightly regulated, and the science presented here demonstrates that CCP disposal does not, on a health-risk basis, warrant any different level of regulation than that for household garbage.

Details of this evaluation can be found in “Comparison of Risks for Leachate from Coal Combustion Product Landfills and Impoundments with Risks for Leachate from Subtitle D Municipal Solid Waste Landfill Facilities,” Report No. 1020555 available at www.epri.com.

**Dr. Bradley is a Senior Toxicologist and Vice President for AECOM Environment. She received her Ph.D. in Toxicology from the Massachusetts Institute of Technology, and is a Diplomate of the American Board of Toxicology. Dr. Bradley has over 20 years of experience in toxicology and human health risk assessment, with specific experience in the management and evaluation of coal combustion product sites. She can be contacted at: lisa.bradley@aecom.com**

### Table 1 - Summary of Results

<table>
<thead>
<tr>
<th>Leachate Data Source</th>
<th>50th Percentile (a)</th>
<th>90th Percentile (b)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HH-C</td>
<td>HH-NC</td>
</tr>
<tr>
<td>LEACH 2000 MSW</td>
<td>4.48E-04</td>
<td>1.45E01</td>
</tr>
<tr>
<td>EPRI CCP</td>
<td>1.23E-03</td>
<td>1.83E01</td>
</tr>
<tr>
<td>Ratio MSW/CCP</td>
<td>0.36</td>
<td>0.8</td>
</tr>
<tr>
<td>Ratio CCP/MSW</td>
<td>2.75</td>
<td>1.26</td>
</tr>
</tbody>
</table>

**NOTES:**

(a) Sum of risk level adjusted ratios of 50th percentile concentration to screening level.

(b) Sum of risk level adjusted ratios of 90th percentile concentration to screening level.

CCP - Coal Combustion Product.

Eco - Ecological results.

HH-C - Potentially carcinogenic human health results.

HH-NC - Noncarcinogenic human health results.

MSW - Municipal Solid Waste.

### Table 2 - MSW and CCP Physical Comparisons

<table>
<thead>
<tr>
<th></th>
<th>MSW Landfill</th>
<th>CCP Management Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Similar leachate toxicity?</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Biologically active?</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Emits explosive gases?</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Emits greenhouse gases?</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Often contains sewage sludge?</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Attracts disease vectors? (rodents, insects, scavengers)</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>
The biennial World of Coal Ash Conference was held May 9-12 in Denver, CO. The University of Kentucky Center for Applied Energy Research and the American Coal Ash Association have successfully co-organized this meeting since 2005. The 515 attendees are testament to the success of this long running meeting.

The timely plenary talks by Lisa Bradley (AECOM Environment) - “Is Coal Ash Toxic?”; and Anne Weir (CIRCA) – “World Customs Organization Harmonized System Classification of Coal Ash” spoke to where the industry is at the moment and were both well-received. The two and a half days of talks gave us 144 oral presentations on topics ranging from “Evaluation of FGD-Gypsum to Improve Forage Production and Reduce Phosphorus Losses from Piedmont Soils” to “Identification and Verification of Self-Cementing Fly Ash Binders for “Green” Concrete”. Of particular interest this year was the poster session. The 31 posters included 7 from the TVA.

Although the exhibitor hall was a bit of a trek from the meeting rooms, the space was cozy and provided a good ambiance for networking with exhibitors. Annely Noble’s (ACAA) ‘passport’ idea proved to be a great success. The winners who had their entire passport stamped and whose names were drawn for the raffle prize were: Mark Bryant and Dustin Six. Both received $250.00 worth of goodies.

Monday night’s welcoming reception proved to be an opportunity to see old friends and make new acquaintances. The other ‘event’ was the Tuesday night reception at Red Rocks Amphitheatre. Honestly, we didn’t expect a snowstorm in the middle of May! The museum inside the visitor’s center and the delicious food made the event worthwhile anyway.

The papers presented are now available for viewing at: http://www.flyash.info/. Remember the peer-reviewed journal: Coal Combustion and Gasification Products. It is an excellent refereed journal for the coal combustion by-product industry, in which authors may publish valuable journal articles.

In the meantime, begin thinking about WOCA 2013 in Lexington, Kentucky, where we promise you the same southern hospitality we have shown over the years.
In Hard Times, Bring your Professional Association Home

Marsha Wilson
Lexington Convention and Visitors Bureau (LCVB)

If you are reading Energeia, it is likely you are someone who belongs to a professional association. You may have presented a paper or poster at a conference; moderated a technical session; or even organized a meeting or conference. Did you do this in your hometown? If not, here is why you should.

It is easy. By calling your local convention and visitors bureau, you can contact professionals who know how it is done. Staff members are able to provide access to all or most of the resources you need, including meeting promotion and media coverage. By hosting your meeting locally, you provide a positive impact to the local economy – as well as display civic pride. Finally, chairing a conference in your community brings pride and prestige to you, your university/business, and your city.

A well-organized conference is a great way to draw attention to the latest developments in your field or industry. You’ll not only be able to show off your city to professional colleagues – from around the nation or from around the world; you’ll elevate your own and your organization’s stature amongst your peers. You will raise your profile locally and internationally. It has the added benefit of potentially generating income for your research and/or department or association. A quick field trip to your lab, place of business, or production site provides an opportunity to show off your capabilities to a group that wouldn’t otherwise be available for tours.

For the past five years, I have happily brought many diverse groups to our beautiful city of Lexington, Kentucky, working with any organization which is engineering/scientific related. With many researchers’ and professors’ assistance and support, Lexington has been honored to host such conferences as the International Coal Preparation Congress; Mycological Society of America; Southeast Archaeological Conference; the International Symposium on Quantum Theory and Symmetries; and the CAER/ACAA organized World of Coal Ash. Our goal is to help drive interest to your meeting by providing excellent service that ensures a wonderful experience for all attendees while meeting in Lexington’s Bluegrass Region.

Because the most recent World of Coal Ash (WOCA) meeting is being featured in this issue of Energeia and as many readers are familiar with the conference, it is an easy example to use in explaining how we work. I first became aware of the meeting when it was held in Northern Kentucky in 2007. For the 2013 meeting, to be held in Lexington, I have already received bids from local hotels, negotiated room rates, and helped plan off-site activities.

Here are some of the things your local visitors’ bureau can do to make organizing a meeting (large or small) easy on the overworked professional.

Before your meeting

• Help with site selection by collecting details from area hotels and securing the hotel proposals for you in an easy to read “bid-book” complete with hotel comparisons
• Coordinate site visits with hotel partners, familiarization tours and make presentations to your board
• Add value to your meeting and lend support with suggestions for local transportation, special events, speakers and companion or children’s programs
• Offer a variety of services including visitor guides, maps, area brochures, and for qualified meetings, joint-marketing possibilities
• Secure vendor recommendations, name badges, imagery, registration assistance, pre-event marketing, local dignitaries and more

During your meeting

• Provide personalized assistance throughout your meeting
• Supply a list of media contacts
• Use established relationships to promote your event

After your meeting

Most visitor bureaus can collect the meeting details and record the information for you. When you bring your next meeting to your city, customized rebooking services save time and make planning easy. The first meeting is the hardest. After planning the first, the rest are much easier.

The convention and visitors bureaus provide consistent and complete destination information. With no ownership in the various hotels it represents, the visitors bureaus do their job best by being service-savvy “information brokers,” bringing the right buyers at the right time to the right sellers with the right resources.

And the best part? These services are FREE!

I would be happy to discuss future Lexington meetings or help you contact the appropriate person in your own city.

Good luck with your next meeting!

For more information:
Marsha Wilson,
Destination Sales, Account Executive
Lexington Convention and Visitors Bureau
859-244-7720
mwilson@visitlex.com
THE INSTITUTE FOR BRIQUETTING AND AGGLOMERATION

32nd Biennial Conference

September 25 – 28, 2011
New Orleans, Louisiana

WILL INCLUDE:

• Intro to briquetting and agglomeration
• Actual operations case histories
• Interactions with members, industry experts,
  Hands-on workshops equipment manufacturers,
  system engineers & designers.

Register online www.agglomeration.org

Contact: Tom Balzola Executive Director (iba@charter.net) or Dr. Darrell Taulbee (Darrell.taulbee@uky.edu)