Teresa Delima
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Fairbanks, AK 99701

AURORA ENERGY, LLC
Keeping Fairbanks Warm

April 10, 2017

Dear Teresa:

Thank you for your email of February 15, 2017 requesting additional information regarding the beneficial use and testing of Aurora Energy's coal ash in the Fairbanks area. We take your concerns seriously, and I wanted to take the time to prepare a thorough response to your questions.

LEAF in the CCR Rule Preamble and USEPA Guidance Documents of Beneficial Use

The preamble to the U.S. Environmental Protection Agency's (USEPA) Coal Combustion Residuals (CCR) Final Rule[1] discusses leaching procedures used for coal ash. Note that the purpose of the preamble in federal rule-making, and here for the USEPA, is to provide the public and the regulated community with the rationale behind their decision-making. It is not a vehicle for making "determinations."

USEPA reviewed the available coal ash leaching data in the context of developing a national risk assessment for CCR disposal to support the rule-making. The national risk assessment aimed to identify coal ash leaching behavior in disposal landfills under a wide range of environmental, geological, and geochemical conditions across the U.S., i.e., under the "different field conditions" that USEPA was attempting to model. In contrast, Aurora's ash going to the two locations you have inquired about are being used for a specific beneficial use under a limited range of conditions. Single-point testing methods (e.g., the Toxicity Characteristic Leaching Procedure (TCLP) and the synthetic precipitation leaching procedure (SPLP)) that the USEPA requires for regulated land disposals and certain projects can be instructive in limited location uses including some CCR beneficial use applications, such as Aurora's. Alternatively, the USEPA was concerned that the single-point leaching test data (e.g., TCLP; SPLP) available for limited locations may not support extrapolation from field data for landfills to the wide range of scenarios that USEPA was planning to include in the national risk assessment.

To support this aim, USEPA funded and supported a project at Vanderbilt University to develop a battery of leaching tests that could evaluate many types of leaching under specified conditions of pH, liquid to solid ratios, among other conditions. These are the tests referred to as the Leaching Environmental Assessment Framework (LEAF). USEPA and Vanderbilt used samples of CCR from various locations in their testing program. USEPA used these data in their national risk assessment, coupled with a wide range of hypothetical environmental conditions. The single-point leaching test results are valuable for specific applications, but in the context of the national rule-making and the diverse range of scenarios USEPA included in their evaluation, USEPA decided that the LEAF testing results were more appropriate to use for the national risk assessment for disposal.

While USEPA used LEAF testing results in their deliberations during the rule-making, the language of that rule-making, 40 CFR Parts 257 and 261, does not make mention of the LEAF testing, nor do the regulations require its use, either for disposal decision-making or for beneficial use applications. Thus, the use of the LEAF testing protocols is not required under the Federal CCR Rule.

[1] Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule. 40 CFR Parts 257 and 261. Federal Register, Vol. 80, No. 74, pp 21302-21501. Friday, April 17, 2015. Available at: https://www.gpo.gov/fdsys/pkg/FR-2015-04-17/pdf/2015-00257.pdf

USEPA released a methodology for evaluating so-called "encapsulated" uses of CCR[2] that it used to conduct a beneficial use evaluation of concrete and wallboard[3] following the guidance and the definition of beneficial use in the Final CCR Rule. In the guidance, USEPA states the following:

> "The "Characterizing Waste" chapter of the Guide for Industrial Waste Management provides examples of some potentially appropriate leaching characterization methods (U.S. EPA, 2003b). When collecting and evaluating data, care should be taken to ensure that the appropriate method(s) be used in generating the final dataset so as to reflect the range of environmental conditions relevant to the CCR beneficial use product."

USEPA also states in a footnote to this paragraph:

> "Note that the leachate characterization methods presented in this guide all evaluate samples at a single pH value. In contrast, the Leaching Environmental Assessment Framework (LEAF) was developed specifically to allow evaluation of leaching potential over the range of leaching conditions expected to occur. The LEAF methods have undergone inter-lab validation in the United States and have been incorporated into the EPA SW-846 analytical methods, available on the EPA website at: http://www.epa.gov/epawaste/hazard/testmethods/sw846/new_meth.htm."

This beneficial use guidance was published after the federal CCR rule-making. While the guidance mentions LEAF and other leaching tests including SPLP, the guidance does not stipulate the use of LEAF or any other specific leaching test. USEPA certainly had the opportunity in developing this guidance to make specific requirements for leaching testing, but it chose not to do so.

In 2016, USEPA released a second guidance document for beneficial uses of CCR and a wide range of other non-hazardous secondary materials[4]. This document addresses the wide-range of beneficial uses not identified by USEPA as encapsulated uses. This guidance document follows the same type of evaluation as used for the encapsulated uses. Nowhere in the guidance sections of this document does the USEPA refer to leaching, or to LEAF.

USEPA also published a compendium of resources that can be used in making beneficial use determinations[5]. Appendix A.3 of the document provides text boxes for a range of leaching tests, including TCLP, SPLP, and LEAF. The appendix makes no specific recommendations on which tests to use.

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[2] Methodology for Evaluating Encapsulated Beneficial Uses of Coal Combustion Residuals. U.S. Environmental Protection Agency. September 2013. Available at: https://www.epa.gov/coalash/methodology-evaluating-encapsulated-beneficial-uses-coal-combustion-residuals

[3] Coal Combustion Residual Beneficial Use Evaluation: Fly Ash Concrete and FGD Gypsum Wallboard. U.S. Environmental Protection Agency. February 2014. Available at: https://www.epa.gov/coalash/coal-combustion-residual-beneficial-use-evaluation-fly-ash-concrete-and-fgd-gypsum-wallboard

[4] Methodology for Evaluating Beneficial Uses of Industrial Non-Hazardous Secondary Materials. U.S. Environmental Protection Agency. April 2016. Available at: https://www.epa.gov/sites/production/files/2016-10/documents/methodology_for_evaluating_beneficial_use_of_secondary_materials_4-14-16.pdf

[5] Beneficial Use Compendium: A Collection of Resources and Tools to Support Beneficial Use Evaluations. U.S. Environmental Protection Agency. June 2016. Available at: https://www.epa.gov/sites/production/files/2016-06/documents/ben_use_compendium_062216.pdf

Thus, based on the CCR Final Rule, and USEPA's guidance documents for beneficial use, LEAF is not a required test for making beneficial use determinations.

Based on the locations and types of beneficial uses Aurora is currently employing for its CCR, it was determined that the SPLP testing is the most appropriate to characterize leaching from the coal ash. Aurora specifically conducted SPLP testing on representative samples of its CCR for the beneficial use evaluation. A summary of that evaluation is provided below.

Summary of the Aurora Beneficial Use Evaluation

For CCR to be used as structural fill, the material must be evaluated to ensure that it meets the requirements for "beneficial use of CCR", which is defined in Code of Federal Regulations, Title 40 (40 CFR) §257.53, as follows:

"Beneficial use of CCR means the CCR must meet all of the following conditions:

1. The CCR must provide a functional benefit;
2. The CCR must substitute for the use of a virgin material, conserving natural resources that would otherwise need to be obtained through practices, such as extraction;
3. The use of the CCR must meet relevant product specifications, regulatory standards or design standards when available, and when such standards are not available, the CCR is not used in excess quantities; and
4. When un-encapsulated use of CCR involving placement on the land of 12,400 tons or more[6] in non-roadway applications, the user must demonstrate and keep records, and provide such documentation upon request, that environmental releases to groundwater, surface water, soil and air are comparable to or lower than those from analogous products made without CCR, or that environmental releases to groundwater, surface water, soil and air will be at or below relevant regulatory and health-based benchmarks for human and ecological receptors during use."

With respect to Condition 4 above, USEPA's "Methodology for Evaluating Encapsulated Beneficial Uses of Coal Combustion Residuals" (USEPA, 2013[7]) indicates that exposure pathways relevant to the beneficial use of the CCR should be identified. The methodology further notes that "All four of [the components of a complete exposure pathway] must be present at either the time of release or at some future time in order for a complete exposure pathway to exist. Otherwise, receptor exposures to chemicals of potential concern (COPCs) are not possible."

[6] The stated reference of placement of CCR on the land in quantities greater than 12,400 tons is currently under reconsideration by USEPA based on pre-publication inquiries/challenges regarding the proper interpretation of a USEPA disposal data base used in developing the language is in Title 40 (40 CFR) §257.53.

[7] USEPA. 2013. Methodology for Evaluating Encapsulated Beneficial Uses of Coal Combustion Residuals. U.S. Environmental Protection Agency, Washington, D.C. Available at: https://www.epa.gov/coalash/methodology-evaluating-encapsulated-beneficial-uses-coal-combustion-residuals

The memorandum provided a characterization of potential exposure pathways associated with the beneficial use of CCR as structural fill. To review, potential exposure pathways to CCR-related constituents in CCR used in the structural fill projects are incomplete for the following reasons:

1) The structural fill will be covered by gravel and/or soil once the development project is completed. The gravel and/or soil cover will prevent:
    a. direct exposure (incidental ingestion and dermal contact) to CCR constituents,
    b. liberation of CCR-related constituents into the air as dust and subsequent migration of dust in wind, and
    c. migration of CCR-constituents in storm water runoff and subsequent transport to the on-site storm water retention basin.
2) Groundwater beneath the project fill sites and in surrounding areas is not used as drinking water; drinking water is municipally supplied. Therefore, even if CCR-related constituents were to migrate from the structural fill to groundwater, exposure pathways to the groundwater would not be complete.

Because there are no complete exposure pathways, exposures to COPCs are not possible. However, despite the fact that there are no complete exposure pathways to CCR used as structural fill in the fill projects, the analytical data for bulk CCR was compared to screening levels to demonstrate that "releases to groundwater, surface water, soil and air will be at or below relevant regulatory and health-based benchmarks."

As noted in USEPA guidance (USEPA, 2013), "Initially, COPC concentrations at the point of release may be used in place of the concentrations at the point of exposure and compared directly to applicable screening benchmarks. This comparison assumes that receptors are exposed directly to the COPCs as they are released from the CCR beneficial use product. For some direct exposures to releases, such as incidental ingestion of dust from the product, this comparison may accurately represent potential exposures. For other indirect exposures to releases, such as ingestion of leachate that has migrated through ground water, it would provide a very conservative comparison."

The analytical data for CCR (solids) was compared to USEPA risk-based screening levels applicable to commercial land uses, under the assumption that full-time workers would contact the material each work day, continuously for 25 years. None of the constituents in samples of CCR were detected at concentrations above the screening levels, indicating that even if the pathways were to hypothetically be complete, "releases would be below relevant health-based benchmarks."

The analytical data for CCR (leachate) was compared to drinking water standards and risk-based screening levels. With the exception of aluminum, none of the constituents in samples of CCR leachate were detected at concentrations above drinking water screening levels and standards. Aluminum was detected in leachate at concentrations above the secondary drinking water standard, but at concentrations below the health-based drinking water screening level. In practice, any leachate generated by CCR used as structural fill would be substantially diluted into groundwater, such that even if the groundwater was used as drinking water, exposure concentrations would be much lower than leachate concentrations.

In accordance with USEPA guidance (USEPA, 2013), when conservative screening as described above has been used to demonstrate that constituents do not exceed screening levels, no further characterization is required to satisfy Condition 4 of beneficial use. The assessment clearly demonstrated that "releases to groundwater, surface water, soil and air will be at or below relevant regulatory and health-based benchmarks."

Teresa, I hope this letter provides you with information you need to better understand the Final CCR Rule and subsequent USEPA guidance on the topic of leaching and beneficial use evaluations, particularly as it relates to the two sites you inquired about.

Sincerely,

A. L. Buki Wright Jr., President
Aurora Energy, LLC