

# Developing Beneficial Use Rules for Coal Combustion Products (CCPs)

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KEYWORDS: coal combustion products, regulations, beneficial use

## ABSTRACT

Development of beneficial use rules for coal combustion products (CCPs) is a critical step toward increasing the utilization of these materials. Many states have developed beneficial use rules; however, several states in the western United States are working to understand how to accomplish this with limited resources to devote to the effort and sometimes limited information to justify the environmental appropriateness of CCPs. In working with several state agencies on a regular basis, the Energy & Environmental Research Center coal ash research team has determined that a consistent and balanced approach is needed to develop reasonable CCP regulation. This approach must be based on protection of human health, the environment, and sound science. An approach relying on a team effort of state regulatory representatives, CCP industry representatives, and impartial knowledgeable coal ash experts is outlined.

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## INTRODUCTION

The 1993 Department of Energy (DOE) Report to Congress titled *Barriers to the Increased Utilization of Coal Combustion/Desulfurization By-Products by Government and Commercial Sectors* (1) identified eleven institutional barriers to coal ash use:

- Lack of familiarity with potential ash uses.
- Lack of data on environmental and health effects.
- Restrictive or prohibitive specifications.
- Belief that fly ash quality and quantity are not consistent.
- Lack of fly ash specifications for noncementitious applications, which results in application of the more restrictive specifications for use of fly ash in cement and concrete.
- Belief that raw materials are more readily available and more cost-effective.
- Viewpoint of states that U.S. Environmental Protection Agency (EPA) procurement guidelines for fly ash in concrete are a rigid ceiling rather than general guidelines for use.
- Actions by environmental agencies that normally support beneficial ash uses in principle, but that frustrate the actual implementation by restrictive regulations.
- Restrictive regulation of fly ash as a solid waste in most states.
- Lack of state guidelines on beneficial ash use.
- Lack of clear federal direction on regulation of beneficial ash use.

In 1993, DOE reported that inconsistency in regulations for use of coal combustion byproducts (CCBs) among federal and state agencies resulted in a confusing patchwork of incentives and disincentives. It was noted that the associated uncertainty tended to foster overly conservative regulatory practices. DOE also indicated that there was a need for widely accepted environmental criteria and tests that deal more realistically with environmental compliance for fairly broad classes of CCB applications.

In a 1998 update to DOE on barriers to increased utilization of coal ash (2), the University of North Dakota Energy & Environmental Research Center (EERC) reported that industry, DOE, and other government agencies had made significant efforts to address the barriers identified in 1993. At the same time, an increased number of states

had addressed CCB utilization through laws, regulations, policies, and/or guidance. Of the 16 states that had not initiated guidance on CCB utilization, 11 were located west of the Mississippi River. Improvements and refinements may be warranted in some states' CCB utilization guidance. Other states may serve as models of CCB utilization guidance. The 11 western states without CCB utilization regulatory guidance warrant some attention. The EERC has worked with regulators in several of these states in a variety of capacities in an effort to understand the hesitancy of states to issue CCB utilization regulatory guidance and answer questions that will hopefully result in progress toward that goal.

The approach the EERC has been developing involves several key phases:

- Identification of environmental and public health issues
- Facilitating an understanding of utilization applications
- Facilitating an understanding of coal ash properties, composition, and constituent mobility
- Defining beneficial use policy

These issues are related, and discussions with regulatory agencies generally include all of these items. A clear understanding of each issue and input from the regulators are essential.

## DISCUSSION

### Environmental and Public Health Issues

Protection of the environment and public health is the mandate of state environmental agencies. Concern for air and water quality and human health drives the identification of issues that must be addressed by agency representatives. These issues are likely to include short- and long-term exposure of humans, animals, and plants to solids, leachate, and airborne particulate. To evaluate these issues, the most probable route of exposure must be identified. The route of exposure may be through leachate that enters groundwater or through runoff that enters surface waters. Another route would be exposure to the solid through ingestion or inhalation.

In many cases, these potential routes of exposure are limited because of the type of utilization application, the handling practices, and the engineering requirements. For example, a CCB that is used in the construction of a road base would be subject to general regulations regarding storm water runoff and dusting during the construction phase of the application. Postplacement, the road base is covered by a surface, and the construction practice limits the infiltration of water into the base. Long-term exposure to the CCB in this application is logically negligible. The CCB is unavailable for ingestion or inhalation, and the CCB contact with water is limited by the design of the application. Exposure will likely be limited to construction scenarios, which should be controlled by good handling and construction practices or to the recycling, reclamation, and/or postuse management of the road/road base. Another example would be use of bottom

ash for ice/skid control. In this application, the CCB is available for all potential routes of exposure noted, but the volume of CCB used is generally low.

Based on the examples noted, it is obvious that care must be used in evaluating the appropriateness of CCB usage and an understanding of the application must play a role. Further, to allow reasonable qualification of CCBs for use in various applications, laboratory testing needs to be related to real-world use scenarios. Comparing results of appropriate evaluations of CCBs, such as leaching tests, to various exposure limits can then provide a means of determining the environmental appropriateness of CCBs in use applications.

### Facilitating an Understanding of Coal Ash Properties, Composition, and Constituent Mobility

Coal ash properties, composition, and constituent mobility are common topics addressed in CCB marketing information, research reports, trade articles, and other documentation. The primary issue in working with regulatory agencies is limited familiarity with this documentation. Further, most agencies request data specific to the CCBs expected to be used in their state.

To familiarize agency representatives, a tiered approach provides the best opportunity to develop a familiarity and understanding of CCBs. Providing a limited number of authoritative general documents describing CCB properties, composition, and constituent mobility is an important first step that gives a base of information on which to build. It is also useful to summarize these documents in a bibliography for reference. Additional information on specific CCBs of interest in a state should also be provided, and physical samples of these materials should be provided to regulatory representatives. Analytical data, such as leachate data, for specific CCBs proposed for use should be presented with comparative regulatory limits and other regional and/or national data.

Meetings with formal and informal presentations and discussions are also important to provide the regulators an opportunity to receive the same information orally and to relay questions and issues to industry representatives and other participants.

Information assembled and presented to regulators must be based on sound science. Well-designed laboratory experiments can answer many questions about the character of CCBs. EPA encourages the use of a performance-based measurement system, which is a set of processes wherein the data quality needs, mandates, or limitations of a program or project are specified and serve as criteria for selection of appropriate methods to meet those needs in a cost-effective manner (62 FR 52098, October 6, 1997).

EERC recommends the use of a test called the synthetic groundwater leaching procedure (SGLP) developed at the EERC. This test is similar to the EPA toxicity characteristic leaching procedure (TCLP) (EPA Method 1311) in that it uses a 20:1

liquid-to-solid ratio and end-over-end agitation at 30 rpm. The 20:1 liquid-to-solid ratio has reasonable scientific validity based on a development process used by EPA for the TCLP. The SGLP generally uses distilled deionized water as the extraction fluid but the leaching solution can vary to meet any requirements of a specific use application. As an example, a carbonate-bicarbonate buffered simulated groundwater has been used to evaluate CCBs that may be placed in a situation where they contact groundwater. The SGLP also incorporates an extended equilibration time of 30 and 60 days, which has been found to be useful for alkaline reactive fly ash. Extended leaching is likely unnecessary for nonreactive CCBs, but it is recommended that long-term leaching be used under any situations where long-term contact between a CCB and water might be expected to occur.

Bulk analysis for trace elements should be conducted using complete digestion in closed Teflon bombs. It should be understood that use of the bulk concentrations of constituents in CCBs is not valid in estimating leachate or runoff concentrations because the solubility of nearly all constituents in the solid matrix is very limited. Because of the complex and variable nature of phase locations of major, minor, and trace constituents in CCBs, leaching may be the best manner of analysis to determine availability of constituents, especially trace constituents.

In some cases, field demonstrations and sample collections may be needed to provide data required to ensure whether CCBs should be used in specific applications. In two western region states, specific field demonstrations and tests have been requested by the regulatory authority for the use of bottom ash for ice/skid control. These field tests focused primarily on the runoff and particulate release from bottom ash placed on roads. The bottom ash runoff was found to meet surface water standards, and the particulate release was found to be less than a competing material.

### Facilitating an Understanding of Utilization Applications

It is important to establish that the utilization of CCBs is not an alternative to disposal and that the applications of interest are beneficial uses. The definition from ASTM E50 for beneficial use is “the substitution of the coal combustion product (CCP) for another product based on similar properties. It includes, but is not restricted to, construction, manufacturing and other applications in which the CCP is used in raw feed for cement clinker, cement including concrete, grout, flowable fill, controlled low-strength material; structural fill; road base/sub-base; soil modification; mineral filler; snow and ice control; blasting grit; roofing granules; mining applications; wallboard; waste stabilization/solidification; and agriculture.” It is important for environmental regulators to understand that CCBs can be used in numerous applications because they are similar to other materials already in use.

Numerous resources are available that indicate the properties and performance of CCBs that make them beneficial in a variety of applications. ACAA (American Coal Ash Association) provides this type of information in conjunction with the Federal Highway Administration in an authoritative volume titled *Fly Ash Facts for Highway Engineers*,

and the Texas Coal Ash Users Group has assembled information for Texas regulators. Other information is available in industry and academic reports and articles. One resource is the state's own Department of Transportation (DOT), which may have knowledge about CCBs in the state and the desire to utilize those CCBs. When this is the case, it may be useful to relay this information from the DOT to the environmental department. The DOT may be able to relay specific information on how the CCB is to be used that will help answer questions posed by the state environmental department.

The environmental agency representatives should not be required or expected to develop a detailed understanding of the use applications intended for CCBs. However, assurance that the CCB to be used is similar to other materials and must meet certain specifications prior to use will provide the basis for their understanding of the use as beneficial. Examples of standard practices, performance criteria, and project- or site-specific controls or permits can be presented to regulators to build awareness of how the CCBs will be used.

### Defining Beneficial Use Policy

As already noted, exposure of humans, animals, and plants to CCB solids, leachate, and airborne particulate is of key interest in determining if CCBs are safe to utilize in a given application. If the exposure risk is low and the concentrations of certain constituents are within predetermined limits, the argument can be made that a reasonable level of environmental safety can be assured. With that conclusion, the next step is development of a beneficial use policy, guideline, or rule, which can serve to eliminate the case-by-case evaluation of CCBs in specific applications.

Limits that may be considered for comparing leachate or runoff quality include the Resource Conservation and Recovery Act hazardous values, the maximum contaminant level, the universal treatment standard, the oral reference dose, the inhalation reference dose, or oral cancer potency factors. State surface water quality standards may also be used or comparisons to existing groundwater quality may be the benchmark.

A guideline or policy can be developed for specific use applications as many states already have (3). Several states provide extensive lists of specific use applications that do not require prior approval of the regulatory agency. Another approach is to develop categories of use and identify applications within these categories. One approach is to group applications where the CCB is "confined" as in controlled low-strength material or "unconfined" as in skid/ice control. The use of the category system makes it simple to add new use applications to the guideline when it is shown that the use fits a category.

### SUMMARY

It is the EERC's experience that state regulatory representatives deal with a wide variety of issues, industry, and waste/byproducts. It is understood that well-designed

beneficial use rules will reduce the regulatory workload, especially as it relates to approvals for use of CCBs in individual projects or at individual sites. Beneficial use rules must protect the environment and human health and safety. The increase in the number of states that have developed CCB use guidelines in recent years is promising, but several challenges persist:

- Several western U.S. states exhibit an overly cautious approach to the development of CCB beneficial use rules.
- There is little consistence in beneficial use rules among states.
- Information on the environmental performance of CCBs is limited and sometimes difficult to obtain.
- Methods of evaluating environmental performance are inconsistent and may not provide scientifically valid information.

To continue to address these “barriers” to increased utilization of CCBs, industry needs to aid the education process by making information available in varying formats with different levels of detail. Environmental performance data needs to be developed and/or made available from full-scale demonstrations of beneficial use applications. The information that the industry and federal government have generated needs to be made more available to regulators and others through electronic media. The CCB industry needs to be vigilant about the use of appropriate methods and interpretation of data. The CCB industry needs to communicate to state regulatory agencies on a regular basis and it needs to continue communication with various federal agencies on federal guidelines for CCB management.

## REFERENCES

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- [3] American Coal Ash Association. *State Solid Waste Regulations Governing the Use of Coal Combustion Products*. American Coal Ash Association: Alexandria, VA, 1998.

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