

# National Synthesis on Regulations, Standards, and Practices Related to the Use of Coal Combustion Products

**Tera D. Buckley<sup>1</sup>, Debra F. Pflughoeft-Hassett<sup>1</sup>**

<sup>1</sup>University of North Dakota Energy & Environmental Research Center (EERC)  
15 North 23rd Street, Stop 9018, Grand Forks, ND 58202-9018

KEYWORDS: regulations, standards, CCP management, marketing, barriers

## INTRODUCTION

Many of the technical barriers associated with coal combustion product (CCP) utilization have been or are being addressed through industry and government-driven efforts, but the U.S. CCP utilization rate is increasing slowly. As an example, the overall CCP utilization rates in recent years were 31.48% in 2001, 35.37% in 2002, 38.10% in 2003, 40.08% in 2004, and 40.29% in 2005.<sup>1</sup> The U.S. CCP utilization rate is an indicator that barriers continue to exist, and experience in the CCP industry suggests that key social and knowledge barriers still exist. One of the primary nontechnical barriers is the broad range of state laws, regulations, policies, and guidelines regarding the use of CCPs.<sup>2,3,4</sup> Some states have worked to develop progressive and effective guidance for CCP utilization that help to increase CCP use while being protective of the environment. Some states still lack the resources and information to feel comfortable with the environmental appropriateness of using CCPs in certain applications, particularly with nontraditional applications such as geotechnical applications. In addition, revising or implementing new state laws, regulations, policies, and guidelines can be a lengthy process, taking a number of years to come to fruition and often frustrating CCP industry stakeholders.

To better understand the status and development of different CCP utilization profiles across the United States, the University of North Dakota Energy & Environmental Research Center (EERC) conducted a series of state reviews.<sup>5,6,7</sup> The U.S. Environmental Protection Agency (EPA), U.S. Department of Energy (DOE) National Energy Technology Laboratory (NETL), American Coal Ash Association (ACAA), and Headwaters Resources, LLC, provided funding for one or all of these reviews. Texas, Florida, and Pennsylvania were selected for review because each of these states has a CCP utilization rate significantly higher (60%–70%) than the national average, are in different geographic locations, and have addressed an array of CCP management issues.

The individual state reviews were designed to: 1) provide an in-depth look at CCP use in each state, 2) showcase keys to successful utilization, 3) describe existing barriers,

4) recommend actions that could be taken to overcome those barriers, and 5) identify threats that could impact future CCP utilization. The final reports from the series of state reviews can be accessed online at [www.undeerc.org/carrc/html/review.html](http://www.undeerc.org/carrc/html/review.html).

This paper previews the information to be presented in a national synthesis report that will be published in mid-2007. The report will translate the observations from individual states to a national perspective and allow readers to readily apply the cumulative experience of the states reviewed to their specific situation. The synthesis report is also expected to be valuable to the states reviewed because they will be able to review documented approaches and activities other states used to increase the beneficial use of CCPs.

## STATE REVIEW PROCESS

To conduct the series of state reviews, discussion group sessions were held during a multiday site visit in a central location within the state. The discussion groups were comprised of key CCP stakeholders representing the following groups\*.

- Government agencies – directors and other key personnel of state or regional transportation and environmental agencies
- CCP generators – environmental and ash managers at electric generating companies
- CCP suppliers – CCP marketers and suppliers of ash beneficiation systems
- Cement and concrete – ready-mix concrete suppliers and cement producers
- Engineering/consulting firms – firms specializing in CCP use in various applications
- Wallboard – users of flue gas desulfurization (FGD) gypsum for wallboard production
- Mining – mining officials from state government agencies
- Special interest – environmental and citizen groups and research institutions

A series of open-ended questions were provided to each discussion group prior to the site visit. During the discussion group sessions, the list of questions guided discussion; however, an open forum was used and allowed for flexible conversations. Those not able to attend a session in person were given the opportunity to provide written

---

\* Each review had different discussion groups representing key stakeholders in that state. The groups listed represent all of the discussion groups held during the series of state reviews and were not included in each individual state review.

comments or participate in a telephone interview. Everyone who participated in the state reviews was provided a copy of the draft final report for review.

The results of the state reviews were organized into keys, barriers, threats, and actions. These sections were modeled after a SWOT (strengths, weaknesses, opportunities, threats) analysis commonly used by marketing professionals to audit an organization and the environment in which it operates. It is the first stage of planning and helps identify key issues. The SWOT terms were modified to reflect terms that the authors felt were more applicable to the CCP industry.

## SUMMARY OF RESULTS

Each state had a different regulatory framework, political climate, infrastructure, economy, coal source, and geographic location. These characteristics made the CCP production and use different in each state. However, once all of these unique characteristics were brought together, the following commonalities were identified and used to translate review observations to a national perspective. The information presented here is preliminary, and preparation of the final national synthesis report continues.

### Organized Industry-Led Groups Aid in Developing Beneficial Use Regulations That Encourage CCP Use While Being Protective of the Environment

Each state had industry groups whose membership consisted primarily of the state's electric generating companies — Texas had the Texas Coal Ash Utilization Group (TCAUG); Florida had the Florida Electric Power Coordinating Group, Inc. (FCG); and Pennsylvania had the Electric Power Generation Association (EPGA). These groups worked to promote the use of CCPs and remove barriers prohibiting utilization, such as the lack of regulations allowing the beneficial use of CCPs. The groups have been effective in working with government agencies because each one represents a unified voice on behalf of its members and allows industry to pool its collective knowledge base and monetary resources to address key issues.

In Texas, TCAUG worked with the Texas Commission on Environmental Quality (TCEQ), Texas Department of Transportation (TxDOT), and General Land Office for over 10 years to develop regulations that would encourage the use of CCPs. TCAUG used a push/pull strategy in its approach by consulting many levels at each state agency because it believed it needed all levels of state agencies to work together. TCAUG invested a considerable amount of time and money to educate state agency employees on the beneficial use of CCPs. As an ultimate result of this effort, TCEQ passed what is commonly referred to as the “Eight Waste Criteria Rule” (30 TAC 335.1, Subchapter R), which cleared the way for CCP recycling in Texas.

Similarly in Pennsylvania, the Pennsylvania Department of Environmental Protection (PA DEP) allowed EPGA to provide input into its regulatory process, which led to the development of PA DEP's Residual Waste Management Regulations (Title 25 PA Code,

Chapter 287, Sections 661–666) and coal mine permitting processes. Because EPGA was allowed input into the regulation process, the industry generally accepted the resulting regulations.

Unlike the other two states, Florida did not have beneficial use rules for CCPs in place at the time of the state review. The beneficial use projects were evaluated on a case-by-case basis. Attempts were made, and continue to be made, by FCG to encourage legislation on this issue. The Florida Department of Environmental Protection (FDEP) realized that adopting beneficial use rules for CCPs would be cumbersome and complicated and stated it would look to the FCG for guidance.

Based on the cumulative experience of the industry groups participating in the state reviews, it is clear that using industry groups to facilitate the development of new regulations or to revise existing regulations is a very effective way of getting industry's voice heard and understood. An education process is typically required to help state agencies understand the complicated issues associated with CCP utilization. This effort can require a considerable commitment of time and money by industry.

#### There is Concern That Federal and State Air Emission Regulations will Render CCPs Unusable for Major Beneficial Use Applications

The Clean Air Act Amendments of 1990 required large reductions in emissions of nitrogen oxide (NO<sub>x</sub>) and sulfur dioxide (SO<sub>2</sub>) from coal-fired power plants. In March 2005, EPA announced the following new clean air regulations that will further reduce emissions of NO<sub>x</sub> and SO<sub>2</sub> and require limits on mercury emissions from coal-fired power plants:

- The Clean Air Interstate Rule (CAIR) applies to SO<sub>2</sub> and NO<sub>x</sub> emissions in 28 eastern states and Washington, D.C. CAIR calls for selected states to have a 70% reduction of SO<sub>2</sub> emissions and a 60% reduction of NO<sub>x</sub> emissions compared to 2003 levels by the year 2015.
- The Clean Air Mercury Rule is the first federal rule to limit mercury emissions from coal-fired power plants. This rule calls for a 70% reduction of mercury emissions by 2018.

These regulations seek to lower levels using cap-and-trade mechanisms by which power plants are assigned emission limits but can exceed those limits by purchasing credits from companies whose emissions are below their assigned limits.

In addition to federal regulations, several states are proposing their own regulations that would require deeper cuts in SO<sub>2</sub>, NO<sub>x</sub>, and mercury emissions over a shorter time frame than required under the federal rules. Universal concerns brought forth by industry related to the impact these federal and state air emission regulations will have on CCP management include:

1. Fly ash from units using sorbent injection for mercury control may no longer be able to be used in cement manufacture unless the manufacturer demonstrates that the use of such ash will not lead to increased mercury emissions from the cement kiln.<sup>8</sup> EPA has voluntarily taken reconsideration on the ban on fly ash where sorbent injection for mercury control is practiced and has been petitioned to reconsider its decision not to place restrictions on the current use of fly ash.<sup>9</sup> EPA plans to complete these reconsiderations by the end of 2007.
2. Other than wet FGD systems, the leading technology to comply with mercury emission regulations is activated carbon injection (ACI). ACI may lead to increased concentrations of mercury-containing sorbents and higher carbon contents in fly ash. Fly ash containing activated carbon will likely no longer be able to be used in concrete because ACI impacts air entraining admixtures (AEAs). Numerous beneficiation technologies have been developed to address this concern; however, the applicability of beneficiation technologies is very site-specific to each power plant and there is limited information available on the potential re-release of ACI-captured mercury from ash-beneficiation operations.
3. Many coal-fired power plants have had to reduce NO<sub>x</sub> emissions, and a variety of NO<sub>x</sub> control technologies have been implemented across the United States. This has resulted in the production of fly ashes with a noticeable decline in quality, namely, the presence of unburned carbon at varying levels. Some fly ash contaminated by unburned carbon are no longer suitable for use in concrete and, therefore, are sold as a raw material for cement manufacture. However, some cement plants cannot use fly ash with unburned carbon contents greater than 30% because of operational problems and the need to meet carbon dioxide (CO<sub>2</sub>) emission requirements and total hydrocarbon limits.
4. The ultimate fate of mercury in FGD gypsum used to manufacture wallboard is uncertain and can vary from facility to facility.<sup>10</sup> Questions also still remain regarding how much mercury is released into the atmosphere during the rest of the life cycle of wallboard (e.g., via dust when wallboard is cut or crushed) and the ultimate fate of mercury once the FGD gypsum and/or wallboard is disposed of in a landfill.

#### State Department of Transportation (DOT) Specifications are Often Used by Other CCP Users in the State

State DOTs have the responsibility to write specifications for road construction defining how CCPs are to be incorporated into DOT projects. State DOTs often look to the American Association of State Highway and Transportation Officials (AASHTO) and ASTM International (ASTM) for guidance on developing their own specifications. State DOTs specifications typically set the bar for other CCP users in the state because the road-building industry generally views state DOT specifications as cautious and stringent, thus lessening the potential for failure. Contractors are also familiar with DOT specifications, making them more likely to be used. For these reasons, it is imperative

that DOT specifications are noted because they set the tone for how CCPs are used across the state.

Many state DOTs have specifications that set a minimum and maximum amount of fly ash that can be used in concrete. However, industry would like state DOTs to consider performance-based standards, rather than prescriptive standards, because they may allow for more CCPs to be used and will produce better concrete in some instances. Initiatives on the federal, state, and local levels will be required to adopt performance-based concrete specifications. National organizations such as AASHTO and ASTM, as well as private and government entities, must first demonstrate the long-term sustainability of concrete developed according to performance specifications. Following the demonstrations, an education process from industry to DOTs will be needed.

#### Improved Communication Between Industry and Government Agencies Could Improve the Impact of Demonstration Projects

Government agencies, legislators, and industry generally agree that making modifications to current regulations or writing new regulations is a lengthy process. This process often requires the completion of one or more field-scale demonstration projects to provide government agencies with the data they need to feel comfortable with the environmental and engineering appropriateness of using specific CCPs in beneficial use applications. Based on the states reviewed, government agencies do not appear to make regulatory decisions based on research performed outside of their own state because they do not believe external studies use CCPs that are identical to those produced by their electric generating companies or take into account the states' unique geographic, geologic, or climatic conditions. Also, laboratory experiments were not viewed as capable of replicating what will happen in the field.

Industry often takes on the responsibility and cost of conducting field-scale demonstration projects with the intention of generating the data government agencies need to make regulatory decisions. However, the demonstration process gets complicated when a government agency requests a new set of data midway through the project or after its completion. Government agencies indicated the demonstration process could be expedited if industry would provide them with the information/data they need up front; whereas, industry indicated that the government agencies should say what information/data they need and then industry would conduct the demonstration in a way to provide it. Turnover of government agency personnel during the course of a demonstration can also be a challenge, especially when a new government decision maker wants to see additional or different data than wasn't planned for at the onset of the demonstration. In some cases, it is difficult or impossible to provide these data without repeating the entire demonstration. Industry further indicated that, in some instances, government agency staff do not have the technical knowledge base needed to completely understand the issues. These roadblocks can delay the regulation process for years.

To help facilitate communications between industry and governmental agencies, it is recommended for industry to partner with a university or consulting firm with experience

and expertise in the specific area to be addressed when conducting a demonstration project. Oftentimes, a third party can provide an unbiased technical perspective on what the field demonstration project can accomplish and aid in the interpretation of data. Industry support groups such as TCAUG, FCG, or EPGA also offer an excellent forum for industry to pool its intellectual and monetary resources and collectively approach state agencies for the mutual benefit of all parties involved, providing the project benefits the majority of members.

### The Promotion and Acceptance of LEED and Other Green Building Programs will Encourage the Use of CCPs in Construction Applications

The U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) Green Building Rating System was created to transform the built environment to sustainability by providing the building industry with consistent, credible standards for what constitutes a green building. Since the City of Austin, Texas, founded its Green Builder Program in 1991, there has been a steady progression of green initiatives from various municipalities and states around the country. Various LEED initiatives including legislation, executive orders, resolutions, ordinances, policies, and incentives are found in 53 cities, 10 counties, 17 states, 33 schools, and 11 federal agencies across the United States and Canada.<sup>11</sup>

The LEED program indirectly encourages CCP recycling by offering points for products containing recycled materials, locally available products, and energy efficient products (i.e., concrete blocks, autoclaved cellular concrete). It is estimated that 18 of LEED's possible 69 assessment points are related to CCP-containing products, namely concrete. However, the current LEED system does not favor the use of fly ash in concrete from a percent content standpoint. Even in Texas, where the LEED program is popular, there have been several LEED-certified buildings that did not incorporate fly ash into their concrete. Furthermore, a major green building conference in Austin did not address CCPs, indicating to the authors and those who participated in the Texas state review that the CCP industry is not doing enough to promote CCP recycling in the green building industry.

The environmental and engineering benefits of using CCP-containing products should be a factor when the decision is made to use products that may or may not contain CCPs. Often, if CCPs are used in construction projects, it is likely because of the economic savings associated when using the material and not because of the fact that CCPs are a recycled material offering environmental and engineering benefits over virgin resources (i.e., decreased need for landfill space, conservation of natural resources, reduced CO<sub>2</sub> emissions, reduced overall cost of generating electricity, and production of better products).

Because the LEED program is growing and becoming the most highly recognized and credible national green building program, the authors suggest that the CCP industry do more to become involved in LEED. LEED offers a forum for the CCP industry to promote its successes to new audiences who may not have heard about the benefits of

using CCPs or considered CCPs to be a valuable recycled material. These new audiences tend to be more receptive to appeals to use recycled products than the traditional clients of the CCP industry and may be able to publicize and promote the merits of CCP use. ACAA recently joined LEED, and it is anticipated that many industry leaders will follow. More work also needs to be done on state and local levels to encourage governments to adopt LEED initiatives that will either directly or indirectly encourage CCP use.

## CONCLUSIONS

With the information gained from conducting the series of state reviews, it is reasonable to perform an analysis on how the successes in the states reviewed can be translated to other states. This paper presented a brief summary of commonalities that appeared when the three state reviews were analyzed. More in-depth information will be provided in a national synthesis report that is expected to be published in mid-2007.

## ACKNOWLEDGMENTS

The EERC would like to express its appreciation of EPA and DOE NETL for the opportunity to work on the National Synthesis on Regulations, Standards, and Practices Related to the Use of Coal Combustion Products project as a grantee. The EERC authors would specifically like to thank Mr. John Sager, EPA, and Mr. William Aljoe, DOE NETL, for their support and valuable input into the preparation of this paper.

## REFERENCES

- [1] American Coal Ash Association. *CCP Production and Use Survey*; [www.acaa-usa.org/CCPSurveyShort.htm](http://www.acaa-usa.org/CCPSurveyShort.htm) (accessed April 1, 2007).
- [2] American Coal Ash Association. *State Solid Waste Regulations Governing the Use of Coal Combustion Products (CCPs)*; Aug 1998.
- [3] Dockter, B.A.; Jagiella, D.M. *Engineering and Environmental Specifications of State Agencies for Utilization and Disposal of Coal Combustion Products*; Final Report Prepared for the Combustion By-Products Recycling Consortium; CBRC Project No. 02-CBRC-W12; EERC Publication No. 2005-EERC-07-04; July 2005.
- [4] Pflughoeft-Hassett, D.F.; Sondreal, E.A.; Steadman, E.N.; Eylands, K.E.; Dockter, B.A. *Barriers to the Increased Utilization of Coal Combustion/Desulfurization By-Products by Government and Commercial Sectors – Update 1998*; Topical Report for U.S. Department of Energy National Energy Technology Center Cooperative Agreement No. DE FC21-93MC30097; EERC Publication No. 99-EERC-07-08; July 1999.
- [5] Buckley, T.D.; Pflughoeft-Hassett, D.F. *Review of Texas Regulations, Standards, and Practices Related to the Use of Coal Combustion Products*; Final Report for U.S.



Environmental Protection Agency and Headwater Resources; EERC Publication 2005-EERC-01-01; Energy & Environmental Research Center: Grand Forks, ND, Jan 2005.

[6] Buckley, T.D.; Pflughoeft-Hassett, D.F. *Review of Florida Regulations, Standards, and Practices Related to the Use of Coal Combustion Products*; Final Report for the U.S. Environmental Protection Agency and U.S. Department of Energy; EERC Publication 2006-EERC-04-03; Energy & Environmental Research Center: Grand Forks, ND, April 2006.

[7] Buckley, T.D.; Pflughoeft-Hassett, D.F. *Review of Pennsylvania Regulations, Standards, and Practices Related to the Use of Coal Combustion Products*; Final Report for the U.S. Environmental Protection Agency, U.S. Department of Energy, and American Coal Ash Association; EERC Publication 2007-EERC-03-04; Energy & Environmental Research Center: Grand Forks, ND, March 2007.

[8] *National Emission Standards for Hazardous Air Pollutants from the Portland Cement Manufacturing Industry*; Final Rule and Proposed Rule, *Federal Register* **2006**, 71, (244).

[9] Pew, J.S. Letter to Stephen L. Johnson, Administrator, Environmental Protection Agency on behalf of the Sierra Club, Feb 20, 2007.

[10] Sanderson, J.; Blythe, G.; Richardson, M.; Miller, C. Fate of Mercury in Synthetic Gypsum Used for Wallboard Production. Presented at DOE/NETL Mercury Control Technology R&D Program Review, Dec 12, 2006.

[11] U.S. Green Building Council. LEED Initiatives in Government by Type. Feb 2007, [www.usgbc.org/ShowFile.aspx?DocumentID=1741](http://www.usgbc.org/ShowFile.aspx?DocumentID=1741) (accessed March 13, 2007).