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Principal Author(s): Dr. Tarunjit S. Butalia, Dr. William E. Wolfe
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Name and Address: The Ohio State University
470 Hitchcock Hall, 2070 Neil Avenue
Columbus, Ohio 43210

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Abstract

The primary objective of the CCP Extension Program is to promote the responsible uses of Ohio CCPs that are technically sound, environmentally safe, and commercially competitive. A secondary objective is to assist other CCP generating states (particularly neighboring states) in establishing CCP use programs within their states.

The goal of the CCP extension program at OSU is to work with CCP stakeholders to increase the overall CCP state utilization rate to more than 30% by the year 2005. The program aims to increase FGD utilization for Ohio to more than 20% by the year 2005. The increased utilization rates are expected to be achieved through increased use of CCPs for highway, mine reclamation, agricultural, manufacturing, and other civil engineering uses. In order to accomplish these objectives and goals, the highly successful CCP pilot extension program previously in place at the university has been expanded and adopted by the university as a part of its outreach and engagement mission.

The extension program is an innovative technology transfer program with multiple sponsors. The program is a collaborative effort between The Ohio State University (College of Engineering and University Extension Service), United States Department of Energy's National Energy Technology Laboratory, Ohio Department of Development's Coal Development Office, and trade associations such as the American Coal Ash Association as well as the Midwest Coal Ash Association. Industry co-sponsors include American Electric Power, Dravo Lime Company, and ISG Resources.

Implementation of the proposed project results in both direct and indirect as well as societal benefits. These benefits include 1) increased utilization of CCPs instead of landfilling, 2) development of proper construction and installation procedures, 3) education of regulators, specification-writers, designers, construction contractors, and the public, 4) emphasis on recycling and decrease in the need for landfill space, 5) conservation of natural resources, 6) better products and significant technical benefits, 7) reduction in the cost of energy production for utilities, 8) substantial savings for end-users, 9) continued economic competitiveness of coal as a fossil fuel, 10) cleaner and safer environment, 11) reduced social costs, and 12) greater economic development.

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Executive Summary

The CCP Extension Program promotes the responsible uses of Ohio CCPs that are technically sound, environmentally safe, and commercially competitive and assists other CCP generating states (particularly neighboring states) in establishing CCP use programs within their states.

The activities of the CCP Extension Program consisted of the following:

1. working with regulatory agencies to produce environmental and technical guidelines and standards for CCP use;
2. working towards overcoming regulatory, technical, economic, marketing, and public perception barriers to use of CCPs;
3. preparing educational materials for end-users which provide detailed instruction of various uses of CCPs and serving as a resource person to end-users;
4. conducting workshops to train end-users and others in the advantages and proper application of CCPs;
5. demonstrating the use of CCPs via preparation of informational materials, papers, presentations, press releases, web site, etc;
6. maintaining an Ohio-specific CCP database, updating it regularly, and providing information to stakeholders; and
7. serving as a liaison among CCP stakeholders in the state.

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- 1) increased utilization of CCPs instead of landfilling
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- 4) emphasis on recycling and decrease in the need for landfill space
- 5) conservation of natural resources
- 6) better products and significant technical benefits
- 7) reduction in the cost of energy production for utilities
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- 9) continued economic competitiveness of coal as a fossil fuel
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Experimental

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11. conducting workshops to train end-users and others in the advantages and proper application of CCPs;
12. demonstrating the use of CCPs via preparation of informational materials, papers, presentations, press releases, web site, etc;
13. maintaining an Ohio-specific CCP database, updating it regularly, and providing information to stakeholders;
14. and serving as a liaison among CCP stakeholders in the state.

Results and Discussion

The specific highlighted activities of the program were as follows:

- The program coordinator reviewed CCP draft specification prepared by Ohio Department of Transportation and Ohio Department of Natural Resources. Written review comments were sent to the state regulatory agencies. Met with representatives of these organizations to obtain a consensus on language of the specifications. Encouraged other CCP stakeholders in Ohio to respond to the draft specifications with technical review comments.
- Served as member of Coal Combustion By-Products National Steering Committee, United States Department of Interior: Office of Surface Mining.
- Served as member of Residuals Management Committee of Ohio Water Association.
- Served as a member of American Society of Testing and Materials, E50.03 committee on CCPs. Provided technical input on standards under consideration by the committee. The committee has asked Drs. Butalia and Wolfe to work on an ASTM specification for the design and construction of CCP liners.
- Presented a technical paper: Butalia, T.S., Market Opportunities for Land Application of Ohio Coal Combustion Products, Beneficial Use of By-Products: Regional Issues, The Ohio State University, Columbus, Ohio, November 30 – December 1, 2000
- The following book chapter was accepted for publication: Walker, H.W., Taerakul, P., Butalia, T.S., Wolfe, W.E., Dick, W.A., Minimization and Use of Coal Combustion By-Products (CCBs): Concepts and Applications, Book chapter for The Handbook of Pollution Control and Waste Minimization, Marcel Dekkar, Inc.
- Attended the ACAA conference in San Antonio and presented the following three technical papers:
 - Butalia, T.S. and Wolfe, W.E., Market Opportunities for Utilization of Ohio Coal Combustion Products, Proceedings of the 14th International Symposium on Management and Use of Coal Combustion Products, January 22-26, 20001, Electric Power Research Institute, Report # 1001158, Palo Alto, California.
 - Fan, L.S., Agnihotri, R., Butalia, T.S., Walker, H., Weavers, L., Thomas, T., Tailored Calcium Oxide Sorbent Reactivation Process and Its Effects on Solid-Byproduct Properties, Proceedings of the 14th International Symposium on Management and Use of Coal Combustion Products, January 22-26, 20001, Electric Power Research Institute, Report # 1001158, Palo Alto, California.
 - Wolfe, W.E., Butalia, T.S., Fortner, C., Permeability Monitoring at an FGD-Lined Pond Facility, Proceedings of the 14th International Symposium on Management and Use of Coal Combustion Products, January 22-26, 20001, Electric Power Research Institute, Report # 1001158, Palo Alto, California.
- Prepared and submitted a technical article to OSM to be published in the CCB Information Network's upcoming CCB Interactive Forum proceedings.

- ❑ The following paper was accepted by FUEL journal for publication subsequent to peer review: Butalia, T.S., Wolfe, W.E., and Lee, J.W., Evaluation of a Dry FGD Material as a Flowable Fill, FUEL Journal, Vol. 80, pp. 845-850, 2001.
- ❑ Visited Youngstown Thermal Plant, Youngstown and conducted an onsite CCP assessment in collaboration with Youngstown State University staff.
- ❑ Provided advice and OSU Extension Fact Sheets to regulatory personnel in Pennsylvania.
- ❑ Mailed the USDOE-NETL press release on the CCP Extension Program to several media outlets on 8/24/00.
- ❑ A poster on use of CCPs form in reclamation was displayed at the Research in Reclamation Conference, Ohio University, Ohio, August 24, 2000.
- ❑ Coordinated with AEP on the construction of the medium-scale FGD-lined wetlands.
- ❑ OCDO issued a press release on the CCP Extension Program on 9/1/00.
- ❑ Reviewed for ACAA the Ohio regulations for the state based report and e-mailed comments to ACAA.
- ❑ Met with Ohio CCP stateholders (OCDO, USDOE, AEP, First Energy, Cinergy, ACAA, ACAA-OC, etc) on several occasions.
- ❑ Copies of the CCP market research report were mailed to CCP stakeholders. Complete electronic version of the 2-volume report can be downloaded from <http://ccpohio.eng.ohio-state.edu>
- ❑ A technical poster on beneficial uses of CCPs for highway applications was displayed at The Ohio Transportation Engineering Conference, Columbus, Ohio, October 30-31, 2000.
- ❑ Visited Medical College of Ohio- Toledo's coal-fired steam generating power plant on 10/31/00 to conduct an onsite CCP production evaluation.
- ❑ The program coordinator agreed to organize and chair a session on CCP Beneficial Utilization at the Pittsburgh Coal Conference, Australia, December 3-7, 2001. No international travel expenses will be charged to the USDOE project.
- ❑ Mailed technical information on CCPs requested by POWER magazine.
- ❑ Participated in the ASCE year 2001 infrastructure assessment survey.
- ❑ Agreed to organize a session on CCPs at the Annual Land Application of By-Products Conference, Columbus, Ohio, November 29-30, 2001.
- ❑ Compiled and e-mailed CCP permeability data to University of North Dakota researchers for potential inclusion in the draft of a CCP ASTM specification being developed for mine reclamation uses.
- ❑ The program coordinator, Dr. Tarunjit S. Butalia, was awarded The Ohio State University's College of Engineering Lumley Research Award for exceptional research activity and success in pursuing new knowledge of a fundamental or applied nature at The Ohio State University's College of Engineering. Recipients of this award are expected to be role models for the rest of the Engineering faculty at the university.
- ❑ The program coordinator reviewed the modified CCP draft specification prepared by the Ohio Department of Transportation (ODOT) for use of fly ash and bottom ash in structural fills. Met with representatives of ODOT to obtain a consensus on

- language of the specifications. Encouraged other CCP stakeholders in Ohio to respond to the draft specification with technical review comments.
- Served as initial Board Member of The Great Lakes By-Products Management Association. This recently formed Great Lakes based organization promotes the land application of by-products through educational and outreach activities. The initial board members include representatives of state agencies, research universities, and recycling organizations.
 - Reviewed CCP proposals for United States Department of Agriculture – SBIR division.
 - Reviewed several technical manuscripts for publication in CCP related journals.
 - The two abstracts submitted for the Recycled Materials International Conference, Washington, DC, November 13-15, 2001 have been accepted for presentation at the conference.
 - Three technical abstracts were prepared and submitted for the October 2001 Lexington Ash Conference, Lexington, Kentucky. The abstracts have been accepted for presentation at the conference.
 - Organized a meeting between Ohio DOT and ACAA-Ohio Chapter on April 16, 2001 to review the proposed Ohio DOT specification of use of fly ash and bottom ash for highway embankments.
 - Met with representatives of City of Hamilton, Ohio University, and Medical College of Ohio to review their current research initiatives on use of CCPs.
 - The program coordinator is co-leading an Ohio specific Fly Ash Interest Group. The group is considering mechanisms by which to increase the use of fly ash in concrete. An OSU symposium is being planned.
 - A technical paper on the CCP market research report was prepared and presented at the Clearwater Conference, Clearwater, Florida, March 5-8, 2001.
 - Met with Ohio CCP stakeholders (OCDO, USDOE, AEP, First Energy, Cinergy, ACAA, ACAA-OC, etc) on several occasions.
 - Provided technical information on beneficial use of CCPs for highway, mine reclamation, agricultural, and manufacturing applications to a wide range of interested parties (within and outside Ohio).
 - ISG Resources, one of the largest ash marketer in the US, had joined as a financial co-sponsor to the CCP Extension Program. All cash and in kind contributions towards the program are being reported as cost-share towards the USDOE project.
 - A technical presentation titled “Coal Combustion By-Products: Opportunities for Reclamation Partnership” was made at National Association of Abandoned Mined Lands Annual Conference, Ohio University, Athens, August 19-21.
 - The Associated Press interviewed Dr. Butalia and published his comments as a part of its wire story published September 5, 2001 titled “Researchers say waste coal ash could improve feedlot condition.” Many newspapers across the US published the wire report.
 - Comments by the program coordinator were published as a part of a Waste News, September 17, 2001 article titled “Coal Byproduct might aid farmers: Researchers in ND and Ohio use ash from power plants to stabilize soils.”

- The Governor of Ohio issued a press release on August 28, 2001 in which it announced a \$868,098 grant to The Ohio State University to study the accelerated response of CCP pavements. Articles on collaborative CCP research opportunities at OSU were published by Business First (September 7, 2001) and Daily Reporter (August 29, 2001).
- The quarterly newsletter of the Ohio Alliance for the Environment published an article “Fly Ash in Concrete: An Environmentally Desirable Product” by Dr. Tarunjit S. Butalia.
- Presented Ohio CCP market research study at the 2001 Ash Utilization Symposium in Lexington, October 2001. Served as a member of the Barton Thomas Best Paper Award Committee.
- Organized oral and poster presentations for 28 CCP related technical paper for the 2001 Pittsburgh Coal Conference in Australia. Selected session chairs and helped schedule four sessions of CCPs at the conference. Presented a technical poster paper at the conference on the characterization and geotechnical use of dry FGD materials. Chaired a session on CCBs at the conference. Dr. Butalia was invited in January 2002 to arrange for the CCB sessions for the 2002 Pittsburgh Coal Conference. Conference abstracts were solicited.
- Organized two talks on CCBs at the Great Lakes By-Products Management Association Conference, November 29-30, 2001 in Columbus, Ohio.
- Assisted OCDO in organizing the APLF tour for CBRC on February 6, 2002.
- Publicized the responsible uses of CCBs through e-mail communications to national audiences.
- Presented the following technical paper at the Ohio Pollution Control conference: Butalia, T.S., Beneficial Use of Solid By-Products from Air Pollution Control Devices at Coal Fired Facilities, Ohio Air Pollution Control Research Symposium, Toledo, Ohio, October 25, 2002.
- Organized several sessions on CCPs at the 2002 Pittsburgh Coal Conference. Presented the following technical paper at the conference: Kim, S.H., Wolfe, W.E., and Butalia, T.S., Decision Support System for Coal Combustion Product Construction Applications, 19th Annual International Pittsburgh Coal Conference, Pittsburgh, Pennsylvania, September 23-27, 2002.
- Organized oral and poster presentations for about 20 CCP papers at the 2003 Pittsburgh Coal Conferences. Selected session chairs and helped schedule four sessions on CCPs. Currently, Dr. Butalia serves as the Program Co-Chair for the 2004 Pittsburgh Coal Conference.
- Dr. Butalia also served on the steering committee of the January 2003 ACAA Symposium, October 2003 Lexington Ash Symposium, and November 2003 Beneficial Use Summit in Atlanta.
- Recent publications and presentations:
 - Butalia, T.S., Wolfe, W.E., Zand, B., Lee, J., Design of Pavements Constructed of Coal Combustion By-Products, 20th Annual International Pittsburgh Coal Conference, Pittsburgh, Pennsylvania, September 15-19, 2003

- Butalia, T.S., Vories, K., Coal Combustion Products: Opportunities for Reclamation Partnerships, COAL-GEN, Columbus, Ohio, August 6-8, 2003
- Butalia, T.S., and Wolfe, W.E., Geotechnical Characterization and Utilization of Dry Flue Gas Desulfurization By-Products, 15th International ACAA Symposium on the Management and Use of Coal Combustion Products, January 27-30, 2003, St. Petersburg, Florida
- Butalia, T.S., Walker, H., and Wolfe, W.E., Characterization and Use of Dry FGD Material from a Gas Suspension Absorber System, 15th International ACAA Symposium on the Management and Use of Coal Combustion Products, January 27-30, 2003, St. Petersburg, Florida
- Kim, S.H., Wolfe, W.E., and Butalia, T.S., Optimum Mixture Design of Coal Combustion Product Materials for Pavement Sections, 15th International ACAA Symposium on the Management and Use of Coal Combustion Products, January 27-30, 2003, St. Petersburg, Florida
- Wolfe, W.E., Butalia, T.S., Poston, R.W., and Brown, S.A., An Example of the Use of Compacted Spray Dryer Ash in a Structural Fill, 15th International ACAA Symposium on the Management and Use of Coal Combustion Products, January 27-30, 2003, St. Petersburg, Florida

Conclusion

The utilization of CCPs can result in both direct and indirect as well as societal benefits. These benefits include 1) increased utilization of CCPs instead of landfilling, 2) development of proper construction and installation procedures, 3) education of regulators, specification-writers, designers, construction contractors, and the public, 4) emphasis on recycling and decrease in the need for landfill space, 5) conservation of natural resources, 6) better products and significant technical benefits, 7) reduction in the cost of energy production for utilities, 8) substantial savings for end-users, 9) continued economic competitiveness of coal as a fossil fuel, 10) cleaner and safer environment, 11) reduced social costs, and 12) greater economic development.

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