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The College of Engineering and Applied Science is pleased to provide you with information about the *UWM Center for By-Products Utilization*, which is a part of our program. The Center is committed to the use of technology to find environmentally and economically effective uses of by-products, not only from industrial processes but also from those generated by the public (i.e., post-consumer wastes).

The Center is dedicated to achieving mutually beneficial cooperation between industry, government agencies, and UWM. Future activities in advancing knowledge of by-products utilization and their practical applications will continue with the help of dedicated students, staff, and faculty at UWM.

The Center's national and international affiliations have brought recognition to the College and the University.

Sincerely,

William D. Gregory, Ph.D., P.E.
Dean and Professor of Electrical Engineering

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UWM CENTER FOR BY-PRODUCTS UTILIZATION
BACKGROUND REPORT

Background

The Center for By-Products Utilization was authorized by the University of Wisconsin - Milwaukee (UWM) in September 1988 and started operation in early 1989. The Center is a part of the College of Engineering and Applied Science (CEAS) at UWM. Its operation was made possible with grants from a group of founding sponsors in 1988. They were Dairyland Power Cooperative, La Crosse; Madison Gas and Electric Company, Madison; Northern States Power Company, Eau Claire; We Energies, Milwaukee; Wisconsin Power and Light Company, Madison; Wisconsin Public Service Corporation, Green Bay; and, National Minerals Corporation, St. Paul, MN, which joined the Center as an Affiliated Member also in 1988. In September 1994, Manitowoc Public Utilities also became an Affiliate Member of the Center.

The UWM Center for By-Products Utilization (UWM – CBU) office and laboratory facilities are provided by the Department of Civil Engineering and Mechanics and the College of Engineering and Applied Science. They are located on the UWM campus in the Engineering and Mathematical Sciences (EMS) Building. The Center's mission is to perform research and develop practical information for the beneficial use of presently discarded by-products from industrial, commercial, and public sector operations. This includes, but is not limited to ash from combustion of coal, coke, wood, sawdust, tires, etc.; used foundry sand; scrap iron slag; pulp and paper mill sludge and grits and dregs; lumber industry waste; used tires; plastics; glass; and other consumer "wastes." The Center has a highly qualified staff with many years of experience in applications of recycling by-products in construction materials and other products. The Center has the support of Affiliated Faculty from other departments on the UWM campus in a great variety of disciplines, which are complimentary to the basic capabilities of the Center's primary staff. The Center is fulfilling its teaching and training function by working with undergraduate and graduate students thereby disseminating its available information to as many future engineers and scientists as possible. In addition to working with sponsors and others, the Center is in contact with governmental agencies, industry associations, technical and professional engineering committees, and other organizations for the purpose of mutual exchange of information and assistance.

Center Operation

The Center's Director is Professor Tarun R. Naik, Ph.D., P.E., faculty of the Department of Civil Engineering and Mechanics, UWM. He has an extensive background in structural engineering and materials of construction. Dr. Naik specializes in concrete technology and evaluation and testing of construction materials. He has taught courses, given seminars, conducted workshops, and presented invited lectures in the use of by-products in construction materials, nondestructive testing of concrete, evaluation of concrete structures, repair and rehabilitation of structures, bridges, and dams, concrete technology, and design of machine foundations and electric transmission line structures, not only in the USA, but also in over two dozen countries. His work on sponsored and other research has resulted in over 250 technical papers and reports. In 1989, Dr. Naik founded the UWM Center for By-Products Utilization. Other UWM-CBU staff includes Rudolph N. Kraus, Assistant Director and Researcher, Dr. Fethullah Canpolat, Research Associate, and Dr. Yoon-Moon Chun, Post-doctoral Fellow. Additional research staff includes several highly qualified technical personnel as well as graduate and undergraduate students.

Mr. Kraus has both a Bachelor's and Master's degree in Civil Engineering. His master's degree research emphasis was

in the area of non-destructive testing of concrete at early ages. Mr. Kraus has participated in UWM-CBU research projects dealing with fly ash, bottom ash, wood ash, foundry sand, and glass in concrete and in cast-concrete products. He has also worked on several projects incorporating coal combustion products, foundry by-products, and post-consumer materials in flowable slurry and flowable self-consolidating concrete. Mr. Kraus has co-authored many reports and papers in these areas. He also assists with coordinating UWM-CBU workshops and seminars promoting the use of by-products in concrete, flowable slurry, and concrete technology. He is responsible for UWM-CBU laboratory facilities and is participating in several research projects in a leading role. Dr. Chun obtained his Ph.D. degree from the University of Wisconsin-Milwaukee in December 2002. His doctoral research work was on the use of residual fibers from the pulp and paper industry in concrete. He is currently coordinating research work on use of coal combustion products and quarry by-products in self-consolidating concrete. Dr. Chun has also co-authored several papers related to his research work and other research conducted by UWM-CBU. He has also assisted with the research work related to the use of wood ash in concrete and flowable slurry (CLSM). Dr. Canpolat is on leave from the Civil Engineering Department of Celal Bayar University, Turkey. He is currently working on issues related to shrinkage of concrete, various research reports and technical papers for UWM-CBU in the area of by-product utilization. He received his Ph.D. degree in Civil (Structural) Engineering from Sakarya University, Turkey, in 2002. Since May 2003, he has been working as a Research Associate at the UWM Center for By-Products Utilization where he has been involved with research on the use of limestone quarry fines, and foundry industry silica-dust in self-consolidating concrete (SCC).

The Center primarily uses the Cement and Concrete Research Laboratories and Construction Materials Laboratory for its research work at UWM. In addition, numerous other laboratories are available on the UWM campus for many multi-disciplinary research requirements as needed by the Center. With the laboratory facilities available, and several planned and recently acquired equipment additions, the Center is able to handle most specialized testing and research needs for construction materials, such as concrete and concrete-making materials, cast-concrete products, wood, asphaltic concrete, etc.

Technology Transfer - Workshops and Symposiums

The Center has sponsored or co-sponsored many workshops to fulfill its goal of technology transfer. The UWM-CBU has sponsored or co-sponsored workshops and symposiums in USA and other countries. For detailed listing of workshops visit the Internet site of UWM-CBU at URL http://www.uwm.edu/dept/cbu Additional workshops and conferences for 2004 and beyond are planned for Milwaukee and other cities.

Research Work

Center researchers have worked on many research projects dealing with various aspects of by-products utilization since 1989. The List of UWM-CBU Reports and Publications covers many subjects in the field of by-products, construction materials, concrete, asphalt, etc.

The Center has conducted research on the utilization of numerous by-product materials. Some of the uses for by-product materials that UWM-CBU have investigated include: use of used foundry sand in concrete, cast-concrete products, and flowable slurry (CLSM); use of numerous types and quality of coal combustion products such as fly ash, clean-coal ash, flue gas desulfurization materials, bottom ash, and slag, in construction materials; use of post-consumer plastics in concrete; use of crumb rubber from used tires in asphalt and concrete; use of residual fibers from the pulp and paper industry in concrete; treatment of contaminated dredged materials for use as a soil amendment; use of wood ash

and combined fuel ash in concrete and CLSM; and development of blended cements using coal combustion products.

Industries are also encouraged to have UWM-CBU perform research and development work for utilization of their by-products. One of the many services that the Center can provide is a waste stream audit. UWM-CBU can also perform physical and chemical characterization and provide a final report that provides a list of prioritized use options for the by-product. The purpose of the characterization is to recommend alternatives to the normal practice of disposing by-product materials in landfills. A partial list of cooperating and supporting companies and UWM-CBU customers since 1989 is given below.

1. Advanced Cast Stone Company
2. Ameren Energy
3. American Fiber Resources
4. APS Concrete Products, Inc.
5. Badger Mining Corporation
6. Best Block Company
7. Bradley University
8. Brown County Port and Solid Waste Department
9. By-Products Recycling Services, Inc.
10. Central Illinois Light Co.
11. Chicago Block & Brick Co.
12. City of Peoria, Department of Public Works
13. City of Milwaukee
14. City Water, Light & Power
15. Consolidated Papers, Inc.
16. County Concrete Corporation
17. Crumb-Colton Block Company, Rockford, IL
18. Dairyland Power Cooperative
19. Dynegy Midwest Generation, Inc.
20. Electric Power Research Institute
21. Fall River Foundry
22. Fiber Clay Council
23. Fort James Corporation
24. Fox River Fiber Corporation
25. Henry Nelch & Son Company
26. Illinois Clean Coal Institute
27. Illinois Power Company
28. Kohler Company
29. Lafarge Corporation
30. Madison Gas and Electric Company
31. Manitowoc Public Utilities
32. Maynard Steel Casting Company
33. Midway Concrete Corporation
34. Minergy Corporation
35. Motor Castings Company
36. National Council of Pulp & Paper Industry for Air and Stream Improvements
37. National Minerals Corporation
38. Neenah Foundry Company
39. New Berlin Redi-Mix, Inc.
40. Northern States Power Company
41. Packaging Corporation of America
42. Ozinga Chicago RMC, Inc.
43. Payne and Dolan, Inc.
44. Pelton Casteel
45. Perstorp Corporation
46. Peters Concrete Co.
47. Radian Corporation
48. Ready-Mix Service, Inc.
49. Recycling Market Development Board
50. Rockford Blacktop Construction Company
51. Rockwell Lime Company
52. Southdown, Inc.
53. Stainless Foundry and Engineering
54. Stora-Enso North America
55. Tenneco Packaging
56. The Falk Corporation
57. United Ready Mix, Inc.
58. U.S. Army Corps pf Engineering
59. U.S. Department of Energy
60. UWS Applied Research Program
61. UWS Solid Waste Research Council
62. UWS Solid Waste Recovery Research Program/Recycling Market Development Board
63. Waupaca Foundry, Inc.
64. We Energies
65. Western Lime Corporation
66. Weyerhaeuser Company
67. Williams Energy Services - Ethanol
68. Wisconsin Aluminum Foundry
69. Wisconsin Department of Administration
70. Wisconsin Department of Natural Resources
71. Wisconsin Department of Transportation
72. Wisconsin Industry for Saving our Environment

73. Wisconsin Paper Council
74. Wisconsin Power and Light Co.
75. Wisconsin Public Service Corporation