

5.0 MECHANISMS TO INCREASE THE BENEFICIAL USE OF RMCs

This section addresses Part (C) of the Congressional mandate requiring EPA to identify potential mechanisms to achieve greater substitution of RMCs in cement and concrete products. The discussion covers a broad suite of existing and potential mechanisms, and contemplates mechanisms that are both within and beyond the immediate purview of EPA and its partner agencies. To help align these mechanisms with the barriers described in Section 4, we group the discussion into three categories followed by a generalized set of mechanisms:

- Procurement policies and material use standards;
- Education, technical assistance⁷⁹, and recognition programs; and
- Economics

Several of the mechanisms described within each category are generally applicable to most types of RMCs.⁸⁰ Consistent with the Congressional charge, however, we also focus on certain RMCs that have historically only been beneficially used at lower levels than other RMCs. For example, the discussion under "Education, technical assistance, and recognition programs," covers programs focused on increasing the use of coal fly ash and foundry sand in cement and concrete.

As presented, many of the mechanisms described in this section apply to non-Federal, as well as Federal projects. The amount of RMCs produced annually in the U.S. surpasses the amount that can be incorporated into Federal cement and concrete projects alone. Thus, we consider this broader application of potential mechanisms due to the fact that increasing reuse rates to higher levels will require greater reuse among both Federal and non-Federal cement and concrete projects.

Finally, this section represents the collective input of a variety of different stakeholders, and includes a wide range of options that have been proposed in various contexts.⁸¹ Some of these options may be outside the scope of the mechanisms and issues that EPA has control over. Further, several of the mechanisms outlined in this chapter may require additional resources to complete and sustain into the future. However, we include this broad range of ideas for the purpose of documenting and briefly discussing the various options contemplated.

5.1 Procurement Policies and Material Use Standards

Procurement policies offer the opportunity to stimulate demand for products making beneficial use of RMCs. We consider several aspects of procurement policies:

- We first review implementation of EPA's CPG and efforts to assess their impact on the beneficial use of RMCs;

⁷⁹ Includes technical research.

⁸⁰ Several of the mechanisms discussed in this chapter are similar in nature to those proposed by: Buckley, Tera D., and Debra F. Pflughoeft-Hassell, "National Synthesis Report on Regulations, Standards, and Practices Related to the Use of Coal Combustion Products," Energy & Environmental Research Center, University of North Dakota. Draft Final Report, July 2007.

⁸¹ The full set of mechanisms identified by industry representatives is summarized in Appendix E to this report.

- Next, we consider efforts to revise engineering and procurement standards to optimize the substitution of RMCs in concrete and cement; and
- Finally, we examine how modifying building and construction standards could help increase the beneficial use of RMCs.

5.1.1 Influence of EPA's CPGs on RMC Beneficial Use

Since its inception, procuring agencies, including EPA, have developed a multi-faceted approach to implement RCRA section 6002 and the CPG program. Components of this approach have both broad and specific relevance to the use of RMCs in Federal concrete projects, including: (1) expanding the number of RMCs covered by the CPG; (2) strengthening and streamlining policy guidance related to green purchasing requirements, implementation, and reporting; and (3) developing and delivering information resources, training, and outreach activities.

With respect to item (1) above, the RMCs currently covered by the CPG include coal fly ash, GGBFS, silica fume and cenospheres. Specifically in 1983, EPA's original procurement guideline designated cement and concrete containing coal fly ash. EPA subsequently amended the designation in May 1995 (CPG III) to include cement and concrete containing GGBFS, and again in April 2004 (CPG IV) to add silica fume and cenospheres.⁸²

To translate the CPG designation of an item into actual purchases, procuring agencies are subject to a number of implementation and reporting statutory requirements. For example, procuring agencies that purchase more than \$10,000 of a CPG item are required, by RCRA Section 6002, to establish (within one year after the item has been listed) an affirmative procurement program for that item. An affirmative procurement program is an agency's strategy for maximizing the purchase of an EPA-designated item. Affirmative procurement programs should be developed in a manner that assures that items composed of recovered/recycled materials are purchased to the maximum extent practicable. Over the years, these programs have been bolstered by a number of Executive Orders; the most recent, Executive Order 13423, requires that Federal agencies promote the purchase of energy efficient, recycled content, biobased, and environmentally preferable products through their purchasing requirements.⁸³

With particular relevance to RMC use in Federal cement and concrete projects, the FHWA and other DOT grant programs are explicitly included as purchasing agencies under RCRA Section 6002, as explained by the conference committee report from the Hazardous and Solid Waste Amendments of 1984 (Cong. Rec. H 11138 [October 3, 1984]):

To assure the fullest participation by procuring agencies, the Conferees wish to resolve any ambiguity with respect to §6002's coverage of the Department of Transportation, in particular the Federal Highway Administration (FHWA). The

⁸² U.S. EPA, Comprehensive Procurement Guidelines, About CPG/RMAN, from <http://epa.gov/cpg/about.htm>.

⁸³ Adapted from: "Fact Sheet: Executive Order 13423 Strengthening Federal Environmental, Energy, and Transportation Management," The Office of the Federal Environmental Executive. OFEE and OMB require agencies to have holistic green purchasing plans that include the EPA-designated recycled content products with other green products and services, rather than a separate affirmative procurement program just for the EPA-designated products.

FHWA is a “procuring agency” under the Solid Waste Disposal Act and is therefore fully responsible for implementing the guidelines and other requirements of §6002. It is the intent of Congress that both FHWA’s direct procurement and indirect Federal-aid programs (Federal Highway Trust Fund) be covered by the requirements of §6002 as amended by this Act. Indirect purchases by the Federal Aviation Administration are also covered under Section 6002 in the same manner as is the FHWA. Coverage of the FHWA’s direct and indirect procurement activities under this amendment extend to the review of procurement specifications pursuant to Section 6002(d), as amended, in addition to the affirmative procurement program required under this section.

Recent efforts have also focused on improving the quality of procurement data and streamlining the reporting process for Federal agencies. For example, in an effort to increase Federal purchasing of energy efficient, recycled content, biobased, and environmentally preferable products, E.O. 13423 and related guidance require agencies to integrate four existing disparate purchasing requirements into an integrated Federal purchasing effort that applies to all types of acquisitions of goods and services.⁸⁴ The Order requires every year that agencies track and report on their purchases of EPA-designated recycled-content items.⁸⁵

Section 6002 of RCRA requires the Office of Federal Procurement Policy (OFPP) to report to Congress every two years on the actions taken by Federal agencies to implement Section 6002. When it became clear that it was not possible to gather accurate information on every agency’s purchases of individual EPA-designated products, OFPP and OFEE convened a workgroup to create a new reporting format. Materials, such as concrete, are supplied or used as part of construction contracts. Contractors generally do not report on the volume of materials supplied or used, let alone the recycled content of materials. For this reason, agencies now provide other evidence of compliance in the annual data reports.

The reporting questionnaire focuses on compliance, training, and auditing and trends analysis to foster increased accountability for program implementation. In the case of construction products, it asks agencies to “Demonstrate how your agency complies with the requirements to purchase EPA-designated construction products containing recovered materials, to the maximum extent practicable. Examples include integrating specific, recycled-content products requirements with the use of the U.S Green Building Council’s Leadership in Energy and Environmental Design (LEED), incorporating recycled-content product requirements into design specifications, and inserting recycled-content product requirements into design/build contracts.”

To optimize program performance, implementation and reporting procedures are supplemented with information resources and training activities. Outreach and inter-agency collaboration activities also occur on an ongoing basis.⁸⁶

⁸⁴ Executive Order 13423, "Strengthening Federal Environmental, Energy, and Transportation Management," Fact Sheet.

⁸⁵ Strengthening the Federal Environment, Energy, and Transportation Management, January 27, 2007.

⁸⁶ For a more detailed discussion of these efforts, see, for example: Office of Management and Budget; Office of Federal Procurement Policy, "Resource Conservation and Recovery Act: A Report on Agencies' Implementation for Fiscal Years 2002 and 2003," October 2005.

This multi-faceted approach to green purchasing has led to many successes, including influencing the amount of RMCs procured for use in concrete products. As one example, for agencies that gather data for specific designated items, for FY 2003, more than 80% of the concrete purchases made by NASA, DOE, and GSA contained coal fly ash or slag. The CPG program, therefore, represents a critical mechanism to achieve higher RMC reuse levels.

To continue and expand upon this progress, however, the procurement guidelines and their implementation are the focus of ongoing improvement efforts. These efforts cover the facilitation role played by EPA, OFPP, and OFEE under the auspices of RCRA 6002 and the Executive Orders, and extend to on-the-ground decision-making of Federal procurement entities and their reporting obligations. We discuss these issues in further detail below.

5.1.2 Discussion of Response to CPGs for RMCs in Concrete and Cement

A number of governmental reports and reviews have commented on the efficacy of purchasing programs for recycled-content products, including, by implication, concrete products containing RMCs.⁸⁷ The conclusions drawn in these commentaries focus on two general limitations: (1) the lack of robust reporting data on volumes of purchased products and related inability to link such volumes to the influence of procurement requirements; and (2) the need for expansion of guidance and tools to facilitate the procurement of products with recycled content. In addition, with respect to RMC reuse and procurement requirements, several stakeholders have suggested that addressing various issues related to material standards and specifications, along with contract bidding procedures, may positively influence reuse rates.

5.1.2.1 Data Limitations

The extent to which the major Federal procuring agencies have purchased products containing RMCs is difficult to measure because few data systems clearly identify purchases of recycled-content products. In addition, agencies do not receive complete data from their headquarters and field offices or their contractors and grantees. As a result, they generally provide estimates, not actual first-hand data, to the OFPP and OFEE.⁸⁸

Industry commenters (e.g., Holcim, Ltd.) emphasized the need for a centralized reporting system that tallies the amount and type of recycled cement/concrete products used in Federally-funded projects. In addition, GAO issued the report “Federal Procurement: Better Guidance and Monitoring Needed to Assess Purchases of Environmentally Friendly Products” in 2001 to evaluate the status of, and barriers to, Federal agencies’ efforts to implement RCRA requirements for procuring products with recycled content. The GAO report contained suggestions focusing on improving procurement processes, guidance, and data systems.

⁸⁷ See, for example, Statement for the Record by David G. Wood, Director, Natural Resource and Environment Issues, US General Accounting Office, July 11, 2002 (GAO-02-928T).

⁸⁸ June 2001, GAO report, “Federal Procurement- Better Guidance and Monitoring Needed to Assess Purchases of Environmentally Friendly Products”

Improvements in data collection also were highlighted in “Leading By Example: A Report to the President on Federal Energy and Environmental Management (2002-2003).”⁸⁹

One example of how relevant procurement data are difficult to both derive and interpret involves the recent analysis of agencies’ Federal Procurement Data Systems (FPDS) data. This review indicated that recycled content products were not being supplied or used in more than 95% of the contracting actions in FY 2002 and FY 2003. While the agencies have not completed their assessment of the FPDS data, EPA believes that the amount of material procured does not accurately reflect the range of products that can be supplied or used as part of support services contracts.

Better reporting, resulting from the initiatives noted above, should yield a more comprehensive information resource to evaluate the performance of the CPG program and identify further areas for targeted improvement.⁹⁰ Detailed data from each contract on the materials, sources, tonnages, haul distances, and mixture proportions would significantly improve the documentation and assessment of RMC benefits in Federal concrete projects. It is important to note, however, that with respect to RCRA Section 6002; EPA, OFPP, and OFEE provide only a facilitation role, and have no oversight or compliance assurance authority. These obligations fall to the individual procuring agencies.

One option for increasing compliance could include OFEE using an awards program to focus on Agencies’ efforts to purchase products with RMCs. OFEE and OFPP can provide negative and positive recognition during the annual Federal budget process. Agencies implementing the CPG guidelines and the EO goals and policies can be rewarded.

5.1.2.2 Procurement Facilitation

The ability of agencies to procure recycled content products is subject to a number of considerations related to information availability, logistics, and costs, among others. EPA and partner agencies continue efforts to provide agencies with the information necessary to effectively promote the purchase of products with recycled content. These efforts focus on outreach, training, and education, along with making relevant information more readily accessible. For instance, one area of concern is that green purchasing mandates may not be effectively extended to government contractors or grantees. As one measure to address this concern, OFEE has revised its training for contracting personnel to emphasize that recycled content and other green products are often supplied or used. Contracting personnel are taught that contracts should require a contractor to supply or use green products.

⁸⁹ “Leading By Example: A Report to the President On Federal Energy and Environmental Management (2002-2003).” October 2004, from http://ofee.gov/final_report1.pdf.

⁹⁰ For example, with more robust reporting data, the RCRA agency data report could be amended to include more specific questions for agencies regarding their purchases and usage of RMCs in construction projects. Currently, due to data limitations, it only asks for a prepared document generally discussing efforts of the agency and not the specific quantities of material used.

5.1.3 Specifications and Bidding Procedures

Another set of suggested mechanisms to increase the use of RMCs focuses on the development of engineering and procurement standards to optimize the substitution of RMCs in concrete and cement. Industry representatives consulted for this report offered observations on how the CPGs could be made more effective. For example, SCA stated that the CPGs should have more explicit requirements regarding replacement rates and the use of ternary mixtures. In addition, the CPGs could have a greater impact if several actions were taken when the review protocol recommends specification changes: (1) reissue the specifications if there is time prior to the project bid date; (2) if the project has already been bid, then require re-bidding; and (3) withhold Federal funding if the project specifiers do not change the specifications.

Some efforts are already underway to implement these mechanisms. For instance, the cement industry has recently promoted the acceptance of the Standard Performance Specification for Hydraulic Cement ASTM C1157 to the DOT's FHWA, Federal Aviation Administration (FAA), Corps of Engineers, and Bureau of Reclamation; however, to date, the effort has met with limited success. There also is a separate effort to harmonize the AASHTO and ASTM standards via an ASTM/AASHTO Task Group, but successful completion of this effort will also take time. In the interim, some companies have modified specifications to their cement to address early strength issues. For example, Holcim has decreased the slag content in its IS blended cement to address seasonal concerns, and the company is currently evaluating the use of different grinding aids that will address the perceived set/strength issue. The cement industry as a whole has taken measures to emphasize the need for proper finishing and curing techniques to offset the scaling issue.

In general, the development of standards for optimized substitution is feasible, provided that the effort is based on a process where the stakeholders with concerns about quality, cost, and risk can participate and identify solutions that address the priorities of each group. However, this process, as noted above, can require significant time to arrive at an acceptable solution, and will require participation of enough government and industry leaders to provide momentum for moving toward a nationally consistent application of standards in different state and local jurisdictions.

5.1.4 Building Standards

Standards for building and construction offer another avenue for increasing the beneficial use of RMCs. First, integrating environmental building requirements into Federal, state, and local public building standards could help promote the use of RMC-based materials. Second, specifications outlining the use of RMCs could be integrated into building contracts. In conjunction with the economic measures described below, the incorporation of additional RMCs into building standards could potentially have a large impact on increased RMC use. We discuss these options below.

5.1.4.1 Building and Construction Industry Practices

The U.S. Green Building Council's LEED Green Building Rating System[®] is a voluntary, consensus-based national standard for developing high-performance, sustainable buildings.

RMC use constitutes only one LEED credit; however, the reduction in GHG that may result from increased RMC could satisfy other credits.

The potential for building industry standards such as LEED to be written into Federal, state, and local public building standards offers a simple method for increasing SCMs in cement and concrete (PCA, 2003). By explicitly identifying building standards that include the use of RMC-based cement and concrete, the building and construction industry will likely become more familiar with these materials and increase their use. In fact, certain Federal agencies already use LEED and have found that familiarity with sustainable design and green materials among architects and construction contractors has been increasing. Modification of building standards could be further pursued in concert with broader green building efforts. Projects, such as the Green Building Initiative, for example, “work with builders and their associations to facilitate understanding and acceptance of sensible green building practices.”⁹¹

Furthermore, continued CPG implementation by FHWA and additional promotion of the Green Highways Partnership are likely to alter current transportation construction practices as RMC use is increased as a result of new practices and usage patterns. See Section 5.2.3 for information on the Green Highways Partnership.

5.1.4.2 Specifications within Building Contracts

EPA and other stakeholders have recognized the need for a guide for procuring green building products and construction services through Federal contracts. In response, EPA has partnered with the Federal Environmental Executive and the Whole Building Design Guide (WBDG) to develop the *Federal Green Construction Guide for Specifiers*.⁹² This guide helps Federal agencies meet their project-specific environmental goals and mandates, and includes the following components:

- Federal Leadership in High Performance and Sustainable Buildings Memorandum of Understanding;
- EPA's Final Guidance on Environmentally Preferable Purchasing;
- Greening of Government Executive Orders;
- EPA's CPGs for recovered content;
- USDA's Biobased Purchasing Program;
- ENERGY STAR® & DOE Federal Energy Management Program (FEMP) Product Efficiency Recommendations;
- Energy Policy Act of 2005;
- ASTM, LEED, Green Globes, and other rating systems and standards; and
- Other “best practices” as determined via industry and public comment.

One effort in particular, the Federal Leadership in High Performance and Sustainable Buildings MOU, guides 19 Federal agencies in the design, construction, and operation of buildings.

⁹¹ The Green Building Initiative, “The GBI – A Better Way to Build.” Accessed July 18, 2007 at <http://www.thegbi.org/gbi/whatwedo.asp>.

⁹² See details at: <http://www.wbdg.org/design/greenspec.php>.

Among other recommendations, the MOU guiding principles include reducing the environmental impact of materials; concrete with RMCs is consistent with this objective. E.O. 13423, “Strengthening Federal Environmental, Energy, and Transportation Management,” January 24, 2007, expanded the applicability of the sustainable building MOU’s guiding principles from the 19 MOU signatory agencies to all Federal agencies.

Another effort, the Unified Facilities Guide Specifications (UFGS) is a joint effort of the U.S. Army Corps of Engineers, the Naval Facilities Engineering Command, and NASA. UFGS are for use in specifying construction for the military services. They include a guide specification for obtaining LEED certification, a general guide specification for referencing the EPA-designated products, and guide specifications for using RMCs in concrete, including coal fly ash, ground iron blast furnace slag, and silica fume.⁹³

5.1.5 Summary of Potential Mechanisms Related to Procurement Policies and Material Use Standards

Below, we summarize the potential set of mechanisms contained in the above discussion. As indicated, in some instances, a lead role can be played by EPA, OFPP, and OFEE as part of their Section 6002 facilitation efforts, while other mechanisms require collaboration across multiple agencies, or a lead role by procuring entities. In addition, certain mechanisms may merit statutory authorization. The potential mechanisms include:

- Integrate and improve procurement systems, allowing for identification and tracking of cement and concrete purchases using RMCs and the RMC volumes utilized. As reporting systems allow, modify the RCRA agency data report to include more specific questions for agencies regarding their purchases and usage of RMCs in construction projects.
- Review all available options for oversight with the implementation guidelines of the CPG. This may involve working to increase awareness of CPG requirements and products and to change the perception that CPG is not mandatory. As a related matter, clarify the CPG clauses to RMC use and other technical standards associated with RMC use. Other options may include a system of negative or positive recognition in the annual Federal budget process, and through relevant recognition programs.
- Continue to work with other Federal agencies to implement policies favoring purchases of recycled materials. Several agencies (e.g., FHWA and DoD) already have such policies in place. In addition, increase outreach to vendors explaining the benefits to CPG material use.
- Develop effective information resources to promote RMC use, including (1) update and maintain the CPG Supplier Database⁹⁴ on a regular basis; (2) issue

⁹³ For more information, see: http://www.wbdg.org/ccb/browse_org.php?o=70.

⁹⁴ EPA’s CPG Supplier Database is a searchable database of vendors who sell or distribute CPG-designated products with recycled content. This tool allows users to search for vendors of a specific CPG product, product category, or

purchasing guidance documents RMANs recommending recovered material content ranges for CPG products based on the most recent information about commercially available products; and (3) develop other information tools as available resources allow.

- Expand training and outreach with OFPP, OFEE, and various green purchasing programs to provide training to Federal agency contracting, purchase card, and program personnel,⁹⁵ including more targeted training related to RMC procurement.
- Identify and develop optimization protocols for improved performance and increased benefits while increasing RMC use in cement and concrete.
- Continue to harmonize the AASHTO and ASTM standards.
- Promote the use of ternary mixtures in the CPG providing the possibility of using both coal fly ash and slag cement
- Continue to work with the Federal Environmental Executive and the WBDG to develop and promote the Federal Green Construction Guide for Specifiers.
- Aid in multi-agency based efforts to integrate environmental building requirements into Federal, state, and local public building standards, including, for example, industry standards such as LEED being written into Federal, state, and local building standards.

5.2 Education, Technical Assistance, and Recognition Programs

Education, research, technology development, demonstration, and outreach programs have the potential to improve the understanding of RMCs and their benefits, and to promote their beneficial use. Numerous government agencies (e.g., FHWA, USDA, EPA) have noted how these types of programs can help address perceptions that RMCs and associated products are inferior or deleterious to health and safety, and how they can improve the information base on which economic and technical decisions are made. Likewise, industry representatives (National Ready Mixed Concrete Association (NRMCA), the SFA, Headwaters, Inc.) consulted for this study have emphasized the importance of education programs for ensuring that end users (e.g., local and state transportation agencies) understand the reliability of RMC-based products.

Together with a number of industry, Federal, and state partners, EPA is undertaking a variety of research, education, and recognition efforts to increase RMC markets and use by improving the availability and flow of information about the beneficial use of a range of industrial materials. The discussion below examines several ongoing and prospective initiatives:

type of material. In addition, users can search directly for a specific vendor by typing all or part of the vendor's name in a search field.

⁹⁵ See, for example, the training programs offered by OFEE at <http://ofee.gov/gp/training.asp>.

- The EPA coal combustion products outreach efforts;
- The EPA foundry sand outreach efforts; and
- Recent industry and public/private collaborations and research.

While the impact of these initiatives is still emerging, they illustrate programs EPA is conducting with the potential to increase the beneficial use of RMCs.

5.2.1 EPA Coal Combustion Products Outreach Efforts

The C²P² is a collaborative partnership program with EPA, DOE, FHWA, ACAA, USDA, EPRI, USWAG and more than 150 partners. This partnership is currently working towards two goals. The first goal is to increase the beneficial use of CCPs from 31% in 2001 to 50% in 2011. The second goal is to increase the use of coal fly ash in concrete from 14 million U.S. tons in 2002 to 18.6 million U.S. tons by 2011.

With other partners, EPA is undertaking a number of research, education, and recognition efforts to improve the availability and flow of information about the beneficial use of CCPs. For example, a 2005 publication created by EPA, DOE, ACAA, FHWA, and USWAG, “Using Coal Ash in Highway Construction: A Guide to Benefits and Impacts,” has helped to explain the environmental benefits and risks associated with the use of coal fly ash in construction applications. EPA also partnered with FHWA to write and publish, “Fly Ash Facts for Highway Engineers.” This technical guide document has been widely distributed. In addition, over the last several years, the C²P² partners have developed a set of projects to increase the amount of CCPs that are beneficially used. These projects include an awards program, which recognizes CCP users, as well as mechanisms designed to allow for a better understanding of the obstacles to the beneficial use of CCPs, and to identify both governmental and private initiatives to address these obstacles.⁹⁶ Some of these activities include sponsoring workshops, publishing information materials, and participating in information exchange forums.

The ACAA’s annual CCP Production and Use Survey is the primary measurement instrument for C²P² goals. EPA will report the amounts and types of CCPs reported by applicants to the C²P² Awards Program. EPA works with ACAA to review the results of this survey, assessing trends in generation and beneficial use, with the ultimate goal of tracking the partners’ progress toward achieving the 50% CCP usage goal by 2011. Through publication of case studies, EPA highlights current practices that result in the successful use of CCPs.

As previously noted, three state reviews have been conducted that examine CCP utilization practices and identify the specific factors that encourage or discourage the beneficial use within each state. These reviews bring together key stakeholders to discuss factors that affect increased CCP utilization. Upon completion of these reviews, EPA will compile the findings in a broader publication.⁹⁷

⁹⁶ In addition to C²P² projects, EPA’s regions have initiated their own projects that will also assist the beneficial use of CCPs.

⁹⁷ Texas and Florida reviews have been completed and released, and a review of Pennsylvania was completed in 2007.

In collaboration with the C²P² partners, EPA has also held two C²P² award presentations to recognize those partners who have made exceptional progress in promoting the beneficial use of CCPs. The C²P² web includes fact sheets on project activities, as well as case studies, increasing the availability of information easily accessible online.⁹⁸ Further research and technical assistance is available via the construction initiative, created in partnership with DOE, FHWA, states, trade associations, and other parties, to facilitate the beneficial use of RMCs in large construction projects.

These collective efforts to increase the beneficial use of CCPs are likely helping to increase the amount of CCPs beneficially used each year. According to ACAA survey data, CCP beneficial use has increased from 32% in 2001 to 43% in 2006.⁹⁹

5.2.2 EPA Foundry Sand Outreach Efforts

EPA has initiated several efforts to increase the reuse of foundry sand. For example, EPA has compiled and published the 2002 *Beneficial Use of Foundry Sand: A Review of State Practices and Regulations*. In addition, EPA partnered with FHWA to write and publish, “Foundry Sand Facts for Civil Engineers.” This technical guide has been widely distributed. Moreover, EPA’s Sector Strategies Division published, *State Toolkit for Developing Beneficial Reuse Programs for Foundry Sand*, in July 2006 (Toolkit).¹⁰⁰ Designed specifically to assist states that wish to develop or improve their foundry sand beneficial use programs, the Toolkit provides program options to states according to their desired preferences and available resources. Starting with a series of questions to help states determine what type of program to design, the Toolkit guides users through a three-stage, six-step roadmap for creating a foundry sand beneficial use program.¹⁰¹ The Toolkit was developed through multiple Foundry Sand stakeholder meetings in 2005 and 2006.

5.2.3 Other Public/Private Collaboration and Research

A number of additional initiatives are being pursued by a variety of industry, not-for-profit, and governmental entities. We describe several such initiatives below.

The Green Highways Partnership. The Green Highways Partnership (GHP) is a public/private effort established to incorporate environmental considerations into the design, construction and operation of roads, beginning with the Mid-Atlantic Pilot. Environmental considerations include practices, such as using RMCs when constructing roads and buildings. RMCs can be used in all aspects of road construction – as a base layer, in the pavement, and in embankments. The Green Highway Partnership is now expanding into a national program designed to emphasize the use of recycled materials in highway construction. This new effort should also help focus the engineering, environmental, and economic reasons to use RMCs¹⁰².

⁹⁸ The C²P² web site is at: <http://www.epa.gov/epaoswer/osw/consERVE/c2p2/>.

⁹⁹ For more facts on C²P², refer to <http://www.epa.gov/epaoswer/osw/consERVE/c2p2/pubs/facts508.pdf>.

¹⁰⁰ The Toolkit is available at: <http://www.epa.gov/sectors/metallcasting/foundry.html>, accessed November 14, 2006.

¹⁰¹ EPA has also published a document providing general information on foundry sand recycling which is available at: <http://www.epa.gov/epaoswer/osw/consERVE/foundry/foundry-st.pdf>

¹⁰² Information on the Green Highways Partnership can be found at: <http://www.greenhighways.org>.

FHWA has been instrumental in assisting EPA in making contacts with state highway officials. Starting in the mid-Atlantic region, EPA and FHWA have hosted several workshops for State environmental and transportation officials and road builders to exchange information and share success stories and concerns about RMCs in road building.

The Federal Highway Administration (FHWA). The FHWA has been successful in promoting RMC use in road construction. Their research, development, and technology transfer efforts have been instrumental in advancing the use of RMCs in road projects. In addition, FHWA has recently undertaken a refocus of their recycling program with a stronger emphasis on environmental stewardship/leadership, which intends to address such items as CO₂ gas reduction, National Green Highway Partnership, storm water management, and pollution reduction through improved pavement design. The Recycled Materials Policy established by the FHWA Administrator clearly links recycled materials (e.g., asphalt, concrete) to the preservation and improvement of the national highway system.

FHWA has been conducting outreach to the road-building community (the states, local governments, and the construction industry) showing that the engineering feasibility of using RMCs has been demonstrated in research, field studies, experimental projects and long-term performance testing and analysis. In addition, to help foster the use of RMCs, the Administrator of the FHWA issued a national policy memorandum expressing the views of the Agency in this regard.

In addition to the above, EPA and FHWA are working with representatives from several by-product generators to cooperate on workshops and technical information needs in an effort to effectively increase the use of these materials in cement substitution, as well as other civil engineering applications.

The Industrial Resources Council (IRC). IRC is an organization designed to promote the use of products, by-products, co-products or other non-hazardous materials in various industrial activities, focusing on advancing the management and use of these materials in ways that are environmentally responsible, technically sound, commercially competitive and publicly accepted. EPA is collaborating with this group, which includes: the Construction Materials Recycling Association (CMRA); ACAA; the Foundry Industry Recycling Starts Today (FIRST); the National Council for Air & Stream Improvement (NCASI); NSA; SCA; and the Rubber Manufacturers Association (RMA). The goals of the IRC are to:

- Stimulate the transfer of information related to the recovery, use, reuse and recycling of industrial resources that can be used by planners, designers, specifiers, regulators, purchasers, manufacturers and constructors or other stakeholders;
- Participate in the development of appropriate codes, specifications and guides for the use of these industrial resources on par with competing materials and products;

- Facilitate awareness and understanding of the environmental, economic, engineering, manufacturing and societal benefits derived from the recovery, use, reuse and recycling of industrial materials; and
- Share experiences of effective strategies that lead to increased utilization of these industrial materials, including changes in codes, guides and specifications.

The Silica Fume Association (SFA). Industry members are spearheading educational efforts to address concerns about the utilization of silica fume. For example, Midwest contractors have reported finishing silica fume concrete parking decks at 85% of the cost of conventional concrete using the single-pass finishing technique. In addition, FHWA's publication IF-05-016, "Silica Fume User's Manual," includes a chapter of "how to" contractor training. SFA supports this chapter with educational videos in an effort to train contractors on how to properly and economically use silica fume concrete (Kojundic, 12/13/2006). Together, these efforts could help address the concerns of contractors resistant to using non-virgin materials.

The Recycled Materials Resource Center (RMRC). RMRC is a national center that promotes the appropriate use of secondary materials, including waste materials and by-product materials, in the highway environment. The Center is an active and viable partnership between FHWA, the University of New Hampshire (UNH), and the University of Wisconsin-Madison.

The Center has a unique role in the growing field of recycled materials use in highway construction—to serve as a catalyst to reduce barriers to the appropriate use of recycled materials. The Center seeks to provide a cohesive approach to the complex engineering and environmental issues surrounding the use of recycled materials, and to serve as a principal outreach organization and evaluator of information, as well as the principal point of contact for information.

The mission of the Center is to promote activities designed to ensure that:

- policymakers at the federal, state, and local levels have the education and technical information needed to formulate policy permitting recycled materials to be considered on equal footing with conventional construction materials;
- a voice dedicated to informing persons that recycled materials exist is present in each of the technical organizations associated with transportation infrastructure;
- existing information on recycled materials is organized and structured into standards, specifications, and typical engineering properties that can be used directly by the design and construction community;
- new and innovative applications of recycled materials are continuously developed; and,

- industries and transportation agencies have the logistical tools needed to connect sources of recycled materials, applications in the transportation infrastructure, and entities involved in supply/delivery.

The RMRC is committed to increasing the wise use of recycled materials and will be working to track various metrics of its impact and resulting changes in recycled materials use in the coming years

5.2.4 Summary of Potential Mechanisms Related to Education, Technical Assistance, and Recognition Programs

Below we summarize the potential set of mechanisms related to the above discussion. As indicated, in some instances, a lead role can be played by EPA and FHWA as part of their facilitation efforts, while other mechanisms require collaboration across multiple public and private entities. The potential mechanisms include:

- Support and expand the C²P² program, as well as continue EPA foundry sand outreach efforts.
- Continue and expand collaboration with DOT on the Green Highways Partnership, incorporating environmental streamlining and stewardship efforts into all aspects of the highway lifecycle. Continue and expand collaborative work with DOE on increased CCP use.
- Work with the IRC to promote the use of products, by-products, co-products or other non-hazardous materials in various industrial activities.
- Work with industry members and trade associations to address barriers.
- Conduct additional state reviews to foster a broader understanding RMC utilization practices.
- Publicize the energy savings and GHG reductions achievable through RMC use.
- Pursue ways to change the perception that anything that was a by-product or waste from an industrial process does not or cannot have the same quality attributable to a virgin or manufactured material.
- Expand current research and data collection efforts. Among other research efforts, RMRC and FHWA are conducting ongoing research on the beneficial use of RMCs in highway construction projects. These efforts include primary research of material specifications and guidance on their use. (www.fhwa.dot.gov/pavement/recycling)
- Pursue a collaborative government-industry research effort to develop concrete air entrainment additives that are compatible with coal fly ash generated by mercury-

compliant power plants. EPA and OFEE are well positioned to convene government agencies, the concrete industry, and the electrical power industry to jointly sponsor such research.

- Increasing EPA outreach and assistance to the coal combustion industry to foster use of mercury controls such that the recyclability of ash is not jeopardized. From developing the mercury standards, EPA's Office of Air and Radiation is well-positioned with the technical awareness and industry relationships needed to mount a program of assistance. Explore new pollution control technologies for mercury emissions that do not render coal fly ash potentially unsuitable for beneficial use.
- Continue to review and analyze life cycle performance and risk assessments of RMC use in cement and concrete.

5.3 Economics

Chapter 4 (Barriers to Increased RMC Substitution) highlights a variety of economic factors that influence RMC substitution levels. As noted in that chapter, the market for RMCs is characterized by small price differences. In addition, the perceived cost savings potentially enjoyed by producers and consumers of RMCs can be limited by the regional variation in the supply of RMCs and transportation costs and constraints. Even where cost savings exist, they may not be deemed sufficient to overcome potential externalities and justify changes in practice. This may occur as a result of barriers related to misinformation, quality concerns, and standard operating procedures that may constrain their use.

Given these market complexities, it is relevant to consider specifically whether and how economic mechanisms implemented by Federal, state, or local governments could potentially motivate increased levels of RMC substitution by minimizing any negative externalities associated with increased RMC use. Particularly with respect to the substantial GHG benefits associated with the use of CCPs, the development of targeted tax credits or accelerated depreciation for necessary infrastructure would be beneficial.

On a basic level, an economic influence in this context would seek to reduce the price of concrete manufactured with RMCs relative to concrete manufactured using virgin materials. In theory, these incentives could be applied anywhere along the material flow of concrete and concrete inputs - at the virgin material or RMC production phase; at the manufacturing phase; or at the end-user phase. The discussion below focuses on transportation funding mechanisms and various other incentives for RMC users.

5.3.1 Transportation Funding Mechanisms

Economic influences aimed at reducing the effective price of RMC substitution could rely on a variety of tax credits and other incentive mechanisms. At the project level, the Federal government could use matching requirements for federally funded highway construction projects to encourage the use of RMCs by reducing any perceived externalities of RMC use by the

project's contractors. For most Federally-funded highway projects, Federal law requires states or localities to match a certain percentage of the construction funds provided by the Federal government. In an effort to encourage greater RMC use, this percentage could be reduced for those projects meeting RMC substitution targets. Improved data collection is critical to the success of transportation funding mechanisms.

5.3.2 Mechanisms for Increased Industry RMC Use

Another set of economic mechanisms would directly sponsor industry in ways that encourage the beneficial use of RMCs. Examples of approaches that would influence the behaviour and decisions of cement producers and other RMC users include the following:

- The introduction of tax credits or accelerated depreciation for installed equipment could enable continued and expanded rates of beneficial use of RMCs. For example, tax credits for investment in slag granulation capacity could help address lower U.S. granulation rates (as noted by SCA).
- Industry observers (e.g., SFA) recommend that when awarding Federal projects, Federal agencies give weighted financial credit to concrete firms practicing the beneficial use of RMCs. This could include the exploration of other various incentive mechanisms, such as tax deductions or credits for firms that meet RMC substitution targets.
- Further research and development (R&D) on the substitution of RMCs could make RMC use more economically viable. Potential incentives for increased R&D on RMC use could include tax breaks or credits of varying sizes depending on the amount of resources expended by each firm.
- Promote the increased use of “green bonds” that are tax-exempt when used for qualified green building and sustainable design projects, as designated by the Secretary of the Treasury and the EPA Administrator.¹⁰³ Under Section 701 of the American Jobs Creation Act of 2004, up to \$2 billion of the bonds can be awarded.
- Within the context of the potential development of a carbon dioxide cap and trade program, consider how emissions credits could be applied toward RMC use.
- Encourage utilities and coal ash marketers to increase utilization rates by investing in storage and distribution assets that increase the availability and reliability of coal fly ash supplies in construction markets. Investment tax credit and/or the accelerated depreciation of capital expenditures for these types of investments would send an economic signal favoring utilization over disposal.

¹⁰³ Provus, Stan. “CDFFA Spotlight: Green Bonds,” July 2005, <http://www.cdfa.net/cdfa/cdfaweb.nsf/pages/july2005tlc.html>.

5.3.3 Caveats

Any potential economic mechanisms discussed in this section would be subject to relevant statutory, regulatory, and budgetary constraints and considerations. The transportation funding and tax related incentives presented in this section are for Congressional consideration only. We recognize that the Department of Transportation does not currently have the legal authority to use transportation funding mechanisms to help increase RMC use. In addition, many of these mechanisms would likely require improved data collection on materials used in Federal construction projects, and additional information regarding documentation of inventories and annual production of various RMCs.