

**2001 Innovative Recycling Grant Proposal:
Reuse of Mixed-Color Container Glass as Aggregate for Asphalt Shingles**

Applicant County: Duval

Primary Contact Person: Jackie Eldridge, Recycling Coordinator.

Complete Address: Department of Solid Waste and Resource Management
515 North Laura St., 6th Floor, Jacksonville, FL, 32202

Telephone: (904) 665-4732

E-mail address: jackiee@coj.net

Grant Request Amount: \$268,000.

Project Timeframe: Eighteen months

Project Abstract:

Presently, Duval County does not have a viable market for recycling mixed-color glass. This material is currently sent to a landfill. The following plan proposes a solution that will divert all of the mixed-color glass from Duval and surrounding counties for a process that will use crushed recycled glass aggregate in the production of asphalt roofing shingles. This will be a cooperative effort between a major local industry, a glass-processor, and other smaller vendors. This plan will divert glass from landfills saving valuable landfill space and extending the usable life of the facility. It will save transportation dollars and it will replace a mined resource (silica-sand) in the production of a common construction material. Furthermore, the use of crushed glass aggregate will remove a hazardous material (crystalline-silica) from the work environment.

Technologies or Processes

Not in Common Use in Florida: This project will use a flexible-shaft impact crusher developed by Minpro to produce an economically feasible glass aggregate from mixed-color, post-consumer glass to be applied to asphalt shingles in place of silica-sand. These processes are patent-pending, and are not in use in Florida at the present time.

Novel application: Current technology utilizes fine-grained silica-sand aggregate for use on the backsides of shingles in a process called “back-dusting”. This project will substitute ground mixed-color, post-consumer glass for the silica-sand aggregate.

Overcoming Obstacles to Recycling/ Waste Reduction in New or Innovative Ways:

Currently there is no viable recycling market for mixed-color glass available to Duval County, so it is sent to the landfill. This project will develop a partnership between Duval County and BFI, Minpro, and Owens Corning that will create a new product using the presently landfilled mixed-color glass. Furthermore, the recycled material needed by Owens Corning will exceed the amount available from Duval County. Therefore, partnerships are being developed to collect mixed-color glass from surrounding counties in order to supply the needs of Minpro and Owens Corning. Additional commercial sources of mixed-color glass, such as home and automotive glass repair shops, Construction and Demolition Landfills, etc. are also being secured. These partnerships will result in a significant reduction in the waste of mixed-color glass for the whole Northeast Florida region.

Benefits/Cost-effectiveness

Environmental Benefits- Methodology: This process involves the creation of a market for a material (mixed-color glass) for which Duval County has no present market. The new shingles will incorporate a post-consumer recycled product, thereby diverting over 3000 tons of mixed-glass from Duval County's landfill. Furthermore, Owens Corning's goal is to replace the entire 15,000 tons of silica-sand by taking the crushed glass from surrounding areas. This will eliminate the need for 15,000 tons of raw silica-sand that is presently mined and used in the back-dusting of shingles.

Thus, the environmental benefits are twofold: by substituting recycled glass aggregate for a mined material, this project will reduce the environmental impact of sand production *and* eliminate the glass that is presently dumped into landfills.

Environmental Benefits- Toxicity: The aggregate produced from recycled glass will replace crystalline silica that is presently used in the back-dusting process of shingle manufacturing. Crystalline silica is considered a respiratory health hazard because it is a lung irritant and prolonged exposure can lead to Silicosis (as cited by Clean Washington Center in *Best Practices in Glass Recycling: Analysis of Glass Dust*, November 1996). Replacing it with the recycled glass aggregate will eliminate exposure to toxic materials in the workplace environment during the back-dusting process.

Economic Benefits: The new shingles are expected to be very marketable. The new shingles will be produced at the same cost as the traditional shingles, but will cause less wear and tear on the processing equipment (due to the less abrasive nature of the crushed glass). Furthermore, the new shingles will be marketed as using post-consumer recycled materials, and will be sold at the same price as traditional shingles.

During the pilot-program, Minpro's central crushing operation will require at least three employees, and the entire collection and distribution process will involve other expanded occupational needs creating related jobs (e.g., collection, transportation, marketing, etc.). Smaller *Enviro-shredders* will be distributed to local business

establishments, helping to collect more glass and reducing the volume for delivery to the main crushing facility.

Both Minpro and Owens Corning expect to expand their operations following the successful completion of the pilot. Portable pre-crushers that collect glass from more rural areas in the periphery are likely to be incorporated into the process to supply the shingle manufacturer's requirements, thereby magnifying all environmental and economic benefits (e.g., more jobs, more glass diverted from surrounding counties, less silica mined, etc.)

Cost-effectiveness:

-How program will result in substantial improvement in cost of recycling/waste reduction: The successful completion of the grant-funded pilot and continued development of the market for the ground glass product will ensure the elimination of current disposal costs for mixed-color glass. For the period of October 1999 through October 2000, this cost (which is split equally between BFI and Duval County) includes \$41,256 for 207 hauls (totaling 2822.94 tons), plus \$63,786 for tipping fees, making the overall cost \$105,042.

-Payback period: Payback period for program costs should be very short, about two and a half years (grant funds disposal costs).

-Sustainability of the program: After the set-up costs are paid for by the grant, the application of the process is expected to be a very successful enterprise. Furthermore, Owens Corning has shown a strong commitment to the City of Jacksonville. They have maintained their current plant for over 30 years, and are also dedicated to running a safe, clean and efficient process. Environmental sustainability is one of their top priorities. For example, they maintain two separators that minimize waste by reintroducing the collected particles back into the shingle production process. They even use the dust filtered out of the air in the process. Also, increased contributions from peripheral locations and post-commercial sources will help keep production costs down, assuring a successful partnership that will benefit all parties involved.

-Cost-effective use of vendors, sub-contractors, products, etc: This process will provide a viable marketing solution for BFI, Jacksonville's primary recycling facility subcontractor. Additionally, other glass users such as local food and beverage establishments, and other sources of post-commercial glass will share in the common benefit of a market for mixed-color glass. Partnerships with surrounding counties will involve many other local businesses in the collection and distribution of the glass, and in the process of making the new shingles.

Transferability

-The proposed process will involve the coordination of Duval County with surrounding counties (St. John's, Clay, Nassau, and Baker) in order to acquire the amount of glass necessary for the grinding process and application. Simplicity will be the key to the success of this endeavor. The main crushing facility is compact and quiet, and Minpro is also developing a variety of crushers for different capacities and uses (e.g., the *Enviro-shredders* for small commercial application, portable pre-crushers to collect from more rural areas, etc.). Likewise, Owens Corning is actively researching the application of a coarser gradation of the crushed recycled-glass for the top-surfaces of their shingles.

All of the technology involved in this process can be easily transferred to other sites that have similar glass disposal problems. For example, most of Owens Corning's 15 other plants around the nation will easily be able to follow Jacksonville's example in converting from silica-sand to recycled glass.

-Specifically, this program will promote transferability by creating a demonstration/promotional video. The video will be sent to other locations to describe the benefits of the process and explain how the procedure can be implemented. Furthermore, Minpro and Owens Corning will actively promote the process and the improved shingle as environmentally friendly. Again, because we expect the amended shingles to remain highly competitive in the asphalt shingle market, the process should also "sell itself" in demonstration of durability, cost-effectiveness, and environmental benefits (diversion of landfilled glass, minimizing sand-mining, and removal of silica from the production process).

Local Support

Local support for this project is demonstrated through a public and private sector partnership resulting in 80% match to the total project costs.

The county will provide \$20,000 in salaries and administrative expenses, including office space, utilities, equipment, supplies, mailing, etc.

Owens Corning will supply \$174,000 for research and development of equipment and product specifications, preliminary material performance testing, product evaluation and marketing of recycled glass shingles, administration, and transportation of material from the grinder to the shingle manufacturing plant. A donation of new shingles to the county for use in Habitat for Humanity housing projects is also included in the contribution.

Minpro International, Limited will provide \$848,000 including labor in the plant to be established in Duval County, plant construction cost not included in the grant expenses, including equipment and warehouse space. Also included will be engineering and administration costs, glass crushers at commercial establishments, and two silos to store the finished product for the manufacturer.

AGENCY OR PARTNER	GRANT FUNDED COSTS	LOCAL SUPPORT	DESCRIPTION
Duval County		\$ 20,000.00	Salaries and Administrative Expenses (Office Space, Utilities, Equipment and Supplies, Mailing, etc.)
DEP*	\$ 140,000.00		Ammortized Use of Glass Crush/Screen Equipment
DEP*	\$ 125,000.00		Processing and facilities costs
DEP*	\$ 3,000.00		Video for Demonstration, Reporting (Transferability) and Marketing Mentored Counties
EnviroGrinder		\$ 150,000.00	Labor in Plant
Shingle Manufacturer		\$ 30,000.00	Research and Development of Equipment and Product Specifications
EnviroGrinder		\$ 427,000.00	Plant construction cost not included in grant expense for plant charges, including equipment, & building
Shingle Manufacturer		\$ 5,000.00	Preliminary Material Performance Testing
Shingle Manufacturer		\$ 15,000.00	Product Evaluation and Marketing of Glass Enhanced Shingles Product
Shingle Manufacturer		\$ 4,000.00	Donation (Manufacture and Delivery) Product for Pilot Building Reroof
EnviroGrinder		\$ 75,000.00	Engineering
EnviroGrinder		\$ 45,000.00	Administration
Shingle Manufacturer		\$ 45,000.00	Administration
EnviroShredders		\$ 27,000.00	Glass crushers at commercial establishments (restaurants)
EnviroGrinder		\$ 124,000.00	Silos to store finished product for manufacturer
Shingle Manufacturer		\$ 75,000.00	Transportation of material from grinder to plant
SUBTOTAL	\$ 268,000.00	\$ 1,042,000.00	
TOTAL COSTS	\$ 1,310,000.00		

*The County will subcontract with the company creating the equipment and processing the glass, as well as a production company to produce the video

TIMELINE	Task		
2001			
April	Start grant		Contracts with subcontractors
June	Equipment Arrive		
July	Installation		
August	Startup		
2002			
April	Video complete		
September	Grant end		
JUSTIFICATION			

DEP's granting the \$268,000 to Duval County will be a win-win situation for all. The state has a need to process this commodity; by establishing this infrastructure, more glass will be recycled, landfill space will be extended, and a better, safer market will be made available. The process is transferable, and there is even potential for growth of future applications.

In response to the question from DEP about the glass aggregate being safer than sand in the back-dusting of asphalt shingles:

Currently, Owens Corning uses silica-sand for the back-dusting of its asphalt shingles. The crystalline-silica (soda-lime-silica, [SiO₂]) in this process is a lung irritant, and exposure to it may lead to Silicosis (as cited in Occupational Safety and Health Administration, www.osha-slc.gov/SLTC/silicacrystalline). While SiO₂ is the primary ingredient in the manufacturing of bottle glass, when glass is formed, the crystalline structure is changed to an amorphous structure and the SiO₂ is no longer considered crystalline (see CWC, *Best Practices in Glass Recycling*, November 1996). Therefore, the crushed recycled glass is safer than silica-sand for those involved in the production of the shingles.