

CHELSEA CENTER FOR RECYCLING AND ECONOMIC DEVELOPMENT

UNIVERSITY OF MASSACHUSETTS



End of Year Report

Fiscal Year 1999

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CHELSEA CENTER FOR RECYCLING AND ECONOMIC DEVELOPMENT FY 99 ANNUAL REPORT

I. BACKGROUND

This report summarizes the work of the Chelsea Center for Recycling and Economic Development undertaken in FY 1999.

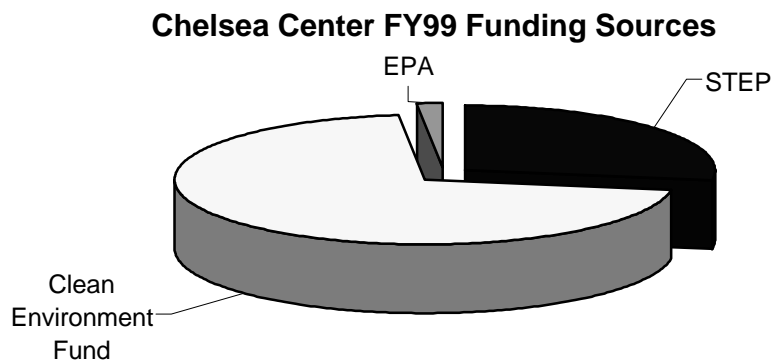
The Chelsea Center for Recycling and Economic Development was founded by the Commonwealth of Massachusetts in 1995 to create jobs, support recycling efforts, and help the economy and the environment by working to increase the use of recovered materials by manufacturers.

The Chelsea Center's goal is to help create an infrastructure for a sustainable materials economy in Massachusetts, where businesses will thrive that rely on locally discarded goods as their feedstock and that minimize pressure on the environment by reducing waste, pollution, dependence on virgin materials, and dependence on disposal facilities.

The Chelsea Center accomplishes this mission through:

- ◆ Working with manufacturers to help them overcome technical and business barriers to increasing their use of recyclable feedstocks;
- ◆ Working with municipalities to help them recognize the value of their waste materials and to turn them into new products; and
- ◆ Working with economic developers and other business service organizations to educate them on the value and importance of working with the recycling industry.

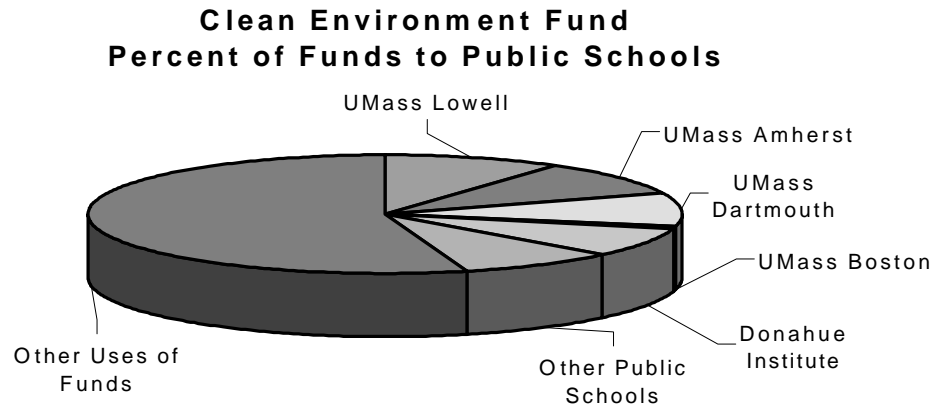
The Chelsea Center was created at UMass Lowell's Center for Environmentally Appropriate Materials as part of the STEP Program, the Strategic Envirotechnology Partnership, a partnership of the Executive Office of Environmental Affairs and the University of Massachusetts. In fiscal year 1999, the Center's budget was slightly over \$1 million. The Center receives the majority of its funding from the state legislature through the STEP program and through the Clean Environment Fund (CEF), which consists of unredeemed deposits from the bottle bill. The Chelsea Center also used funds granted from the US Environmental Protection Agency, Region 1.



STEP funds, administered through UMass Lowell, were used to pay salaries, fringe, and expenses for three staff – the Executive Director and the Directors of Business and Technical Programs. STEP funds also covered overhead such as rent, phones, and office supplies and systems. CEF funds were used to pay salaries of two staff people – the Chelsea Center's Office Manager/CEF Coordinator and the Director of Economic Development Programs – as well as most program funds. CEF funds are administered by the Donahue Institute for Governmental Services at the University of Massachusetts President's Office. EPA funds were granted in FY 98 for the Chelsea Center to hold eight workshops for economic developers and financiers about working with the recycling industry; these funds were carried into FY99 and are administered by the UMass Lowell Research Foundation.

The Chelsea Center accomplishes much of its work through alliances with public colleges and universities. In FY'99, approximately 37% of the Chelsea Center's CEF funds (exclusive of two full-time staff salaries) went to the University of Massachusetts campuses for research, business assistance, interns, and for overhead to the Donahue

Institute. Another 8% went to other public schools (universities, high schools, and community colleges). The remainder paid for consultants, private researchers, manufacturers, etc.

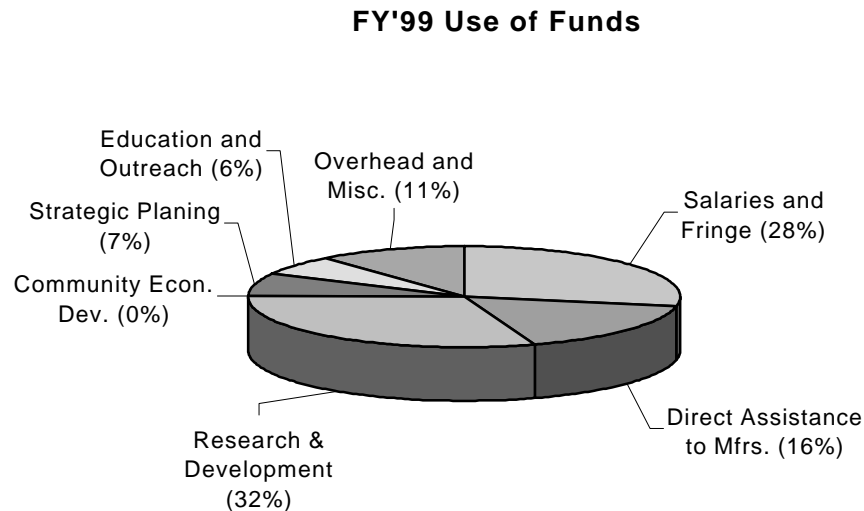


II. PROGRAMS AND RESULTS

Programs for FY 99 were divided into the following categories:

- ◆ Direct Assistance to Manufacturers
- ◆ Research and Development
- ◆ Education and Outreach
- ◆ Community Economic Development
- ◆ Strategic Planning

The following chart shows the breakdown between the various programs, salaries, and overhead.



A. DIRECT ASSISTANCE TO MANUFACTURERS

Two rounds of solicitations were issued through a Request for Responses (RFR) for testing of products or materials and for new product development. The first solicitation, issued in November 1998, was faxed to 224 manufacturers of recycled products located in, or attempting to locate in, Massachusetts. A second solicitation was released in February 1999 and was sent to an additional list of approximately 700 manufacturers targeted by SIC code that did not yet use recycled content, in order to encourage its utilization. University researchers often led the projects or worked with the companies to accomplish some aspects of the research. Where this occurred, it is noted on the tables below: UML=UMass Lowell, UMA=UMass Amherst, UMD=UMass Dartmouth.

Independent Testing

Grants were available for up to \$5,000 per project. Four proposals were received after the first solicitation and all were selected for funding. One testing proposal was funded in the second round. In addition, three projects were funded independently of this solicitation. Of the eight projects awarded for funding, three grants were not used by the grant recipients for a variety of reasons.

Company	Product/Test	Results
First Round		
Recycline (UML)	Color testing of recycled polypropylene for use in the Preserve™ toothbrush.	Testing resulted in development of formulations for three new colors of toothbrush handle. The new handles went into production in Fall '99. Recycline anticipates that the new color formulations will increase sales, thus increasing the use of recycled polypropylene.
Erickson Materials	Explosivity testing for a powdered rubber made from scrap tires.	Grant returned due to loss of interest on the part of the company. Rouse Polymerics, who has taken over the company, may be interested in following up on this project.
New Horizon Mgmt. and Consulting	Testing of properties of paperboard made from plastic coated paper (i.e., milk and juice boxes).	This grant was ultimately not used due to difficulties in securing project partners in the allotted grant period. However, successful testing could lead to the opening of a pulping operation for coated papers in Western Mass, and a market for close to 80,000 tons/year of paper.
Plate and Patch	Testing of a paving patch material that incorporates fly ash from coal plants.	This grant was not used by the company due to loss of interest on their part. Successful testing could have opened a large market for fly ash and other recyclables that could be incorporated into this material.
Second Round		
Recycline (UML)	Compounding and Testing of the Ultra Slide Scuffboards	Helped move the company from pilot scale to production scale. Discovered several techniques to reduce warping and improve quality of the final product.
Independent		
American Adhesive Coating Co. (UML)	Testing of ABS material from paper core ends to evaluate its marketability	Tests done include hardness, Izod impact, melt flow index and density. When the tests were complete, the market was not good, so the company is waiting to market the material.
SelecTech (UML)	UltraViolet testing for SelecTimber recycled plastic landscape timbers	All formulations evaluated exhibit very good tensile property retention after several months of carbon arc testing, which correlates to approximately eight years of outdoor exposure.
SelecTech (UMA)	Material strength testing for SelecTimber recycled plastic landscape timbers	This report presents initial testing to determine strength and stiffness of the recycled plastic landscape timbers. Strength and stiffness requirements are based on proposed usage. Timbers were more flexible than the theoretical performance of wood timbers, but more than exceeded load requirements for the expected applications. It is reasonable to expect that timbers used in typical loading conditions will perform properly and not fail.

New Product Development

Grants of up to \$8,000 per project were available for this use. Seven proposals were received in the first solicitation, and four were selected for funding. One ultimately turned down funds due to concerns about intellectual property. Seven proposals were selected for second round funding. Two additional proposals were funded with remaining funds, one for development of tire chips as a filtration medium in septic systems, and another as matching funds for a DEP Recycling Industries Reimbursement Credit grant to recycle aseptic packages (milk and juice boxes).

Company	Project Description	Results
First Round		
Conigliaro Industries	Formulation development and field testing of Cold Patch made from thermoplastics from chipped computer housings.	Developed cost-competitive formulation for Northeast markets, which has since been commercialized and sells as “Boston’s Best Patch.”
Recycline (UML)	Optimization of Ultra Slide Scuffboard.	No report yet
SelecTech	Processability and performance of resilient floor tiles.	New system improves processability, consistency and performance of the final floor tiles.
USDA Forest Prod. Dev. Lab.	Development of wood/plastic composites using recovered materials.	Chose not to accept grant due to concerns about intellectual property.
Second Round		
Recycline	Design, specification and development of prototype for children’s toothbrush.	Three designs developed; prototype selected. Stakeholder groups provided feedback.
Arlin Mfg., Inc.	Modification of equipment to manufacture recycled scuffboards.	Significant steps were made towards the development of the final product. Production rates and yields to make the product commercially viable were achieved. Several techniques to reduce warping and improve quality of the final product were discovered.
Dorchester Industries	Development of a process to continuously extrude recovered ultra-high molecular weight polyethylene (UHMWPE) scrap.	Successful preliminary results for sheet extrusion of UHMWPE.
Indigo Glass	Design and prototype for snow vehicle from recycled plastic.	Company not happy using recycled plastic. Issues with type of molding process selected, as well as liability and insurability of the final product. Has shifted focus away from recycled plastic to virgin feedstock, although may consider it for a similar product.
Happily Ever After (UML)	Prototype design of recycled plastic bird feeder.	UMass Lowell graduate students developed prototype for company to present to prospective molders. Company will be meeting with engineering firm to further development.
SelecTech	Development of a Fire-Retardant Floor Tile.	A variety of fire-retardant formulations were developed. Level of post-consumer content did not affect the fire rating.
Paradise City Glass	To work with Smith County Voc-Tech to develop a process to mass-produce recycled art-glass	Report not yet received – company has since gone out of business.
Independent		
Tire producers (UMD)	Testing of new use for tire chips in septic systems	Scrap tire chips leach inorganic metals and non-metallic anions when distilled/deionized water is in contact with them, though the concentration of the leachate does not violate Primary Drinking Water Standards. With regard to Secondary Standards, iron, manganese, chloride and sulfate appear to be of main concern. Chloride and sulfate show a decreasing concentration profile with increasing volume of water contacted.
New Horizon Mgmt. and Consulting	To develop a paper product made from aseptic packages (i.e., milk cartons and juice boxes)	Part of the engineering work for the aseptic packages was completed this fiscal year, and the remainder will be completed in FY00. Results will be shared with MA paper mills to entice them to use this material.

Internships

The Chelsea Center sponsors a ReTERN— recycling internship— program, paying for senior or graduate level college interns to work for a recycled product manufacturer to solve a business or technical issue. The internship program can be for a semester, or, new in FY99, a summer. The Chelsea Center solicits projects from companies and seeks to match qualified interns with these companies. Three interns were also placed in public sector

internships with the Chelsea Center, Worcester Polytechnic Institute, and UMass Boston, and with one non-profit organization, MassRecycle.

Company and Intern	Project	Outcome
Greenleaf Composting Company; Eva Papp, UMass Boston, intern.	Research on generation rates of raw materials in the area.	Internship was never completed due to student's work overload.
Osmos International; Teguh Wahyono, Djanis Hernadi, Northeastern University, interns.	Cost benefit analysis and market research for their Tall Oil based adhesive.	A report on the current applications and market for tall oil was produced, as well as an initial cost-benefit analysis of the use of tall-oil based adhesive.
Recycline, Inc; Narendra Nagaraj, UMass Lowell, interns.	Market research and project plan development for production of Scuff Board; public relations campaign design and marketing research for Preserve™ toothbrush.	Intern conducted market research, developed product requirements and performed financial analysis to assist with production of the <i>UltraSlide</i> . Intern further developed the market research into a "Sales Prospects Portfolio" which will ultimately help Recycline develop a strategic marketing plan for the Scuff Board.
Chelsea Center; Jagdish Chokshi, Boston University, intern.	Three-year evaluation of the Chelsea Center, and development of case studies of recycled product manufacturers.	The intern interviewed clients (manufacturers) and stakeholders (other business assistance providers). Overall evaluations were good (above 4 on a scale of 1-5), and yielded suggestions for improvement. Case studies will be used by Chelsea Center to promote goals of the Center.
Worcester Polytechnic Institute; Paul Graves, WPI, intern.	Lab research for street sweepings and catch basin cleanings in Worcester, and identification of technologies to assist the Commonwealth in finding alternatives to landfilling it. Continuation of work from FY99.	The project resulted in a report on the regulation and characterization of street sweepings and catch basin cleanings in the City of Worcester. The report also discusses potential reuse opportunities for these wastes. (See Research and Development section of this report for more information).
Longleaf Lumber; Loren Rees, Boston University, intern.	An analysis of their lumber mill business to determine the cost to produce a board foot of flooring.	Intern successfully completed the cost analysis thereby providing the company with a useful tool to help guide their pricing structure.
East-West Education Development Foundation; Jagdish Chokshi, Boston Univ., intern.	Development of a streamlined cash flow analysis with the goal being to reduce the time involved in the process.	Cash flow analysis was designed and implemented. EWF was very pleased with the results.
Bay State Paper; Qing Zahn, UMass Boston, intern.	Characterization of solid waste streams generated at the mill, assessment of waste minimization opportunities, and research into outlets for the waste.	An assessment of the wastes generated at the company was conducted and a report was compiled.
Paradise City Glassworks; David Simon, Gregory Keefe, UMass Amherst, interns	Research and writing of company's business plan	The project was not completed. The company has since gone out of business.
MassRecycle; Dmitriy Nicolayev, Tufts Univ., intern.	To solicit companies for the Buy Recycled Pavilion at the New England EnviroExpo.	The project resulted in over 30 companies exhibiting in the Buy Recycled Pavilion.
Recycline; Marina Kurkina, UMass Boston, intern.	Marketing internship to develop strategic alliances for company.	The internship resulted in a number of contacts being made with the target audiences and the compilation of two outreach reports – one for universities and one for environmental orgs.
Walden Products; Domenic Armano, Tufts University, intern.	To assist in development of their new recycled plastic roof rack.	The intern successfully collected all the necessary data for a variety of car models, and did it well below budget! Data has been used for a new 1999-2000 Fit Guide for their product.

UMass Boston; Chris Colhard, UMass Boston, intern.	To increase the purchase of recycled products at UMass.	The intern successfully met with a number of buyers and facilities personnel on campus. He conducted lunchtime 'vendor' shows to introduce them to various products and vendors. They decided to focus on three – recycled paint, anti- freeze and motor oil. Trials are underway currently on the Boston campus.
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Trade Show Grants

In order to help recycled product manufacturers in marketing their products, the Chelsea Center offered grants of up to 50% of exhibit fees, not to exceed \$500 per company per year, to exhibit at Build Boston, the Recycled Products Vendor Fair sponsored by the Operational Services Division, MassPlastics, the New England EnviroExpo, and other trade shows that they may identify. No company chose to exhibit at Mass Plastics this fiscal year.

Company	Build Boston	Vendor Fair	Mass Plastics	Enviro Expo	Other
Architectural Timber and Millwork	X				
Laser Two		X			
Longleaf Lumber	X				
National Fiber Insulation	X				
Paradise City Glass		X		X	
Red Sun Press		X		X	
Conigliaro Industries				X	
ERC Wiping Cloths				X	
LaCerta Group				X	
Earthsafe				X	
Recycline				X	
Greenleaf Composting				X	NE Flower Show
Supply Solutions					Star Exposition
F&B Rubber				X	
AAA Laser Services				X	
Bay State Envelope				X	
SelecTech		X		X	

Evaluations were done for exhibitors at the Buy Recycled Pavilion at the New England EnviroExpo, which accounted for eleven out of the twenty-one grants above. Nine companies (75%) completed and returned their evaluation forms. Of those nine:

- ◆ 100% felt they had ample time and information necessary to register for the event.
- ◆ When asked what influenced them to participate, 89% rated cost as a significant factor, and all of those felt that the fee was reasonable. One respondent who did not grade the fee as reasonable said they felt "it was not unreasonable." People also rated the size of the show and the opportunities to network with a "like-minded" or "green-minded" audience a positive as well.
- ◆ Eighty-nine percent indicated that they received the promotional materials in time to send them to potential visitors.
- ◆ 100% felt that the booth space provided was ample for their needs.
- ◆ Sixty-six percent were happy with the number and quality of contacts and sales they made at the show.
- ◆ Sixty-six percent indicated they would consider exhibiting at the show again next year.
- ◆ Of those that said they might not or would not return next year, the reasons ranged from not finding their target audience, to the time of year being too hectic, to not being satisfied with the amount of advertising done during the show to promote the Buy Recycled Pavilion.
- ◆ Finally, 22% of respondents felt that a show that is shorter than three days would be preferable for them.

To summarize, it appears that the majority of exhibitors felt that the show was affordable, and were satisfied with the results and would return again next year.

NERC Venture Forum

The Chelsea Center co-sponsored the Northeast Recycling Council's 4th Annual Recycling Venture Forum, held in Massachusetts in May in conjunction with the New England EnviroExpo. Seven companies presented at the Forum, two of which, Crispina Designs, Inc., and SelecTech, Inc., were from Massachusetts. Crispina Designs, located in Housatonic, makes dolls, clothing, and home furnishings from recycled textiles. SelecTech, located in Taunton, manufactures molded products for the outdoors, traffic control, and industrial/commercial flooring. Prior to the Forum, NERC held a business training workshop, which included a public speaking coach invited by the Chelsea Center to work with presenting companies. While it is too soon to know the full results of the Forum, at least one of the Massachusetts companies gained financing leads.

Chelsea Center staff assisted Crispina Designs in developing their business plan and presentation for the Venture Forum. The Chelsea Center continues to work closely with Crispina in their business development planning.

Other Assistance

The Chelsea Center also:

- matched Greenleaf Composting of Jamaica Plain with a senior level marketing class at UMass Boston. The class helped Greenleaf conduct market research for the launch of their first retail product – compost sold in small buckets targeted toward the small urban gardener. The students' work resulted in a survey and collection of data from over 200 retail outlets in the Boston area. Using these results, Greenleaf Composting is planning the official rollout of the new product in January, 2000. Their goal is to sell 5000 buckets in the first year.
- met with many companies to identify possible assistance, including funding, siting, and technical help. These included Longleaf Lumber, SelecTech, Hillside Plastics, Hardigg Industries, Paradise City Glass, Foster Miller, Conigliaro Industries, HiTech Hose, Armron Corporation, ReHarvest, Creative Paper, Recycling Separation Technologies, Indigo Glass, Sirius Pulp and Paper, and others.
- provided a reference to the Sustainable Jobs Fund for SelecTech, which helped them obtain funding anticipated to create ten new manufacturing jobs.
- successfully worked with two companies to get them to apply to be on the state's purchasing contract.
- provided input to the DEP on the RFR for the Recycling Industries Reimbursement Credit, marketed the availability of the grants, and participated in evaluating applicants.
- responded to a variety of information requests concerning sources and uses of materials, including sawdust, textiles, and plastics.

B. RESEARCH AND DEVELOPMENT

University Research Grants

A Request for Proposals (RFR) was released in February '98 soliciting research projects to be implemented in FY'99 to overcome a technical barrier relating to increasing recycling. An advisory committee was convened to review proposals. The following research projects were selected:

- Improving the Economic and Environmental Aspects of Electronics Recycling – Tufts University
This project worked with the plastics supply chain to identify the capabilities of Massachusetts industry to process engineering thermoplastics (ETPs) from used electronics; assessed supply and identified markets; demonstrated performance in injection molding applications; and initiated a series of Stakeholder Dialogues to discuss barriers and opportunities in recycling and reuse of engineering thermoplastics.

The difficulties in sourcing material provided a pragmatic illustration of the gaps in the supply chain. For example, it was found that resins meeting certain criteria were not readily available. It seems, however, that given a quality feedstream, the use of recycled-content resin is technically feasible. The greatest challenges are in processing the mixed resins to achieve quality standards, and in building the knowledge-base and confidence in the quality of the recycled resins to facilitate its introduction in new product.

- Development of Novel Applications of EVA Crosslinked Scrap in Thermoplastics – UMass Lowell
This work investigated blends of thermoplastics with recycled ground rubber. The recycled ground rubber was blended with polypropylene (PP) to form a new material that can be used in applications such as sports surfaces. The physical properties of these experimental blends have been shown to compete with commercial sports surfacing and flooring, and to be (theoretically) cost competitive.

In essence, the work has converted a thermoset material into a thermoplastic, which can be reused and converted into new products simply by re-heating the material and forming it into shape in much the same

manner as other thermoplastics. The melt flow index of the PP was determined to be a key factor in the mechanical properties of the blends. By proper selection of the components and compatibilization techniques, the blends can be tailored for specific applications. The results of this work can be used to guide manufacturers in the proper selection of materials and techniques to utilize recycled rubber in blends for a variety of product applications.

- An Investigation of the Potential for Expanding the Manufacture of Wood-Plastic Composite Products in Massachusetts from Recycled Materials – Mt. Wachusett Community College

This work provides a broad overview of the trends, volumes, manufacturers and character of wood and plastic wastes as well as the technological developments and markets of wood-plastic composites. A final seminar was held at the college to present new potential technologies and trends in the field.

- Feasibility of On-Site Processing of Clam Bellies as Fish Feed – UMass Dartmouth (continued from FY 98)
Report not submitted

- Recycling and Reuse of Mixed Fiber Fabric Remnants – UMass Dartmouth (continued from FY 98)

Flocking: This work shows that polyester/cotton/Lycra (PCL) apparel waste can be successfully converted into a flockable fibrous material. The PCL flocked aluminum sheet was found to absorb light and mechanical impact energy, and showed improved frictional properties. Results suggest that the PCL flock may be useful for mechanical energy transfer clutch plates or for special anti-skid frictional applications.

Oil Absorption: From this work, the potential use of these fibrous waste materials for oil spill clean-up applications can be justified. They could be put into knitted “sock” booms or mats and used in oil-spill emergencies where initial rapid rate clean-up of spilled oil is desired. Furthermore, this shredded textile waste material could be mixed with more traditional oil spill clean-up fibers to enhance their oil absorption capacity.

Nonwoven Fabrics: The application of needle punched fabrics from recycled materials was quite wide and varied. Needled fabrics were made from the recycled materials generated in this study. Waste in processing was high, but there are applications for this as a stuffing material.

An RFR was again released in February for work to begin in the summer of '00. Five projects out of ten proposals submitted were selected, pending availability of funds. An advisory committee provided input into the selection. Selected projects are:

- Development of Synthetic Aggregate for Construction Material – UMass Lowell
- Evaluation of Use of Manufactured Waste Asphalt Shingles in Hot Mix Asphalt – Worcester Polytechnic Institute
- Use of Scrap Tire Chips as Substitute for Gravel in Residential Soil Absorption Systems – UMass Dartmouth
- Process Development of Scrap Rubber/Thermoplastic Blends – UMass Lowell
- Recycling Market Development for Engineering Thermoplastics from Used Electronic Equipment – Tufts University

Paper Mill Research

As a follow-on to a survey funded by the Chelsea Center last fiscal year, and in keeping with the recommendations of the Strategic Plan for Recycling Market Development, MVMP – the Merrimack Valley Manufacturing Partnership – identified two pilot projects that could lead to increased use of recycled paper by paper mills. The Chelsea Center funded these two projects for \$10,000 and \$10,527 respectively. Erving Paper provided an unsolicited match of \$5,000.

- Erving Paper Mills evaluated the installation of a Beloit/Maule GR-Kneader for improved fiber dispersion, which would increase Erving's ability to use a lower grade waste paper and increase first pass fiber retention. Trial results show that the tested system configuration can produce a high quality deinked pulp. Though the furnish contained a significant amount of “stickies” and dirt, the final pulp had an acceptable level of contaminants and brightness. This trial shows that Erving Paper's furnish can be deinked using Beloit technology to give a quality final product. This trial used a white grade furnish mix of 50% Mixed Office Waste paper and 50% Coated Book, but the general conclusions can be applied to most paper recycling processes.
- Creative Paper, Inc. automated the present pulper reject dumping procedure and researched specific equipment systems capable of filtering and screening out contaminants more efficiently. With the installation of the new system, Creative Paper, Inc. is now able to use 30% mixed waste paper. Overall efficiency of the screening and

cleaning has dramatically improved, reducing the amount of fiber lost from the system. Fewer contaminants enter the paper processing system, resulting in a cleaner product and permitting utilization of a dirtier furnish (recovered stock). The volume of waste requiring disposal has also been substantially reduced.

UMass Demonstration Project-Plastic Timbers

The Chelsea Center chose a product manufactured by SelecTech of Taunton, SelecTimbers™, for a demonstration project at the University of Massachusetts. The timbers are made of 100% recycled plastic and are injection molded, making them lighter than other plastic lumber which is generally extruded. The Civil Engineering departments constructed two walls with cooperation from facilities personnel –one at UMass Dartmouth and one at UMass Amherst. The purpose is to evaluate the drainage and reinforcement performance of these timbers in retaining walls. Testing will continue into FY00 to cover one full year. Information learned can be used by SelecTech to help market the timbers.

Pilot Purchase with OSD

The Chelsea Center worked closely with the state's purchasing arm, the Operational Services Division (OSD) to identify and purchase Massachusetts manufactured recycled products. Products purchased were: remanufactured toner cartridges, recycled plastic planters, recycled paint, mulch, recycled workstation panels, and cold patch made from recycled plastic (computer housings). These products were provided free of charge to municipalities, institutions, and other public agencies in the state in exchange for feedback from the users on performance. In addition, the agencies are asked to make a commitment that should the products work to their satisfaction and be cost effective, they will purchase more of them in the future. OSD is currently receiving feedback from the users. They will then compile a report that will be complete in early to mid 2000.

Street Sweepings (see also internships above)

In FY 98, the Chelsea Center contracted with the Worcester Polytechnic Institute (WPI) to perform lab research on street sweepings from the City of Worcester, and look into alternative uses of the street-sweepings, in order to keep them out of the landfill. The work was completed in FY99, and the final report will be posted on the Chelsea Center web site. Findings show that there are a number of potential reuse alternatives for the soil components of street sweepings and catch basin cleanings. Several of these alternatives are pre-approved by DEP; the rest would require a DEP approved Beneficial Use Determination. The report discusses the composition of these wastes, as well as an implementation plan to begin dealing with this problem.

The City of Worcester collects approximately 7000 cubic yards of street sweepings and 5000 cubic yards of catch basin cleanings which are all disposed of in a landfill that is due to be capped in 2000 (this does not count the 60,000 cubic yards of leaves that are collected in the fall, all of which are composted). With the closing of the landfill, the City is faced with either trucking the street sweepings and catch basin cleanings to other municipalities, or reusing them. The researchers from WPI have met with representatives from the DEP, Chelsea Center, the City of Worcester, and EOEa to discuss implementation.

MassHighway Recycled Product Use

In the first half of the fiscal year, the Chelsea Center met with Debra Tucker, Director of Research at MassHighway Department (MHD) to begin discussions of potential joint projects. As a follow up, the Chelsea Center facilitated a meeting with twelve MHD staff and interested parties to present information about the use of recovered materials in highway applications, and to brainstorm ideas for highway projects that might be jointly funded by the Chelsea Center and the Northeast Transportation Consortium (NETC). Presenters at the session included Dr. Dana Humphrey, University of Maine, on civil engineering uses of tires; Dr. Walaa Mogawer, UMass Dartmouth and Dr. Rajib Mallik, Worcester Polytechnic Institute, on paving applications (plaspalt, glassphalt, RAP, shingles, cold patch); Dr. Carl Ho, UMass Amherst and Dr. Heather Miller, UMass Dartmouth on landscape timbers. Other products/materials discussed included soil amendments, street sweepings, and traction aids. Meeting minutes and a survey were sent to participants, and MassHighway representatives were asked to rank their interests.

Since the spring meeting and completion of the survey, Chelsea Center staff has been working with the new MHD Recycling Coordinator, Jessica LeBlanc, and DEP staff to develop specific projects and funding mechanisms based on the input received. The group expects a project to be underway in early FY 01.

Beneficial Use of Foundry Sand

As part of the research funded by the Chelsea Center in FY98, the Center for Energy Efficiency and Renewable Energy (CEERE) at UMass Amherst surveyed 22 foundries in the state regarding their experience with the

Beneficial Use Determination (BUD) Process and identified alternative uses for spent foundry sand. This work could potentially benefit the 60 foundries in the State. The report made several recommendations regarding revision of BUD policies and reuse options for sand. As a follow-on to this work, the Chelsea Center funded CEERE to do an analytical survey of the properties of spent sand as they relate to potential risks associated with Best Management Practices for reuse. Results will be available in FY00.

Value Added Uses for Pallets

The Chelsea Center provided matching funds to the Center for Ecological Technology (CET) to look at potential low and medium value added uses that could be made from pallet scraps in the Berkshire area. CET received funding from the USDA Forest Service and the Massachusetts Department of Environmental Protection to look at creating a pallet refurbishing facility, and the value added products component would be a part of this operation. Pallets are one of the materials targeted in the state's Strategic Plan for Recycling Market Development (see Strategic Planning section of this report).

The potential uses identified by CET include custom crates, garden products, fencing, and outdoor furniture. The report also identified potential users of the wood residue, comprised of unusable pallet components and cut-offs from production. Results of the research show that the economics are there to create such a refurbishing and manufacturing operation, and CET continues to work on this project.

Recycling Economic Information Project

In FY 98, the Chelsea Center provided funds for the Northeast Recycling Council (NERC) to begin a study of the economic impacts of the recycling industry in the northeast. Funds were provided to get NERC through the initial stages of selecting a consultant and raising funds to complete the full study. Throughout FY99, the Chelsea Center participated in an advisory committee for the project.

The goal of the U.S. Recycling Economic Information Study is to compile basic economic statistics on the nation's recycling and reuse industries. Economic Modeling will also be included for Massachusetts. This information can be used to:

- Compare recycling economic activity to other industries
- Compare the amount of recycling activity in different business categories
- Report and promote statistics on all facilities involved in recycling
- Publicize the potential benefits of siting a particular type of recycling facility
- Estimate the increase in economic activity from a particular increase in sales
- Identify the estimated total economic impacts associated with currently existing recycling businesses

The study is being completed in two phases – Phase One, in which the Chelsea Center is participating, targets the ten Northeastern states and Phase Two, a separate study, targets the remainder of the nation. The Phase I study is piloting and refining the methodology for gathering information and the format for reporting it, and is managed by the Northeast Recycling Council. This phase will provide state-level statistics for six sponsoring states, plus regional level statistics for the Northeast region as a whole. The final report will be available in FY 00. The National study is managed by the National Recycling Coalition and will provide national level and state level statistics for sponsoring states.

C. EDUCATION AND OUTREACH

Publications

Reports:

All of the Chelsea Center's work results in reports that are made available to the public. The Center had nine technical reports available in FY99, as well as Phases I, II and III of the Strategic Plan for Recycling Market Development (see Strategic Planning below). Over 200 copies of technical reports relating to plastics, rubber, paper, and electronics were distributed locally and internationally. These reports are also available in PDF format from the Chelsea Center's web site. Technical Reports available in FY99 were:

- #1 A Study on the Recycling of White, Natural, and Mixed Color HDPE Bottles, 1998, Robert Malloy, Department of Plastics Engineering, University of Massachusetts Lowell
- #2 Environmental Impacts of Recycled Rubber in Light Fill Applications: Summary & Evaluation of Existing Literature, 1998, Helen Liu, Joey Mead, Ross Stacer, Department of Plastics Engineering, University of Massachusetts Lowell

- #3 Feasibility Study: Use of Discarded LDPE Shrink Wrap from Boatyards as an Injection Molding Feedstock, 1998, Robert D. Vernon, Southeastern Massachusetts Manufacturing Partnership and James M. Baker, Advanced Corporate Technology
- #4 Papermill Recovered Waste Paper Survey, Gary W. Diadone, Merrimack Valley Manufacturing Partnership
- #5 Electronics Recycling Vendor Survey, 1998, William Waters, Product Takeback Services
- #6 Potential Markets for CRTs and Plastics from Electronics Demanufacturing: An Initial Scoping Report, 1998, Patricia Dillon, Dillon Environmental Associates
- #7 Scrap Electronics Processing, 1998, John Pepi, Office of Waste Management, University of Massachusetts Amherst
- #8 A Survey of Foundry Participation in the Massachusetts Beneficial Use Determination Process, 1999, Eric Winkler, Beka Kosanovic, Tom Genovese, Ian Roth, Center for Energy Efficiency and Renewable Energy, University of Massachusetts Amherst
- #9 Erving Paper – Dispersion Pilot Project, 1999, Thomas Newton, Erving Paper, Craig Calvert, Beloit Corporation
- #10 Accelerated Aging of Specific Formulations of Recycled High Density Polyethylene Based Landscape Timbers, 1999, Robert Malloy, Department of Plastics Engineering, University of Massachusetts Lowell
- #11 Recycled HDPE Timber Retaining Wall Investigation, 1999, Heather J. Miller, Department of Civil Engineering, University of Massachusetts Dartmouth
- #12 Preliminary Investigation of Tire Shreds for Use in Residential Subsurface Leaching Field Systems, 1999, Sukalyan Sengupta and Heather J. Miller, Department of Civil Engineering, University of Massachusetts Dartmouth

The Directory of Recycled Products Manufacturers

This Directory was updated in February and includes profiles of 173 manufacturers. These manufacturers employ over 12,000 people and use close to 4 million tons per year of recovered materials. The directory and updated listing of manufacturers is also located on the Chelsea Center's web page. The web and new directory indices allow people to find manufacturers based on geographic location, material used, and end-product made. The Environmental Protection Agency created a map showing the location of the manufacturers for the Directory.

Workshops

Beneficial Use Determination

The Chelsea Center co-sponsored a half-day workshop about Beneficial Use Determinations (BUDs) with MassRecycle. This workshop aimed to explain to manufacturers what BUDs are, who needs them, and what the process is to get one. The Chelsea Center worked with MassRecycle and the DEP on developing the agenda, and covered the costs of the event. Over 50 people attended the workshop.

Construction and Demolition Debris

Construction and Demolition debris (C&D) is one of the priority materials identified in the Strategic Plan for Recycling Market Development (see Strategic Planning below). The Chelsea Center co-sponsored a focus group with the Construction Materials Recycling Association and the USDA Forest Products Lab. About 30 people attended this meeting, including regulatory officials, landfill operators, and C&D processors. Recommendations from the session included: improving communication between regulators and regulated entities, creating a C&D task force at DEP, developing more markets for C&D fines, developing new value added markets for wood products; doing more R&D on potential new products; looking at European models of government intervention in C&D recycling, and promoting more materials separation at construction sites for recycling.

Plastics Focus Group

The Chelsea Center hired the firm of DSM to conduct a focus group to determine why companies do and don't use recycled plastics to make new products. Turnout for this session was productive, but small, and, with additional funding from the American Plastics Council, DSM conducted a mail survey of 246 plastics manufacturers. Eighteen percent (18%), or 45, of the 246 manufacturers surveyed completed them. Of these respondents, the majority are injection molders, and 29% currently use post-consumer resin (PCR). Suggestions for methods to increase the use of PCR include broader education for customers, increased quality of the PCR, and an increased supply of post-consumer injection-grade material.

Organics Stakeholder Forum

The Chelsea Center co-sponsored a statewide focus group on organics recycling with the Center for Ecological Technology (CET), the Department of Environmental Protection, and the Environmental Protection Agency, Region I. The event was organized and facilitated by CET and brought together over 100 stakeholders to identify barriers to increased diversion of organic material from landfills. Food waste and organics are priority materials identified in the Strategic Plan for Recycling Market Development. Recommendations resulted in a report prepared by CET and include:

- Education and outreach to targeted industry sectors
- Clarification of existing regulations
- Promulgation of Compost Facility Regulations
- Streamlining and increasing consistency of permitting and enforcement processes
- Create or redefine an advocacy role for various parties
- Provide grant or other funding to address specific barriers
- Develop RFPs for organic recycling services and infrastructure development

Fostering Economic Development through Recycling

The Chelsea Center received funding from the Environmental Protection Agency, Region 1, to develop and conduct a workshop entitled "Fostering Economic Development through Recycling." This workshop is a follow-on to a workshop co-sponsored by the Chelsea Center, the Northeast Recycling Council, the Department of Environmental Protection, and the Massachusetts Office of Business Development. The purpose of the workshop is to educate the economic development and finance communities about the recycling industry, the importance of working with it, and the resources available to help them work with this industry. The workshop includes a video about how recycling works in Massachusetts, case studies presented by recycled product manufacturers, and an overview of resources. The EPA contracted with the Chelsea Center to streamline the workshop, and to hold two workshops centrally located and another six to be co-sponsored with local entities. The Chelsea Center held its first two workshops in early March in Boston and Springfield, and continues to solicit local co-sponsors for satellite workshops to be held in fiscal year '00. One workshop is already scheduled in the city of Taunton.

Industrial Recycling Symposium

The Chelsea Center co-sponsored and helped organize an Industrial Recycling symposium in June with the Office of Technical Assistance, WasteCap, and MassRecycle. With over seven sessions, ranging from "Regulatory Aspects of Recycling and Materials Reuse" to "Materials Exchanges" to "Manufacturing with Recycled Materials," the Symposium had over 100 attendees. Additionally, there were over 20 exhibitors presenting related services and products.

Massachusetts Recycles Day

For the second year, the Chelsea Center co-sponsored Massachusetts Recycles Day. MassRecycle was the organizer of the event, which included promoting over 200 events throughout the state, holding a press conference, and sponsoring a raffle to promote the concept of buying recycled products. Discussions were begun with MassRecycle regarding development of an exhibit of recycled products for Massachusetts Recycles Day 1999.

www.chelseacenter.org

The Chelsea Center revamped its web site and it now includes reports, a detailed listing of services, recycled product manufacturers in the state, organizations providing various services to businesses, and other resources. A designer has begun work to make the site more visually appealing and user friendly.

Newsletter

One issue of the Chelsea Center's newsletter was published. The newsletter provides updates of Center activities, profiles a manufacturer, and gives information about other activities of interest in the state to manufacturers, business assistance organizations, trade associations, and other interested parties.

Recycled Product Procurement

The Chelsea Center contracted with WasteCap of Massachusetts, through their Buy Recycled Business Alliance, to purchase a list of Massachusetts subscribers to *Purchasing Magazine*. WasteCap used this list to promote recycled product procurement, with an emphasis on the purchase of recycled products manufactured in Massachusetts, by telling them about the Directory of Recycled Products Manufacturers. This project supports recommendations in the

Strategic Plan for Recycling Market Development concerning promoting “green” marketing. Over 30 purchasers requested the guide.

The Chelsea Center also contracted with WasteCap to convene a series of breakfast meetings for the private sector to inform them about purchasing recycled products. Three breakfast meetings were held, with a fourth one being planned for FY '00. The three breakfasts were held at Western New England College in Springfield, East-West Education Foundation in Boston, and Polaroid Corporation in Waltham. Between 9 and 15 people attended each breakfast. The workshop elements were rated good to excellent on the evaluations.

Other Outreach

Other examples of outreach include:

- ◆ Creating press releases about various programs and activities. These are released to both trade and local press, and distributed through the internet.
- ◆ Speaking to other organizations about Chelsea Center programs and services, including the local chapter of the Solid Waste Association of North America, the Planners Network, the New England EnviroExpo, the Environmental Careers Organization, an MIT class, and to recycling coordinators.
- ◆ Submitting articles to the MassRecycler, UMass Outreach News, Massachusetts Environmental Ventures, and E-Call.
- ◆ Providing input to the Commonwealth of Pennsylvania, who is interested in starting a recycling market development program.
- ◆ Successfully nominating Dr. Robert Malloy, Professor of Plastics Engineering at UMass Lowell, for a faculty award to recognize the work he has done to support the Chelsea Center, manufacturers, recycling, and his students.

D. COMMUNITY ECONOMIC DEVELOPMENT

A staff person was hired in FY 99 to run the Center’s new Community Economic Development through Recycling Program. A Request for Responses was developed to offer grants to municipalities and community-based organizations for Recycling Based Economic Development (RBED) through projects such as:

- Infrastructure Development: identification of target materials and opportunities for RBED, how it links to industrial revitalization or development, and inclusion in municipal or regional economic development plans.
- Assessment of Local Inputs and Outputs: Assessing the waste materials generated by residential and non-residential sources in the community and inputs used by local manufacturers and using this information to:
 - Convert Existing Businesses: Identify and work with manufacturers that could potentially substitute locally generated recyclable materials for virgin feedstock
 - Start-Up New Businesses: Identify new businesses that can use recovered materials to make new products
 - Develop an Implementation Plan: To do the above and keep information updated as businesses and needs change.
- Public Input: Hold meetings with the community to determine what types of recycled products manufacturers would be desirable and under what circumstances, and develop a plan of action to attract such companies, and/or work with the community and existing recycling companies to overcome any negative attitudes that exist between them.
- Financial and Technical Incentives: develop and/or implement innovative mechanisms to retain, support, attract, and facilitate recycling based manufacturing, and identify or implement steps to start a new business venture(s).

The RFR was released in February for projects to be implemented in FY00, pending availability of funds. The RFR was sent to approximately 800 municipal recycling coordinators, community development organizations, municipalities, and others. Eligible applicants could be either municipalities or community based organizations, and had to include a partnership of the municipal recycling office, the municipal economic development office, community based organization, and business leader. An advisory committee was convened to assist in review and ranking of proposals. The committee consisted of representatives from the Environmental Diversity Project, the Massachusetts Association of CDCs, EPA Region 1, DEP, and the Executive Office of Environmental Affairs. Four proposals were chosen for funding in FY00. These are:

- Remanufacturing Enterprise for Boston: The Manufacturing Engineering Department at Boston University will explore the potential for a remanufacturing enterprise in Boston. This project comprises the first stage in a larger two-year program to set up successful remanufacturing enterprises in Boston’s inner city. Specifically, Boston University will investigate the potential for medical equipment remanufacture in Chinatown. By identifying community-based remanufacturing opportunities in Chinatown, Boston University and its local

partners will help to revitalize the community's economy. The Boston Office of Business Development and the Asian Community Development Corporation also support this project.

- **Materials Flows through the Community – Creating New Resource Opportunities:** The Center for Ecological Technology (CET) will work with community partners to conduct a pilot project in Adams and North Adams to identify the flow of materials generated by businesses. CET will survey local businesses to collect information about materials inputs and outputs, work force requirements, primary products, waste characteristics and processes/business activities. This information will then be analyzed to identify materials options and exchanges for existing businesses, as well as opportunities for new business development. By developing an inventory of available materials and business needs, CET aims to strengthen existing and attract new businesses, and promote sustainable economic development in Adams and North Adams.
- **Waste Reduction and Composting Initiative:** Through its Chinatown Waste Reduction Initiative (CWRI), the Asian Community Development Corporation (ACDC) aims to adapt urban fast composting technology to Chinatown's food-related business waste streams, and develop a business plan for commercializing and marketing the technology. The Boston Chinatown neighborhood is a densely populated community of nearly 44 acres with a significant concentration of food-related businesses. This project will assess the economic benefit potential of urban composting technology, and other material reuse or exchange programs that reduce the cost of waste collection.
- **Recycling Based Community Economic Development Plan:** The purpose of this project is to develop a recycling-based community economic development initiative for the City of Taunton, which will be incorporated in the Sustainable Taunton Development Committee's redevelopment strategy. Taunton's Industrial Development Commission will inventory manufacturers' solid waste, and assess the material as potential feedstocks for new recycled-based manufacturing opportunities in the City, as well as for new business opportunities for existing recycling enterprises.

E. STRATEGIC PLANNING

In FY 98 the legislature called for creation of a Strategic Plan for Recycling Market Development. Work began on this project in December 1997, and the final plan was completed in March 1999. The plan was developed in three phases: Phase I is an assessment of the supply and demand for materials targeted by the legislature to be included. Phase II identifies material specific opportunities for those commodities for which supply is greater than demand and for which there are opportunities for public intervention. Phase III, the Strategic Plan, puts together recommendations from Phases I and II, and also lays out an approach for recycling market development in the State, including creation of a Market Development Steering Committee.

The Chelsea Center hired the firm of Dorn and Associates to develop the plan, working closely with an advisory committee consisting of stakeholders representing economic development, recycling, and business interests. The consultants also drafted a Memorandum of Understanding anticipated to be entered into by DEP, EOEA, MOBD, and the Chelsea Center. The Chelsea Center will investigate issues relating to signing of the MOU next fiscal year.

As a follow-on to the development of the Strategic Plan, Dorn and Associates was also hired to develop an Implementation Plan for the Chelsea Center. This is a two-year vision that reorganizes the Center's work into the major categories of the Strategic Plan. Year One (FY'00) will focus on improving the effectiveness and efficiency of existing programs, and initiating several new activities to augment existing ones. Additional planning work will also be done to prepare for future program expansions. In Year Two, (FY'01) new programs and services will be launched aimed at improving the Chelsea Center's outreach capabilities and capacity to proactively identify and address recycling market development needs and opportunities. It is anticipated that CEF and STEP funding will continue to play a major role in supporting these efforts:

- ◆ *Feedstock Conversion* Encourage existing Massachusetts manufacturers to convert from virgin and/or expand their use of secondary, materials to the extent that technologies and markets allow.

- ◆ *Technology Development and Commercialization*: Encourage the development and commercialization of innovative recycled products and manufacturing technologies for recycled products in Massachusetts.
- ◆ *Support of Existing Recycled Product Manufacturers*: Facilitate the ability of existing Massachusetts recycled product manufacturers to gain access to financial, professional, educational, and infrastructure resources.
- ◆ *New Recycled Product Manufacturing Business Development*: Encourage and support the startup of new recycled product manufacturing businesses in Massachusetts, including not for profit and for-profit community based enterprises.
- ◆ *Buy Recycled*: Support the purchase of recycled products, particularly those manufactured in Massachusetts.
- ◆ *Recycled Product Manufacturing Business Attraction*: Promote involvement of Massachusetts economic development entities in attracting recycled product manufacturing businesses to Massachusetts and the region to consume target materials, as identified in the Strategic Plan, and through subsequent supply and demand assessment efforts.
- ◆ *Organizational Development*: Provide for the physical, human, and financial resources and management systems that will ensure the effective and efficient delivery of Chelsea Center programs and services.
- ◆ *Planning and Analysis*: Ensure effective and efficient recycling market development and participate in ongoing communication, joint decision-making, market intelligence gathering, planning and evaluation among the entities involved in recycling market development in Massachusetts.
- ◆ *Outreach*: Effectively convey information on market development and Chelsea Center services to target audiences.

III. IN SUMMARY...

In Fiscal Year 1999:

- ◆ Over 300 people participated in workshops sponsored or co-sponsored by the Chelsea Center;
- ◆ Over 10 manufacturers directly benefited from 15 grants to develop, improve, or test recycled products, and many other companies benefited from referrals and other assistance;
- ◆ 17 companies received 21 grants to offset the costs of marketing their products at exhibitions;
- ◆ 173 companies received free publicity through the Directory of Recycled Product Manufacturers;
- ◆ 14 interns helped 12 companies and organizations address some sort of business challenge;
- ◆ 33 municipalities and other agencies received recycled products manufactured in Massachusetts through pilot purchases;
- ◆ More than 10 state and national organizations worked with the Chelsea Center on projects such as workshops, market research, and information gathering;
- ◆ Professors and students at 10 public and private schools participated in work with the Chelsea Center through applied research, internships, and technical assistance to manufacturers;
- ◆ A Strategic Plan for Recycling Market Development for the Commonwealth was completed and is being implemented; and
- ◆ 5 new or improved recycled products entered the market, with others to come in the near future, due to Chelsea Center assistance.