

University of Missouri Environmental Sustainability Report 2009

MU Environmental Affairs Committee

November 2010

INTRODUCTION

In April 2003, the Environmental Affairs Committee released its initial study, “The Impacts of Campus Activities on the Environment.” That initial report was the Committee’s first attempt to address resource use and environmental issues at the University of Missouri (MU) in a comprehensive manner. Each year since, questionnaires have been distributed to various campus departments in the early months of the year to collect follow up information from the initial report. Attempts have been made to collect data comparable to that collected in the initial report. In addition, survey questions have been updated to better define resource usage and impacts. In 2008 the committee decided to change the name of the report from “The Report on the Impacts of Campus Activities on the Environment,” to, “University of Missouri Environmental Sustainability Report,” in order to better reflect common terminology and to more accurately describe the report’s purpose. This report contains the data for calendar year 2009. In some cases, data is shown for the fiscal year instead.

FINDINGS—GENERAL CAMPUS STATISTICS

There are at least two ways of interpreting environmental information. One way is to look at gross resource usage statistics. Another way is to normalize information based on statistics such as number of students, number of employees, number of buildings, budget and other factors.

General statistics for 2009 are as follows:

- Number of students (enrollment Fall 2009): 31,314 (26,828 full-time equivalents)
- Number of faculty and staff (full-time equivalents): 11,980 (includes student full time employees, but excludes Hospital employees)
- Total campus expenditures (excludes Hospital): \$996,540,000
- Total Hospital expenditures: \$557,795,000
- Gross square feet of campus buildings¹ (excludes Hospital): 16,320,352
- Gross square feet of hospital²: 2,260,000

FINDINGS—RESOURCES

Energy

Campus Facilities, through its Energy Management department, is responsible for providing energy to campus. The service area is the Columbia campus. Steam, but not electricity is provided to the VA Hospital. Ellis Fischel Cancer Center and Columbia Regional Hospital obtain electricity from the City of Columbia and natural gas through Ameren UE and energy marketers.

In 2009, the campus consumed 244 million kilowatt hours of electricity, a 1% decrease from the previous year. The campus consumed 2.72 billion pounds of steam, a 14% decrease from the previous year. Reduced steam use was due to the cool summer, reduced use of steam driven chillers by University Health Care, ongoing energy conservation efforts, and increased electricity

¹ Campus square footage does not include the farms and research centers off campus.

² Hospital square footage includes University Hospital, Columbia Regional Hospital, Ellis Fischel, University Physicians clinics, and associated buildings.

purchases from the grid. Compared with 2000, these numbers represent increases of 24% (electricity) and 5% (steam), respectively.

In 2009, energy was provided from the following sources: coal – 73%, natural gas – 2%, tire derived fuel – 2%, purchased electricity – 21% and 1% was provided by biomass.

Campus Facilities has a continuing program of energy conservation projects. In 2009, projects at Middlebush/Gannett and the Agriculture Building converted heating and cooling controls to variable air volume and connected to the chilled water loop. The expected annual energy savings of these projects is \$379,305, and within five years will pay back the entire investment.

Energy conservation efforts since 1990 were calculated to result in a \$4.6 million cost savings during the past year. Additionally, energy conservation savings reduce the need for capacity to generate additional energy, lowering long-term investment costs for new production equipment by another \$2 million annually. This total annual cost avoidance of nearly \$6.6 million is equivalent to a \$241 annual reduction in tuition per student.

Campus Facilities aggressively pursues opportunities to reduce the overall cost of utility production and supply. Initiatives such as the tire derived fuel program, implementation of chilled water looping technology, installation of digital power plant controls, motor efficiency improvements, and maximization of the use of cogeneration at the MU Power Plant, all contribute to lowering the cost of the production of energy.

In conjunction with these energy and cost saving efforts, Campus Facilities is increasing the use of biomass fuels used at the MU Power Plant. A project is underway to replace an existing coal fired boiler with a new biomass boiler. This boiler is necessary to reliably meet the steam needs of the MU campus, and will be fueled exclusively by biomass fuels. Design, procurement and construction activities are already in progress. The new boiler is expected to be operational in 2012.

Water and Wastewater

Campus Facilities, through its Energy Management department, uses five deep wells to supply potable water for the main MU campus. Wastewater is discharge to and treated at the City of Columbia publicly owned treatment works.

In 2009, 668,863,000 gallons of water were used, a 10% decrease from the previous year. Between 2000 and 2009 there was a 7% decrease in water usage. The decrease in water use in 2009 was most likely due to the wet conditions experienced throughout the year, mild temperatures, water conservation efforts, and increases purchases of electricity from the grid. Of the water consumed, 445,358,000 gallons were discharged to the sanitary sewer, a 3% increase over the previous year.

A recent water conservation project at the MU Power Plant uses recycled waste water from the plant's water treatment system to reduce the potable water supply for the plant's cooling water system. Reject water from the reverse osmosis equipment, which is normally sent to the sanitary sewer, is being redirected to the plant's cooling towers. This new process will reduce the volume of waste water, and lower the amount of potable used in the production of steam and electricity. In addition to reducing plant water use by 3-5%, the annual cost avoidance is expected to be approximately \$30,000 - \$50,000.

Energy saving technologies and water/wastewater efficiencies are incorporated into new designs to reduce water use, discharges to the sanitary sewers, and operating costs for the life of the building. Campus Facilities staff are also evaluating the possibility of additional gray water capture and reuse in the power plant to further reduce potable water use.

Food

Campus Dining Services (CDS) is the primary organization for residential and retail dining services at MU. CDS operates 11 retail locations and six residential locations. Examples of residential locations include Plaza 900 and Eva J's. Retail locations include Wheatstone Bistro and Starbucks in Memorial Union, Catalyst Café in the Life Sciences Center, Bookmark Cafe in Ellis Library, the j-Café in the journalism school, and several convenience stores (Mizzou Markets). CDS registered over 3.76 million transactions in the year ending June 30, 2009. The number of transactions is split between residential locations, with about 2.37 million transactions, and retail locations, with about 1.39 million transactions.

CDS uses a competitive bid system to locate a supplier and then purchases items as needed from the bid winner. With the bulk of purchases from that supplier, cost of goods sold (all food and non-food items) totaled over \$6.8 million for the FY2009. Item selection is based on customer needs and desires and the best values available. CDS, however, has started to emphasize finding supplies of food that satisfy customer, economic, and environmental standards.

Local food purchases are generally considered more sustainable because they travel less distance and therefore have less of an environmental impact. CDS purchases many products on a regular basis from their primary distributor, located in St. Louis, and from several locally-based (Missouri/Illinois) suppliers including:

19,766	pounds of Louisa pasta products
2,700	pounds of Savage meats
4,695	pounds of burgers and pork fritters from Holten Meat, Inc.
6,280	pounds of Lasco mixes
480	pounds of Brevé Coffee
5,805	dozen cage-free eggs
66,659	dozen assorted San Luis tortilla
3,636	pounds of Companion Bakery cheesecakes

For the different coffee shops, Campus Dining Services purchased 3,565 pounds of coffee from Kaldi's, a St. Louis roaster, and 1,200 pounds of coffee from The Roasterie, a Kansas City roaster.

In the fall of 2009, Campus Dining Services began a relationship with Missouri Food 4 Missouri People, which acts as a broker for locally grown products. Through that connection Campus Dining Services also purchased over 11,000 pounds of alfalfa sprouts, cucumbers, eggplant, onions, peppers, tomatoes, squash, and cabbage; 560 pounds of sweet potatoes; 1,850 pounds of assorted melons; and 9,200 pounds of apples.

Campus Dining Services purchased 7,600 pounds of beef roasts and burgers from Legacy Beef in Salisbury, Missouri, and 170 large bags of popcorn from Golden Nugget Popcorn Company. Campus Dining Services purchased 37,000 gallons of milk, 1,200 gallons of cream, 16,000 pounds of sour cream and cottage cheese; 15,000 pounds of yogurt, and 3,000 gallons of ice cream from the local Prairie Farms/Central Dairy company. Campus Dining Services also purchased 24,000 loaves of bread and 33,000 dozen buns and rolls produced by Interstate Brands in Missouri.

Few requests have been made to CDS for organic foods; therefore organics are not specifically pursued. There are no items offered in residential dining that would be considered 100% organic. Mizzou Market convenience stores offered assorted organic items such as pasta sauce, assorted chips, toaster pastries, pastas, chocolates, and cereals.

In addition to offering vegetarian and vegan choices in all residential dining facilities, Campus Dining Services continued to improve the quality of vegetables offered. This was facilitated in two direct ways: first, by seeking to source more fruits and vegetables grown within our region, thus ensuring a fresher more flavorful product, and second by increasing the quality of recipes through fresher ingredients and variety of cooking techniques. The goal is to have at least 50% of the vegetable dishes be fresh and “complex” – meaning advanced combinations of ingredients and cooking methods. In 2008, this definition accounted for 11% of vegetable choices. In 2009, that number increased to 32%.

Environmental successes during the past year:

- Continued recycling of fluorescent light bulbs, estimated at 180 bulbs annually
- Sold approximately 2,700 reusable drink and coffee mugs (excluding Starbucks products)
- Sold approximately 5,000 beverage refills, resulting in no additional packaging/cups
- Used recycled-paper napkins in all facilities
- Avoided use of Styrofoam packaging in the department
- Recycled cardboard in seven Campus Dining Services locations
- Recycled glass, plastics, and metal at Plaza 900 and plan to expand recycling to other facilities
- Purchased several “Energy Star”-rated pieces of kitchen equipment, including a dishwasher and refrigeration equipment for the new student center.
- Converted water-cooled freezer/refrigeration walk-ins at Rollins to air-cooled units that will conserve sizable amounts of water
- Installed new energy efficient windows in the Rollins dining facility
- Continued following the recommendations established by the Energy Committee in 2008-2010. These recommendations include:
 1. Monitor exhaust hood use (limited run time for menu production only)
 2. Reduce lighting during non-service time periods
 3. Reduce lighting levels during all daylight times, when appropriate
 4. Reduce pre-warming times for heating equipment (wells, ovens, grills, fryers, etc.)
 5. Restrict water usage in dish rooms during slow and non-use periods of time
 6. Continue reduction of HVAC use based on building use, hours of day, academic breaks
- Sent sold waste oil from Campus Dining Services units to a recycling company for re-use
- Used motion sensor lighting controls in recently renovated/constructed operations
- Used instantaneous heating system in three locations, resulting in the elimination of hot water storage tanks
- Operated a waste pulper for Rollins dish room, which created biodegradable pulp from napkins, paper cups, and food waste; provided pulp to Sustain Mizzou for use in the Sustain Mizzou and community gardens
- Placed a waste pulper for the new student center kitchen
- Authored proposal for grant with the Student Fee Capital Improvement Committee for the purpose of expanding the use of pulpers to other CDS locations
- Expanded selection and improved display of organic food in Mizzou Market—Hitt Street convenience store
- Tracked plate waste in the five all-you-care-to-eat residential dining facilities and posted the results of average waste for each month of the academic year (for customer review)

- Conducted a one-week plate waste awareness campaign (“Can the Waste”) each academic semester that featured the impact of food waste in residential dining facilities
- Continued to purchase local products (e.g., apples, fresh produce, pasta, tortilla shells) from local growers and manufacturers
- Used window film and blinds to decrease heat transfer through windows in summer and cold in winter
- Maintained petroleum-spill containment and clean-up kits in all locations; updated related training with management staff
- Recycled used office paper, telephone books, and other paper waste, as well as ink cartridges
- Replaced the department mail car with a golf cart that reduced automotive emissions and resulted in fuel conservation.
- Participated in the residence hall promotion “Dashboard” where residence halls compete in an energy savings contest.

A leading industry trend being embraced by Campus Dining Services is the sourcing of more local products. Specifically, this is targeting not just local products, but those of a higher quality than traditionally sourced items. This ties in perfectly with our efforts to reach out to today’s more health conscious consumer. Studies show that flavor is the most important thing to customers and providing the freshest, best tasting fruits and vegetables is a winning combination for their customers. Campus Dining Services has set a goal of 15% of food purchases coming from the local region (Missouri and adjacent states). In 2008, the total was 9%; in 2009, this increased to 11%; and the target is 15% for 2010.

Working with MU dietetic students, the Residence Hall Association, Sustain Mizzou, and the University Sustainability Office, Campus Dining Services is providing educational information in the residential dining facilities to educate students about the implications of plate waste. This past year, they tracked and posted the amount of plate waste that occurred in the all-you-care-to-eat residential dining facilities; they plan to continue to focus on strategies for reducing plate waste. They presented the “Can the Waste” promotion once each academic semester in residential dining venues. Additionally, they posted signs to promote waste reduction by voluntarily going trayless at the tray pick-up points. Campus Dining Services and the Residence Hall Association surveyed students about “going trayless” in the residential dining facilities. Students were overwhelmingly opposed to “going trayless”; therefore, Campus Dining Services made no change and continued the education promotions on food waste. Campus Dining Services will continue to educate students on various aspects of sustainability and encourage them to make conscious, positive decisions related to sustainability (e.g., take only what they will eat and reduce food waste, use refillable mugs). Campus Dining Services’ philosophy related to sustainability is to “work with” students to make positive change, rather than “to do something to” students related to sustainability. The sustainability efforts will continue during the coming year with the contribution of 10 hours of student labor sponsored by the University Sustainability Office. This person will assist Campus Dining Services in identifying and implementing future sustainable measures.

One driving industry trend that Campus Dining has embraced is the emphasis on cuisine that is nutritionally balanced. Of most importance in this effort is that food items remain delicious and well received by customers. Their focus in this area has been on removing trans-fats, replacing saturated fats with unsaturated fats, incorporating more fresh fruits and vegetables, using healthier cooking techniques (e.g., saute/roast vs. fried), and incorporating more grains and legumes. Many of these items have been achieved with an additional focus on incorporating regional and global flavors.

Solid Waste and Recycling

Solid waste and recycling services are overseen by Campus Facilities, through its Landscape Services department, for the main MU campus, University Hospital and Clinics, Ellis Fischel, and Columbia

Regional Hospital.

A total of 7,352 tons of solid waste was generated in 2009. This was a 9 percent decrease from 2008. The amount of material that was recycled is shown in Table 1 below. The overall total recycled increased 18% over the previous year and accounted for 31% of waste generated.

Table 1—Recycling Data for FY2009

Item	Pounds Recycled
Mixed Office Paper	1,930,542
Cardboard	1,025,806
Newsprint	135,480
Electronics	47,388
Steel	348,921
Aluminum	32,858
Plastic Bottles	80,506
Glass	108,115
Grass Clippings	211,000
Batteries	1,950
Miscellaneous	648,575
Total	4,571,141

Specific projects were conducted in 2009 regarding recycling, and the totals from these projects are included in the above table. Each project's results are listed in Table 2.

Table 2—Recycling Totals from Special Projects

Projects (Totals Included Above)	(tons)
Tiger Treasures	17.0
Indoor Beverage Container Recycling	23.4
Tiger Tailgate Recycling	19.0
Drop Off Recycling	63.6
Sidewalk Recycling	16.2
Paper Recycling (academic, administrative, support)	965.3
Cardboard (academic, administrative, support)	512.9
Newsprint (academic, administrative, support)	67.7
Total	1,685.2

In addition to the above activities, MU engaged in several other waste utilization activities. One was the use of 4,329 tons of chopped tires as fuel in the power plant. A second was the use of 3,230 tons of wood chips as boiler fuel at the power plant.

Hazardous Materials

Environmental Health and Safety coordinates the campus hazardous waste management program. The service area for these programs includes the Columbia campus, University

Hospital and Clinics, Ellis Fischel Cancer Center, Columbia Regional Hospital, University Physicians clinics, off-site research facilities (including farms), and the Missouri Rehabilitation Center in Mt. Vernon.

Table 3 below shows amounts of various types of hazardous materials disposed or recycled by campus for the past five years. In previous years, large quantities of regulated waste were produced from remediation activities at University Garage from a leaking underground storage tank and occasional other cleanup activities. In 2006, DNR declared that Garage remediation qualified for a risk-based closure. As a result, there were no longer the significant quantities of regulated wastes being disposed from that project in 2007. Universal wastes consist of batteries and fluorescent lamps, both of which are sent to recyclers.

Table 3—Hazardous Materials Disposal

Material	2004	2005	2006	2007	2008	2009
EPA regulated Hazardous Waste	129,000	116,700	126,000	117,000	103,000	112,700
Medical/pathological waste	443,000	480,000	486,000	426,600	456,300	395,360
Low level radioactive waste	37,000	20,700	6,700	7,600	19,900	14,000
Regulated wastes (special projects)	227,000	400,000	240,000	0	42,900	291,868
Mixed wastes (radioactive/haz waste)	840	335	208	441	233	423
Used oil to reclamation	13,800	11,500	13,700	17,600	17,600	11,452
Universal Waste to recycling	33,500	33,100	26,700	28,800	22,700	30,728
Asbestos	NR	NR	NR	NR	67,000	207,000

Notes: All measurements are in pounds. NR=Not Reported

EHS has operated a chemical recycling program that takes unwanted excess chemicals from laboratories and returns them free of charge to other interested campus researchers. In FY09, EHS recycled 2,440 chemical containers, which had an avoided purchase cost, adjusted for MU discounts, of \$175,600. EHS also recycled 584 pieces of laboratory equipment (mostly glassware) with an avoided purchase cost of \$22,475. EHS also removed 1.2 kilograms of mercury devices from its facilities and replaced them with non-mercury devices.

EHS has developed comprehensive procedures for the safe handling, storage and disposal of various types of hazardous materials, and provides training classes to several thousand employees each year on these topics.

Security issues have become significant factors in use and control of hazardous materials. Many of the recent regulatory changes are due to security concerns.

FINDINGS—INFRASTRUCTURE

Purchasing

Purchasing is centralized under the University System offices; MU is serviced by a campus Procurement Service Center.

Corporate Express (Staples) provides about 60% of the paper used by MU. Staples has received a very high sustainability rating from *Newsweek* magazine and was named to the Sustainable Business 20 in 2008. OfficeMax provides about 6% and the remainder is spent with non-contract vendors. Paper use data was only available for Corporate Express. Procurement works with contract vendors to promote recycled paper usage, order efficiency, and other sustainable activities.

In FY09, the campus purchased from Corporate Express:

- 8,522 cases of paper without recycled content
- 475 cases of paper with 30% recycled content
- 109 cases of paper with 100% recycled content
- 247 cases of specialty papers, including colored copy paper and color laser paper

In addition to campus purchases, Printing Services (see below) moved to 30% recycled paper as their standard paper and purchased 4,400 cases of this.

There was no data available on toner cartridges or surplus property this year.

Printing Services

Printing Services reported a variety of resource usage statistics for FY2009. For inks, the breakdown was as follows: vegetable/soy – 97%, metallic – 3%, low VOC petroleum based – 0%. This continues to represent a significant change away from low VOC to vegetable/soy. Paper cost was reported at \$1.5 million, down about 13% from the previous year. According to Procurement records, Printing Services moved to 30% recycled paper as their standard paper this past year and purchased 4,400 cases of such paper. Approximately 15% of Printing Services’ business used digital processing; this was about the same proportion reported the previous year.

In FY2009, the following amounts of materials were recycled: 294 tons of paper, including cardboard and 7 tons of aluminum and 8.3 tons of aluminum. These numbers were down from the previous year, as predicted, because of reduced demand for their services due to economic conditions.

Residential Life

Residential Life has provided normalized data for its students for the past several years (Table 4). Though these numbers are based on the best available data, the Committee is not sure that the year to year comparisons are strictly valid.

Table 4—Selected Environmental Data for Residential Life

Statistic	2005	2006	2007	2008	2009
Capacity of Residence Halls	6033	5800	5805	5910	6808
Gallons of Water per person per day	27	40	38	39	38
Kilowatt hours of electricity per person per day	5.91	8.05	8.4	11	12.5
Pounds of solid waste per person per day	1	1	1	1	1

The population served increased substantially in FY2009 due to the opening of Mid-Campus Housing and arrangements for students to be housed in two off-campus apartment complexes (Mizzou Quads and Tiger Diggs).

Residential Life continued to implement numerous environmental initiatives in FY2009. Residential Life provides recycling containers on each floor and the larger recycling containers provided by Civic Recycling and the City continue to be popular.

Residential Life has implemented a variety of reuse strategies as its Master Plan continues to be implemented. During FY2009, Hudson and Rollins were closed for renovation. The following items were salvaged for Residential Life inventory:

- All new student room furniture, closet organizers and mirrored medicine cabinets for 41 rooms
- A variety of chairs, tables and marker boards from lounges
- Chairs from laundry rooms and kitchens
- Front desk furniture and equipment
- Emergency light fixtures
- Door closers in good working order
- Automatic door opening equipment
- Exterior access hardware and equipment
- Door hardware in good working order and all lock cores
- Fire extinguishers
- Key boxes
- Appliances
- Fire alarm parts, such as FCI panel and devices with the panel.
- Exterior phone and blue light
- VAV boxes
- Good working air conditioners
- 6-8 window sashes
- Smoke detectors
- Exhaust and restroom fans
- Miscellaneous other items

In addition, the following items were salvaged from Hudson and Rollins for use at specific locations:

- All black framed student room chairs
- Four sofas and 16 lounge chairs
- Student room furniture (10 beds/springs, 75 set of bed ends, 30 dressers, 20 chairs)
- 420 student room mattresses
- Classroom tables and chairs
- Library tables and chairs
- Bike racks
- Miscellaneous other items

When Mid-Campus Housing (Hawthorn, Galena, Dogwood) and Defoe-Graham opened the following items from salvage were reused:

- Stack chairs from studies
- Round study tables
- Dry erase boards
- House lounge sofas
- Main lounge study tables
- Hall Coordinator apartment furniture
- Classroom furniture, chairs and tables

- Study chairs
- Bookcases and shelves
- File cabinets
- Dishes, glassware, silverware, cookware and kitchenware all donated by staff reused in kitchens to avoid the use of paper/plastic/Styrofoam items

Residential Life worked with Sustain Mizzou on the Mizzou Dashboard program for an energy conservation competition. Plans are to expand this competition to more residence halls in addition to the three that participated. Residential Life again participated in the Tiger Treasures Rummage Sale with items being donated by students leaving campus to reduce the amount of items going into the landfills.

These experiences have helped Residential Life to be more environmentally conscientious. For instance, Residential Life has required its contractor to recycle carpet tile and provide receipts from recyclers. Student room furniture suppliers are required to recycle all cardboard shipping materials.

Landscape Services

No new information received.

Building Planning, Design and Construction

No new information received.

FINDINGS—EDUCATION

Environmental Studies

Environmental Education at MU is loosely coordinated by the Environmental Studies Program (<http://web.missouri.edu/~umcsnresiwww/index.html>), which is administratively housed in the School of Natural Resources. The program has one half-time faculty member, Jan Weaver. Her office is in 208 Tucker Hall.

Environmental Studies provides career and major advising for undecided students (and academic advising for students seeking an Environmental Studies major or the 15 hour certificate in Environmental Studies. The program also compiles the list of environmentally related courses (see above), and a list of faculty doing environmental research (<http://web.missouri.edu/~umcsnresiwww/faculty.html>), it puts out a monthly newsletter covering an environmental topic and listing the local environmentally related events, maintains a calendar of local environmental events, helps students find internship opportunities with local organizations, agencies or businesses, and assists with advising Sustain Mizzou and Greeks Going Green.

Environmental Degrees

There are approximately five career areas in the environmental field: 1) advocacy, outreach and communication; 2) policy and regulation; 3) scientific and engineering services; 4) conservation and natural resources; and 5) outdoor and environmental education. Table 5 shows how MU majors line up with these career areas and the number of undergraduate students graduating from each of these majors from 2005 to 2009.

Table 5 Undergraduate students earning degrees in environmental career areas

"Environmental Majors"	Degree	2005	2006	2007	2008	2009
Environmental Studies	BA	1	1	3	1	0
Environmental Geology	BA	0	1	0	3	3
Civil & Environmental Engineering	Bsci	9	55	61	68	68
Soil, Environ & Atmos Sciences	BS	15	19	19	14	30
Fisheries & Wildlife	BSFW	34	31	48	39	33
Forestry	BSF	18	22	24	31	19
Parks Recreation & Tourism	BS	42	27	40	29	33
Total in each year		119	156	195	185	186

The alignment of particular majors with career areas is very rough, and students in other majors may be well-prepared for an environmental career by a careful selection of classes, internships and extracurricular activities. Political Science students can go into the environmental policy area, Journalism students may end up in an outreach or advocacy position, Chemistry or Geology students may work in scientific and engineering services, and Biology students may work in conservation and natural resources. By the same token, not every student in an "Environmental Major" goes into the environmental field.

To help students in other majors prepare for an environmental career, MU offers a certificate in environmental studies, 15 hours of coursework that complements their major and helps meet general education requirements. There were no certificate students in the 2009, compared with an average of six per year for the previous four years.

Table 6 shows the number of graduate students completing degrees in Environmental Majors with their percentage of the total graduate and professional students finishing degree programs at MU. There is also a graduate certificate in Conservation Biology which graduated 2 students in 2009.

Table 6 Graduate students earning advanced degrees in environmental career areas

"Environmental Majors"	Degree	2005	2006	2007	2008	2009
Soil, Environ & Atmos Sciences	MS	10	5	7	6	4
	PhD	5	1	1	3	2
Civil & Environmental Engineering	MS	16	15	17	16	10
	PhD	5	5	2	8	3
Fisheries & Wildlife	MS	9	5	11	5	7
	PhD	4	3	4	5	3
Forestry	MS	4	7	3	3	6
	PhD	0	3	4	2	2
Parks Recreation & Tourism	MS	4	4	5	4	2
Total in each year		57	48	54	52	39

Environmental Courses

In addition to offering degrees that lead to environmental careers, MU offers about 10 courses at the freshman or sophomore level with significant environmental content. This means, as determined by the course description, syllabus or interviews with the course professor, the course deals substantively with natural biological and physical processes *and* with the social, political and economic factors that lead to damaging or disrupting those processes. The total number of students taking those courses in the last year (Fall 2009 and Spring 2010) was 1,107 or 4.6% of the total student body.

There are also about 30 other courses that address environmental issues substantively but which are not taught regularly or which have several prerequisites, and around 60 classes that deal in some way with environmental issues, either because they use case studies, or they build content and/or skill in a particular natural resource area. For example, Atmos Sci 1050 Meteorology is critical to understanding climate change, but may not necessarily cover the social, political and economic aspects of warming. If that student also takes a behavioral or social science course that mentions an environmental issue, they may be able to connect changes in the environment with human activity in a substantive way.

Based on enrollment in the ten courses listed above and in other upper level courses and more specialized natural resources courses, it is reasonable to conclude that at least 5% and as much as 10% of the student body may learn about environmental issues and sustainability in courses at MU.

FINDINGS—RESEARCH

Research Farms

The College of Agriculture, Food and Natural Resources manages 22 farms consisting of 14,500 acres.

Some of these farms recycle used oil for space heating. In FY2009, approximately 1,000 gallons of used oil was recycled in this manner.

Staff and students on the Research Farms who used hazardous materials go through Environmental Health and Safety (EHS) training programs. Additional annual training is provided by EHS on the Spill Prevention, Control and Countermeasures plans for fuel stored as well as waste oil and petroleum storage from any of the large equipment items.

Some research is performed with genetically modified organisms. Procedures for storage, handling and disposal of seed and vegetative tissue are dictated to the Principal Investigator and they are held accountable. Work done by Research Farm staff and students are performed under the supervision of the Principal Investigator. Typical control methods for control of genetically modified organisms include avoidance of contamination by equipment and destruction of the crop prior to some reproductive phase. USDA-APHIS inspections are routinely made during the growing season. However, most of the genetically modified organisms currently in use for production have been approved and are not subject to USDA-APHIS inspections.

The past two years have been much wetter than normal, which has caused some challenges. One such challenge has been to keep animal waste lagoons from overflowing. In typical years, waste water from these lagoons can be used to apply nutrients and water to nearby crop land. However, there are regulatory restrictions on quantities and the land can only take so much water. With great attention, the Research Farm staff has had good success preventing discharges from these lagoons in spite of several severe

storms.

Manure storage structures at the Dairy Farm and Beef Research & Teaching Farm have helped with manure management. These storage structures provide flexibility in when manure is spread. In some cases, manure is provided to farmers not associated with the University.

A hay bedding and storage barn has been constructed at South Farm to compost used bedding from the Horse Farm. This compost has been offered to neighborhood gardeners.

There are a number of trends that have affected current or projected operations. In the biotech area, regulations for genetically modified organisms and new products have become stable and achievable, which has enabled better planning of research activities. New regulations have come into place that affect the application rate of animal waste on land. Fertilizer prices, which typically mimic fuel prices, have recently increased incentives to recover and make use of animal manure. Both MU research farm operations and local farmers have shown increased interest in using animal manure from the Research Farms for fertilizer. Two lagoons on South farm have recently been closed due to the construction of Discovery Ridge. The Research Farms are looking for ways to manage animal manure to control moisture and odor.

The nitrogen fertilizer situation is somewhat in flux. After the Oklahoma City bombing, the availability of ammonium nitrate became uncertain. Urea was looked at as a substitute, but has some significant drawbacks. As a result, several of the farms are seeking other sources of nitrogen to assure crop needs. South Farm, the Dairy Farm, and Bradford Farm are looking at beginning or increasing composting activities. Potential issues that must be overcome are transportation of the animal bedding, waste from known diseased herds/populations, and breakdown of bacteria, viruses and antibiotics in the composting operation to assure the use of compost generated for application on vegetable crops.

Research Reactor

Radioactive releases in 2009 to the sewer system totaled 51 millicuries of tritium and 24 millicuries of all other isotopes. These were 1% and 2%, respectively, of the allowable sewer release limits. Air releases in 2009 for Ar-41 totaled 978 Curies; however, this was only 70% of the Technical Specification limit. Air releases of Tritium totaled 6 curies—less than 0.1% of the Technical Specification limit.

Low level radioactive waste shipped from the Research Reactor in 2009 totaled 785 cubic feet, which was less than one third the previous year.

MURR requires that all persons with unescorted access to the research reactor have basic radiation protection training. Those persons working in laboratories and other restricted areas attend the hazardous material training program provided by Environmental Health and Safety and receive additional radiation protection training.

As mentioned last year, the Barnwell Radioactive Waste Disposal facility remains closed to facilities from states outside the Atlantic Waste Compact. This leaves MURR with no place to dispose of our Class B&C low level radioactive waste. As a result, Class B & C low level radioactive waste will continue to be stored on site until a disposal option is available.

FINDINGS—STUDENT ACTIVITIES

This section provides a description of student environmental groups and activities.

Eleven student organizations were identified as having direct environmental missions:

Coal Free Mizzou - <https://theorg.missouri.edu/SearchByOrganization.aspx?organizationID=16420>
Emerging Green Builders - <https://theorg.missouri.edu/SearchByOrganization.aspx?organizationID=16682>
Environmental Science Club - <http://www.snr.missouri.edu/seas/academics/organizations.php>
Greeks Going Green - <https://theorg.missouri.edu/SearchByOrganization.aspx?organizationID=16685>
Mizzou Hydrogen Car Team - <http://www.mizzouhydrogen.org/>
Solar Decathlon Team - <https://theorg.missouri.edu/SearchByOrganization.aspx?organizationID=16517>
Soil and Water Conservation Society - <http://www.snr.missouri.edu/seas/academics/organizations.php>
Sustain Mizzou - <http://sustainmizzou.students.missouri.edu/>
Tigers for Community Agriculture - <https://theorg.missouri.edu/SearchByOrganization.aspx?organizationID=16553>
Tigers for Tigers - <http://tigers.missouri.edu/>
Weatherization, Mizzou - <https://theorg.missouri.edu/SearchByOrganization.aspx?organizationID=16222>

These student organizations had various missions and levels of activity.

MSA Sustainability Committee

The MSA Sustainability Committee actively works to connect students, faculty, and staff, increase sustainability education, and advocate for environmental sustainability at the University of Missouri. This committee has the following goals:

- Promote and facilitate communication between administration and students in regards to environmental sustainability
- Educate students, faculty, and staff on environmental sustainability issues
- Assist in the dissemination of information about environmental sustainability on campus
- Connect the various groups, organizations, and individuals working on environmental sustainability on campus
- Monitor and track student-driven environmental sustainability movements

Student Sustainability Fee

In 2009, students passed a referendum adding \$1/semester for sustainability to their student fees. Funds from this fee supported several part-time student sustainability positions and were also a source of grant funds for student sustainability projects.

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

In January 2009, an administrative leadership group released a report on sustainability. Several recommendations were made including:

- MU should appoint a sustainability coordinator
- MU should appoint a sustainability council
- MU should adopt a sustainability statement
- MU should review current policies and develop new policies
- MU should create a campus wide communication plan for sustainability

These recommendations were embraced and implemented by Chancellor Deaton.

This report is intended as a supplement to the report issued in April 2003 and subsequent annual updates. It is intended to provide information about the environmental impacts of MU activities and to stimulate discussion about these impacts and projected trends. The Environmental Affairs and Sustainability Committee notes that there are many success stories contained within this report. On the other hand, the

report points toward opportunities in a number of instances. The Committee welcomes feedback about the data collected, the way the material is presented and any conclusions that are drawn.

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