

Clemson University

# Environmental Audit

Executive Summary

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2.0



## The Auditing Process

The Story of an Audit: An Instructor's Preface / by Mike Pulley / Feb. 24, 2014

In 2009, during my first year at Clemson, I was handed an intriguing assignment. It came from Ashley Cowden Fisk, director of Clemson's award-winning Client-Based Program. Assign students in English 314 (Technical Writing) and English 304 (Business Writing) the task of completing an updated environmental audit of our institution. I saw it as an exciting challenge because I had spent more than 20 years working as a technical writer and environmental journalist before entering the teaching profession and coming to work as a lecturer in the English Department at Clemson. The audit would give the students here a chance to apply advanced communication skills in the kind of real-world contexts I had faced in my own career as a writer and communications specialist.

An audit is a systematic, comprehensive assessment of an institution's operations and activities from an environmental perspective. And to complete such an assessment, the students (undergraduate juniors) would be schooled in research (both secondary and primary), project planning, audience analysis, teamwork, and, of course, writing and revision, among other skills. In short, this was a dream project that would help prepare our majors for the kinds of problem-solving skills and tasks they would face on the job in future careers. This project also fit into the university's commitment to service learning, or engaged learning, another key part of our mission as a top-25 university. That made it a ready-made project for the Client-Based Program, a service learning program largely housed in the English Department but also functioning under the umbrella of the Pearce Center for Professional Communication in the College of Architecture, Arts, and Humanities.

The students who worked on the project initially reported to the Clemson University Environmental Committee (CUEC), our project client. In the first two years, we were heavily assisted by Jamey Lowdermilk, a graduate student in Applied Economics and Statistics who served as the audit coordinator and committee liaison. Another key representative from the Committee was Robin Newberry, Chief Environmental Safety Officer for university facilities. He visited many of our classes, helped explain the goals of the project, and was always willing to take calls and make recommendations when students went about their research.

Clemson's previous audit, also completed by students, had been released in 2006. Our initial approach was to study the details of this report, follow its 13-chapter structure, and build on its findings. We quickly learned that the period between when an audit's information-gathering process ends and its editing process concludes can be awhile. Much of the data and trend lines in the 2006 audit ended around 2003 or 2004. Therefore, our goal was to try to begin our coverage from that point in time and move forward when at all possible. There are no uniform record-keeping processes across departments, so the amount and kinds of data available varied from department to department and section to section.

One of my mentors, Don Ray, an award-winning journalist and writing coach, used to inspire me again and again with the following question: "Always keep asking yourself, 'Who would know? Who would know?'" And I found myself posing the same question to my students who worked on this report. Of course, the people who *did know* are the many department managers and staff members in the dozens of various departments and programs at Clemson, and these staffers became our allies over and over in the challenging job of collecting the data and compiling it here in the most useful, analytical fashion we

could muster. All of those helpful staff members can be found listed under the title “Information Sources” on the first page of each audit section, and to these dozens of helpers we owe a great deal of gratitude.

Clemson’s push to become a more sustainable, environmentally-friendly university meant that a lot had happened since the last audit was completed in 2006. My students and I discovered that the complexity of the task at hand was more than we expected. During some semesters, the task of gathering and compiling data into meaningful *Excel* charts alone kept us busy. We produced rough drafts that would get handed off to the next team, and the process would begin anew the following semester. Our continuing efforts to update each chapter with the latest data and program changes showed us that the content of an audit is naturally a moving target. Soon, semesters turned into years, but the process gave 176 students a chance to play a part in the project and learn so much from it. The project also gave these students a chance to share their own ideas and opinions about what can be done to improve Clemson’s sustainability efforts down the road. You will find these opinions expressed within each section under the heading, “Auditor’s Perspective.”

Jamey Lowdermilk, our first coordinator, graduated and moved on. The Environmental Committee disbanded, and the project continued during the past two years under the oversight of the President’s Commission on Sustainability, and our new coordinator, Thomas Jones, Director of Custodial, Recycling, Solid Waste and Special Events. Eventually, we needed to give up on the bottomless task of trying to keep up with that moving target of change and share what we have gathered with the rest of the campus and the community. We did it in the fall of 2013 with the help of two last Technical Writing sections (English 314)—they focused heavily on a final, nuts-and-bolts editing job and fact-checking effort.

Of course, all statements and opinions in this report come from the students and many participants and should not be construed as official university policy. By design, this audit is not totally comprehensive—that moving target keeps on moving and ensures this is true. The university’s ongoing effort to become more sustainable means that much of the information in this document is already out of date. Despite all of our many fact-checking efforts, there may be a few discrepancies.

Ultimately, the goal of an audit is to help an institution ask more meaningful questions about its operations and activities, to reflect on where it has been in the past, make corrections if needed, and plan more wisely for the future. Hopefully, this document will do some of that. But perhaps most importantly, it gave nearly 200 students a chance to serve their alma mater in a profound, meaningful way, and to receive in return a challenging opportunity to learn by applying the kinds of advanced communication skills that will mean much to them as they grow and move forward in a more complex, technologically-oriented 21<sup>st</sup> Century. May the lessons of this project *serve them* in that regard for many years to come.

## Executive Summary

A key trend emerges in the details of Clemson University's latest environmental audit, a report that tracks campus activities during the 10-year span between about 2003 and 2012. Despite the university's substantial growth in student, faculty, and staff populations during this period, the university, under President James Barker's leadership, launched major efforts in moving toward a more sustainable campus. The Central Energy Facility announced the eventual phase out of its coal-burning boiler and has greatly reduced the use of this undesired fuel by favoring cleaner-burning natural gas. Recycling levels increased substantially with the aid of new programs like University Housing's Solid Green as well as the purchase of 7,000 new recycling bins. A new carpool program was started, bike lanes were improved, and the Greenlink bus system was added to give Greenville and Easley commuters their first mass transit option. The installation of low-flow toilets and other measures helped the campus greatly reduce its water usage. Procurement Services adopted a new Sustainable Procurement Policy and has used it as a guide in some of its largest purchases of goods and services. These are just a few of the many examples of how Clemson is going green, all documented in the 13 sections that comprise this audit.

However, the audit also documents how Clemson University has a long way to go in to become a truly sustainable campus. In some areas, the campus has taken just the first few baby steps in the right direction, and the coming decade will determine how well it continues to make progress in its green efforts. This document is a sort of roadmap for these sustainability goals because embedded in each section are numerous ideas and potential changes that will allow every department and every person in the Clemson family to play a part in these efforts to come.

This report is not a news story. Data-gathering in some sections ended several years ago, and significant changes continued to occur throughout campus as the report made its way through the final editing and quality-control stages. Not all sections provide a complete picture of the past decade because departments have varied widely in their own data-gathering efforts. For example, the Clemson Area Transit (CAT) system generally keeps ridership numbers only for three years back, which made it difficult to look at longer-range trends. But this report's true power is in the historical perspective it provides of a campus during a key turning point in time. It's a record of how an institution founded in the 19<sup>th</sup> Century is awakening to its chance to become an environmental leader as a top-25 public university in the 21<sup>st</sup> Century.

### Air Quality

Clemson University is the site DHEC uses to record ozone measurements for Pickens County. The campus measuring station showed the county exceeding limits for ground level ozone and particulate matter on many days during the past decade or two. This didn't cause the county to receive an outright non-attainment status, but regulators still considered the county's attainment status marginal at best. However, 2014 data is expected to show an improvement in the county's overall air quality. The university itself is not considered a major contributor to the county's air pollution problems. The university's primary contributor to air pollution is the Central Energy Facility (CEF). It tracks four main pollutants: sulfur dioxide, nitrogen dioxide, carbon dioxide, and particulate matter. However, the university has been well within its permitted limits for these emissions. The university reduced its emissions in recent years by relying more heavily on natural gas and burning coal as backup fuel only.

Under former President James Barker's leadership, Clemson adopted an overall goal of becoming a net-zero carbon emissions institution by relying more and more on renewable energy sources in addition to a plan to eliminate use of coal altogether.

## **Biohazardous Waste**

During the nearly eight-year span covering fiscal 2003 to September of 2010, Clemson University's annual bio hazardous waste production increased. In that period, the amount of bio hazardous waste grew from about 12,000 lbs. in fiscal 2003 to more than 16,000 lbs. in fiscal 2009. The annual amount collected averaged 526 boxes per year with an average pick-up of 22.1 times per year. Most of the increase is attributed to research conducted by graduate programs, all part of Clemson's push to become a top-20 university. Clemson University spends nearly \$18 per box annually to dispose of bio hazardous waste generated on campus. With bio hazardous waste production rising, costs have risen, too, rising from \$5,722.74 in fiscal 2003 to \$17,076.00 in fiscal 2009.

Biohazardous waste produced on campus is disposed of bimonthly. The current method of waste disposal at Clemson University is by incineration. While some campus locations autoclave waste on site prior to offsite incineration, the autoclaving is done merely as an added safety measure, not as a method of disposal. Autoclaving renders potentially infectious waste less dangerous. Clemson does not autoclave as a disposal method because that would require the university to meet the more complicated, stringent standards for such a practice. The university has contracted with several different companies in recent years to pick up all bio hazardous waste from campus and transport it out of state where it is incinerated and disposed of.

## **Energy**

Clemson had two major developments in its energy programs in the past decade, and both were based on green environmental factors. One was a move away from a reliance on coal to a higher consumption of cleaner-burning natural gas. The university now burns coal only as a backup fuel and plans to eliminate the burning of coal altogether. By fiscal 2010, electricity accounted for 50% of the university's energy mix, natural gas accounted for another 43%, and coal had dropped to just 7%. The university does rely on a number of other fuel types such as propane and fuel oil for special needs in labs and such, but these make up a minor segment of overall consumption.

The other substantial change was a decrease in overall energy consumption due to the implementation of energy conservation measures. Energy consumption increased steadily from 2003 to 2006 by about 11.2%. However, usage levels fell by 10.4% between 2006 and 2009 as the conservation measures took effect. By 2009, consumption levels had fallen to near 2003 levels. While consumption fell, total energy cost continued to rise. The university still paid roughly 24.3% more in 2009 than in 2006. The total cost rose from about \$7 million in 2006 to more than \$9 million in 2009. A contributing factor to the rising cost is the university's switch to natural gas in place of coal. On average, natural gas was at least twice the cost per MMBTU of coal until 2009. Not surprisingly, the majority of the energy used by the campus is for the heating and air-conditioning systems. While the university buys most of its energy from Duke Power, the university also generates some of its own power with a mix of boilers and turbines at the Central Energy Facility on campus. The campus expects to gain additional savings in the future as it continues to implement more conservation measures.

## Hazardous Waste

Hazardous waste management at Clemson University falls into two categories. Each year, the university budgets \$200,000 to pay for routine management and disposal of hazardous waste on campus. In the period tracked, the university did not exceed this budget. Additional amounts are paid out whenever hazardous waste spills occur on campus. These additional spill cleanup costs vary depending on the number and nature of the spills. For example, in fiscal 2006 the cost of spill removal was \$439,656.34 while in 2008 it was only \$31,875.87. The amount of routine hazardous waste produced varies by department. For example, the total amount of hazardous waste produced by all academic departments in fiscal 2009 filled a total of 9,950 drums, yet University Facilities, a nonacademic department, produced 10,265 drums of hazardous waste in that year.

Spills are a result of some type of environmentally hazardous discharge, leakage, or other environmentally harmful incident. They account for the majority of projects involving the removal of hazardous waste from 2004-2010. Monetary values are used as a scale to represent the amount of contamination that was created. The amount of contamination and the cost of cleanup are typically directly proportional. The data available for fiscal 2004 shows that no spill costs were incurred. During the 2005 fiscal year, there was a coal pile excavation and cleanup on McMillan Road that caused the yearly spill cleanup cost to be very high, or just under \$400,000. The \$439,656.34 spent in 2006 was on a major cleanup at 401 Daniel Drive. Old heating oil tanks were found to be leaking, and immediate action was taken for the cleanup. In fiscal 2007, contaminated soil excavation and disposal from the old zoology site caused the yearly spill cleanup cost to be more than \$400,000 yet again. On the other hand, the cost of spill removal in the following three-year period from 2008-2010 dropped to levels far less than \$100,000 per year.

## Pesticides and Grounds Management

The Pesticides/Grounds Management section focuses on four major sections: the main campus, the athletic grounds, Walker Course, and the Experimental Forest. Landscaping Services applies pesticides and herbicides on main campus areas on an as-needed basis. Fertilizer is used on the main campus to support the growth of grass. Approximately 1,306 pounds of nitrogen fertilizer was used in 2009. The university invests significant time, money, and effort into tree maintenance. As of 2010, about 6,000 trees were growing on the main campus area. The university follows a practice of planting at least two trees for each tree cut down. Tree loss is primarily due to old age, disease, and damage by squirrels, but in 2008 the university launched a squirrel contraceptive research project to limit squirrel damage.

The athletic department uses various fungicides, herbicides, and insecticides on all athletic fields. The processes used to maintain all of the athletics fields on Clemson University's campus are mowing, airfying, and fertilizing. The athletic department spends approximately \$38,000 per year on various pesticides. All of these are essential to keep playing fields healthy and safe. Nitrogen fertilizer is used on playing fields to help the turf grass grow and stay healthy.

The Walker Course uses many chemicals throughout the year on an as-needed basis. Inventory is taken every year in February. All chemicals applied are kept in a handwritten logbook. After inventory is taken, it is submitted to Clemson University's Environmental Health and Safety (EHS). These logbooks would be reviewed if the Department of Pesticide Regulation wanted to review the Walker Course's chemical usage. Nitrogen fertilizer is used to help turf grass grow and stay green. In 2009, 14,353 lbs. of nitrogen was used. Integrated Pest Management (IPM) techniques are used to prepare and maintain the grounds.

Clemson Experimental Forest stretches over 17,500 acres and is “a multipurpose green space” Some of its many uses include research, teaching, recreation, hunting, fishing, natural resource conservation, and timber harvesting. The Experimental Forest produces approximately two million board feet of timber annually. The forest is continually regenerated with the yearly planting of between 60,000 to 100,000 trees. All funding comes from timber sales and not from Clemson University. The funding is used for many purposes including pesticides. Pesticides are mainly used to ward off predators such as the southern pine beetle.

## **Procurement**

Sustainable procurement, or the practice of purchasing goods and services in an environmentally friendly manner, is a relatively new concern at Clemson. The university adopted a sustainable procurement policy in 2008, and the state of South Carolina instituted a green purchasing policy in 2009. The university’s sustainable procurement policy includes the following purchases: environmentally friendly products, products made with recycled content, low energy appliances, and products made by companies that are environmentally conscientious. Clemson’s policy, however, is largely a set of voluntary guidelines. Individual departments are allowed to make their own decisions about purchases on items less than \$2,500. Items above that limit would go through the campus Procurement Services department.

While Procurement Services chartered itself with the responsibility of choosing contracts that are environmentally friendly, the department must still honor some contracts that took effect before the sustainable procurement policy took effect. Another issue limiting green purchasing on campus is the simple issue of awareness. Procurement conducted a survey of faculty and staff in an effort to gauge awareness of the sustainable procurement policy. The results of the survey showed that there is still much more that can be done to raise awareness of the policy. The university also does not have a system to track the level of green purchasing, but it does have figures indicating that the possibility for green purchases is huge. For example, about 62% of all purchases made in fiscal 2009 could have been made in an environmentally conscious manner. That number was equivalent to about \$96 million of all purchases made in that year.

## **Radioactive Waste**

Radioactive materials and radiation-producing equipment are vital and necessary components of the university’s biotechnical research programs and scientific disciplines. These programs produce radioactive waste, which is handled and disposed of in accordance with a comprehensive Radiation Safety Program designed to protect the health and safety of employees, students, the public, and the environment. This program adheres to the laws and regulations set forth by the U.S. Nuclear Regulatory Commission and South Carolina Department of Health and Environmental Control (DHEC). On campus, all of these activities fall under the direction and control of the Radiation Safety Officer and the Radiation Safety Committee. All workers handling radioactive material or waste must receive extensive training, including lecture and written exams, before being qualified to handle radioactive material. Between 2007 and 2010, the university properly disposed of thousands of pounds of radioactive waste. More specific numbers were not made available. There have been no accidents or spills of radioactive waste on campus since the arrival of the current Radiation Safety Officer in 1990.

## Recycling

Since Clemson's 2006 Environmental Audit was published, the level of recycling on campus has increased. This rise was fueled by more student involvement; new recycling programs; updated equipment at Clemson's recycling center; a reorganization in staffing for collections of recyclables; and the acquisition of 7,000 new recycling bins. Clemson's Municipal Solid Waste (MSW) recycling rate was 22.5% in fiscal 2011, an increase over the previous year's rate of 21.5% (T. Jones, personal communication, 2011). When considering all recycling on campus, including non-MSW categories such as Construction and Demolition (C&D) debris, the campus has fared much better. For example, the campus' total landfill avoidance rate was 73.5 percent in fiscal 2011 primarily due to heavy construction activities on campus and the subsequent recycling of the large quantity of construction debris generated.

The increase in recycling has generated an economic benefit for the recycling program. For example, gross revenues for the program hit approximately \$85,000 in fiscal 2011 compared to about \$23,000 five years earlier in fiscal 2006. By contrast, the program's net expenses substantially dropped during the same five year period, going from about \$15,000 in fiscal 2006 to less than \$10,000 in 2011. An examination of the data indicates that Clemson has made substantial strides in recycling activities over the past decade. However, the campus is poised to make even bigger strides in the coming years thanks to a flurry of recent changes. Clemson expects recycling rates to double in the next few years as new programs mature and staff and students make more use of the 7,000 new recycling bins.

## Solid Waste

Since the 2006 environmental audit, the amount of solid waste has trended downward despite a growing campus population of students, faculty and staff. For example, the university produced about 3,600 tons of solid waste in 2007. But that number had dropped to about 2,700 tons by 2010. The decrease is attributed to the university's increasing attention to recycling programs. A new procurement program that encourages green purchases also has helped reduce solid waste. Solid waste amounts are expected to continue dropping in the future as the university's recycling efforts continue to expand. Auditors had difficulty analyzing some solid waste trends in the previous decade because Clemson's solid waste production fell under several managers. That problem was rectified when all production was consolidated under the direction of Thomas Jones, Director of Custodial, Recycling, Solid Waste and Special Events for the campus. This should make it easier for future auditors to get a better understanding of the campus' various waste streams.

The main producers of solid waste on campus include University Housing, on-campus facilities, and Aramark, the university's dining services provider. Substantial amounts of waste are also generated by football games and other special events. Most of the non-toxic municipal and residential waste on campus is taken to a transfer station in Pendleton where it is collected by Waste Management, Inc. in a contract with the university. While the amount of waste has dropped, the contracted cost per ton rate paid to Waste Management has risen. After 2007, this company began transporting the campus waste to the R&B Landfill in Homer, Georgia. Clemson also has a Construction and Demolition Landfill in the Clemson Experimental Forest where some waste from construction sites on campus is taken. The material is covered with soil to aid in its disintegration back into the land under a study looking at land reclamation practices.

## Transportation

In the area of transportation, auditors primarily studied two main sectors—Parking Services and the Clemson Area Transit (CAT) system. Tracking what happened with campus parking in the past decade proved difficult due to a record-keeping flaw. No valid data exists on the number of parking permits issued for the period from 2006 to 2009 due to the former hang tag system. Parking Services only tracked permits when hang tags were first sold and did not track the issuance of stickers that were placed on older hang tags. Hence, the number of hang tags recorded for those years only reflected newer hang tags sold and not the total number in use. However, this issue was rectified in more recent years after the department eliminated the use of the multi-year tags. Valid data does exist for the first half of the previous decade, and it showed a significant jump in parking permits sold between 2000 and 2005. In 2005, just over 21,000 permits were sold compared to 15,386 in 2000.

While the number of permits may have risen, the total number of parking spaces decreased during the previous decade from just over 13,000 to just under 13,000. The decrease was due to spaces lost because of new building construction. Just under 12,000 spaces were available to campus students, faculty, and staff. However, research showed that the number is adequate for demand. Generally, only about 81 percent of spaces are occupied during peak usage. Not surprisingly, complaints about parking availability are based on the location of empty spaces. Though there is a surplus during peak hours, most of the excess parking is located within resident student lots or in less popular overflow lots on the perimeter of campus.

While there has been some talk in the past of easing this problem by constructing new parking garages, the university's current approach is in the green direction of trying to reduce commuter traffic to campus rather than encouraging it. The university launched a new carpool program and most recently added the Greenlink bus system as an alternative for commuters who live in Greenville and Easley. This approach has numerous environmental advantages. Adding parking spaces would increase storm water runoff problems. With fewer cars on campus, Parking can move toward its goal of making the core campus more pedestrian and bike friendly. Fewer cars also reduce the release of greenhouse gases.

CAT Bus, a key part of the university's goal of reducing campus commuter traffic, has seen both a rise and fall of total ridership numbers since 2006. In 2006, the amount of passengers CAT served was 1,343,234. This grew by 31.87% to 1,771,346 in 2007. The following year saw an increase of 1.86% to 1,804,235 passengers. However, in 2009, there was a sudden drop to 1,544,886 passengers; this was a decrease of 14.37%. This was likely caused by a reorganization of routes in late 2008 due to the onset of the recession and budget cuts. However, the CAT bus system has moved in a more positive direction since that time with more route refinements and the addition of the larger articulated buses.

## Wastewater and Storm water

Wastewater and storm water have huge impacts on Clemson University's campus. If not handled properly, wastewater and storm water have the potential to pollute the water that is discharged into natural water bodies, harming the organisms that interact with it. Wastewater management is federally mandated by the Environmental Protection Agency to lower the environmental impacts of a treatment plant's water discharge. The Clemson University Wastewater Treatment Plant (CU WWTP) has a successful history of maintaining its effluent within its permitted restrictions. In 2008, the U.S. Environmental Protection Agency recognized Clemson University as a Center of Excellence in

Watershed Management. To receive this designation, “the institution must demonstrate technical expertise in identifying and addressing watershed needs.” This includes the involvement of students and faculty members in watershed research and reaching the financial ability to become self-sustaining.

Maintaining storm water involves limiting the discharge of pollutants and ensuring that watersheds remain unaffected by human factors such as construction or transportation. Engineers often have the responsibility of addressing storm water issues prior to construction and are legally responsible if any issues should arise. One of the most important concepts related to storm water planning and design is making sure that development activities have a minimal effect on a natural stream’s peak flow and velocity, as this affects how well animals and microorganism thrive in the environment. The EPA does not regulate Clemson University to gather and record data on storm water because Clemson is not considered a Municipal Separate Storm Sewer System (MS4) yet, though in 2010 the city was on the threshold of MS4 status. Clemson, in fact, was already moving towards obtaining an EPA permit to begin a storm water management program as of that year.

## **Water Use**

Overall water usage at Clemson University was on a downward trend during the second half of the previous decade. For example, usage dropped from roughly 181.8 million gallons in 2006-2007 to 158.6 million gallons in 2009-2009. The drop is attributed to the university’s substantial water conservation efforts during these years. For example, the university installed a number of low-flow toilets across campus. Dining facilities contributed to the effort by switching to tray-less cafeterias. Athletics saw its water usage increase during these years due to the drought, but it also implemented conservation efforts. Irrigation of fields was limited to nighttime, and this significantly reduced evaporation. The university tracks this all-important resource by monitoring usage in four sectors: dining services, dormitories, athletics, and major academic/research buildings. Generally, campus housing accounts for the largest portion of usage, averaging 47%, followed by major academic/research buildings at 29%. Athletics accounts for about 13% and dining 12%.

## **Workplace Safety**

The Workplace Safety section of the audit primarily considers on-the-job injury trends at the university during the period from 2004 to 2009. Most injuries fall into three categories. The first is sprains, strains, spasms, and tendonitis. A second category includes falls and slips. The third area involves cuts, punctures, and scrapes. Injuries in the first category (sprains, strains, etc.) dropped significantly during this period. The third category of cuts, punctures, and scrapes also saw significant declines. However, the number of injuries in the middle category (falls and slips) has held steady at best and even went up in 2008 and 2009. The overall reduction in most injuries is based on a number of efforts by the university to reduce such problems. For example, the university conducted a number of ergonomic reviews of employee workstations and cut many injuries associated with this issue. Safety awareness has also made a difference. Employees have been offered training on the early signs and symptoms of ergonomic injury and illness. The university also has upgraded all of its safety manuals. However, the growing problem of falls and slips indicates that more work is needed.