



Clemson University to begin field experiments on nuclear-waste storage

A team of more than 20 researchers from across the state will begin running field experiments at Clemson University next year to find the best ways of storing nuclear waste.

Experiments have been done on a small scale in labs, but a new outdoor site will allow researchers to test underground storage methods on an intermediate scale in real-world conditions, said Clemson associate professor Brian Powell.

“If we can do that, then our confidence in these waste disposal scenarios will be much, much higher,” Powell said. “This stands to be a premiere test-site in the country.”



Brian Powell connects tubes to a testing device in the Clemson Environmental Technologies Laboratory.

Experiments will be conducted in an above-ground, prefabricated container that university officials are calling a “research testbed.”

Researchers have decided to put the facility near the Clemson Environmental Technologies Laboratory in Anderson, Powell said. Clemson is leading the study, and researchers from South Carolina State University and the University of South Carolina are collaborating.

The study will be funded by a \$5.25 million grant from the U.S. Department of Energy’s

Experimental Program to Stimulate Competitive Research.

Clemson President James P. Clements said that an impressive team has been assembled to study an issue of vital importance to South Carolina and the nation.

“About half of South Carolina’s energy comes from nuclear power,” he said. “We also have to deal with legacy waste from weapons production. It’s crucial to our health and the environment that we find the best storage methods.

“The study will bring together some of the state’s top minds to advance the science behind environmental monitoring, remediation and disposal of radioactive contaminants.”

South Carolina is home to seven nuclear power plants, and six more are close to the state’s borders. Two nuclear reactors are under construction in South Carolina and Georgia.

South Carolina is also home to Savannah River Site

“The state is well-positioned to make a decisive contribution to the future of nuclear energy,” said John Ballato, Clemson’s vice president for economic development.

“To do so, it’s imperative that we understand the scientific and engineering needs of safely dealing with the waste.”

Nuclear waste storage takes on heightened importance in the Edisto River basin, which is surrounded by nuclear facilities and is home to S.C. State, said Zheng Chang, an associate professor of nuclear engineering at the Orangeburg university.

“It’s really important to do research and find out how to deposit this nuclear waste,” Chang said. “We also need to know the behavior and characteristics if the nuclear waste is leaked into the environment.”

Travis Knight, the director of USC’s Nuclear Engineering program, said that nuclear power is an important part of the nation’s energy portfolio. While growth has slowed recently due to cheap fossil fuels, particularly natural gas, waste will continue to be an issue.

Space exploration, oil drilling and nuclear medicine all involve radionuclides, he said.

“Our study is solving a complex issue in an inter-disciplinary nature,” Knight said. “It’s an opportunity to advance the science.”

Researchers plan to study legacy waste from weapons production and the waste that comes from generating nuclear power, Powell said.

Components of used nuclear fuel can be reprocessed into fresh fuel. But even with reprocessing, some leftover material is no longer usable.

“We’ll be looking at that stream of waste as well,” Powell said. “The current U.S. policy is not to recycle spent fuel. The thinking worldwide, though, is that recycling some of this material is really the way to go. We want to be ready to deal with that option.

“The defense related nuclear waste has already gone through this recycling process. So we already have some of this waste that we need to deal with anyway.”

A persistent concern among researchers is whether small-scale lab experiments will yield the same results when performed on a larger scale, Powell said.

Powell said he didn’t know of any other test site that can run experiments on the scale that Clemson plans to offer. The only exception would be Department of Energy sites that have been contaminated by many years of operation, he said.

“The Clemson site will have the advantage of allowing researchers to control the experiments,” Powell said.

The study’s goal is to find safe, secure and cost-effective ways to isolate waste that ensure environmental and human health are protected.

“To do that, we’ve got a very wide range of possibilities, the vast majority of which are focused on underground burial of some sort,” Powell said.

Larry Dooley, Clemson’s interim vice president for research, said that what stood out about the grant to him is how it encourages collaboration among several institutions to work for the common good.

“We’re building a team,” he said. “We can accomplish more together than we can separately.”

The team includes expertise in nuclear engineering, radiochemistry, health physics, environmental science, hydrogeology, geophysics, plant physiology, computational modeling, sociology and civil engineering.

Anand Gramopadhye, dean of Clemson's College of Engineering and Science, said that the grant will enable the university to do world-class research that helps create a sustainable environment.

"The end result will be a team of engineers and scientists who have the tools and skills to deal with waste from commercial nuclear energy and legacy weapons production," he said.

"The size of the grant reflects on the quality of the leadership and the high quality of research that will be delivered."

The \$5.25 million grant is among the "big hits" that have helped put new research funding on the upswing for Clemson's College of Engineering and Science, said Tanju Karanfil, associate dean for research and graduate studies.

"We've surpassed \$40 million in the most recent fiscal year, and final numbers are still coming in," he said. "This is a testament to the intellectual quality, creativity and competitiveness of our CES faculty members."

Most of the grant money will pay for the manpower to conduct experiments and gather data, Powell said. More than 50 undergraduates, graduate students, post-doctoral researchers and faculty members are expected to be involved, he said.

Some of the money will also pay for equipment, Powell said.

David Freedman, interim chair of the Environmental Engineering and Earth Sciences Department, said he expects the new facility to draw more exposure to a program that already has an expanding national reputation for excellence.

"The study will be another feather in the department's cap," he said. "Students and professors will have a chance to participate in research on a scale not available anywhere else."

The team's work is supported by the U.S. Department of Energy, Office of Science, Basic Energy Sciences.

Powell said the test site will pose no risk to people who live and work nearby.

"We will get approval from DHEC to build and run the site," he said. "We're operating a

sister facility like this at the Savannah River Site. We know how to build it and run it well.

“The Clemson site will be secured to prevent access by non-authorized personnel and will be routinely monitored.

“Furthermore, though we will be monitoring below-ground processes, the experiments will be conducted in above-ground containers to prevent any possibility of releases to the environment.”

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