

# No quake zone?

## Keowee, Hartwell dams built to take the shake

BY GREG OLIVER  
THE JOURNAL

Tucked into the hillside of the Blue Ridge foothills in northern Oconee County, a pair of hydroelectric stations and three nuclear reactors churn out millions of megawatts of electricity.

Three dams, seven dikes and six spillways hold back 5.5 billion gallons of water that make all that power possible.

Ever since March 11 when an 8.9 magnitude earthquake triggered a tsunami that destroyed five nuclear reactors on Japan's northern coast, the question has lingered — what could happen if an earthquake rattled the foundation that holds back Oconee's massive wall of water?

Although they are rare, South Carolina is not immune to earthquakes. The most famous is the Charleston earthquake of 1886, which caused \$6 million in damage — \$141 million in today's dollars — and claimed between 60 and 110 lives.

Closer to home, in 1913, Union County South Carolina experienced an earthquake that by today's standards would probably be measured as 5.5 on the Richter scale.

According to a group of College of Charleston geologists who head the South Carolina Earthquake Education Program, the Piedmont/Blue Ridge area is susceptible to smaller earthquakes (magnitude 2-4), "especially near dams."

Walhalla, which is located near some minor faults, is subject to small and infrequent earthquakes. But the 1913 earthquake had its epicenter in Newry, occurring at 7:42 a.m. May 19, 1971.

Experts attributed the cause of the Newry quake to a slippage of the Broad Fault and other faults in the area led by the immense weight of Lake Keowee, a manmade structure held back by the Keowee Dam.

Duke Energy spokesperson Robert Cook said the Keowee dams are safe.

"Our hydroelectric dams are routinely inspected, not only by Duke Energy, but regulators and, every five years, an independent engineering consultant," Cook said. "These dams were built to withstand any kind of seismic activity based upon the 1886 Charleston earthquake, meaning they have the ability to withstand the magnitude of the worst earthquake."

To understand the company's belief in the safety of the entire Keowee-Toxaway project is to understand the enormity of the project, which has its roots in corner offices of Duke Power in 1948. That is when scientists and engineers gave company officials the

go-ahead to pursue the means to make the Keowee-Toxaway Project a reality.

But it wasn't until 1965 when a public announcement regarding those plans would be revealed at a press conference in the historic Clemson House.

There, Duke Power President W.B. McGuire said his firm would create a large power-generating complex that would use dammed river valleys to provide a source for hydroelectric, pumped storage and nuclear power.

In the ensuing years, Duke would also create a dam safety program that monitors and maintains 53 hydroelectric dams in the Carolinas to ensure they are safe. Additionally, all elements of the program are reviewed by the independent Federal Energy Regulatory Commission's Division of Dam Safety and Inspections.

"They look at the integrity of the dam and the ability of the dam to withstand any kind of failure," Cook said. "We have numerous measures we go through and check."

Duke Energy maintains emergency action plans for all 29 hydroelectric stations and works with all county and state emergency management agencies and does drills and preparation for any

kind of event — something they have been doing from the very beginning.

Brad Keaton, chief dam safety engineer for the Duke Energy Carolinas Hydrofleet, said trained personnel are sent to inspect the dams anytime more than two inches of rain occurs within a 24-hour period or if there is any type of seismic activity. Divers even inspect the underwater portions of the hydroelectric structures.

"We're quite proud of our dam safety program," Keaton said. "All of our earth dams

are inspected every two weeks by trained Duke personnel, and all of the dams in Lake Keowee are considered earth filled dams. All of our concrete dams are inspected at least once every quarter by the same trained personnel, and they receive engineering inspections annually by Duke trained engineers."

Inspections include spillway gate testing, in which each spillway gate is opened annually to pass water and fully opened at least every five years. Every fifth inspection requires an independent dam energy consultant, Keaton said.

"This individual is an independent contractor who comes in with a fresh set of eyes," he said. "A functioning spillway is one of the most important features of a dam."

While Walhalla and Newry are two areas in Oconee County to have been hit by some form of earthquake — coupled with Lake Keowee experiencing some seismic activity more than 30 years ago — Keaton maintains that such instances are historically rare. First,

Keaton said, the Keowee dams are rolled homogeneous earthfill dams constructed using modern design and construction practices.

"Well constructed earthfill and rockfill dams have a history of good performance during earthquake shaking with no detrimental effects," Keaton said.

Keaton added that the dams have also been analyzed for earthquake loading and fully meet established federal criteria that assure safe operation and performance in the event of an earthquake.

greg@dailyj.com | (864) 973-6687



**Above, work on the Keowee Dam spillway was well under way when this photo was taken in 1968. Left, 2 million cubic yards of dirt were used for the 3,500-foot Keowee Dam, which is 155 feet tall and 800 feet wide at its base.**

PHOTOS FOR  
THE JOURNAL





#### DAM FACTS

**Construction of the Keowee Dam** began on March 2, 1966.

**Major earth** moving operations were under way by 1968.

**The dam** is 3,500 feet long — twice as long as the other two dams in the project.

**It contains** 2 million cubic yards of earth.

**It is** 155 feet tall, 800 feet wide at its base and narrows to 20 feet wide at the top. Two large turbines power generators that create electricity.

**An 850-foot** long tunnel, 33.5 feet in diameter, supplies water to the turbines.

**9 million** gallons of water can pour through the turbines in one minute.

**The Jocassee Dam** uses pumped storage, allowing turbines to go in reverse and pump previously used water back into Jocassee from Lake Keowee.

PHOTOS FOR THE JOURNAL

Top photo, the official groundbreaking for the Keowee-Toxaway site was April 11, 1967, even though work on the Keowee Dam had officially begun on March 2, 1966. Bottom photo, the two levels of Lakes Jocassee and Keowee are evident in this aerial photograph taken in 2005.



On April 2, 1970, the gates of the Keowee Dam were closed, allowing for the final impoundment of water. Here, Keowee is shown filling from the earthen dam near Newry.