

SALUDA DAM REMEDIATION COLUMBIA, SOUTH CAROLINA	YEAR COMPLETED	
	PROFESSIONAL SERVICES 1990 – 2005	CONSTRUCTION (IF APPLICABLE) 2001 – 2005
PROJECT OWNER'S INFORMATION		
PROJECT OWNER South Carolina Electric & Gas	POINT OF CONTACT NAME Mr. James Landreth	POINT OF CONTACT TELEPHONE NUMBER (803) 217-7224

RIZZO Associates (RIZZO) was retained by South Carolina Electric & Gas (SCE&G) as the Design Engineer and Construction Manager for the remediation of Saluda Dam, located in Columbia, South Carolina. The \$275 Million Project was completed in 2005 and, at that time, was the largest active dam construction project in the U.S. The Saluda Dam is the third largest Roller Compacted Concrete (RCC) dam in the U.S. and is one of the Top 20 in the world. The Saluda Dam received the 2006 United States Society on Dams (USSD) Award of Excellence for Construction Projects; and the Outstanding Civil Engineering Achievement (OCEA) as the most outstanding project for 2006 as chosen by the American Society of Civil Engineers (ASCE). **The Saluda Dam is one of only four dam projects that have won the ASCE OCEA award since its inception in 1960.**



The Saluda Dam, which impounds Lake Murray, is owned and operated by SCE&G, and is located on the Saluda River, 10 miles upstream of Columbia, South Carolina. With more than 500 miles of shoreline, water area covering about 78 sq. miles, and storage capacity of more than 2,100,000 ac-ft. of water, Lake Murray is one of the largest man-made lakes in North America. The Dam, completed in 1930, as an earthen dam, is 211 feet high and 7,800 feet long. It was originally constructed for hydroelectric generation, but today the lake is also the source of cooling water for the coal-fired McMeekin Steam Electric Plant, a source of drinking water for the region and the largest recreation facility in Western South Carolina.

The dam has undergone several renovations since its construction. The most current one is a seismic upgrade to comply with current federal regulations. RIZZO, with input from a Board of Consultants and FERC, evaluated alternatives for the remediation and decided on a large backup dam as the most feasible and cost effective solution. The new 211-foot tall structure is a combination of rockfill and RCC dams. The new dam was designed to prevent catastrophic flooding and to ensure the safe shutdown of the associated hydro and fossil stations. While construction of the 5,500-foot long rockfill section was a major effort, the most challenging and innovative aspect of the project dealt with constructing the 2,300-foot long RCC section in a narrow corridor, between the existing dam and existing facilities.

In addition to the dam construction itself, the project entailed development of an on-site quarry, excavation of multiple ash-ponds, replacement of 6-foot diameter pipes, which deliver cooling water to the on-site coal-fired plant, and operation and closure of an ash landfill. Replacement of the pipes involved tapping into penstocks, supplying water to the Hydropower Station, and required outage of both plants. To minimize economical losses, a tightly choreographed sequence of steps was developed for the pipe replacement. The project was multifaceted with an aggressive schedule, with more than 350 people working on site around the clock. The new dam was built immediately downstream of the existing dam. Excavation at the toe of a high-hazard dam with full reservoir was a very dangerous undertaking. RIZZO designed and supervised an extensive dewatering program with over 1,500 wells working non-stop to lower ground water levels and facilitate excavation. To evaluate effectiveness of the dewatering system and monitor dam safety during excavation, hundreds of fully-automated inclinometers and piezometers were installed in the dam. These instruments provided a continuous real-time stream of data and helped engineers to make timely decisions about safety and progress of construction. The Instrumentation and Monitoring Program was highly praised by industry experts and federal regulators.

With space constraints precluding open-cut excavation, several retaining walls were required to support the 50-foot deep excavation for the new dam. The project included construction of a 1,500-foot long and 40-foot high tie-back retaining wall, a 45-foot high soil bentonite cut-off wall, a 40-foot high soil-nail wall, and a local jet-grouted wall. Because of highly irregular and often unpredictable bedrock profile, the wall designs had to be revised in several instances. RIZZO worked closely with the contractor value-engineering the walls to fit site conditions. This close cooperation allowed the construction to progress with no delays, despite difficult site conditions and shortage of materials due to a tight steel market.

Construction of the rockfill portion of the dam entailed placement of 3.5 million cubic yards of soils and rock. The RCC section for the dam required 1.3 million cubic yards of RCC and mass concrete. All materials were produced on-site. Daily blasting in the quarry, supervised by RIZZO geologists, produced rock for the construction. Shot rock was then delivered to the on-site crushing plants, which supplied various aggregates for the RCC, rockfill, and filters. Two Aran RCC mixing plants, with 500 cubic yards/hour capacity, each provided RCC and mass concrete. Due to the hot climate, extensive chilling was required. Seven chillers, each with a 230-ton capacity, cooled aggregate and water for the RCC mix. At the peak placement in November 2004, approximately 18,600 cubic yards of RCC was placed in a 24-hour period, establishing the new world record. RIZZO provided Construction Management (CM) services for the project that included coordination of all construction activities. RIZZO was the single point of contact for the project and provided CM services that included a Document Control System, schedule responses to RFIs, cost estimates for extra work, preparation of initial bid documents, contract administration, construction monitoring of all activities, cash flow projections, review of Value Engineering proposals, claim analysis and negotiation, dispute resolution, performance analysis, and payment application approvals. The RIZZO staff numbered approximately 30 people and included engineers, geologists, surveyors, design and CADD personnel, construction supervisors, RCC supervisors, environmental compliance personnel, safety personnel, and instrumentation engineers and technician monitors.

