

TAUMSAUK UPPER RESERVOIR REBUILD FOUNDATION GROUTING AND PENSTOCK UPGRADES LESTERVILLE, MISSOURI		YEAR COMPLETED
		PROFESSIONAL SVCS: January 2006 – May 2010
PROJECT OWNER'S INFORMATION		
PROJECT OWNER Ameren Missouri	POINT OF CONTACT NAME Thomas Hollenkamp	POINT OF CONTACT TELEPHONE NUMBER (314) 957-3406

Paul C. Rizzo Associates, Inc. (RIZZO) conducted the forensic analysis as to the root cause for the failed Upper Reservoir at the Taum Sauk Pumped Storage Facility. Ameren Missouri contracted RIZZO to provide a conceptual and then a detailed design of the new dam as well as manage the construction of this \$400 million rebuild. The selected rebuild consisted of constructing a Roller Compacted Concrete (RCC) dam. The final Project involved the placement of 2.8 million cubic yards of RCC and is the largest RCC dam in the U.S. *The Taum Sauk Upper Reservoir Rebuild Project won the 2010 USSD Award of Excellence for Construction Projects and the ESWP 2010 Project of the Year Award. The Project is also a Finalist for the 2010 American Society of Civil Engineers' distinguished Outstanding Civil Engineering Achievement (OCEA) Award.*



RIZZO's Scope of Work is detailed as follows:

DESIGN ENGINEERING: RIZZO prepared conceptual designs for several options and a detailed design for the selected option for rebuild of the Upper Reservoir. Design requirements, construction costs, schedule, and potential regulatory challenges with each option were fully evaluated. A symmetrical (0.6H to 1.0 V upstream and downstream faces) RCC dam was selected for the Upper Reservoir Rebuild.

FOUNDATION GROUTING: RIZZO designed and managed the foundation grouting program for the new dam. The grout curtain was installed along the upstream toe of the new dam using real time computer monitoring and balanced, stable grout mixes. The curtain was installed with a double angle orientation to effectively intercept and treat the prevailing geologic features and multiple opposed lines were used to effectively seal highly fractured zones of the foundation. The grouting program was performed concurrent with dam construction and foundation preparation activities, requiring careful coordination with adjacent construction activities. Since the Upper Reservoir has been refilled, seepage through the foundation has been minimal.

OUTLET WORKS INSPECTION: RIZZO performed a detailed inspection of the outlet works for the pumped storage facility and prepared an inspection report. The outlet works consists of a 450 ft. long, 26 ft. diameter vertical shaft, a 4,765 ft. long, 25 ft. diameter horizontal rock tunnel, and a 1,807 ft. long, 18.5 ft. diameter steel lined tunnel and penstock. Inspection activities included a scan of the vertical shaft using a video camera and Ground Penetrating Radar and a visual inspection and geologic mapping in the rock tunnel. The steel lined tunnel and penstock were visually inspected, thickness readings were taken using an Ultrasonic Thickness meter, and ovality checks were performed by a surveyor.

TUNNEL LINER REPAIR: A section of the steel lined tunnel had buckled and cracked several times during dewatering of the outlet works over the history of the project. RIZZO developed a design for repairing and patching the cracked section of the steel lined tunnel with steel plates along the invert. The design also included localized grout treatments and a new drainage system to relieve external pressure during future dewatering.

VERTICAL SHAFT REPAIR: Grouting and shotcrete patching were performed in the lined section of the vertical shaft. Shotcrete patching was needed to patch deteriorated shotcrete in several areas, and grouting was needed to fill voids between the shotcrete lining and the surrounding rock. Grouting and shotcrete patching was done from a platform that was raised and lowered in the 450 ft deep, 26 ft diameter shaft. Grouting was done using the lugeon/permeability method with 9 separate grout rings at different elevations in the shaft. Very low grout pressures were used to prevent damage to the existing shotcrete lining in the vertical shaft.

CONSTRUCTION MANAGEMENT: As Construction Manager (CM), RIZZO retained a full staff of on-site personnel, including: engineers, construction supervisors, AutoCAD personnel, surveyors, and environmental compliance and safety personnel. RIZZO was the single point of contact for the Project and was the Owner's Representative on-site, provided on-site supervision and coordination of all construction activities. RIZZO's responsibilities included: scheduling, budget and cost control, inspection of the Contractor's work, approval of pay applications, contract administration, preparation of contract documents and technical specifications, health and safety programs, requests for information and approval of project submittals.

