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Contact: Lori Spragens, 855-228-9732, ext. 4
lspragens@damsafety.org

20th Anniversary of the Folsom Dam Spillway Gate Failure

Commitment to Maintenance and Periodic Design Reviews of Aging Appurtenant Structures are Necessary to Ensure Dam Safety and to Protect our Water Resources

July 17, 1995 marks one of the U.S.'s most significant dam incidents when radial Gate Number 3 at the Folsom Dam failed while being opened. This sent uncontrolled flows up to 300,000 gallons per second over the next seven hours down the American River towards the Northern California City of Sacramento. Fortunately, the flows were moderated by the downstream Nimbus Dam and contained within downstream levees designed for higher flood flows. While recreationists were evacuated from the downstream area, neither loss of life nor significant downstream damage occurred. Unfortunately, 40% of the water stored in this 18 square mile lake was lost due to the gate failure.

Folsom Dam was designed and constructed by the U.S. Army Corps of Engineers between 1948 and 1956 and was transferred to the Bureau of Reclamation (Reclamation) for operation and maintenance in 1956. After the failure of the spillway gate, the dam's owner, Reclamation, assembled a multi-agency team to investigate the incident. The team attributed the gate failure to overstressing of the gate's arms and bracing due to excessive friction at the gate's steel trunnion pins (essentially, hinges on which gates rotate). Friction at trunnion pins was not accounted for in the gate's design, consistent with state of the practice during the mid-1950s when the gates were installed. Investigators surmised that the friction at the trunnion pin had increased due to corrosion on the bearing surface of the pin, a condition attributed to age, environmental conditions, and reduced maintenance. Gate 3 was subsequently replaced, and the other seven radial gates at Folsom Dam retrofitted to updated design standards.

The gate failure resulted in a significant lesson learned for dam safety in California and throughout the country. Following the failure, the California Division of Safety of Dams (DSOD) directed owners of dams under State jurisdiction to fully inspect, investigate, and evaluate the structural integrity of their radial gates. Federal agencies—specifically Reclamation, U.S. Army Corps of Engineers, and the Federal Energy Regulatory Commission—embarked on similar programs to evaluate radial gates of dams under their purview. These programs resulted in the structural retrofit of a number of similar gates.

"The 1995 Folsom gate failure is representative of several ongoing dam safety challenges," said Lori Spragens, Executive Director of the Association of State Dam Safety Officials (ASDSO). "Twenty years later, we're still upgrading dams that were built prior to modern design and construction standards—and that's a large percentage of the nation's dams. The average age of the 84,000 dams in the U.S. is 52 years old. As dams age, routine maintenance also becomes more important, and even this can be quite expensive."

Spragens said that "ASDSO estimates that an investment of $21 billion is needed to repair the nation's aging, yet critical high-hazard potential dams—that is, dams whose failure is expected to cause loss of life."

In light of California's ongoing drought, Spragens remarked, "When we think about how precious the resource of water stored behind a dam can be for an area like California, and how unfortunate it can be when a large portion of an impoundment is lost during a dam safety incident, it's a reminder of the importance of our nation's

dam infrastructure, and the critical need to appropriately fund and conduct routine inspections, maintenance, and rehabilitation construction projects."

The Association of State Dam Safety Officials, a national non-profit organization founded in 1984, works with dam owners and state and federal lawmakers to create strong dam safety programs. ASDSO encourages members of the public to educate themselves on both the benefits of dams and the risks of dam incidents and failures. Residents can determine if they live in a dam failure flood inundation zone by contacting their local emergency management agency or the state dam safety program.

ASDSO recommends that people who live near dams familiarize themselves with evacuation routes, make sure all family members know what to do in the event of an emergency and prepare an emergency kit.

In conjunction with the Federal Emergency Management Agency, ASDSO created a booklet, *Living with Dams: Know Your Risks*, that is a good starting point for individuals seeking answers about dams near their communities. An accompanying guide, *Living With Dams: Extreme Rainfall Events*, explains how communities can reduce the chances of a dam failing from an extreme rainfall event, such as that which occurred in Virginia in June 1995. Both booklets are available at www.livingneardams.org.

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The Association of State Dam Safety Officials (ASDSO) is a national, non-profit organization founded in 1984 and dedicated to improving dam safety through research, education and communication.
Web: www.damsafety.org