

Assessing the Hydraulic Performance and Integrity of Concrete-Lined Spillways

Benjamin Israel Devadason, P.E., CFM., Gannett Fleming, Inc.

Paul G. Schweiger, Gannett Fleming, Inc.

Seth D. Thompson, E.I.T.

Since the Oroville Dam spillway chute failure incident in February 2017, many dam owners have been concerned about the performance and integrity of their dam's concrete-lined spillways during high velocity releases and have initiated their own spillway assessments to evaluate the possibility for similar potential failure modes. Although published research and empirical knowledge is available in the dam safety community on the various hydrodynamic phenomenon that can act adversely at concrete-lined spillways, a fundamental understanding of the hydraulic forces and their potentially catastrophic effects on concrete-lined spillways is sometimes not well understood. This presentation and paper discusses the important adverse hydraulic forces and their effects that can threaten the performance and integrity of concrete-lined spillways during high velocity flows, with a focus on cavitation, stagnation pressures, slab uplift pressures, and water surface profile irregularities. A historical perspective of these hydraulic forces and effects on spillways will be illustrated with case studies. Available analytical methods to assess spillway performance and integrity along with a discussion of the critical thresholds that indicate the potential for development of catastrophic scenarios will be presented. Recommendations for the use of CFD modelling to confirm spillway performance will also be discussed.