

Dam Safety Risk Analysis and Risk Management Practice at the Bureau of Reclamation: Lessons Learned from over Two Decades of Experience

Karen A. Knight, P.E.¹

¹Bureau of Reclamation, Director – Security, Safety, and Law Enforcement, P.O. Box 25007 (84-44000), Denver, CO 80225-0007; e-mail: kknight@usbr.gov

ABSTRACT

The desire to more appropriately prioritize resources within U.S. Department of Interior (DOI) Bureau of Reclamation (Reclamation) and to better understand the risk posed by its dams to the public required Reclamation to move beyond a deterministic based assessment of its dams. Risk assessment and risk management were viewed as a logical method to prioritize these resources for the most benefit to the public. Through research and development, Reclamation pioneered the application of risk assessment to its portfolio of 367 high hazard dams. Since the late 1990s, Reclamation has performed over 1300 quantitative and semi-quantitative risk analyses on its portfolio of dams. This paper discusses early efforts in risk assessment, the evolution of risk analysis within Reclamation's dam safety program to its current state of practice, and some key ongoing initiatives. The focus is on the role of risk-informed decision making within the overall context of a dam safety risk management program.

The 1990s saw Reclamation transition from an organization focused on modifying dams based on deterministic deficiencies to an organization fully engaged in the practice of risk-informed decision making. Risk-informed decision making continues to evolve due to several factors; (1) risk analysis methodology and our understanding of dam performance and structural response to loadings continues to improve, (2) our understanding of the potential for, and magnitude of, seismic and hydrologic loadings continues to change, (3) the physical performance of some dams changes over time as the structures continue to age, and (4) the populations at risk downstream of some dams are increasing.

Adopting a probabilistic, risk-informed approach to dam safety, after many years or decades of deterministic approaches, did not occur seamlessly or easily within Reclamation. In some aspects, the frame of reference used in traditional engineering analyses slows the transition to risk-informed concepts. That transition is a process that takes time and involves a cultural change to the way the organization and staff approach dam safety evaluations and decisions. There is little question that a fundamental grounding in the evaluation of potential failure modes helps usher the cultural change to risk-informed thinking, improves the organization's understanding of structural performance, and improves the overall safety of dams each agency is responsible for.