

National Strategy to Address Public Safety Around Dams

Issue Paper

1. PURPOSE

This paper is intended to bring awareness to and obtain the support from the Dams Sector and United States Governing bodies to assist in the development of a national strategy that includes supporting technical guidance tools to reduce the number of fatal public safety accidents occurring at and around dams in the US.

2. BACKGROUND

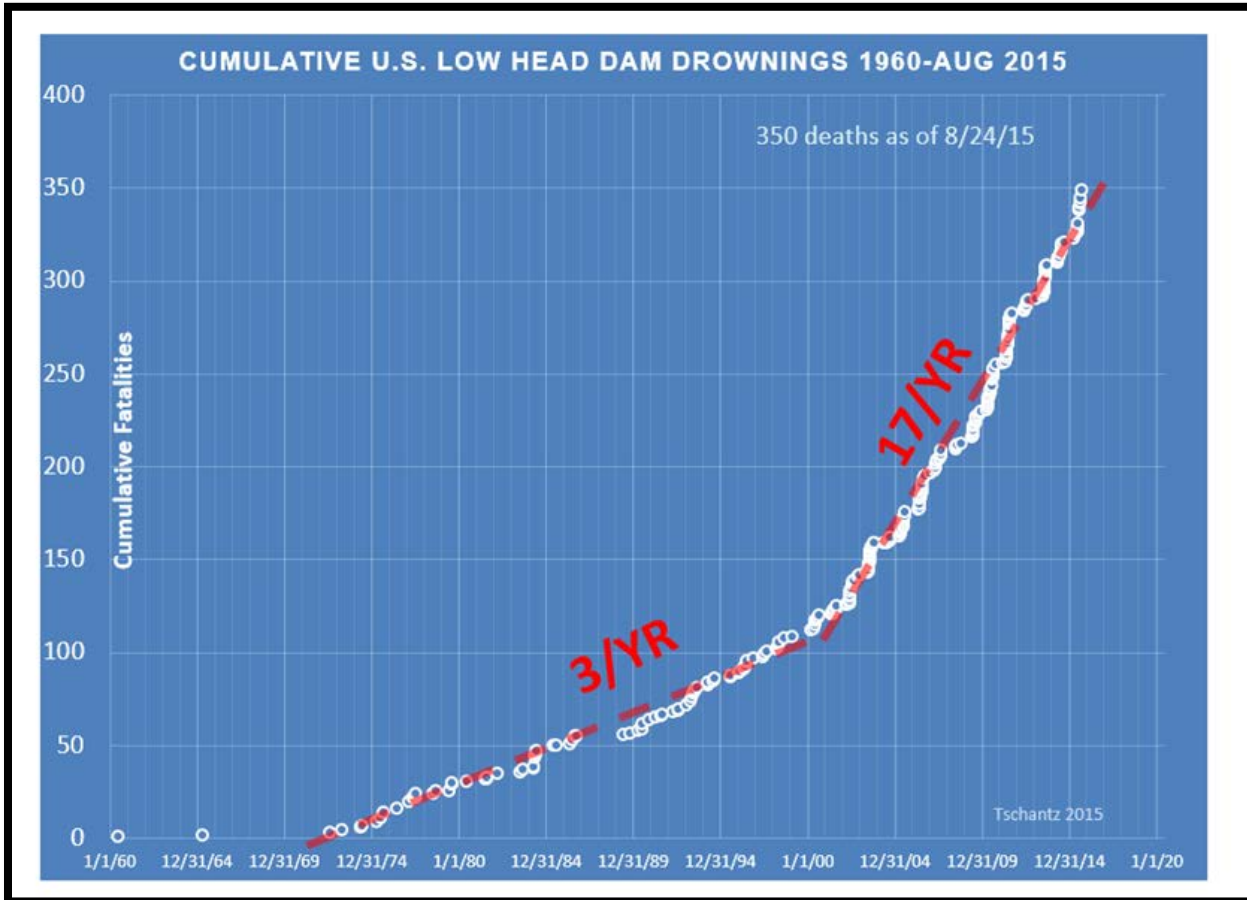
Dams and their impounded reservoirs are public destinations for a wide range of recreation activities. Many of these activities make use of dam features for extreme sports that include unauthorized and unsafe actions, resulting in accidents and fatalities. Often times first responders succumb to hazards while attempting to rescue victims. A troubling statistic uncovered by Dr. Tschantz, professor emeritus of the University of Tennessee, is that during the past 35 years there have been **over eight times as many fatalities** from accidents at dams than there have been deaths resulting from dam failures; 320+ reported drownings at dams versus 40 deaths from dam failures [Tschantz, 2015]. This same trend has been observed in other countries. Over the entire history of Canada, more people have died in accidents around dam sites than from structural failure of dams [CDA, 2011]. Of significant concern are the growing populations near these structures and the increasing online postings of extreme sports activities by youth in and around restricted industrial sites at water control structures.

While accidents at dams are reported regularly in the local and national media, little statistical data is available to assess the full national extent of the problem. There is no national strategy addressing public safety or database to collect information on dam-related accidents. The state of Iowa reports an estimated 97 drowning deaths at dams, of which 18 occurred since 1998 [Beeman, 2012]. Minnesota's Boat and Water Safety Section of the Department of Natural Resources reports 52 deaths, and 50 injured or rescued people, at dams in that state between 1974 and 2002 [Tschantz, 2011]. In Illinois, the Fox River has a notoriously dangerous segment of 15 dams in the 115-mile reach. At the Yorkville Dam, on Fox River, at least 12 people are reported to have drowned since it was rebuilt in 1960. Drayton Dam on the Red River in Minnesota claimed 12 lives between 1965 and 1995.

A study by Tschantz from a database of accidents he collected from 1960s through 2015, reveals at least 282 injuries and/or death-related incidents at low-head dams in 39 states. In these incidents, there have been at least 100 injuries and over 350 drowning deaths. These figures only include accidents obtained by Dr. Tschantz from documented news articles and local officials primarily at low-head dams, the focus of his research. The actual number of accidents are unknown and are likely much higher, but collective statistical data is lacking. Dr. Tschantz's research shows a disturbing trend that the number of documented accidents at low-

head dams in the U.S. has been increasing in recent years, as shown in Figure 1. These statistics demonstrate the need for the dam industry to focus attention on identifying and correcting the hazards created by the dams.

Figure 1. Cumulative U.S. Low Head Dam Drownings from 1960 to 2015 [Tschantz, 2015]



Although the most significant hazard and cause of fatalities is the transient submerged hydraulic jump or hydraulic roller that is often attributed to flow over low-head run-of-the-river dams, there are many other hazards that exist at dams that have contributed to accidents and fatalities. Dozens of fatalities, resulting predominantly from boating accidents, occur immediately downstream from larger conventional dam spillways, and turbine releases. [Dr. Roland Hotchkiss, BYU Professor of Civil & Environmental Engineering, who maintains a broad BYU database website of fatalities at dams, reports nearly 500 deaths related to low head dams (note: the BYU database includes contributions from Dr. Tschantz).]

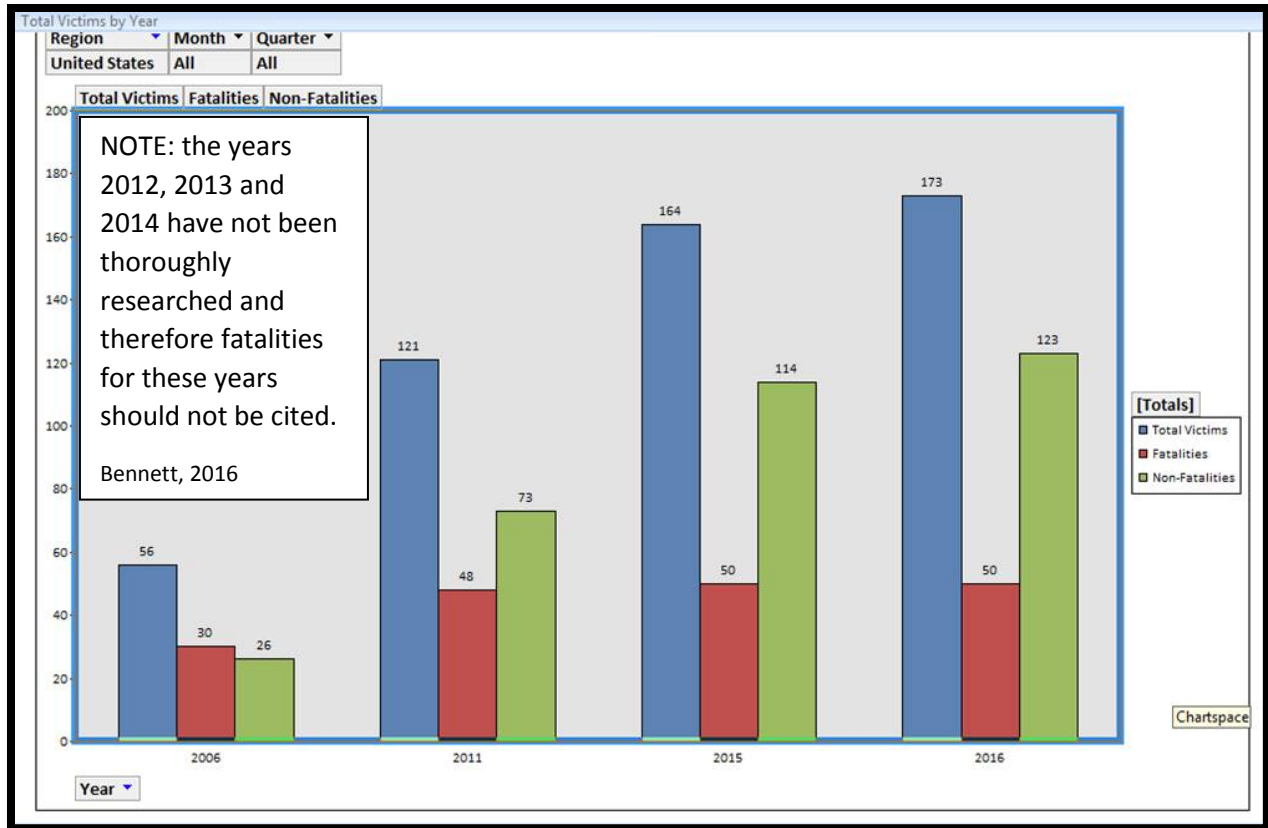


Figure 2. US Based Incidences in and around Dams

(T. Bennett, Personal Communication, OPG External Public Safety Incident Database, January 2, 2016)

Other hazardous conditions produced by and around dams include: strainers, sudden releases with rapidly increasing flow conditions, confined spaces, unpredictable currents, submerged structures, hidden dam crests, watercraft over spillways, entrapment, stranding, bridge and box culvert apron drop-offs, and steep slopes and slippery surfaces.

In response to the increasing number of accidents and fatalities at and around dams, several countries and organizations have recently formed work groups with the aim of learning, fostering cooperation, and developing solutions. Countries in the forefront include Canada, France and Norway. In 2010, ICOLD formed Technical Committee I - Public Safety around Dams, with representatives from 21 ICOLD Member Countries, including the United States. The ICOLD Committee has been tasked with producing a State of Practice document that includes providing information on hazards and risks, current practice, legal frameworks, and mitigation measures. Amongst the National Committee contributions to the ICOLD publication has been the Canadian Dam Association (CDA) Guidelines on Public Safety around Dams. The CDA guidelines include an approach for evaluating public safety at dams and developing and implementing a site-specific public safety plan using a risk assessment methodology.

Within the United States there exist several guideline type documents addressing public safety controls, most notably those produced by the FERC (1992), USBR (1996) and the USACE (????). In each case the documents are written at a high level, and do not include a robust methodology to assess the hazards in order to select appropriate control measures. However, most states and dam owners do not have any formal policies or guidelines for addressing public safety. Public safety at and around dams tends to fall through the cracks between state dam safety, and boating or water safety. Most of the Federal Agencies that produced these documents have each identified the need to update. This presents an opportunity to align the practice in the United States around a common set of objectives and methodologies for assessing hazards and treating risk. What is missing is a national, coordinated effort for protecting the public at and around dams, including smaller dams that are exempt because they fall below the state or federal jurisdictional size categories.

3. SECURITY CONCERNS

The increased number of extreme youth activities at dams have created a security risk in and around these structures. Many of these activities are captured by cell phones or GoPro video recording devices, and later uploaded on video website platforms. Some of the videos capture images of critical assets, and record access routes into and /or around security features that to restrict access to critical areas in and around water retention structures. This information has the potential to be used by threat actors in pre-attack surveillance, preparation, and planning. For this reason alone, the security community should be involved in supporting a National Public Safety program for dams, and developing training material to educate dam owns to the potential risks to security when unauthorized activities are ignored and discounted.

4. ASDSO COMMITTEE ON PUBLIC SAFETY AT DAMS AND USSD COMMITTEE ON PUBLIC SAFETY AND SECURITY FOR DAMS

In response to the growing need to address public safety issues at dams, both ASDSO and USSD have formed committees over the past two years to address the growing concerns around public safety.

Public Safety is inherently defined as the safety consequences on the public (including visitors, boaters, first responders, workers and trespassers) that are potentially exposed to hazards at dams, other than dam failures, resulting from the existence and operation of dams.

The goal of these two committees is to promote a future where all dams are safe to the public.

5. PUBLIC SAFETY FOR DAMS WORK

The efforts of the two committees have identified that the US needs a national approach towards identifying hazards created by dams that put the public at risk, while tracking public safety accidents, and evaluating the success safety measures have on minimizing the risks to the public. The following is a list of areas that would be worthwhile pursuits that could be used as good guidance, but would require significant attention and resources to address and potentially stem the growing number of public safety accidents that dam owners are facing:

- Develop and Maintain a Database of Accidents, Fatalities, and Hazardous Activities at Dams
- Monitor Trends and Relevant Issues (Examples: Dam dropping, right to fish laws)
- Assemble and Make Available Information and Resources on a public Web Page Dedicated to Public Safety around Dams. Consider a database that includes the following subject categories:
 - Research and other information on Hydraulic Hazards (emphasis on understanding physics of hazardous submerged hydraulic jump)
 - Educational Resources
 - Warning Signs & Buoys
 - Pamphlets
 - Videos
 - Websites
 - PowerPoint Presentations
 - Papers
- Post Mortem Incident Investigation Case Studies
 - Crisis Incident Investigation Team
 - After action reports
 - Case Studies of Specific Incidents (Videos of news reports, news articles, blogs, etc.)
- Development of Technical Information on Controlling Exposure and Mitigation Strategies
 - How to evaluate for and create Exclusion Zones
 - Design of Portage Facilities Around Dams
 - Patrolling
 - Information on Emergency Response/Rescue
 - Rescue Procedures
 - Rescue Equipment
 - Site Enhancements
 - Information on Eliminating Hydraulic Hazard
- Research on how to design dam structures that can minimize if not eliminate hydraulic hazards

- Structural Modifications to Dam
- Dam Removal
- Other

6. NATIONAL STRATEGY ON PUBLIC SAFETY AT DAMS

The efforts of both ASDSO and USSD have drawn significant attention from the dam community throughout the US, highlighting the growing demand for education on issues related to Public Safety. Today, both organizations are encouraging the scheduling of guest lecturers and workshops on Public Safety topics. (USSD will be hosting a CDA workshop on their Technical Guidelines on Public Safety for Dams at their April national conference in Anaheim, CA). However, more is needed. Similarly, ASDSO included a concurrent technical session on Public Safety around dams at the March 2017 Southeast Regional Conference in Nashville. Today the demand for a unified message on matters of Public Safety requires:

- **National Dam Incident Tracking Database**
- **Educational Products**
 - *Publications*
 - *Papers*
 - *Workshops*
 - *Seminars*
 - *Presentations*
 - *Public meetings*
 - *Webinars*
 - *Media briefings and consultation*
- **Message(s) that are Targeted for the Audience**
 - ***Designers*** - Avoid creating hazards & eliminate or mitigate existing hazards.
 - ***Inspectors*** - Identify hazards, recommend or enforce appropriate action.
 - ***Maintenance staff*** - Understand hazards, follow best practices for working around dams, and maintain public safety features at dams.
 - ***Dam Owners*** - Understand legal responsibilities, exposure, and risk reduction options.
 - ***State Regulators*** - Understand scope of hazards, available resources, and state regulatory practices.
 - ***First Responders*** - Understand hazards, follow best practices for emergency response, learn about latest response equipment and techniques.
 - ***Contractors/Divers*** - Understand hazards, follow best practices for working around dams, avoid creating hazards at dams when constructing temporary diversion and care of water facilities.
 - ***Recreating Public*** - Understand and avoid hazards.

- **Media** - Accurate reporting and promote public education.
- **Cooperation with other Groups Focused on Promoting Public Safety Around Dams**
 - Other Professional Associations, CDA, ICOLD
 - Boater Safety Organizations
 - Fishing Organizations
 - Parks and Recreational Agencies
 - First Responders

7. RECOMMENDATION

It is the opinion of ASDSO and USSD that the Dam Safety and Security governing bodies (National Dam Safety Review Board and DHS Dams Sector Coordinating Council) are in a position to provide support and technical assistance in the development of national guidelines and best practices for the US Dams Sector on public safety around dams. The initial intent is to develop public safety guidelines similar to what has been done for Canada and currently under development through ICOLD for participating international members. The focus of the initial technical guidelines would be to identify and illustrate best practices and risk reduction strategies that could address:

- Signage standards and guidance
- Risk assessment
- Identify and Mitigating Public Safety Hazards
- Eliminating Public Safety Hazards
- Preparing for Emergency Response in context to public safety incident at a dam
- Education

There is a significant amount of work that is needed, but the ongoing efforts within ASDSO and USSD is helping to fill in some of these gaps. The bottom line is the US requires a national strategy to address the growing trend of public safety accidents and incidences occurring at Dams and their impounded reservoirs in this country.

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