Spring has just about sprung as I write this where I am. Of course, many might question whether or not that even applies to California? What that means is there’s a good chance we are past the worst of the winter storms. If we remain incredibly lucky, California’s Oroville Dam might actually hold together long enough for critical repairs to be completed this spring and summer. I don’t think people appreciate just how close the spillway failure came to being a massive, unbelievable catastrophe. When the powers that be issued the emergency evacuation order for the surrounding communities, they fully expected the spillway to burst within the hour. They didn’t say that it “might” fail within the hour; they said that it “would” fail within the hour. Luckily, they were wrong. It is not clear how large a catastrophe that would have unleashed, but it would have been far larger than 200,000 people running for their lives indicates. That, as they say, would have been just the tip of the iceberg.

A dam failure (although apparently, the dam itself wasn’t in danger of failing; rather, it was the top 50 feet or so of the spillway) of this magnitude would have immediately demolished the towns directly downstream. It probably would have also caused the entire Sacramento River, and possibly the San Juaquin River, to breach their levees and spread out across the width of the valley. At the time of the event, the entire river system in California was full to overflowing due to heavy rains and many simultaneous levee failures were already in progress. I live on the western edge of “The Valley” — in what used to be the shallows of the annual lake that was the Sacramento Valley. I expected my house to be flooded only four or five feet deep, based on the behavior of previous floods in my neighborhood. The resulting flooding from the loss of the dam, plus the loss of miles of levees, would have returned the entire valley back to its original untamed state of being a vast, temporary, inland sea.

This raises some interesting considerations from the system safety point of view. For one, are events such as this even within the purview of our profession? After all, wasn’t this really an act of nature? I suppose the periodic flooding of the valley could be considered an act of nature, but once nature was “tamed,” it seems to me that we took responsibility for the consequences. It would have been unimportant if there were no buildings, no facilities and no infrastructure to protect — but we built levees and dams to control the rivers so that we could make use of the area for our purposes.

Assuming these are the kinds of things that system safety should be involved with, it is pretty amazing to observe what actually appears to have happened. Based on my rather hazy recollection from 55 years ago, I recall that this particular dam was controversial from its inception because it is the highest dam in the United States. It is perhaps the largest earthen dam in the world (depending on the definition of “largest”), is built on top of an earthquake fault and is situated so that its failure would destroy much of the Sacramento Valley infrastructure. Supposedly, it is built to withstand the strongest possible earthquake in the area — assuming anyone actually knows what that might be. As the lake filled, the weight of the water and the dam caused a number of local earthquakes, which further ramped up the public’s fear of a dam failure. If I recall correctly, one of the solutions to the possible failure of the dam and spillways because of earthquakes was to add an emergency spillway that worked by simply being overtopped — no fancy mechanisms required. Of course, since it was assumed that this event would never happen, the emergency spillway was never verified as capable of actually containing the flow of water that might result. It turns out that it couldn’t, and the flow that it was actually exposed to was nowhere near the maximum possible (or credible).

Then came the day the main spillway failed. We all watched in horror as the “pothole” got larger and the destruction became immense, while the lake level continued to rise rapidly with no safe way to control it. I doubt if the cause of the pothole will ever actually be
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My question is whether or not this is an example of a “non-traditional” system safety problem that we could, or should, be involved with. There are many parts of this discussion that seem like traditional system safety issues. The concerns range from siting, initial design, on-going inspection and maintenance, communications between involved entities such as various dam operators of upstream dams, and downstream impacts of levee design and maintenance, among others. It seems like a classic system safety problem, with classic system safety failures of many of the elements coming together at the same time. Actually, the problems were always there — it just took a specific set of circumstances to unveil the hazards that had been hidden from view.