Int. J. Engng Ed. Vol. 22, No. 6, pp. 1287–1296, 2006
Printed in Great Britain.
0949-149X/91 $3.00+0.00

Lessons in Social Responsibility from the Austin Dam Failure*

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While many are familiar with the Johnstown Flood of 1889, another significant dam failure in Pennsylvania occurred twenty-two years later in Austin. This paper tells the story behind the design, construction and ultimate failure of this early concrete dam and the subsequent disaster in the town below it. Correspondence between the design engineer and the dam's owner along with other period documentation provide important insights into social responsibility leading to the question: how should society protect the public from the misuse of technology? The roles played by the town citizens, engineer, owner, state and Federal governments, and a professional engineering society are examined.

Keywords: ethics; social responsibility; dam failure

CATASTROPHE IN AUSTIN

POTTER COUNTY in north central Pennsylvania has always been about trees. When the first pioneers arrived in the early 1800s, its long mountain ridges and tight valleys were thick with virgin stands of pine and hemlock. Freeman Run wends south through one of those narrow valleys, and the towering hemlocks that hugged its slopes were some of the finest known to exist at the time. In 1884 Frank H. Goodyear of Buffalo, New York bought timber tracts there and began a full-scale lumber industry. He built a large lumber mill along the Freeman Run, and a town quickly grew up around it. That town, Austin, Pennsylvania, became legally incorporated in 1888.

Over the next twenty years a separate hardwood mill and a kindling wood mill were established in Austin. A few miles south along the run, a large tannery was built in the town of Costello. The trees in the area were consumed at an enormous rate; the ridges and valleys were stripped of their virgin timber. By the early 1900s all that remained around Austin were the trees deemed unsuitable for the lumber mills and the waste wood left scattered along the slopes by the lumbermen.

Those remains provided a valuable resource for the next industry to come to Austin. In 1900 George C. Bayless of Binghamton, New York erected a major plant for the production of pulp and paper. By 1910 it employed around 200 workers. Water was an important component in the manufacture of Bayless' paper from pulpwood. The Freeman Run became the source for water at the plant. However, it was a very unreliable source. During rainy fall or spring seasons it would gush with water; in the dry summer months it would shrink to a trickle. To solve this problem, Bayless built a system to impound the water of the Freeman Run, which culminated in the construction of a concrete dam about a mile above his plant and two miles above town (Fig. 1). It was 544 feet long and rose 45 feet above ground level. A small lake formed behind the dam that contained an estimated 200 million gallons of water [1]. When completed around December 1, 1909, it appeared that the water problems for Bayless were solved.

September 30, 1911 began as a typical Saturday for the 2300 citizens and visitors to Austin. Some people got up and went to work in the mills; the stores on Main Street opened their doors for business; a matinee played at the theatre; many folks began their weekend household chores in the wooden frame homes around town, and it was primary election day. A person waiting for a shave at the local barber shop or sitting in the doctor's office could have picked up a copy of the town newspaper, *The Austin Autograph* [2], from earlier that month and read the following direct excerpts. They give modern readers a glimpse of the human lives and small town social life of the community.

> Mrs. Alfred Rees and children and Mrs. G. Appleby of Costello were shopping in town Monday.
>
> And then the whining schoolboy with his satchel and shining morning face creeping like a snail unwillingly to school.
>
> Mrs. Ben Harvey and little daughter Alvera of Wellsville are visiting relatives in town.
>
> The Methodist Sunday School last Sunday was comprised of 181 persons.
>
> There are too many mere boys smoking cigarettes in Austin.
>
> The large crowd of people that saw last Sunday's

* Accepted 27 April 2006.

Fig. 1. The Austin Dam (courtesy of the Potter County Historical Society).

> baseball game between Austin and Roulett were almost electrified by the phenomenal play made by John Coleman, who was the star of the game.
>
> B. P. Hutchison, who has been employed by the Austin Hardware Company in the harness department for some time now, is now located on Turner Street in the rooms recently vacated by Geo. Horton, where he started business for himself.
>
> Numerous recent rains will probably make the potato and corn crops in some sections almost normal.
>
> Signs of a Hard Winter
>
> If we are to believe the rural prophets, who make their predictions from certain signs they see in nature, then we must anticipate a long winter . . . There are signs they say of a hard winter.

As the newspaper indicated, it had been a rainy month, but the sun shone on the morning of the 30th. Twice before noon, false fire alarms shrieked from the paper mill whistle as a result of electrical difficulties caused by some telephone company employees working on the lines. Again at 2:00 p. m. the whistle screamed an alarm, which was ignored, not surprisingly, by many folks in town. Within minutes, a roar and a rumble were heard moving down the valley from above town. Then a roiling, tumbling, smoking, cloud-like mass appeared advancing toward Austin. In a few moments the lives of more than 2000 human beings were changed forever. For about 78 of them, death accompanied the tumultuous flood. For the rest, life hinged on a dash for survival. Escape meant finding a quick route through town to one of the slopes of the valley. Fencing to the west blocked the way for many who chose that route, and they were swept away. The men, women and children who made it to high ground, looked back and watch in dazed horror as the tumult smashed their houses, stores, factories, churches and schools into twisted piles of splintered rubble. In a matter of minutes the wave had passed, moving on to wreak havoc down the valley and on to Costello (Fig. 2). The air was filled with raw emotion and human drama as the survivors went about the task of finding loved ones, assessing the damage and later starting to rebuild their lives. For days the newspapers and other publications across the country documented the individual stories of human tragedy and heroism (Figs 3 and 4). Just as the hillsides reflected the desolation left from the fallen trees of the lumber industry, the valley along Freeman Run showed the desolation that resulted from a fallen community. In time, people would begin seeking reasons for such great loss. In time, people would begin to consider where the social responsibility should reside to protect a community from such a disaster.

No rational person would find acceptable the resulting pain, suffering and damage that resulted from the Austin Dam failure. Shortly after the disaster, people began to assess responsibility for the calamity. While initially the search was aimed at finding those responsible (and hence liable) for the failure, a larger question arose that focused on

Fig. 2. The broken Austin Dam *circa* 2000.

determining who in society had the social responsibility to prevent such harm [3]. Now, almost one hundred years later, a fresh look makes clearer the roles that people and organizations could have and should have played.

Consider now how the following parties at the time of the dam failure could have taken action to prevent it: (1) the Citizens of Austin; (2) the Design Engineer; (3) the Bayless Pulp and Paper Company; (4) The Commonwealth of Pennsylvania and (5) the Federal Government (6) a professional engineering society.

THE CITIZENS OF AUSTIN

The Citizens of Austin can be viewed as a group of individuals, who each could have sought independently some legal recourse to enforce safety measures upon the owner of the dam, The Bayless Pulp and Paper Company. They could also have acted collectively through their town council to put pressure on the paper company to ensure the dam's safety. In the first instance, works on the period [4,5] indicate that while many people had personal fears concerning the fact that they were living their lives directly beneath a huge impoundment of water, they were nonetheless reluctant to face the general ridicule that met those who spoke out publicly. One individual, who questioned publicly the safety of the dam on numerous occasions, was a grocery store owner in town, William Nelson. It is reported that townspeople would chide him and say, 'If that dam should break, you would hardly get your feet wet on Main Street.' [6] He was known to visit the dam frequently for his own 'personal inspections,' but his warnings went unheeded. Tragically, both he and his wife perished in the resulting flood.

A Coroner's Inquest was held in early November of 1911 into the deaths of a few of the people who perished in the flood. During the examination of several of the town's citizens, the following question was raised, 'Did you or did the town ever express your concerns about the safety of the dam to the Bayless Company?' The clear implication by the questioner was that the responsibility belonged to the citizens to do so. The answer to the question was invariably, 'No.'

An article [7] written within a week of the disaster posed some related and important questions.

> Why, many still ask, did not the town government of Austin concern itself with this vital phase of the people's safety? The members of the town council agree that it was never discussed by them officially. A member of the board of county commissioners states that the body also never considered the matter— although the dam and mill were both outside the borough limits of Austin and in their jurisdiction. Who were the town officers? F.N. Hamlin, superintendent of the Bayless mill, was president of the council. Another member of this body was the master mechanic at the mill. 'With Hamlin as president,' remarked one of the other members, 'it would have

Fig. 3. Austin before the dam break (courtesy of the Potter County Historical Society).

taken a pretty good man to get up on his feet and say anything about the condition of the dam.' Who was the town burgess? Michael Murrin, superintendent of some outside work for the Bayless mill. Were these men as town officers likely to make a protest about the Bayless Company?'

The conclusion:

> It shows a predominantly American community so saturated with dependence upon an outside power from which it drew its livelihood that its very instinct for self-preservation was inhibited.

Fig. 4. Austin after the dam break (courtesy of the Potter County Historical Society).

THE DESIGN ENGINEER AND THE OWNER OF THE DAM

The Design Engineer for the Austin Dam was a professional consulting engineer from Wilmington, Delaware, T. Chalkley Hatton, M.Soc.Am.C.E. (according to his stationery). He was hired to design the dam by the Bayless Pulp and Paper Company's President and owner, George C. Bayless. Beginning early in 1909, Hatton and Bayless had a continual string of correspondence [8] regarding the design and eventual construction of the dam. The following critical excerpts provide insight regarding their individual view (or lack thereof) of social responsibility and the safety of the dam.

While reading the following direct quotations from the correspondence, pay particular attention to three aspects of the dam's design and construction. They proved to be critical factors in the subsequent failure: (1) exclusion of a recommended control valve for the drain pipe to empty water from behind the dam in a high-water emergency; (2) exclusion of a concrete barrier, which was called a 'cutoff wall,' recommended to be built beneath the upstream face of the dam to prevent water from seeping under the structure and causing it to slide; and (3) construction that exceeded the recommended height of the dam allowing excessive water pressure to push against it.

Here are the relevant excerpts from the correspondence between T. Chalkley Hatton and George C. Bayless:

March 25, 1909—Hatton to Bayless:

Total cost estimate—$84,040.68

Included—Gate house complete with gate valves, screens, channel walls, cast iron blow-off and supply pipe through the dam, est. $3,755.00

March 29, 1909—Bayless to Hatton:

I had a meeting of our directors and they seemed unwilling to expend more than about $85,000.00 on this water proposition and we will have to cut every possible corner.

Can we not also decrease the cost of the filter or screening proposition for leading the water down from the dam to the mill, and for cleaning out? This item is figured at nearly $3,800.00, and I hope we can simplify it and cut it down. Please do everything you can to reduce the cost of this construction, making it safe of course at the same time.

March 30, 1909—Hatton to Bayless:

Regarding cutting corners on the work, I assure you I am in perfect accord with your desire, and to do this I have gone over and over my plans, having made three complete sets to date, and cut each section down a little until I have not a yard more material of any kind than I can do without in order to make it work safe.

Yes, I can cut the gate house out entirely, and put the 36′ cast iron pipe through the dam with screen chamber in the upper end. Putting a 20″ Y on the lower end of the 36″ pipe, a 36″ gate valve and a 20″ gate valve, and using one pipe for both cleaning out and supply. This will cut off $1,800.00 from the estimate.

It is my purpose to keep the cost of this dam down to its lowest point, but I must insist, so long as I am consulted by you, upon its being safe, both now and hereafter, not only for your safety, but for my own reputation as an engineer. (Note the design at this point took the dam 11 feet below the ground surface.)

May 24, 1909—Bayless to Hatton:

I am sorry that the rock you found at eight feet below the natural surface of the ground was not sufficiently thick so as to make a cutoff wall unnecessary. This is an expensive part of the job and I am anxious to hold the price down to the minimum cost wherever we can and make the dam secure.

October 1, 1909—Hatton to Bayless:

There is point, however, with which I am not entirely satisfied, and that is the absence of a proper valve on the outer end of the 36′ cleanout pipe.

While I understand that you do not anticipate using this cleanout pipe, still there are times arise, or likely to arise, in all high dams, when for safety of the structure, it may be desirable to open up the cleanout pipe and release the pressure, and if you had a 36′ valve to do this, it could easily be done. Whereas with a cap over the 36′ pipe, as the plan now has it, it would be almost impossible, if not quite impossible, to take this cap off with the pressure against it, and I still feel that a 36′ valve should be placed on the end of this cleanout pipe and I wish you would take this matter under consideration and advise me of your decision.

October 2, 1909—Bayless to Hatton:

I do not think at the present time we will put a 36″ valve on the front side of the dam for controlling the water pipe. We have a cap made for the pipe and it will be sufficient at least for the present.

November 1, 1909—Hatton to Bayless

Last night I received a telegram from Mr. Rommel, stating you desired to raise the spillway for the dam, two feet, and asking for instructions today. I have made a computation of the structure, based upon increasing the height of the water two feet, and I find that it would be dangerous to the stability of the structure to increase the height of the water above what we have provided, and I send you a little sketch, showing wherein it would be dangerous. . . . I, therefore cannot recommend to you any increase in the height of the water above what has already been provided, and cannot make any changes to the dam, unless you instruct me to do so over your written signature, thus relieving me of all responsibility.

November 6, 1909—Hatton to Bayless

You write that a few weeks ago you thought it best to put two more feet on top of the dam, and at the same time you raised the spillway two feet. If you did these two things at the same time, I never knew it. My assistant engineer advised me a few weeks ago that you directed him to raise the free-board two feet, but no mention was of the spillway being raised, until last week, when you wrote a letter to Mr. Hamlin, at the bottom of which you added in ink, instructions to raise the spillway two feet. This letter was shown to me when I was in Austin this week.

Ordinarily such directions are taken up with your consulting engineer, who is given the opportunity of advising with you before a change of plan is authorized, but in the Austin work all direction for changes have been given without the Consulting Engineer knowing anything about it, except that he has been informed by his Assistant, after directions have been given to him.

November 8, 1909—Bayless to Hatton:

I understand that the top of the spillway on your plans was 4 feet below the top of the dam and that we could use three feet of splash boards in the spillway provided by doing so the water did not overflow the entire length of the dam. . . . I assumed that the dam would hold, if it was in time of flood filled to the top of the walls with water. If this is the case, we might as well make the spillway two feet deep instead of four feet, and not provide any splash boards.

In regard to instructions given to Mr. Hamlin, he is the only way we have to get anything done on the dam. Mr. Hamlin is of course expected to report the matter to your assistant and he to you. Letters which I have written from this office to your Wilmington office have some of them remained unanswered and others have been answered a very long time after the letters have reached Wilmington and consequently we concluded that the only way to do business was through your representative at Austin who probably was in touch with you at all times.

Any suggestions of ours in regard to the dam we would expect to be referred to you for final decision, as you are supposed to be the only one to determine these matters so far as we are concerned.

These words in their correspondence speak clearly and loudly for themselves. Hatton's recommended valve and drain pipe provided a critical safety feature at a modest price when compared with the cost in life and property from a dam failure. His recommended cutoff wall provided some protection against instability of the dam's foundation, which proved to be the greatest uncertainty in his design. The precise height constraint that Hatton placed on his design was closely linked to his tight limitation on building materials to save costs.

Bayless' responses to these recommended safety features showed him to be a flinty eyed businessman, who looked solely for every possible place to save a dollar. This was his clear intention and not a mere oversight as indicated by his direct instructions to Hatton's assistant and others at the worksite to countermand the original recommendations regarding the drain pipe valve, the cutoff wall and the final height of the dam. Given that the flood destroyed almost his entire pulp and paper plant, he proved to be penny wise and pound foolish to the extreme. His decisions were bad business as well as lacking even a modicum of social responsibility for the lives and livelihood of his neighbors downstream in Austin. (Actually they were his neighbors more removed as he resided in Binghamton.) In all of this correspondence, no reference was made to the safety of the citizens of Austin.

On the surface, Hatton's part of the correspondence suggested that he tried to do a proper job. However, to evaluate fully his sense of social responsibility, the following two questions need to be answered:

1. Was the dam safely designed?
2. What more could Hatton have done to prevent the tragedy from the dam's failure?

The first question addresses his technical competency, the second his moral compass.

An evaluation [9] of Hatton's design for the Austin Dam revealed that he followed the standard design criteria [10] of his day, but not successfully. He chose to design a gravity dam, which is a dam that stays in place and holds back water from the dam's sheer weight. This type of dam was recommended for situations where the base of the dam rested on solid rock with no chance for water to seep underneath. Based upon tests that he conducted, Hatton thought the rock along the Freeman Run met this condition. However, lack of construction of his recommended cutoff wall behind the dam contributed to substantial seepage beneath it. The design criteria around 1900 were intended to prevent two major modes of failure (Fig. 5). The first was tipping. In this situation a

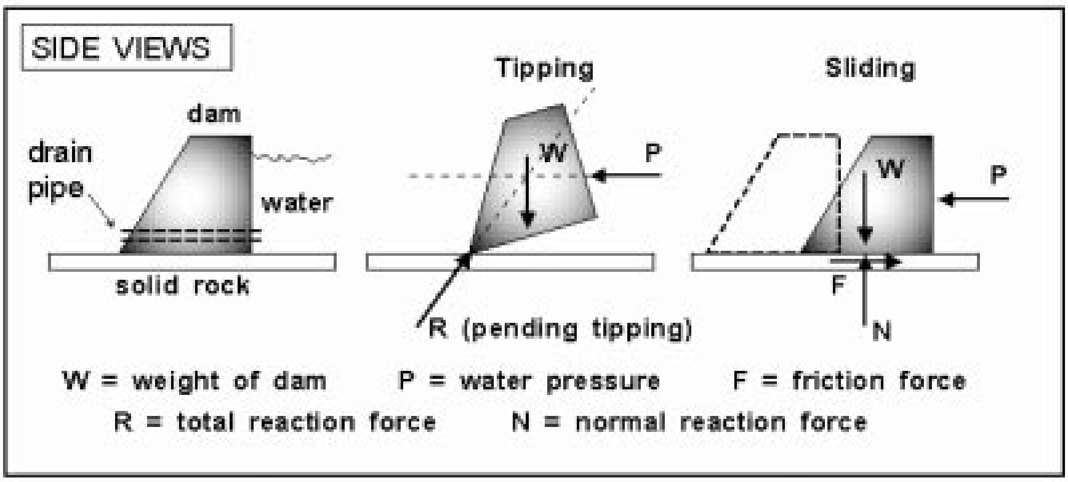

Fig. 5. Gravity dam failure modes *circa* 1891 design criteria.

dam would tumble over if the weight of the dam were insufficient to counteract the tipping action created by the pressure of the water behind the dam. This is an easy calculation to perform, and the weight is directly proportional to the area of the cross section of the dam (shaded side view in the figure). In the cited correspondence, Hatton indicated that to save material and hence cost, he shaved down his cross section to the point where he reported a safety factor of 1.88 beyond what he needed to prevent failure. A safety factor quantifies how many times a given design variable exceeds the minimum value required for safe operation. In this case Hatton designed his dam to be 1.88 times heavier than that needed to prevent it from tipping over. The standard of his day called for a safety factor around 2.0, so his design was marginally safe with respect to tipping. Independent calculations [9] verified Hatton's assessment of potential tipping.

The second mode of failure involved the dam sliding downstream under the pressure of the water behind the dam. To prevent this, the dam's weight must generate a sufficient frictional force between itself and the rock below to resist the force arising from the water pressure. In the simplest situation, the ratio of the friction force beneath the dam, F, to the weight of the dam, W, is defined as the coefficient of friction. It depends upon the type and condition of the materials in contact. If the coefficient of friction in a given situation were equal to 1.0, then the friction force would equal the weight of the object above. When a person steps into a slippery bath tub or on to an icy sidewalk, the coefficient of friction becomes closer to zero, and their weight does not help to prevent them from slipping. Based upon calculations of the coefficient of friction required to keep the Austin Dam from sliding, it appears that the design was marginal at best, and inadequate if any seepage occurred between the dam and the rock. Required coefficients ranged from 0.44 to 0.83 for water levels behind the dam ranging from 45 to 55 feet. Possible values from the literature in 1891 [12] ranged from 0.5 to 0.75 for contact between dry rock and masonry. The problem was more critical when water existed between the contacting surfaces. For example, the coefficient of friction [11] reported for granite on moist clay was 0.33. This value was far below the range of needed values to prevent the Austin Dam from sliding. After the dam was constructed, significant amounts of water were reported to have seeped beneath the dam. Hence the contact surface between the dam and the rock below would have been well lubricated. Even with the proposed cutoff wall, Hatton's design failed to guarantee the dam's safety for the sliding mode of failure.

It is clear from Hatton's correspondence that he had serious concerns about the dam's safety. He knew that Bayless had overruled several of his recommendations that were related directly to that issue. Yet, his primary concern appears to have been his own reputation and liability. It is disturbing to note that in the excerpt from November 1, 1909, Hatton believed that Bayless' signature over any changes in the recommended design relieved him, Hatton, of *all* responsibility. Nowhere did he express concern for the safety of the citizens living down the valley below the dam. One could argue that he was honoring his contract with Bayless, wherein he could only suggest, not approve, design recommendations. While that may or may not be true, it did not relieve him from his professional and moral obligation to look out for the well being of the community that was affected by his work. So, what else could he have done? The answer is simple. He could have warned the people in town of potential danger and pressured Bayless to make the dam safe. It is reported [13] that one of the first telephoned warnings to the townspeople that the dam was failing on September 30th came from the ladies who operated a brothel in a house that sat on the hillside that overlooked the dam. It would appear that Cora Brooks, the owner of the establishment, had the sense to issue a warning when she saw pending danger. Hatton was as guilty as Bayless of neglecting his social responsibility.

There is another chapter in the brief history of the Austin Dam that is even more unbelievable and highlights further the negligence of Bayless and Hatton. The catastrophe of September 30th, 1911 was not the first structural failure of the dam. Within two months after the completion of the dam, a sudden January thaw in 1910 caused the water level behind the dam to rise to more than 40 feet and to flow over the spillway. During a visit to the dam, plant superintendent Hamlin observed several large cracks and significant movement in the structure; it had bowed thirty-two inches at the top center and eighteen inches at the bottom center (Fig. 6). He notified people in town of a possible dam failure and set about to relieve the water pressure on the dam. The 'times likely to arise' (about which Hatton has warned Bayless in the correspondence of October 1, 1909) had come. And they came much sooner than anyone expected. The 36″ valve that Hatton had so strongly recommended to drain the impoundment was sorely needed, and the cap that Bayless had installed instead was located directly under the water that rushed over the spillway. As Hatton predicted, it could not be removed. Desperate to reduce the water level, company men used dynamite to blow out several feet of the top of the dam on the left side when facing it from downstream. In addition, they lowered another satchel of dynamite down from the top of the spillway and blew the cap off of the cleanout pipe. The water behind the dam was drained, and a disaster was averted. However, the cracked structure was further weakened by the blasting, and the true extent of damage to the dam was never determined.

Bayless contacted Hatton shortly afterwards for recommendations to restore the dam for 'safe' operation. Hatton in turn contacted Edward Wegmann, Jr., formerly chief engineer of the New York Aqueduct Commission and a recognized expert on dam construction. Wegmann and Hatton submitted two primary recommendations to Bayless in February. The first called for nearly doubling the cross section of the dam and hence increasing significantly its weight by piling large rocks and rubble against the downstream face. The second requested the excavation of a large ditch on the upstream side down to impervious rock stratum and filling it with concrete to build a proper cutoff wall to prevent seepage. Hatton later stated [14]:

> The plans and recommendations were submitted in February, 1910, since which date I have had no further connection with the dam and do not know what measures were taken to reinforce it.

Bayless ignored the recommendations and initiated repair of the holes caused in the dam by the dynamite blasting. Over the following year the water was permitted to accumulate behind the dam until September 30th, 1911, when it once again ran over the spillway. By then, of course, Hatton and Wegmann, having given their advice, had washed their hands of the whole situation.

STATE AND FEDERAL GOVERNMENTS

Institutional organizations in society that could have exercised their social responsibilities prior to the Austin Dam failure were the professional engineering societies, the Commonwealth of Pennsylvania and the Federal Government. It is not that these groups had no prior indication of the extensive damage to life and property that could result from a poorly designed, built or maintained dam. Twenty-two years before on May 31, 1889 an earthen dam failed in Pennsylvania because of poor reconstruction and maintenance. The resulting Johnstown Flood [15] destroyed several communities down the Conemaugh Valley and

Fig. 6. The bow in the Austin Dam in the winter of 1910 (courtesy of the Potter County Historical Society).

took the lives of over 2000 people. At the time of the failure, the earthen dam was owned by the South Fork Fishing and Hunting Club. The club's membership was composed of some of the most powerful industrial leaders of the 19th century, including Andrew Carnegie, Henry Clay Frick, Andrew Mellon, Henry Phipps and Robert Pitcairn. That alone may account for the fact that that the flood was deemed an 'Act of God'. No liability was assessed to anyone or any group, and no state or federal legislation regarding dam construction or safety followed.

In a recent historical fact sheet, the Pennsylvania Department of Environmental Protection (DEP) [16] stated that:

> Despite the complaints of many downstream residents and officials, the club did not correct [the earthen dam's] problems, and in 1881 [at the time of the dam's reconstruction] no state or federal laws existed to require these corrections.

Following the Johnstown Flood, there were over 20 additional dam failures in the State of Pennsylvania culminating in the Austin Dam failure before legislation on dam safety was proposed.

Frank E. Baldwin's story illustrates the conflicting values that existed for many people in positions of power during this period. He was a state senator from the district around Austin. He was also the attorney for the Bayless Pulp and Paper Company. He owned thirty houses in Austin, which he rented out. His parents and a sister lived in town. As a state legislator he was in a position to work for legislation that would have ensured the safety of the Austin Dam. However, before September 30, 1911, it was well known that he favored 'property rights over human rights.' In a tragic irony he lost both as his parents, sister and houses perished in the flood.

Shortly after the Austin Dam failure, Pennsylvania Governor John K. Tener encouraged the state to adopt dam safety laws. Local lore [17] has that the proposed law stalled in the State Legislature until April 1912 when the sinking of the Titanic caused a groundswell of public safety interest in the country. This anecdote reinforces the perception that is frequently heard even today regarding governmental inaction in the public's behalf . . . Some people will have to die before anything gets done. Again from the PA DEP fact sheet [18]:

> Finally, in 1913, the Water Obstructions Act [19] (Act of June 25, 1913, P.L. 355) was passed, empowering the Water Supply Commission of Pennsylvania to regulate the design, construction and maintenance of dams and other water obstructions. . . . One of the most important provisions of this act gave the Water Supply Commission the power to investigate the condition of existing dams and other water obstructions and, if the structure was found to be unsafe, require the owner to repair or remove it. If the owner could not be found, or refused the commission's instructions to repair/remove, the commission had the power to repair or remove the unsafe structure and recover the cost of said operations from the owner.

Therefore, the Austin Dam failure had at least one positive, if belated, outcome: the creation of the first, powerful law in a major industrial state aimed at protecting the public from unsafe dams. (The State of Rhode Island reported that its dam inspection and inventory program began in 1883 [20].)

Even after the Austin Dam failure, the federal government maintained the position that dam safety and inspection were primarily state responsibilities. This is a position that is still in effect. However, in 1972 the U.S. Congress passed the National Dam Inspection Act, which authorized the Secretary of the Army, acting through the Chief of Engineers, to carry out a national program of inspection of non-federal dams for the purpose of protecting human life and property. Between 1978 and 1981, the U.S. Army Corps of Engineers inspected 749 high-hazard dams in Pennsylvania. A high-hazard dam is defined as one so located as to endanger populated areas downstream by its failure. Reports from these investigations were filed with the PA DEP on each dam, and in the years since, the agency has continually worked with the owners to maintain or replace them when necessary.

PROFESSIONAL ENGINEERING SOCIETY

Finally questions were asked shortly after the Austin Dam failure about the social responsibility of the professional engineering societies [21].

> [Since January of 1910] Where were the engineers of the state of Pennsylvania during the eighteen months that this dam 'was the sword of Damocles'? If an epidemic had menaced the health of 2300 people we should have considered it the duty of the medical profession to have pointed it out and initiated movement speedily to end it. May not the public fairly ask that with respect to public safety the engineering profession show the same sort of spirit and activity we are beginning to expect from the medical profession with respect to public health.
>
> A committee from the American Society of Civil Engineers, consisting of some of its most distinguished members, visited Johnstown after the disaster to that city twenty-two years ago. They made a report. It dealt with the engineering problems shown by the demolished dam, and it doubtless has been of great value in spreading abroad a sounder technique of dam erection. But it failed entirely to deal with possible legislative measures which might have assured a more general living up to those standards. Nor is there any evidence that the engineering profession in Pennsylvania made any effort on the basis of that report to secure the enactment of any law looking toward the more adequate protection of the people of that state, though the *Engineering News* twenty-two years ago declared that the time had come for establishing state supervision, in the interest of public safety, of all public dam construction.

It is a fact that the professional engineering society that had the closest ties to dam design and construction was Hatton's own Soc. Am. C.E., the American Society of Civil Engineers, now known as ASCE. Apart from the encouragement of laws on dam safety and liability, Soc. Am.C.E. could have worked actively to promote a culture among its members that placed social responsibility at the top of their professional priority list. Today such a canon for professional behavior is embodied in the engineers' code of ethics. But in the early 1900s, the professional societies viewed issues of social responsibility to be left solely to the purview of each individual's own conscience and moral compass [22].

CONCLUSION

In conclusion, with the exception of a very few citizens of Austin, not one of the parties involved with the design, construction or operation of the dam at the local, state or federal levels displayed any sense of social responsibility. All, including governmental and professional organizations were silent on the responsibility for such a tragedy. These lessons from the Austin Dam failure can serve as a reminder to all citizens and societal organizations and institutions of the necessity for constant vigilance in seeking to utilize and monitor technology in ways that are consistent with public safety and well being.

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13. Largey.
14. Taylor, 1115.
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17. Private communications, Donald Martino, Chief, Division of Dam Safety, PA-DEP, Harrisburg, PA, (10/29/2003).
18. *DEP Fact Sheet*.
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