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What Does Safety Cost?

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One hundred and twenty years ago a fire in the cold storage facility at the World's Fair in Chicago claimed the lives of 16 victims, mainly fire fighters, and injured many more.¹ Recent news reports of multiple fatalities in China and India have shown that the lessons have still not been learned.

Multiple contributory factors in the Chicago fire were identified in the paper I presented to ASHRAE in 2009.¹ The plant was steam-driven and the chimneystack from the boilers had not been built according to the approved drawings, leaving the decorative wooden trim at the top of the stack liable to be ignited by the hot gases. The boilers had been reduced from the original specification to save money, but the refrigeration load had been increased. The structure of the building was made of flammable material and the air-distribution system within the building helped to spread the fire.

Emergency resources on site were inadequate; for example, there were no ladders capable of reaching the top of the stack, and the water pumps did not have enough pressure to spray it from a lower level. Completion of the building was delayed by late changes to the design, including the addition of an ice rink on the top floor of the building, which was being commissioned on the day of the fire. The plant had probably never been worked so hard before, and was not properly commissioned. There was supreme overconfidence in the construction company, store operators and fire department.

The lessons for today are as relevant as they were 120 years ago. The original designs were not followed in order to save cost, which greatly increased the risk of accident. We still see people taking uncalculated risks by skimping on safety provisions in projects or by ignoring apparently unimportant design details to save money. It is also evident that many warnings were ignored in the 1893 incident, and the same is true today.

Systems seldom fail catastrophically without there being a prior series of advance warnings. For example, liquid hammer can cause large ammonia leaks from

defrost systems, but it usually does not break the system the first time it happens. Warning signs such as banging or knocking during defrost must not be ignored. It is extremely important to develop a safety culture that records "near misses" as well as accidents and treats them as seriously as if a casualty had occurred.

Investigating accidents such as the Chicago Cold Store fire is difficult because sometimes there is not enough information but there also can be too much. It is possible to have two contradictory statements, and the investigator must consider whether each witness is credible, whether his statement makes sense and whether it matches what other people are saying. Two apparently contradictory statements can sometimes be reconciled when the whole story is known, but it is also possible that both witnesses are wrong and the truth lies somewhere else.

Eyewitness accounts are particularly useful—they tell you what they saw, and what they heard, smelled and felt. They also tell you what they didn't experience—for example,

there are no reports of a smell of ammonia immediately before the fire. They will also describe things that they saw but didn't understand—for example, several witnesses to the Chicago fire mentioned a puff of white "smoke" from the base of the chimneystack. This is thought to have been steam, vaporized by a fire at the foot of the chimney when the fire fighters started spraying the top of the stack.

Follow the design, even if you don't understand it, and seek approval from the designer for any changes. Make sure that the plant is properly commissioned, do not just set to work. This includes confirming to the designer that the plant behaves as intended, with no surprises. Make sure that safety equipment is provided and is in good order and establish a review procedure to ensure that the plant and associated equipment remains in good order. Use news of other accidents and near misses to improve your plant safety. It is good to learn from your mistakes, but it is always better to learn from someone else's.

References

1. Pearson, A. 2009. "Lessons learned from the cold storage fire at the Chicago World's Fair of 1893." *ASHRAE Transactions*. ■



The lessons of the 1893 Chicago fire are still not being heeded.

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