Risks Assessments for Fuels & Process Heating Equipment
"Codes & standards are not enough!"

By John R. Puskar, P.E.

The idea of codes and standards is lovely. It's guard rails for the safe design, installation, operation, and maintenance of fired equipment. However, in my opinion, lots of people have relied on them way too much and don't understand that they are minimum requirements for what should be considered "good practices". When I tell people some of the flaws and hidden minor issues in many codes and standards, they look at me like I have two heads. If you think that you've done all you can for the cause of safety by trying to comply with a code or standard, you are sorely mistaken.

So maybe you've got ovens or furnaces next to each other because it makes sense from a material handling and production perspective. There's nothing in a code or standard to tell you not to do that. However, if one of them has a firebox explosion, the other could also be out of service, which could be your facility's total productive capacity.

Maybe fuel trains are constructed such that an accident near the firebox takes out gas piping before the safety shut-off valves. If this were to happen, fuel could be released for some extended period until someone thinks about getting to a manual shut-off valve. There's nothing in any codes or standards that I know of that addresses this kind of risk.

The scenarios identified above have happened many times. NFPA, the National Fire Protection Association, publishes more than 300 documents (codes, standards, and recommended practices). I counted 167 of them that mention the term "risk assessment." A summary of the structure of some documents is A) Do everything that the manufacturer of the equipment or components says you are supposed to do, B) Do everything within the main body text of this document, C) Do a "risk assessment" of critical areas. This "risk assessment" requirement makes for a "catch-all" in many cases for things that can be a problem but is not spelled out in

the document. It's not necessarily because the document is terrible; it's more because there are infinite numbers of possible variations of equipment, operating conditions, operators, fuels, etc., that cannot be well addressed in the consensus document creation process.

Document users generally understand A & B. However, unless you've spent time in the process industry, you're likely to have absolutely no idea of what doing a "risk assessment" means. If you look for definitions within some of the NFPA documents, you might find what appears within NFPA 1250 (Recommended Practice in Fire and Emergency Service Organization Risk Management), "An assessment of the likelihood vulnerability and magnitude of the incidents that could result from an exposure to hazards."

Many ask, "How do I conduct a risk assessment?" If you try to answer this, you may find rampant confusion. Many terms are thrown around like PHA[1], HAZOP[2], and "What if" studies. NFPA 654[3], it states that "7.2.6 A documented risk assessment acceptable to the AHJ, (authority having jurisdiction), shall be permitted to determine whether or where a dust explosion hazard or dust flash-fire area exists." The problem is that people on a project or constructing something rarely understand just who the AHJ is actually. The definition of an AHJ is also somewhat confusing. In 40 years, I have yet to meet a building code official or other AHJ who knows much of anything about conducting risk assessments. There is also scant little guidance given on what techniques to use.

I am writing this article to provide some insights into what I consider a critically important world (risk assessments) that is somewhat cloaked in mystery for a large segment of people outside of the immediate process industry.

If you're new to the topic and are interested, let me tell you that the motherlode of this subject matter resides within the AIChE[4] and its CCPS, (Center for Chemical Process Safety). They have numerous great courses, books, and webinars that can make you an expert. I have also found the ANSI/ASSP[5] standards Z690.1,.2, and .3 very helpful. These are titled respectively, Risk Management Principles and Guidelines, Risk Assessment Techniques, and Vocabulary for Risk Management. You may be surprised to know that there's a table with dozens of different techniques in the Risk Assessment Techniques document. It's essential to pick the right technique for the right circumstances.

I think that perfect should not get in the way of good. You might try the Zurich Hazard Analysis Process if you're new to the topic and want to experience a tool that I have found very helpful and not complicated to use or understand. If you Google it, you'll find it and explanatory materials and even software you can download at no cost. I have personally applied this to many projects to enhance the level of safety and reliability well beyond just following codes and standards.

The process safety world and all of the great tools and insights it brings has a home within many fired equipment standards. These worlds (process safety and fire protection) are colliding. You would do well as a professional and as an organization to reach out and welcome this coming trend before it's no longer a choice but a necessity. There are lots of things to learn and many tangible benefits for new projects and even for assessing things once they are installed.

[1]PHA, Process Hazard Analysis, (see also OSHA PSM requirements and OSHA PHA)
[2]HAZOP, Hazards and Operability Study, (a risk assessment technique)
[3]Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids.
[4]American Institute of Chemical Engineers, www.aiche.org
[5]American Society of Safety Professionals, www.assp.org

About the Author

Mr. Puskar is currently the President of Prescient Technical Services in Cleveland, Ohio. His firm provides strategic safety solutions related to flammable gas safety and the prevention of fires and explosions related to piping systems and combustion equipment in the oil and gas industry. Mr. Puskar is a licensed professional engineer in Ohio and 6 other states. Mr. Puskar holds a bachelor's degree in Mechanical Engineering from Youngstown State University and an MBA from the Weatherhead School of Management at Case Western Reserve University in Cleveland, Ohio. Mr. Puskar is the 2015 National American Society of Mechanical Engineers (ASME) Uzgiris-Barnett medal winner for a lifetime of safety contributions to the industry. Mr. Puskar has served on several National Fire Protection Association (NFPA) standards and code committees including 86 (ovens and furnaces), 85 (boilers), 820 (wastewater treatment plants), and 56 (flammable gas piping safety). Mr. Puskar served as a Senior Energy Systems Engineer at Standard Oil of Ohio before leaving in 1984 to start the world's largest industrial fuels and combustion equipment safety testing firm in the world in 1984. He later sold the company with 43 employees and worldwide operations in 2011 to Eclipse Combustion. His firm lead the creation of corporate safety programs related to fuels and combustion for Ford Motor Company, General Motors, Alcoa, ConAgra, US Steel, and dozens of others. Mr. Puskar has published and presented more than 50 papers at conferences and in peer-reviewed journals. Mr. Puskar's first book was released in 2014 by John S. Wiley & Sons, "Fuels and Combustion Systems Safety, What You Don't Know Can KILL You".