



# PROPERTY



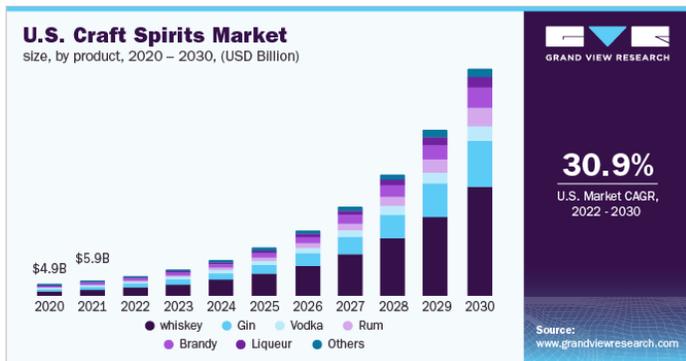
## COMMENTARY PAPER

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# Production of distilled spirits is fraught with risk

Distilleries have experienced significant growth in the past few years. COVID-19 lockdowns lead to elevated alcohol consumption in general, but now that social and business restrictions have been lifted in several countries, tasting rooms have renewed traffic. A significant portion of this growth can be attributed to the adoption of micro-distilleries, which are popping up globally. Micro-distilleries are often craft-style facilities – far smaller than their commercial counterparts – that produce hard alcohol in small quantities, usually in single batches.

Many commercial distilleries are located in rural areas. In contrast, micro-distilleries – their equipment, barrel warehouses and mash rooms – are often located in repurposed buildings in densely populated urban centers. The good times are expected to keep barrels rolling for years to come. Grand View Research forecasted a compound annual growth rate (CAGR) of 30.9% for the U.S. craft spirits market between 2020 and 2030.



## Distillery hazards

The hazards associated with distilleries differ at various stages of production and are minimized or exacerbated by how well the equipment and structures are maintained. To understand these hazards, let's explore the production process.

According to Diane Spinner, principal consultant fire services at EFI Global, there are multiple production steps and risks to consider. The first step includes milling, which is the separation of grain from foreign objects, crushing the grain open, and grinding the grain into a suitable consistency. Grain milling produces a great deal of dust, which can be highly combustible in large quantities.



The second step includes malting – germination of barley followed by drying, and the third step includes mashing – a process that combines the crushed grain with hot water in preparation for fermentation. During the fourth step of fermentation, the alcohol content is quite low, so fire risk isn't as much of a concern. Once distillers get to the fifth stage, referred to as distillation, ignition is a serious concern due to the flash point of ethanol. In this case, “flash point” refers to the lowest temperature at which ethanol evaporates to form a mixture with air that could ignite if exposed to an open flame or spark. Distillation is therefore the process of vaporizing the ethanol in an effort to separate it from water and collect the condensation.

Ms. Spinner concludes by stating that, spirits age in oak barrels usually for a period of at least three years. Over time, some of the flammable liquids in the barrels evaporate into the air – also known as the “angle's share” – which creates an explosive atmosphere. Many large fires have occurred in the barrel storage facilities.



## Fire code

Up until 2021, the distillery industry was largely self-regulated. When considering the larger commercial distilleries and their typical rural locations, fires rarely spread beyond those facilities. However, due to the growing popularity of micro-distilleries and the risks associated with their urban settings, the 2021 international fire code (IFC) was updated to include a new chapter (chapter 40) that clarifies and specifies requirements for the storage of distilled spirits in barrels and casks.

- Section 4003 – Precautions against fire: 4003.1 spill control, 4003.2 ventilation, 4003.3 sources of ignition. Example, “The rooms and spaces shall be provided exhaust ventilation at a rate of not less than 1 cfm per square foot [0.00508 m<sup>3</sup>/(s · m<sup>2</sup>)] of solid floor area. The exhaust ventilation shall be accomplished by natural or mechanical means, with discharge of the exhaust to a safe location outside the building.”
- Section 4004 – Storage: 4004.1 storage, 4004.2 empty containers, 4004.3 basement storage, 4004.4 bulk beverage storage area. Example, “There shall be no storage of combustible materials in the bulk beverage storage area not related to the beverage storage activities.”
- Section 4005 – Fire protection: 4005.1 automatic sprinkler system, 4005.2 portable fire extinguishers. Example, “The storage of distilled spirits and wines shall be protected by an approved automatic sprinkler system required by Chapter 9.”

## Distillery loss scenarios

### Bardstown, KY - fire

Thunderstorms rolled through Bardstown, Kentucky with sustained winds of 75 mph, torrential rains and vivid lightning. A warehouse utilized to house aging whiskey barrels, also called a rickhouse, caught fire. While the 42 rickhouses on the grounds were spread apart for risk control, barrel after barrel of high-proof ethanol exploded with some flames reaching 350 ft. into the air. In total, six other rickhouses caught fire and 90,000 barrels of whiskey were consumed. At the time, the lost barrels represented 2% of the world’s whiskey. According to the president of the distillery, “The fire was so complete that there was little evidence for experts to examine.” Investigators determined that there wasn’t any indication arson was the cause and classified the fire as undetermined.



### Hardin, KY - explosion

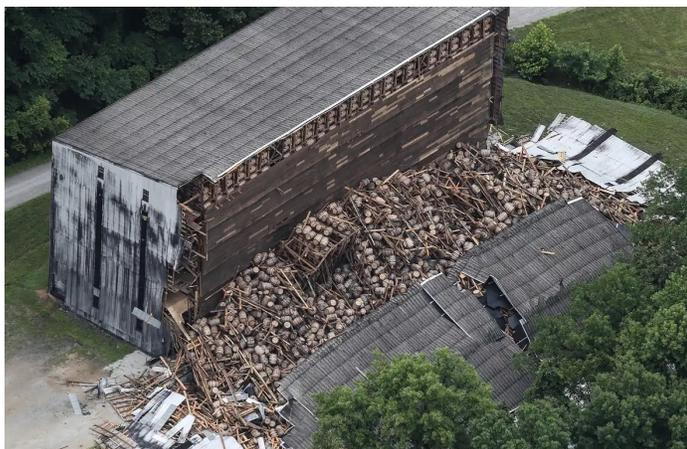
An explosion within a moonshine distillery left two distillers with severe burns, one of which succumbed to his injuries. The distillery was severely damaged. The investigators report noted that, “The over-pressurization of a still – an apparatus utilized in the production of moonshine – that was neither designed to hold pressure nor equipped with a correct pressure relief valve, likely led to the rupture and subsequent fire that killed one worker and seriously injured another.”



The report goes on to state that, “The rupture is believed to have caused the contents of the still to reach high temperatures that resulted in burn injuries to the two employees. Pop-off valves and pressure gauges are utilized to reduce the potential for a blow-out. The valve installed on the still that failed was rated for 150 pounds per square inch (psi). Being that the still was not designed or intended to be a pressure vessel, a pressure relief valve rated at 150 psi appears extremely excessive. Further, the information sheet regarding this particular model still states that each Revenoor still is built with a safety valve and operates on less than one pound of pressure. This is in direct contradiction to the rating listed on the valve installed.” The distillery was cleared of any negligence. The distillery owner and surviving employee are in litigation with the still manufacturer over installation and the subsequent sale of the Revenoor still with the wrong pressure relief valve.

### **Bardstown, KY - collapse**

A decades old rickhouse designed to store 20,000 barrels was undergoing repair when it experienced a partial collapse. Approximately 9,000 barrels were involved in the collapse. Two weeks later, the rest of the rickhouse collapsed. The rickhouse was 1 of 29 built on the grounds that had a concrete foundation and a wooden structure with aluminum siding.



Approximately 9 months later, at the same distillery, a beer well failed. Once fermentation is complete, the fermented batch is transferred to a surge tank. This tank is called a beer well and allows the distillery to ferment a new batch while the beer wells content is waiting to be distilled. 120,000 gallons of whiskey mash spilled as a result.

### **Frankfort, KY - fire**

A fire destroyed a massive rickhouse filled with 45,000 barrels of bourbon. Lightning was suspected as the cause of the fire. The heat generated melted firetruck lights. Bourbon flowed into Glens Creek and the Kentucky river, polluting the water and killing wildlife along a 62-mile stretch.

## **Mechanical risk control and preventive measures**

According to Walker Mechanical, “From the pipes to the boiler and the drainage, a distillery has a lot of points where mechanical failure can strike. The heart of a distillery is its boiler. A reliable boiler provides consistent heat and steam pressure quickly and on-demand. Most modern boilers require little maintenance beyond blowing down at the end of the day to clear sediment that collects at the bottom. Not taking this simple step can result in facility issues that damage the drains and plumbing.

*When making a grain-based beverage like whiskey or vodka, there’s going to be a lot of grain dust in the air, which is highly explosive. Moving all that out requires good ventilation and air filtration with a backup manual system in case something breaks. The ventilation needs to extend to the fermentation room and cask storage as well. Fermenting releases carbon dioxide while alcohol vapors come off the still and casks. Both create an unhealthy breathing environment for workers.*

*Pipes serve as the arteries of the distillery, moving mash from the cooker to the fermentor and spirits from the tank to the cask. They twist, bend, and join in a lot of places along the path, making them vulnerable to leaks. Age, corrosion, and pressure strain those pipes and can also lead to leaks over time.*



*A distillery puts out a lot of heat – one of the most common issues in distilleries – but it also needs to be able to cool things down quickly. If the chiller struggles to get temps low enough to cool the mash quickly, there could be a leak or electrical failure. With the cooker, fermentor and other tanks, inspecting the welds for any stress or cracking is critical. Stress or cracking could be indicators of too much pressure build-up, which could in turn lead to a rupture or explosion. Depending on the pressure rating of the tank, a crack might form before a pressure gauge ever activates.”*

## **Property loss considerations**

Losses in distilleries range from fires and explosions to leaks, spills and beyond — all of which can harm workers and delay or completely shut down production. Adverse weather, improper equipment installation, facility and equipment maintenance, as well as equipment failures, all impact distilleries. While recovery from these losses is not that much different than other commercial facilities, retaining experts that are fully versed in distillery mitigation is critical to managing the recovery scope and the carrier’s overall exposure.

## About EFI Global

EFI Global, part of Sedgwick, is a well-established brand with an excellent reputation in the Americas, Africa, Asia-Pacific and Europe as a market leader in environmental consulting, engineering failure analysis and origin-and-cause investigations. Each year, EFI Global completes more than 45,000 projects worldwide for a wide range of clients, such as commercial, industrial, institutional, insurance, government, risk managers, public and private entities. EFI Global is one of the world's most respected emergency response firms, capable of providing practical solutions to the most complex problems. Our multidisciplinary team of first responders, project managers, engineers, geologists and scientists are selected for their technical proficiency and in-depth industry knowledge to aid clients in resolving technical problems. For more, see [efiglobal.com](http://efiglobal.com).

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## Get in touch with an expert



**Stephen Buck, IAAI-CFI – Great Lakes district manager**

As a district manager, Stephen Buck has nearly 21 years of experience as a firefighter, police officer, and fire origin and cause investigator. His work within the fire and law enforcement communities, as well as in the private sector has given him the opportunity to investigate more than 1,000 fire and explosion incidents throughout Indiana, Illinois, and Kentucky. His expertise includes explosion scenes, fatalities, subrogation losses and multi-million-dollar losses. For more information, contact [steve.buck@efiglobal.com](mailto:steve.buck@efiglobal.com).



**Scott Carroll – director of client services**

With 20 years of experience in the disaster mitigation and recovery industry, Scott Carroll serves as director of client services. Scott effectively facilitates evaluations of high-tech electronic, electrical and mechanical equipment that was impacted as a result of fire, water or other disaster event(s). For more information, contact [scott.carroll@efiglobal.com](mailto:scott.carroll@efiglobal.com).



**Diane Spinner, IAAI-CFI, IAAI-CFI (V), NAFI-CFEI, IAMI-CMI, ECT – principal consultant, fire services**

Based in South Florida, Diane Spinner is a fire investigator with 22 years of experience in fire service/investigations and law enforcement. Mrs. Spinner has conducted over 4,000 investigations in her career, including qualifying as an expert witness in arson related judicial proceedings. She has more than 600 hours of training specific to fire origin and cause investigation including classes from the National Fire Academy, Criminal Justice Training Institute and Michigan State Police. Mrs. Spinner is a certified fire investigator through the International Association of Arson Investigators, a certified marine investigator through the International Association of Marine Investigators and a certified fire and explosion investigator. For more information, contact [diane.spinner@efiglobal.com](mailto:diane.spinner@efiglobal.com).



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