ARTICLE

FROM CONCEPT TO CODE:

The Pathway for ILDFA to Become a Code Compliant Solution

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Introduction

When I joined Safespill, I wasn't stepping into a polished office or a proven business model. The company barely had a product, more like an idea for a product, and there was no industry acceptance or clear market for it. The original Safespill office was a small, shabby unit in an industrial park in Southeast Houston, but inside there was opportunity. This office was filled with tools, prototypes, and ambition. The product being developed inside was an aluminum floor system designed to drain ignitable liquids before they could ignite. Just aluminum, gravity, and water. Simple in theory, but disruptive in practice.

I started at Safespill while I was still a student at Rice University. I wanted to work on something that made a difference in the world. I cared about the environment, and I wanted my work to make a tangible difference.

During my college career, when I thought about what I wanted my future to look like, I was inspired by a Greek Proverb, "Society grows great when old men plant trees in whose shade they shall never sit." But I wasn't an old man. I didn't necessarily care about "sitting in the shade," my focus was on "planting the trees," no matter how difficult it would be.

I didn't want to be another engineer lost in a massive organization, blinders on, toiling day and night on a minute detail of a product or industry I didn't care about. Safespill offered something different. It wasn't flashy. It was gritty, uncertain, and high-risk. But I saw potential to go against the grain and prove that an environmentally safe alternative to foam-based fire protection was possible.

Not long after I joined Safespill, Tristan Mackintosh, Safespill's Founder and CEO, asked me to create a few educational presentations to help our small sales team, which at the time was just Sam Bowen. The material was simple, explain the basics of fire science and chemistry.

I was still an intern, and this was one of the first opportunities I had to contribute something meaningful. During the presentation, I mentioned the fire triangle (fuel, oxygen, and heat) and explained how removing any leg of that triangle prevents combustion.

When I finished, Tristan and Sam sat there for a moment. Then Tristan said, "That's exactly why this works. We're not trying to smother the fire. We're removing fuel from the triangle."

Safespill's Fire Triangle Logo

That realization stuck. It later became part of Safespill's logo, and more importantly, part of how we defined what made our technology different. Traditional systems react to a fire after it starts: foam blankets an ignitable liquid pool fire, removing oxygen from the equation. Sprinklers suppress heat. ILDFA approaches this catastrophic scenario differently. By draining ignitable liquids before ignition, we remove fuel from the fire triangle, in most cases before the ignitable liquid ignites.

In essence, Safespill doesn't fight fires, it prevents them. It's the difference between wearing a seatbelt and relying on an airbag.

Inventing the Examination Standard

In 2013, during a draft meeting for **NFPA 409, Standard on Aircraft Hangars**, Tristan presented our concept of a drainage-based approach to reducing ignitable liquid hazards to the NFPA Technical Committee on Airport Facilities.

This generated interest in the approach, particularly from FM. The discussion quickly expanded beyond aircraft hangars to other occupancies where ignitable liquids present significant hazards. Shortly after, FM presented a roadmap for development of our product.

To understand the roadmap, it helps to clarify how FM is structured:

- **FM (https://www.fm.com)** is a industrial property insurance company that relies on engineering-based standards to reduce loss exposure. FM develops Property Loss Prevention Data Sheets aimed at providing guidance to control fire hazards, natural hazards, and equipment hazards. These data sheets are used by FM engineers and insured clients to mitigate risk in commercial and industrial facilities.
- **FM Approvals (https://www.fmapprovals.com)** is an Nationally Recognized Testing Laboratory (NRTL), that performs independent testing and certification of products to verify that they perform as intended when properly installed and maintained.

The message from FM was clear: continue developing the technology, generate credible data, and when the system is ready, pursue certification through FM Approvals. Earning an FM Approval would require structured testing, documented reliability, and repeatable performance.

During the Summer of 2016, we performed validation tests at our own fire testing facility near Houston, TX. After demonstrating the floor's capabilities and collecting preliminary data, Safespill formally presented our product to FM Approvals for examination. Unfortunately, it did not fit neatly into an existing category for fire protection systems, so an examination standard needed to be developed to evaluate the system.

Validation Testing at Safespill Fire Testing Facility in Houston, TX

In September, we manufactured and shipped the first-ever functional Safespill Floor to the FM Research Campus in Rhode Island for testing.

Over the following months, I worked on-site alongside fire fighters, technicians, and engineers from FM Approvals. We built multiple Safespill Floors and conducted numerous failure-mode and performance tests to evaluate the system's capabilities.

FM Approvals collected test data and used this data to develop **FM Approval Standard for Ignitable Liquid Drainage Floor Assemblies (Class Number 6090).**

This standard gave our technology an industry recognized name, **Ignitable Liquid Drainage Floor Assemblies (ILDFA)**, and provided criteria to evaluate a new type of system that had not previously existed within the fire protection industry.

In 2017, Safespill became the first manufacturer to obtain an FM Approval under the new examination standard for ILDFA. That milestone validated years of testing, collaboration, and persistence. But more importantly, it represented a

bridge between innovation and acceptance: proof that ILDFA could not only perform but be trusted under the rigorous performance criteria required by FM Approvals.

Our relationship with FM and FM Approvals has remained strong since our initial discussions. John LeBlanc, a member of FM's Chief Engineer's Group and an industry-recognized expert in ignitable liquids, has helped champion this ongoing collaboration.

Since 2017, we have continued to work with FM Approvals as we have developed new, improved designs for our ILDFA.

In 2022, **FM Property Loss Prevention Data Sheet 7-93,** *Aircraft Hangars, Aircraft Manufacturing and Assembly Facilities*, was updated to include ILDFA as the primary protection recommendation for aircraft hangars with fueled aircraft.

We continue to work closely with FM as we explore new product applications for ILDFA beyond aircraft hangars. This has included additional testing at the FM Research Campus and progress toward the inclusion of ILDFA in additional FM Property Loss Prevention Datasheets and NFPA 30, Flammable and Combustible Liquids Code.

Building Confidence Through Testing

The FM Approval was a major milestone, but not the finish line. To gain acceptance across the fire protection industry, we needed to have ILDFA included in fire protection codes like NFPA 409, Standard on Aircraft Hangars. We needed to prove that ILDFA was capable of more than just performance in fire tests. We needed to demonstrate long-term reliability, scalability, and adherence to fire protection codes that could be approved by AHJs.

Between 2017 and 2019, I dedicated nearly all my time to large-scale fire testing at Safespill's fire testing facility just outside of Houston. We ran nearly 100 full-scale fire tests, each one an opportunity to learn, fail, and improve.

Simulated Sandstorm on ILDFA during Failure Mode and Effects Analysis

Fire can be unpredictable. A test could succeed one day and fail the next, even under nearly identical conditions. Every failure forced us to dig into the details, ensuring that tests were repeatable and delivered consistent fire protection performance.

Were the failures a result of a variable we could control, like flushing water pressure, pump flow rate, or liquid detection response time? Or was it something outside of our control, like wind conditions, ambient temperature, or a faulty piece of test equipment?

We spent long days and nights isolating variables, collecting data, and trying to understand what each result meant. Houston's heat and humidity didn't make it easier. When a test failed, cleanup meant more sweat and late nights setting up for another test the next morning.

Safespill Install and Fire Testing Crew at Tyndall AFB for AFCEC Test Program

I wasn't just sitting at a desk, designing the system with CAD software; I was running the CNC mill, assembling the system, building the test apparatus, organizing toolboxes, driving trailers, sweeping floors, and pumping fuel. It was exhausting, but it built a deep understanding of the intricacies of ILDFA and a profound respect for the intensity and destructive effects of the fuel fires that we were testing.

Those were hard years, but they shaped me as an engineer. I learned to respect the complexity of fire behavior and learned the importance of isolating variables and approaching complex problem-solving challenges with a straightforward, disciplined, no nonsense approach.

Through it all, I was motivated by people who believed in the product. Their feedback wasn't sugar-coated, but it was constructive and focused on the same goal: a better method of fire protection for ignitable liquids.

2019 Live Fire Demonstration

By 2019, we were ready to share ILDFA with the NFPA 409 technical committee in a live setting. We invited technical committee members to Houston to see a full-scale fuel fire test in person. This wasn't simply a demonstration or rehearsed performance.

Group Inspecting ILDFA at Safespill Testing Facility before Fire Test

Before ignition, we walked the group through the system and gave them "a peak under the hood." Attendees were able to look at all aspects of the testing floor and ask whatever questions they felt were necessary. Then, we started the test. We used JP4 fuel to simulate a spill from a breached external wing tank. Once ignited, the fire spread quickly, but within 90 seconds, it was gone. The floor was cool to the touch.

That day was a major step in transforming ILDFA from a concept into a tangible, proven system. It earned trust, not because we said it worked, but because everyone could see it with their own eyes.

Throughout the entire product development process, we focused on transparency. Other fire protection systems relied on "trade secrets" and "confidentiality". Fire protection consultants and manufacturers have made a lot of money by making it seem like fire protection is complicated. But our focus was always on keeping things simple.

From Testing to Code

Two years later, during the second draft meeting for the **2022 edition of NFPA 409**, ILDFA was on the agenda. COVID forced the meeting online, but the intensity didn't change. Every word of the proposed code language was debated and refined. For four days, I sat in a small room on Microsoft Teams with Tristan. We answered questions, provided test data, and clarified technical points. It felt like we were getting grilled, but in hindsight, the technical committee was very supportive. However, this was a radical change for a code that hadn't allowed hangars without foam since the 1980s. They had to be sure that we were legit.

By the end, the committee voted 28 to 2 in favor of adoption. The two dissenting votes came from committee members who didn't witness the fire test, didn't ask us questions about the system, and unsurprisingly were manufacturers of foam products and systems.

ILDFA was officially recognized in the 2022 Edition of NFPA 409 as an accepted method of protecting hangars from ignitable liquid fires, without using foam.

That moment was surreal. Nearly a decade of testing, documentation, and giving it our all had finally paid off.

After all the work that I had put in, it was about more than just getting into code and opening the door to commercial opportunities, it had become personal. It was about proving that we had developed a better, safer, and cleaner way of protecting aircraft hangars.

Lessons Learned

Since joining the NFPA 409 technical committee in 2020, I've seen how hard it is for new technologies to make it into the code. There's no checklist for innovation. The burden of proof is always on the innovator, and that's how it should be. A working prototype isn't enough, you have to demonstrate that your technology can be installed, inspected, and maintained reliably by others, not just your own team.

Earning FM Approval and NFPA 409 code adoption wasn't about flashy presentations or clever marketing. It was about discipline, hundreds of tests, countless rejected public inputs and public comments, endless revisions to technical documents, and the willingness to learn from failure. It was about earning the trust of experts like FM, NAVFAC, and members of NFPA Technical Committees.

Safespill's mission has always been clear: to transition the world to environmentally safe fire protection. For me, that mission is personal. I started this journey because I wanted to make a difference, and I've seen firsthand how persistence, collaboration, and discipline can move an entire industry forward. Innovation in fire protection isn't about shortcuts, it's about respect for science, for the people who make up the community, and for the responsibility we have to protect lives and the environment without compromise.