TIME IS MONEY

Mark Krajewski, Aspen Aerogels, US, discusses how specification of the right insulation can significantly impact the start-up of LNG facilities, allowing them to begin ahead of schedule.

In 30 months, construction of an entire export facility was completed, from breaking ground in late 2019 to first gas in late 2021. The success was the result of planning and execution, from design through construction and start-up. Critical to achieving both time and budget goals was specification of the right insulation materials and the right insulation partner.

Specification of the proper insulation enables LNG liquification processing and transport to be effective, efficient, and safe. The choice of insulation can also have significant

COVER STORY

Figure 1. Cryogel Z pipe spools fully insulated and vapour sealed. After a 1000 mile trip, these pipes showed zero failures of the insulation system. In comparison, the rigid system showed multiple areas of condensation, icing, and loss of vapour barrier integrity upon testing.

Figure 2. Fully insulated with Cyrogel Z and a vapour barrier, these nearly 300-ft-long sections were assembled at ground level and hoisted into racks. The flexible design of Cryogel Z was the only solution trusted to enable the offsite fabrication for this project.

Figure 3. LNG terminal in Thailand shows a fully insulated contraction loop enjoying a reduced dressed-out final dimension in comparison to standard duty insulation materials.

impact on design, construction, and maintenance of a facility. It has been estimated that insulation material costs account for only 2% of project material costs; however, installation time can span up to 40% of a construction schedule. Conversely, selection of the wrong materials can have catastrophic impact, adding to construction delays, start-up failures, reduced yields, and increased maintenance costs. This case looks at the critical nature of insulation, and why Cryogel® Z aerogel insulation was instrumental in the success of this project.

Success starts with specifications

Insulation is specified to achieve certain design goals for a defined level of thermal performance of the entire system. While varied materials may achieve the necessary thermal requirements, several other factors were considered during FEED in the specification of insulating materials on this project. The design team was familiar with Cryogel Z after successful use during construction of another liquefaction export facility located on the mid-Atlantic coast of the US. They knew they were able to shave months off the insulation schedule and had zero call-backs related to Cryogel Z insulation installation or performance. The design team also recognised in partnering with Aspen Aerogels again, that they would get the support they needed to properly execute this challenging build. With the help of the Aspen Aerogels technical services team, they crafted a detailed specification and installation procedure.

Cyrogel Z would provide the required thermal benefits and do so in less space, enabling engineers to design the piping modules with smaller insulated dia. piping. By reducing the effective piping OD, the design team was able to reduce the height and width of racks and modules, saving not only space but also a major reduction in steel cost. The space savings with Cyrogel Z also enabled engineers to reduce the overall footprint, saving additional expense, and creating a facility where workers could move more freely doing their jobs. Acoustical benefits of the blanket design would reduce noise generation, and the passive fire protection benefit helps reduce fire risk. Finally, in specifying Cryogel Z, the engineering team knew they could rely on product durability, which allowed for critical components to be constructed offsite. In doing so, they could compress an already ambitious construction schedule.

Impact of insulation on construction schedule

The construction phase of such a massive undertaking is the longest, most complex element of a green field LNG facility. Variables in supply

and labour require constant adjustment. In specifying Cyrogel Z, construction logistics were simplified by using a single material for multiple applications, from insulation of straight runs to insulation of complex geometries. They were also able to significantly reduce the number of material storage containers onsite. Because of the intuitive, fast, and simple installation, the construction team could train the workforce quickly. With the help of Aspen Aerogels onsite training, a high standard of quality for installation was established, since only those certified to install were allowed.

Perhaps the most significant impact of using Cryogel Z was the ability to construct assemblies offsite. Nearly 300-ft-long sections of pipe were insulated with a vapour barrier, assembled into modules, and transported to the construction site. Because Cyrogel Z has a durable yet flexible blanket design, these long sections could be hoisted into place, fully insulated, and tied into the facility, requiring only minor labour to seam. Based on past success, the design and construction teams were confident the assembly would withstand the vibration and flex of transport, and install without damage to the insulation system. A system utilising rigid, brittle insulation would not have held up. The lead construction manager estimated the ability for offsite construction cut six months vs. onsite construction, equating to millions of dollars saved in scaffolding, labour costs, and mitigation of start-up issues.

Withstanding a hurricane, and more

To add to the challenge of construction, this project had to deal with not only one, but two significant hurricanes, Laura and Delta. When these came through in 2020, the team was physically unable to reach the site for approximately three months, halting all construction. Extensive thought had gone into protection of the facility from such events, and the advance planning paid off. When crews arrived after the hurricane, the team found only minimal damage to the facility. This included areas installed with Cryogel Z, validation yet again of the durability of Aspen Aerogels materials.

And if two hurricanes were not enough adversity, the project was constructed during the full breadth of the COVID-19 pandemic. Training installers and inspectors became a critical element of success. But how to accomplish the required training during a lockdown? Make sure the right partner is chosen. To address the need for remote training, Aspen Aerogels' technical services team developed a custom, multi-language learning management system (LMS) to train new insulators specific to the project.

Unexpected problems, innovative solutions

As with any construction project, unexpected problems arise. While Cryogel Z was the specified choice for cold applications, other materials had been specified in various hot applications. However, when issues such as space, weight, availability, labour, or schedule challenges were encountered, the crew turned again to Aspen Aerogels and this time, Pyrogel® insulation. One example occurred when engineers discovered using mineral wool in the power plant required larger insulated dia. pipes than planned, resulting in significant clashing issues. If pipe runs had to be redesigned and moved, they would incur a major schedule set-back. In a joint effort between the engineering team, construction team, and Aspen Aerogels, the proper Pyrogel design was created, material delivered, and the crews quickly trained. Despite having other insulation products on-hand and realising this material would never be used, the change to Pyrogel saved more money by preventing another delay in the construction schedule.

The start-up

The ultimate test of design and construction is the start-up. Tens of thousands of square feet of insulated pipes showed no failures or icing upon start-up. Production ramped up quickly, testament again to the value of material design and intuitive installation. The facility has already processed and shipped more cargo than originally anticipated, and construction continues to build additional capacity.

Of course, any facility will always require continuous maintenance. Given the versatility and durability of both Cryogel Z and Pyrogel blankets, a decision has been made that both materials be maintained onsite. Simplification of inventory and use of materials which can be easily removed and replaced will help expedite inspection and maintenance work, as well as minimise ongoing waste generation.

When asked if Cyrogel Z would be used on future LNG projects, the construction site leader emphatically notes "it is the only way to do it."

Across the globe, a look back

The ability to accelerate construction and finish projects ahead of schedule is a huge win for the engineering, procurement, and construction (EPC) firm and owner. But if the system installed does not perform as designed and do so for the long haul, it cannot deliver the value promised to the customer.

In 2016, PTT LNG Company Limited completed the Terminal 1 Phase 2 project using Cryogel throughout the facility. Six years later, the system continues to perform as designed.

As PTT looks ahead, they expect Cryogel to deliver the same value and have specified it in the construction of all cryogenic piping in their new flagship Nong Fab import terminal in Thailand, which will increase capacity by an additional 7.5 million t and is scheduled to receive its first cargo in 4Q22.

The bottom line, when looking to design, construct, or maintain an LNG facility, is that selection of the right insulation matters. Unfortunately, the total value of an insulation system is often overlooked or viewed as an individual commodity which could be easily interchanged. This is a costly misconception. Selecting the right insulation solution saves time, and time is money. LNG