

WHEN YOUR TEAM NEEDS
HIGH-LEVEL HAZARD
PROTECTION,
YOUR TEAM DESERVES
A FORTRESS.



FORTRESS
PROTECTIVE BUILDINGS

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FORTRESS MEANS TRUSTED, BALANCED HAZARD PROTECTION



FORTRESS PROTECTIVE BUILDINGS WAS BORN FROM KNOWLEDGE, EXPERIENCE, AND TRUST.

With 35 years of risk assessment and expertise, BakerRisk knows what hazards businesses face. And they know what it takes to face those risks every day, to manage them, and to create a protected space that allows personnel to work in at-risk conditions. BakerRisk took that knowledge and worked in partnership with industry leaders to create the company that checks all the boxes for protective buildings – FORTRESS Protective Buildings.

FORTRESS began with an advantage. Building on BakerRisk's history of investigation, analysis, loss-prevention study, testing, material science, onsite study, R&D, and valued business partnerships, FORTRESS creates the types of protective buildings that businesses need to provide maximum safety for their teams.

SAFE

Protection must withstand the most dangerous hazards such as explosions, fire, toxicity, thermal extremes, and weather.

ADVANCED TECHNOLOGY

Protection must be designed to keep the most advanced technology online and operating while adapting to future technology.

TURNKEY

Protection must meet the very highest standards but without interruption to the working of the facility. Ideally, this “plug and play” solution would be without construction interruptions or production delays.

QUICK INSTALLATION

Protection must be provided in weeks, not months or years. The span of time from design to finished installation must be as short as possible.

PROVEN

There is no on-the-job trial for personnel protection. Effective protection comes from a knowledge base built on experience and field testing – testing that mimics the extremes of the real world.

FORTRESS PROTECTIVE BUILDINGS: PRECAST, FLEXIBLE, AND FIELD-TESTED



FORTRESS DESIGNS, MANUFACTURES, AND INSTALLS READY-FOR-OCCUPANCY PRECAST PROTECTIVE BUILDINGS THAT PROTECT YOUR TEAM FROM EXTREME HAZARDS.

WHY IS FORTRESS DIFFERENT — AND BETTER FOR YOUR TEAM?

FORTRESS comes from one of the most trusted names in risk — BakerRisk. So while the FORTRESS name is young, we are experienced. After two years of design and extensive testing by BakerRisk, FORTRESS is changing the way industrial companies view hazard-resistant buildings. While other builders may focus on the impact to the building in a high-hazard event, FORTRESS focuses on protecting the occupants of the building. FORTRESS's goal is to eliminate injuries to occupants after high hazards impact the building.

Because we have built on the considerable wealth of knowledge at BakerRisk, we have the advantage of knowing what actually happens in extreme situations. We have situational awareness based on decades of investigating events, testing of hundreds of materials, and analyzing stores of data.

From all this experience, FORTRESS has learned that you need:

PROTECTION IN EXTREMES

PRE-ENGINEERED WITH LAYOUT FLEXIBILITY

QUICK INSTALLATION

MINIMAL DISRUPTION

DESIGN SIMPLICITY AND FLEXIBILITY WITH FOUR UNIQUE PRECAST UNITS

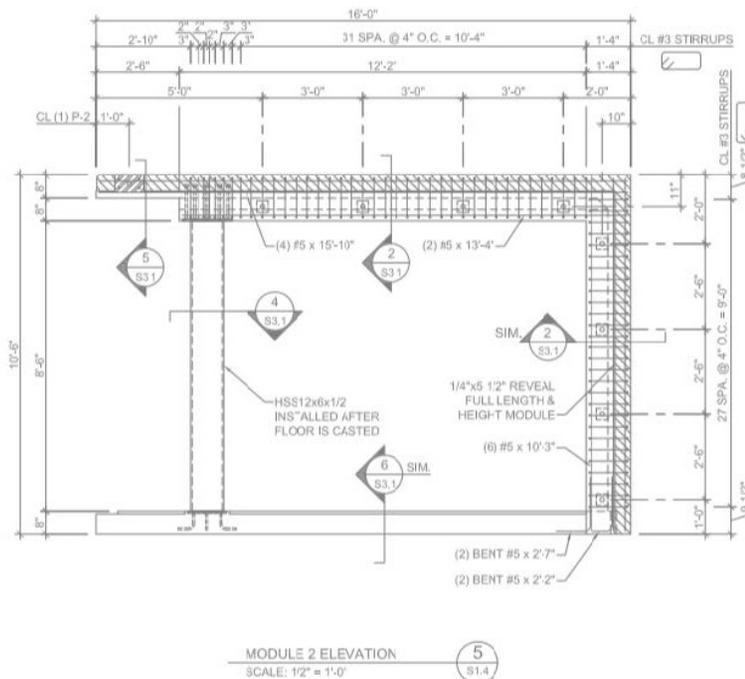
SIMPLE IN DESIGN BUT SUITABLE FOR ANY NUMBER OF USES, THE FORTRESS PROTECTIVE BUILDING EXPERTS CAN MAKE FOUR BASIC PRECAST UNITS WORK FOR YOUR UNIQUE NEEDS, WHETHER THEY ARE OPERATOR SHELTERS, CONTROL ROOMS, GUARD HOUSES, OR OTHER USES.

Creating a number of varied floor plans from just four basic precast unit designs means significant time and cost savings compared to traditional purpose-built structures.

FORTRESS precast concrete units are fabricated at one of Tindall Corporation's PCI-certified plants to FORTRESS specifications, then transported to the site and installed with minimum disruptions. Tindall is one of the largest producers of precast building systems in North America and a pioneer in the fabrication of precast components. Tindall has provided innovative precast, prestressed concrete building solutions for more than 10,000 projects in over 50 years of operation.

Once the FORTRESS concrete units arrive on site, they are bolted together at a rate of 8–10 per day. The carefully planned and executed assembly process means minimal equipment is required and minimal disruption at the job site. Businesses especially appreciate that FORTRESS understands the need for safe, fast, high-quality, and non-disruptive installation from site preparation to occupancy.

Once the exterior is assembled, BakerRisk's proprietary thermal seals are applied, grouting between the pad and the units is completed, blast doors and windows are fitted, and the waterproof sealing is applied. Interior finish choices vary and can include comfortable working areas with conference rooms, restrooms, offices, HVAC and utility rooms, and Shelter-in-Place systems.



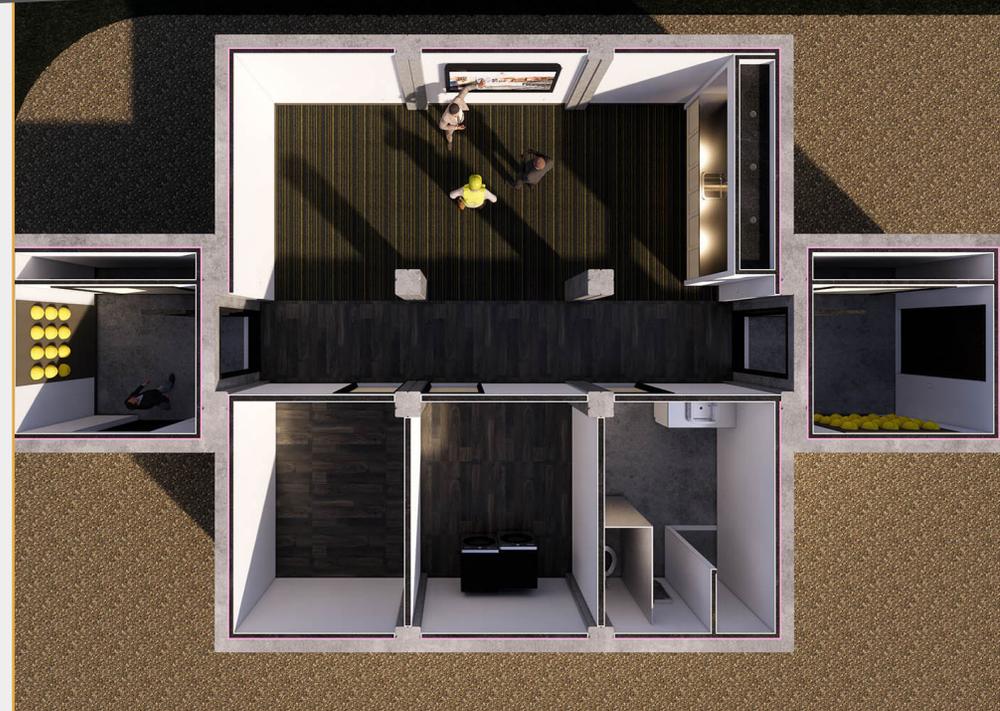
WATCH THE BUILD PROCESS

SAFE, FLEXIBLE, COST-EFFECTIVE, QUICK INSTALLATION



SAFETY PROTECTION IN EXTREMES

The FORTRESS Protective Building has undergone hundreds of hours of testing for multiple hazards to ensure that your personnel will be protected from fragment, overpressure, thermal, toxic, and extreme weather threats. FORTRESS has consistently exceeded design criteria in every test performed by BakerRisk's world-renowned testing team. The safety of your personnel is our primary focus.



LAYOUT FLEXIBILITY

The precast units used in FORTRESS construction mean every building is adaptable and customizable for your needs – whatever the situation. This flexibility also provides a comfortable, functional building for personnel. We even offer individual components to fit existing structures for special needs.

SAFE, FLEXIBLE, COST-EFFECTIVE, QUICK INSTALLATION



COST-EFFECTIVE

Pre-designed and precast mean savings over traditional purpose-built structures. A FORTRESS Protective Building starts saving you money from the beginning. From the earliest discussions of your protective needs, FORTRESS has the advantage of BakerRisk's years of risk assessment, consequence analysis, hazard-identification studies, material science, site surveys, building design, and testing. With this knowledge, FORTRESS works with you to provide the best solution to protect your team. We listen to you, advise whenever needed, and work with you to create a plan that builds your protective structure in a cost-conscious way.



QUICK INSTALLATION

Because FORTRESS is planned with your business in mind, the patent pending, precast units are created in one of the Tindall manufacturing facilities and trucked to your site ready to install. That means buildings using standard finishes and floor plans may be ready for occupancy in as few as five weeks. Every part of the FORTRESS building process is designed to minimize disruption due to construction and maximize your time of use. We understand that your business cannot be interrupted. And we know that you need a turnkey process that allows you to keep doing what you do while we provide your protection solution.

EVERY COMPONENT BUILT TO PROTECT



Because FORTRESS believes in providing you with the protection you need, all hazard-resistant components of our FORTRESS Protective Buildings are also sold independently to meet your site needs.

Every component is built to the same high safety specifications as any FORTRESS Protective Building. And each building component is fully tested by BakerRisk for hazard protection against fire, explosions, toxic ingress, fragments, and extreme weather.

So, whether you choose individual components or a complete FORTRESS Protective Building system, you have the peace of mind that comes from protecting your personnel with the best available products.

OUR EXPERTS CAN HELP YOU DETERMINE WHICH FORTRESS PRODUCTS CAN PROVIDE YOUR TEAM WITH THE VERY BEST IN HAZARD PROTECTION.

CONTACT KAREN VILAS FOR MORE INFORMATION ABOUT COMPONENT PRODUCTS.



EVERY COMPONENT BUILT TO PROTECT



BLAST-RESISTANT DOORS



FORTRESS blast-resistant doors provide your team with protection from explosions, smoke, fire, and toxic impacts.

In order to pass our field tests, a FORTRESS blast-resistant door must be fully operable after being subjected repeatedly to:

LOAD TESTS AT OR BEYOND FORTRESS'S DESIGN FREE-FIELD PRESSURE OF 8-PSI, >200 PSI. MS

PROLONGED FIRE IMPINGEMENT

AIR INGRESS TESTING

BALLISTIC THREATS

BEYOND BLAST PROTECTION

FORTRESS blast-resistant doors are guaranteed not to result in smoke or toxic off-gas when tested for direct flame impingement of a prolonged 1/2-inch propane jet fire.

Deansteel Manufacturing fabricates the FORTRESS blast-resistant door according to FORTRESS standards. Deansteel is one of the country's leading fabricators of independently tested and analyzed door and frame products.

BLAST-RESISTANT WINDOWS



Windows are not a weak spot in a structure with FORTRESS blast-resistant windows. These windows protect your personnel from the extremes of jet fire and high-pressure blast events.

FORTRESS blast-resistant windows were created using the expertise of the BakerRisk design and testing team and built by Crittall Window manufacturing to meet all FORTRESS specifications. At the BakerRisk test facilities, FORTRESS blast-resistant windows are tested to ensure they perform beyond FORTRESS design specifications while providing protection from these extremes:

40-MINUTE DIRECT IMPINGEMENT FROM A 1/2-INCH PROPANE JET FIRE

REFLECTED BLAST LOAD TESTED TO 21 PSI AT LONG IMPULSE

The FORTRESS blast-resistant window was created from the Crittall Windows HydrocarbonFire window, a part of their BlastLine range of products that BakerRisk has adapted to meet the FORTRESS product line's high-hazard requirements.

The result is a blast-resistant window that has excelled in field tests for both extreme blast and fire protection.

EVERY COMPONENT BUILT TO PROTECT



THE FORTRESS GAS SENTRY, FORTRESS'S SHELTER-IN-PLACE CONTROL BOX

Acting as the brain behind the amazing technology, every FORTRESS Protective Building includes an SIP control panel known as the FORTRESS Gas Sentry. This control panel was designed by BakerRisk and manufactured to interface with gas detectors outside and inside the building to initiate HVAC shutdown, damper closures, trending of gas concentrations, activation of fresh air flow, and many other functions – all to ensure the safety of your team inside the FORTRESS SIP at all times.

The FORTRESS Gas Sentry is designed to grow with your needs and includes expansion capabilities and a modern human-machine interface (HMI) aligned to the building layout. Its ability to record details also provides an asset to protect your personnel from toxic gases.

Because the effectiveness of an SIP depends on a number of factors such as the leak tightness of the building, operating philosophy of the building, maintenance, and a robust monitoring program, the FORTRESS Gas Sentry is built with all these factors in mind. And it is designed to monitor toxic concentrations not only within the shelter but also outside, at air intakes, and at key locations within the building. Timely sheltering and evacuation decisions depend on the accuracy of sensors that monitor gas concentration trends from strategically placed gas detectors. The FORTRESS Gas Sentry provides the readings needed to make informed, safe decisions.

FORTRESS combines our own experience with numerous major manufacturers' products and with BakerRisk's research and expertise in gas detection for flammable and toxic gas to create a customized panel, detectors, and HMI to suit your needs. We'll provide full support from design to commissioning.

[CONTACT US](#)

KEY FEATURES OF THE FORTRESS GAS SENTRY:

MULTI-POINT MONITORING AND ALARM OF TOXIC AND FLAMMABLE GAS DETECTORS

USER-FRIENDLY HMI ADAPTABLE TO FIT DIFFERENT BUILDING LAYOUTS

TRENDS AND DATA STORED FOR FUTURE VIEWING

CUSTOMIZABLE ALARM SCREEN TO SHOW HIGH-PRIORITY ALARMS AT THE TOP

ABILITY TO INITIATE AUTOMATIC SHUTDOWN OF HVAC, DAMPERS, EXHAUST FANS, AND OTHERS

ROBUST MONITORING SYSTEM OF THE SIP ROOM ENVIRONMENT WITH THE ABILITY TO INITIATE FRESH AIR SUPPLY

SIMPLE CALIBRATION FUNCTIONALITY WITH LOGGING OF CALIBRATION TIMESTAMP

EASY BYPASS OF TRANSMITTERS IN MAINTENANCE

UPS BACKUP FOR THE PANEL AND PANEL-POWERED DETECTORS

PASSWORD-PROTECTED SYSTEM TO PREVENT INADVERTENT CHANGES IN SETPOINTS OR ACTIONS

SHELTER-IN-PLACE DESIGN



A safe place for personnel, the Shelter-in-Place (SIP) design keeps your team safely away from toxic gases while the outside environment is brought under control.

SIP is a safe, non-toxic environment to protect personnel while outside operators respond to emergencies and/or give personnel time to safely don PPE and evacuate according to emergency response plans. The FORTRESS SIP design by BakerRisk is made to resist gas infiltration in an emergency and includes an additional inner room with an even higher level of toxic-leak protection for personnel who must shelter in place.

If the complete FORTRESS SIP design is not an option for your site, FORTRESS can still help provide your team protection with a highly effective toxic shelter that reduces risk to occupants. As always, FORTRESS will provide the solution to unique protection needs whether you are starting your SIP plan from the ground up or are modifying an existing building.

To better understand the high-tech safeguards of the FORTRESS SIP design, take a virtual tour with FORTRESS President Bill Mather.

[TAKE A VIRTUAL TOUR](#)

OUR DESIGN CONSULTANTS CAN HELP ASSESS SHELTER NEEDS BY ANALYZING:

TOXIC GAS DETECTION

HVAC SYSTEM AND EXHAUST FAN ISOLATION

ISOLATION OF VENTILATION (DAMPERS) AND OTHER MAJOR LEAK PATHS

MULTI-BARRIER SHELTER DESIGNS

BARRIERS THAT ARE HIGHLY RESISTANT TO INFILTRATION

PURGE, SCRUBBING, FILTERING, AND PRESSURIZATION SYSTEM DESIGNS

HIGHLY EFFECTIVE FALLBACK (EVACUATION) PLANS

FUNCTIONALITY OF THE SIP AND SAFETY OF SIP OCCUPANTS

PROVEN PROTECTION

We hit our FORTRESS buildings with our best shot: fire, wind, rain, explosions. We shot fragments at them, impinged jets of fire, applied crushing pressure, hit the doors and windows with blasts and fire, and ran them through the rigors of the Wilfred E. Baker Test Facility. And we are satisfied that FORTRESS buildings performed above design specifications. The FORTRESS Protective Buildings and everything in them emerged safely. We are confident that FORTRESS Protective Buildings can protect your personnel from multiple hazards.

EXPLOSION



FRAGMENT



FIRE



TOXIC



EXTREME WEATHER



PROVEN PROTECTION

FRAGMENT PROTECTION TESTING

PERFORMED IN THE HIGH-PRESSURE TEST RIG

BOTTOM LINE: THE FORTRESS WALL PANEL PROVIDES PROTECTION FROM A 1" PROJECTILE THAT IS EQUAL TO A 3/4" STEEL PANEL.

Specifications of projectile testing of wall panel in the High-Pressure Test Rig

Concrete specimen with geometry, thickness, and reinforcement matching FORTRESS wall panel

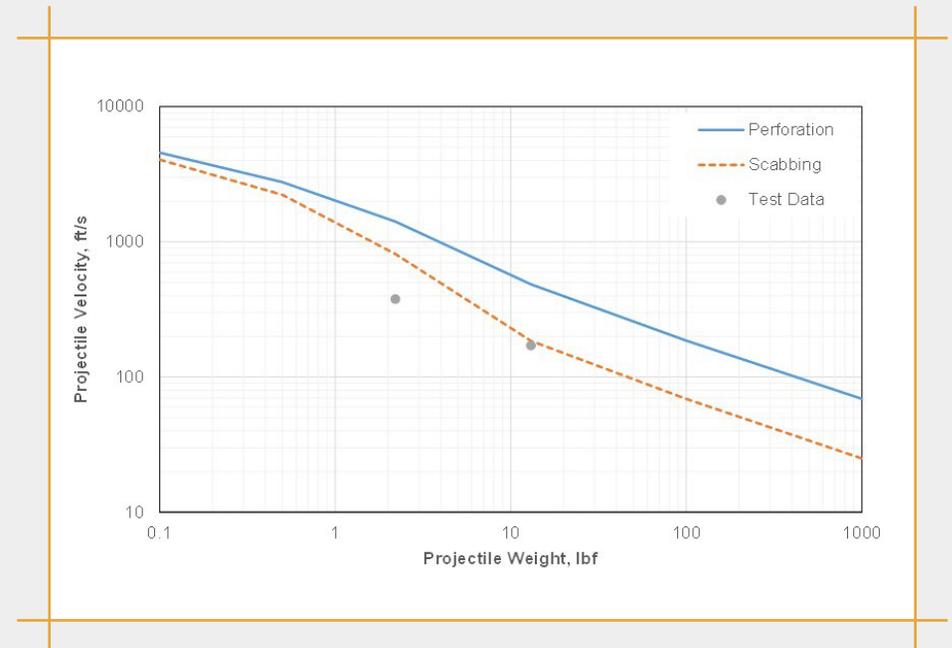
Projectiles were mild steel cylinders of equal length and diameter (varying size/weight)

Tests conducted using a gas gun developed by BakerRisk for fragment throw

Results indicated negligible vulnerability for both projectile sizes

Test #1: 2.2 lb. at 378 ft./s (no spalling)

Test #2: 13 lb. at 171 ft./s (localized spalling)



Fragment Spall and Penetration Capacity of FORTRESS

PROVEN PROTECTION

BLAST PROTECTION WALL PANEL AND JOINT TESTING

DYNAMIC TESTING PERFORMED IN THE SHOCK TUBE TEST RIG

BOTTOM LINE: FORTRESS WALL PANELS AND JOINTS WITHSTOOD REPEATED TESTING AT PRESSURES BEYOND DESIGN BASIS OF 8PSI, >200 PSI.MS.

Dynamic testing of wall panel in the Shock Tube Test Rig

10 ft. x 10 ft. target area

Included panel joint, corner joint, and reaction frame

Five tests conducted on a single panel configuration

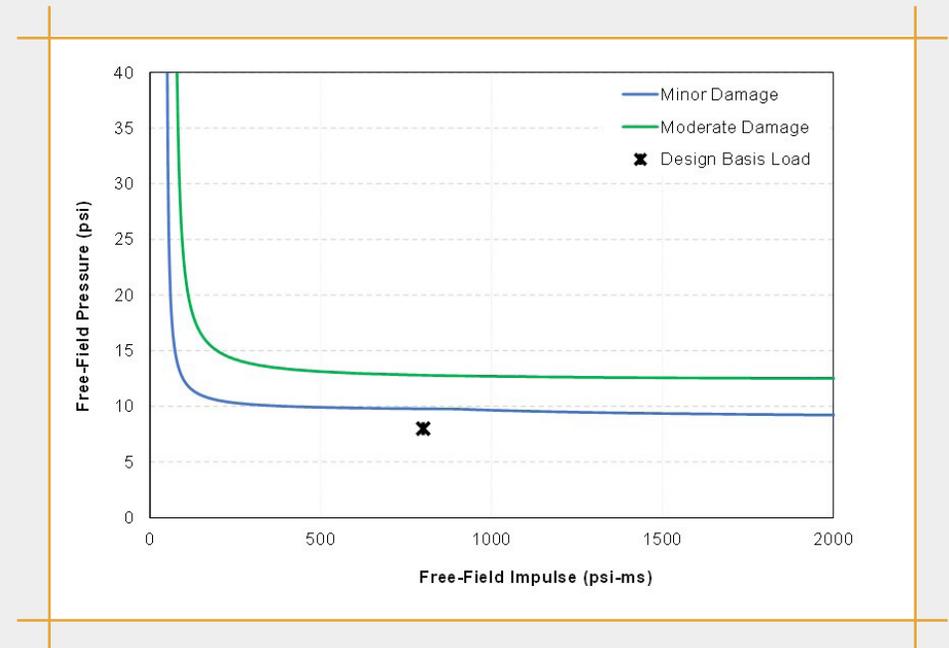
Design basis free-field loads (1)

Reflected loads (4)

Results indicated negligible vulnerability at design basis loads

Test #1: 11.3 psi at 1,006 psi.ms resulted in a max displacement of 0.5 inches (hairline cracks)

Test #2: 20.9 psi at 1,639 psi.ms resulted in a max displacement of <1.25 inches (cracking)



Pressure-Impulse Curve for Building Damage

PROVEN PROTECTION

BLAST PROTECTION WALL PANEL AND DOOR TESTING

DYNAMIC TESTING PERFORMED IN THE SHOCK TUBE TEST RIG

BOTTOM LINE: AFTER SEVEN BLASTS REACHING OVER 20 PSI, THE FORTRESS DOOR STILL OPENED.

Dynamic testing of blast door in the Shock Tube Test Rig

10 ft. x 10 ft. target area

Included panel and door

Seven tests conducted on a single panel configuration

Design basis free-field loads (4)

Reflected loads (3)

Results indicated negligible vulnerability at design basis loads

Test #5: 10.9 psi at 990 psi.ms resulted in a max displacement of 0.375-inches (hairline cracks)

Test #6: 20.0 psi at 1,433 psi.ms resulted in a max displacement of 0.635-inches (hairline cracks)



Door still opened after seven tests.

PROVEN PROTECTION



THERMAL PROTECTION WALL PANEL AND JOINT TESTING

PERFORMED AT THE PROCESS SAFETY TEST RIG

BOTTOM LINE: FORTRESS WALL PANELS WITHSTOOD A BARRAGE OF SATURATED PROPANE JET FIRE FOR 30 MINUTES WITH THE INSIDE AIR TEMPERATURE REMAINING $\le 110^{\circ}\text{F}$ AND WITH NO INGRESS OF SMOKE OR TOXIC COMBUSTION OFF-GASES.

Impinged jet fire of door in the Process Safety Test Rig

¼-inch propane jet fire for one hour

Full height panel with the thermal barrier in panel joint

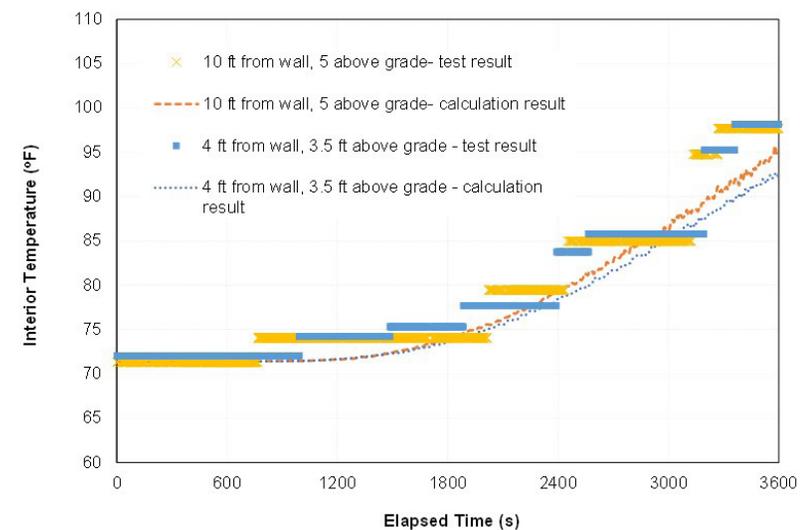
Additional small-scale testing of joint seal products

Patented product resists fire and thermal degradation as well as prevents ingress of smoke and toxic combustion products

Results indicated negligible vulnerability for design basis thermal exposure

Resistant to temperature rise as well as smoke and toxic combustion off-gases

Temperature remains below 110°F, well below ASTM E119 required 139°F



Thermal Heat Rise from FDS Calculations and Experimental Testing

PROVEN PROTECTION

THERMAL PROTECTION WALL PANEL AND DOOR TESTING

SMALL-SCALE TESTING OF DOOR COMPONENTS TO CONFIRM PERFORMANCE AT THE PROCESS SAFETY TEST RIG

BOTTOM LINE: FORTRESS DOORS WITHSTOOD A BLAST OF SATURATED PROPANE JET FIRE FOR 30 MINUTES WITH THE INSIDE AIR TEMPERATURE REMAINING <100°F AND ONLY THE PAINT AND THE GREASE IN THE DOOR HINGES BURNED.

Impinged jet fire of door in the Process Safety Test Rig

¼-inch propane jet fire for 30 minutes

Small-scale testing of door components to confirm performance

Results indicated negligible vulnerability for design basis thermal exposure

No significant smoke or toxic off-gasses from the direct fire impingement

Temperature remains below 100°F inside the structure

Door was still functional after grease was replaced post-test



PROVEN PROTECTION



AIR INGRESS PROTECTION MAIN BUILDING TESTING

TRACER GAS TESTED IN CONJUNCTION WITH THE PATENT-PENDING SHELTER-IN-PLACE (SIP) CONTROL SYSTEM

BOTTOM LINE: BOTH THE MAIN BUILDING AND THE PATENT-PENDING SIP CONTROL SYSTEM WERE SUBJECTED TO REPEATED AIR INGRESS TESTING OF OVER EIGHT HOURS WITH RESULTS BEYOND DESIGN BASIS.

Tracer gas tested in conjunction with the patent-pending SIP Control System.

Main building volume and interior SIP room

Inherent gas ingress protection

Limited gaps in building shell

Vestibules at building entrance/exits

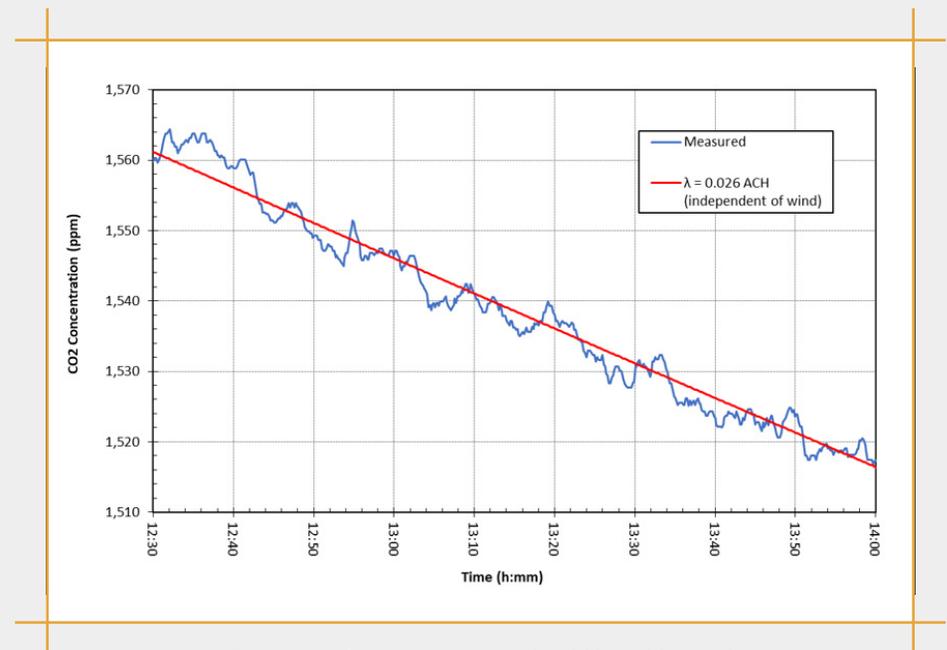
System to monitor and alarm/isolate

SIP room with systems and controls

Results indicated protection beyond design basis

Main Building: 0.08 ACH with a 5-mph wind

SIP Room: 0.026 ACH



Protection from gas ingress should be addressed as part of an overall site emergency response plan.

IT COMES DOWN TO HIGH-QUALITY PROTECTION



FORTRESS Protective Buildings are made for the moment you never want to experience. The moment of an extreme blast. Or raging fire. Or extreme weather. Or clouds of toxic gases. The realities of industrial applications today have taught us that these moments can come. And at the moment of extremes, protection must also be extreme.

Ideally, no expense would be spared in providing protection for personnel. However, those charged with providing this type of protection must find solutions that are cost-efficient, turnkey, and minimally disruptive to processes and production. FORTRESS provides this necessary balance.

In FORTRESS Protective Buildings, protection is both of the highest quality and flexible for your business needs. FORTRESS is a balanced solution for hazard protection. FORTRESS experts will gladly show you how our solutions apply to your hazard protection needs.

CONTACT

KAREN VILAS

KVILAS@FORTRESSPROTECTIVEBUILDINGS.COM

281-822-3100





FORTRESS
PROTECTIVE BUILDINGS

KEEP THEM SAFE.
GET A FORTRESS.