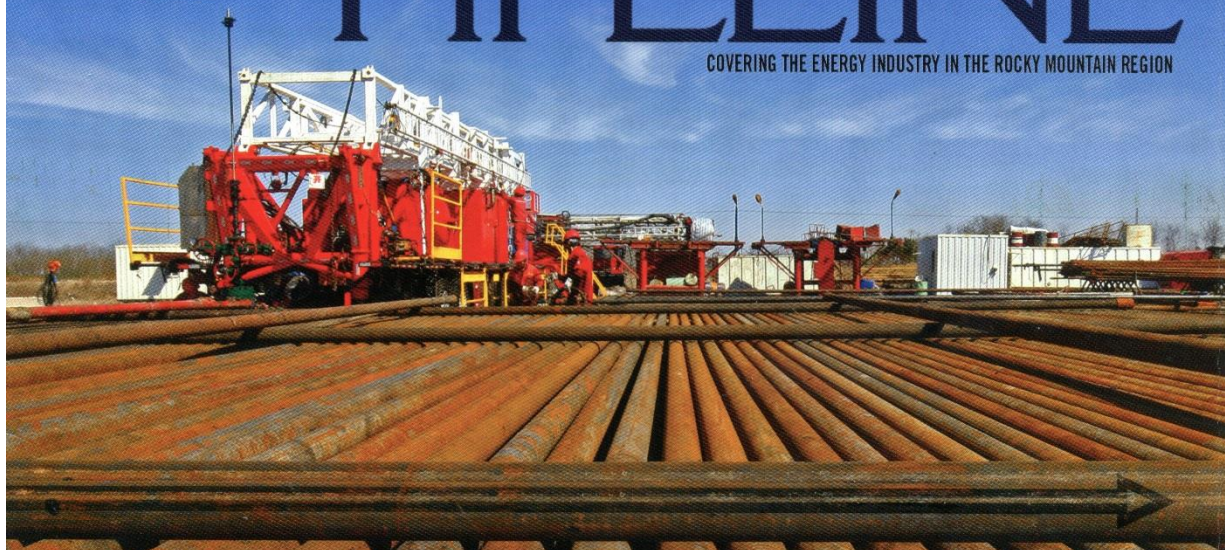




ENERGY PIPELINE

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TECH TALK

PORTABLE SAFE ROOM FOR OIL FIELD WORKERS DURING TORNADOES

BY GARY BEERS • FOR ENERGY PIPELINE

TORNADOES POSE RISK IN OIL FIELDS

The major tornado alley in the U.S. extends from the Dakotas south to Texas and crosses several major oil/gas producing basins. Recently, there have been incidents of tornado damage to oil field facilities and field crews.

- Gas drilling rig (Canadian, Texas, May 2015).
- Man camp (Watford, North Dakota, May 2014).
- Oil storage facilities (Cushing, Oklahoma, May 2013).

In another instance, an oil rig (Calumet, Okla.) was demolished by a tornado in May 2011, but there were no injuries to the 12-member field crew and the facility damage was \$14 million. The oil company had taken precautions to anchor the rig's change house to withstand a F5 tornado, at a cost of \$500,000. This precaution was taken by the company's vice president for human resources in response to a tornado-based incident (in 2007) where another oil company's trailer house was blown away, killing one man and injuring another. In 2012, the company's drilling superintendent told the IADC Health, Safety, Environment and Training Conference and Exhibition held in Houston, the following:

"Twelve men walked into that change house, and twelve men walked out. I'm going to challenge everybody that's got authority to go out on a limb... and try to make some kind of emergency plan. Get something out there for (your crew). Come up with an idea, because (an emergency) will happen and you can't say (your plan) won't work." (Drilling Contractor, K. Scott, 2012).

Further, the superintendent added the precaution was implemented after initial doubts and resistance.

OPTIONS FOR WORK CREWS IN REMOTE AREAS

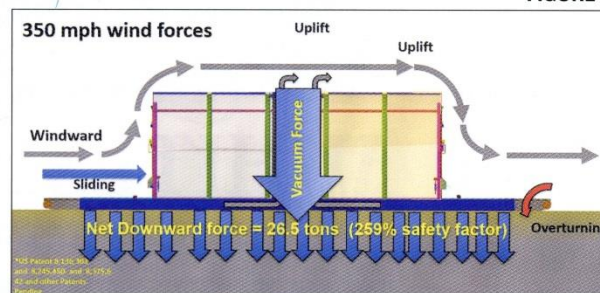
Fortunately, the work crew at the above remote site near Calumet was lucky and had access to a "safe room" due to the presence of one of the rooms in the drill rig structure. This option is not commonly available to field crews working on temporary projects in remote areas (i.e., pipeline construction, work-over of oil/gas wells, construction of oilfield storage tank area, haul road construction) or living in small man camps.

Sheltering-in-place options have evolved over the decades from fixed underground shelters (i.e., root cellars, engineer-designed concrete or steel shelters) to above-ground, engineered, anchored shelters that are designed to withstand EF-5 tornadoes, as well as industrial debris from oilfield structures. In 2008, the National Storm Shelter Association was formed and adopted standards for the best available technology for above-ground storm shelters (Mobile Safe Rooms, O. Scott, Well Servicing Magazine, 2015). Two types of anchoring are the only methods proven to withstand extreme wind forces of a tornado and associated airborne debris.



For over 50 years, **GARY BEERS**, has worked in numerous fields of environmental science as a consultant, regulator and educator. This career included senior management position with major consulting, nonprofit and public organizations. He has founded several successful firms to capture emerging resource management markets. One of his latest ventures, EnviroScienceINFO, provides content for public media.

FIGURE 1



- Gravitational anchoring is realized when a concrete or metal shelter is anchored to the ground with a foundation and associated wire anchors. Since these are permanent shelters, 'new' shelters must be constructed for each "move" to the next remote site for protection of the field workers. This is a very expensive approach.
- Aerodynamic anchoring is realized when the tornado winds are utilized to hold the shelter in place. Without the need for a foundation, the advantages of this shelter are portability and less expense. Because of this patented, unique design and associated "near absolute" protection level, a description is provided on the next page:

PORTABLE SAFE ROOM

The portable safe room comes in two models (reddogshelters.com). The capacity of the smaller unit is 12 people and is trailer-mounted for transport by a 2-ton truck. The capacity of the larger unit is 32 people and requires a tractor trailer/lowboy for transportation as non-permitted load.

Aerodynamic anchoring is based on Bernoulli's principle for fluid dynamics which

states that an increase of the speed of air over a surface causes a decrease in pressure on that surface. For example, due to the lift created by the wing design, a Boeing 747 that weighs 500,000 pounds can take off at about a 150 mph wind speed.

The design of the portable safe room (Figure 1) is based on the fact that if low pressure created by a wind can be made to pick an object up, then that same low pressure can be made to push the object down. The safe-room shelter weighs 40,000 pounds, but when a 350 mph wind passes over the shelter, the effective shelter weight is over 115,000 pounds. As a result of this massive downward force and the unique shelter shape and configuration, the shelter is locked to the ground, which keeps it from being lifted, overturned or otherwise being moved by the wind. In fact, the higher the wind speed, the stronger the shelter is anchored to the ground. An EF-5 tornado has winds of up to 250 mph. Since wind forces increase geometrically with wind speed, wind loads at 350 mph are twice as forceful as those at 250 mph. Most residential and community storm shelters are designed for wind speeds of 250 mph.

The safe room can be equipped with many features. The standard features include blast-resistant, air conditioners/heaters, rapid cool-down station, retractable desk and benches, and an external tornado/ lightning warning system consisting of external strobes and siren alarm. Popular optional features include bubble-tight hatch closures with positive pressure breathing air supply for noxious gas exclusions, television monitors, DVD players, computer workstation, self-contained diesel generator (eight-day run), first aid kits, eyewash station, security camera, and automatic emergency cardiac defibrillator.

The safe rooms may be acquired as a purchase or through a lease. The large model costs about \$130,000 while the smaller model costs about \$92,000. Lease arrangements are made on a site-by-site basis.

UTILITY

The portability and relatively low cost of these "near absolute protection" safe rooms should receive interest for a variety of other uses for work crews at remote sites. Certainly, major construction projects come to mind. ♦

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