

Puerto Rico Refinery/Tank Farm Explosion on 23 October 2009



You probably read about the Friday 23 October 2009 explosions at a refinery and tank farm at Bayamon near the capital of Puerto Rico. This led to one of the largest refinery fires in history. Nearly half of the 40 tanks caught fire and black smoke bellowed high into the air causing fear of an environmental disaster.

You know that extinguishing a fire this size is very hard as fixed fire water systems are most likely destroyed by the explosions and back-up systems are often not available. The equipment of the local fire brigade is typically no match for fires of this size.

Though the cause is not clear yet, we can be sure that this event will lead to a stream of research reports, analysis of safety measures, legal disputes, and discussions about fire fighting strategies.

So, here is another 'low probability, high impact event'. Previous recent ones include the Texas Refinery (US) in 2005 and the Buncefield Oil Depot fire (UK) in 2005.

Our company distributes Hytrans High Volume Pumps in Australia and New Zealand.

It is very early days, but what happened?

At 12.30am multiple tanks exploded or caught fire.

A shock of 2.8 on the scale of Richter was measured. Flames were as high as 100ft and a black toxic smoke stack could be seen from satellite images. The US Federal Aviation Administration diverted plane traffic because of the smoke.

The wind was blowing mostly offshore which prevented an environmental disaster on the well populated island. Only 2 people (from a nearby US Army base) were injured.

The cause of the disaster

This is not known yet. The FBI has been called in and is treating the site as a crime scene, which is described as a 'routine' procedure.

On Friday graffiti with the text: 'Boom, fire, RIP, Gulf, Soul, ACNF' was found in highway tunnels.

Extinguishing the fire

Refineries usually have fixed fire water systems; a network of (underground) pipes connected to fixed pumps and fixed monitors.

History has taught us that these systems function well when there are no explosions, but explosions will often damage the system and render it useless. Buncefield was a recent example.

A medium sized refinery will need at least 50,000 litres of water per minute, while a fire truck often does not carry more than 5,000 litres of water. Setting up pumping capacity over longer distances to provide a continuous flow of water takes time and uses resources better employed elsewhere.

In Puerto Rico, 130 firefighters were deployed with fire trucks. The focus was on cooling the non burning tanks and containing the flames.

The National Guard brought in their heavy equipment (not specified).

Neighbouring pharmaceutical industries made their own fire trucks available.

A pipeline was erected from a nearby bay, pumping seawater to the site.

So far information is sketchy about 4 issues:

1. Availability of enough foam. Foam needs to be mixed with the fire water in order to cover the fire with a blanket of foam, smothering the fire by causing a lack of oxygen. No foam is required for cooling the unaffected tanks. Was there enough foam?
2. Water pollution. Contaminated run off water (a mix of water, foam, oil and other particles) is typically environmentally hazardous and needs to be temporarily stored or transported to predetermined reservoirs. Transport by truck is possible, but one will need a very large number of trucks to deal with the required 50,000 litres per minute. Was there enough temporary storage?
3. Back-up systems / piping / hoses and pumping to get water from the nearest source.
These were available to extinguish the Buncefield fire in 2005 and were ready to start pumping within only a few hours. (Hytrans High Volume Pumps (HVP's) owned by the UK Government and stationed at multiple fire stations across the country). Were there HVP's?
4. Air pollution
The wind direction was favourable (mostly blowing offshore) but a state epidemiologist who monitors asthma told the Associated Press that the smoke is "extremely toxic" and that people with asthma will "definitely hyper-react to this." More than 1,000 people were evacuated from their homes on Friday.

Comparison between Buncefield and Puerto Rico

Buncefield:

Additional foam was stored on site and trucked in from chemical industries nearby. When the fixed fire water system was destroyed by explosions, Hytrans High Volume Pumps (HVP's) were quickly made available by UK Government to transport water from an open water source 1.5 miles away. Contaminated water was pumped to other locations (the firefighting could not actually start until the system to capture contaminated water was set up).

Puerto Rico:

Additional foam was shipped in from the US Virgin Islands

We assume that the fixed water system was destroyed by the explosions. Due to the proximity to the sea, a temporary pipeline was installed from a local bay to supply fresh seawater to the site.

A special makeshift pool was dug to collect contaminated run off water from the fire, while road tankers trucked the water to a treatment plant.

What does the chemical industry know about risks?

- A low probability, high impact event can happen anywhere.
- Refineries and other hazardous sites comply with local safety regulations, but in Australia these regulations do not yet specify back up foam or systems.
- Explosions will often render fixed fire water systems useless, leaving fire extinguishing at the mercy of fire brigades.
- Fire brigades simply do not have the capacity to deal with fires of this size.
- Letting the fire burn longer than necessary leads to avoidable environmental damage and health threats.

Does Puerto Rico mean anything for Australia?

- Refineries and fire brigades have done the disaster scenario preparation and planning, and training but the missing links seem:
 - Are regulatory requirements best practice?
 - Are the probabilities for high impact events changing given our ageing refineries and larger storage tanks?
 - Does industry have sufficient back up foam supplies, contaminated water storage capacity and back up fire fighting systems?
 - Should we equip for a low probability, high impact event?
 - Who should equip for these disasters - Industry, fire brigades?
 - Who pays, who trains, who maintains?
 - Should more co-operation between industry and fire brigades be encouraged?

Kind regards



Arnaud Diemont
Director

Photographic impressions of the Puerto Rico refinery:



Photographic impressions of UK Government owned HYTRANS High Volume Pumps:

