

Corroded Tanks!

May 2017

In 2001 there was an explosion in a tank containing spent sulfuric acid (which contained some hydrocarbon) from a refinery alkylation process (Fig. 1). Eight workers were injured and there was one fatality. Spilled sulfuric acid reached a river causing environmental damage. Contractors were repairing a platform in the tank farm when a spark from hot work ignited flammable vapors in the tank. The tank had significant corrosion, and leaks had been found annually for several years. All reported leaks were repaired, except for one discovered a few months before the incident. At the time of the incident, several additional holes in the roof and shell of the tank had not been reported. An operator did file an “unsafe condition report” a few weeks before the explosion. A hot work permit had been rejected because of high flammable vapor concentration, but corrective actions had not been taken by management.

In January 2016, there was a fatal incident in a different refinery, also caused by tank corrosion. During the evening shift, an operator went to a tank farm to manually measure the temperature and level in several tanks containing hot oil (Fig. 2). This required climbing to the top of the tanks. The operator did not return for some time and did not respond to radio contacts. His colleagues went to the tank farm to investigate, found his vehicle parked there, and also found a large hole in the top of one of the tanks (Fig. 3). The tank was emptied and the body of the operator was discovered in the tank – he had fallen through the hole into the tank. The tank roof was found to have severe internal corrosion. The roof failed when the operator stepped onto the top of the tank.

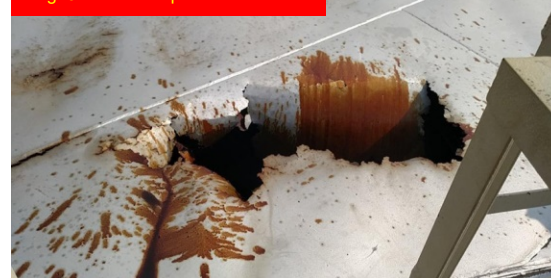
Fig. 1: Spent sulfuric acid tank after explosion



Fig. 2: Hot oil tanks



Fig. 3: Hole in top of hot oil tank



Did you know?

Corrosion of tanks and other equipment can be dangerous in many different ways, for example:

- Holes in tanks can allow toxic or flammable vapors to escape into the surrounding environment.
- Corrosion can weaken tanks, pipes, or other equipment so they can fail under normal operating conditions.
- Equipment which is severely corroded may be structurally weakened. A tank top may not be able to support weight on it, corroded pipes might weaken and break, and corroded equipment supports or building structural steel can collapse.

What can you do?

- Report holes in tanks or severe corrosion to management. If there is no action to correct the problem, don't give up, and escalate the concern if needed.
- Don't ever walk or climb on equipment which is not intended for that purpose. Do not walk or climb on anything that looks badly corroded – it might not support your weight.
- Report corrosion of piping, pipe supports, vessels, equipment supports, ladders, stairs, work platforms, building structural steel, or any other critical equipment.

Report corroded equipment and holes in tanks!

Questions:

Students may find helpful the full CSB [incident report](#) and this [webpage](#).

1. **(15 min)** Besides reporting and fixing holes and cracks in tanks, what are three of the biggest lessons to take away from the 2001 exploding tank incident? *Hint:* consider the danger of welding and repairing numerous holes every year for several years and how this is affected by hot work (*i.e.* welding). Consider also how the corrosion can be prevented.
2. ***** (20-30 min)** Besides not walking on the top of tanks and avoiding walking on anything which looks weak or corroded, what design or procedural changes would you have implemented as a result of the 2016 tank roof corrosion incident? *Hint:* You may find this [resource](#) and the full [incident report](#) helpful.
3. **(5 min)** *What did you learn?*
Besides reporting holes or corrosion in tanks, support structures, piping, etc. and not walking or climbing on equipment which is unable to support your weight, what lessons have you learned from this article and how can you apply them to your chemical engineering career?