



Safety Impact			Environmental Impact		Production Impact		Damage
Fatalities	Injuries	First Aid	Leak Volume	Reportable	Days	Cost	Cost
0	0	0	Large	Yes	?	\$\$\$\$	\$\$\$\$

The Incident

A major fire erupted and caused extensive property damage including collapse of a 50 m tall vacuum distillation column. The blaze covered an area of approximately 800 m² at one point and eyewitness accounts said that the flames reached 150 m in height and could be seen from several kilometers away. The fire department co-ordination centre sent 23 firefighting vehicles to tackle the fire. The fire was finally extinguished approximately 5½ hours later although some spot fires continued to burn for several more hours. The refinery was only able to run at around 55% capacity for several months until a mothballed vacuum distillation unit that was originally designed for bitumen feedstock production was revamped for vacuum gas oil production as an interim measure to minimise lost production. The revamped unit started up on 14-Feb-07, enabling production to be ramped up to around 72% capacity. The fire-damaged unit was eventually rebuilt and restarted on 20-Jan-08, thereby restoring the refinery to its pre-fire capacity.

Background

The cost of lost production was less than might have been expected because refinery throughput was already reduced because it had been forced to import crude oil by tanker after an incident on a supply pipeline 10 weeks earlier resulted in the pipeline being shut down indefinitely. It had still not been restarted 4 years later. The pipeline shutdown and refinery fire had both occurred in the midst of negotiations over sale of the formerly state-owned refinery. Suspicions were raised as to whether these incidents were accidents or industrial sabotage, but no evidence of foul play was found.

Causes

The immediate cause of the fire was loss of primary containment (LOPC) due to rupture of the vacuum bottoms line as a result of thinning caused by a combination of high temperature sulphidation and erosion. A major contributing factor in the destruction of the entire unit was absence of fireproofing on the vacuum distillation column skirt. Root causes included inadequate inspection and inadequate design (incorrect metallurgy of the vacuum bottoms piping).

Lessons

Sulphidation corrosion (also known as sulphidic corrosion) is a result of naturally occurring sulphur compounds found in crude oils. In the absence of hydrogen, the rate of sulphidation corrosion depends on many factors such as the concentration and type of sulphur compounds present and the fluid temperature and flow rate. Hydrogen sulphide (H₂S) is the most active sulphur species from a corrosion perspective and sulphidation corrosion rates increase rapidly above 260 °C (500 °F), especially for carbon steel. Sulphidation corrosion can be localised or general in nature although the majority of cases exhibit general thinning. If general thinning occurs over a large enough area, a rupture of the pressure containment envelope (in this case piping) can occur, resulting in a release of a large quantity of material to atmosphere. High chrome alloys should be specified for all wetted piping or equipment operating in sour service at temperatures above 260 °C (500 °F) because they offer excellent resistance to high temperature sulphidation.

Fireproofing is a passive fire protection system which enables a degree of fire exposure to be tolerated while a fire is being brought under control and extinguished without major collapse or further failures that could lead to the spread of burning liquids and exacerbate property damage. Since vacuum distillation columns contain large inventories of flammable hydrocarbons above their autoignition temperature, fireproofing should be applied on external surfaces of the column support skirt. Consideration should also be given to applying fireproofing on the internal surfaces of the column support skirt if it contains any flanges or valves. However, fireproofing should not be applied to the bottom head of the column even if the internal surfaces of the skirt are being fireproofed.