


Incident Title		Hot Alkylate Release During Pump Maintenance	
Incident Type		Fire and Explosion	
Date		8 th April 2004	
Country		USA	
Location		Ciniza, NM	
Fatalities		Injuries	
0		6	
		Cost	
		US\$ 13 m (2005) – Ref. 1	
Incident Description		<p>The day before the incident, operators attempted a scheduled switchover of the motor-driven iso-stripper bottoms recirculation pump to the turbine-driven spare pump. However, the spare pump would not rotate, so a work order was raised to repair it the next day. [Switching of the 2 pumps was done regularly to prevent accumulation of corrosion deposits which could cause seizure of the pumps or erosion/scoring (“galling”) of the pump’s mechanical seals.]</p> <p>An operator issued a permit outlining the work to be done and the safeguards required including energy isolation of the pump set and use of lock out/tag out (LOTO) protocols for the relevant isolation valves. The pump isolation valves were quarter-turn plug valves operated manually using a valve wrench. While preparing the pump for maintenance, the operator saw the suction valve wrench was aligned with the process piping, so he turned it 90° believing he was closing the valve (in fact he was opening it). He tagged the suction and discharge valves to indicate they were closed and to prevent inadvertent opening. One of the 2 assigned mechanics then fitted locks and tags on the same valves. [Neither mechanic had seen the operator prepare the pump for maintenance. Both assumed it had been fully isolated as the suction valve appeared to be closed and the operator had tagged both isolation valves.]</p> <p>The operator disconnected a temporary hose connection between the pump vent and the flare header to verify zero pressure in the pump casing. A small amount of liquid flowed out of the hose for a few seconds then subsided. The mechanics proceeded to unbolt the shaft coupling and the flange connecting the pump to its casing. As the flange was prised apart, alkylate at 10.3 barg (150 psig) and 177 °C (350 °F) was suddenly released. The alkylate ignited and several explosions occurred 30 – 45 seconds later. Six employees were injured (some seriously burned) and production was not resumed until 4Q04.</p>	
 <p>Credit: US Chemical Safety Board</p>			
Incident Analysis		<p>Basic cause was a release of flammable liquid (alkylate) due to disassembly of the spare pump with its suction valve inadvertently left open.</p> <p>Critical factors included: 1) Both iso-stripper bottoms pumps had suffered recurring seal leaks or pump seizure problems (23 in the prior 12 months), 2) Operators used valve wrench positions as valve open/closed indicators, 3) The vent line on the spare pump casing was plugged with solid deposits, 4) The iso-stripper operating pressure was ≥ 1.7 bar (25 psi) above industry typical (the resulting higher temperatures led to accelerated corrosion).</p> <p>Root causes included: 1) Inadequate preventative maintenance (failure to identify and correct causes of recurring pump problems, high risk breakdown maintenance routinely undertaken), 2) Failure to conduct a management of change (MoC) review (change from handwheel to bar-type hand wrench), 3) Inadequate equipment design (removable valve wrench collar could easily be installed in wrong orientation, position indicator on stem not easily visible), 4) Inadequate lock out/tag out (LOTO) procedure (verify isolation effective).</p>	
Lessons Learned		<p>1) LOTO procedures for maintenance of machinery should specify all measures required to verify a safe energy state, 2) A rigorous MoC review should be carried out before any changes are implemented on process plant, 3) Preventative maintenance is less hazardous than breakdown maintenance.</p>	
More Information		<p>1) “Oil Refinery Fire and Explosion”, US Chemical Safety and Hazard Investigation Board (CSB), Report No. 2004-08-I-NM (2005).</p>	
Industry Sector		Process Type	
Oil & Gas		Alkylation (HF)	
Equipment Category		Equipment Class	
Not equipment-related		Not applicable	
		Incident Type	
		Explosion & Fire	
		Equipment Type	
		Not Applicable	