


Incident Title		Debutaniser Drain Line Failure	
Incident Type		Fire	
Date		10 th June 2000	
Country		UK	
Location		Grangemouth (Stirlingshire)	
Fatalities		Injuries	Cost
0		0	Unknown
Incident Description		<p>During restart of the fluid catalytic cracker (FCC) after an electrical power failure, an operator noticed a hydrocarbon vapour leak in the unsaturated gas plant (USGP) section of the unit shortly after liquid transfer from the debutaniser column to the downstream rerun column had been initiated. The control board operator was notified and feed to the FCC was stopped. A few minutes later, while a team of operators was investigating and attempting to isolate the source of the leak, the vapour ignited on contact with an uninsulated section of slurry pipe at the debutaniser reboiler and a major fire erupted. The operators escaped safely and a fire detector in the nearby hot oil pumphouse alerted the control board operator that a fire had started.</p> <p>The incident was attended by on-site emergency services and the external fire brigade. The fire was brought under control within 90 minutes and the remaining hydrocarbon inventory was allowed to burn off. It was finally extinguished after a total duration of approximately 6½ hours. Fortunately, no-one was hurt. The effluent treatment plant's storm water tanks quickly filled to capacity due to the combination of recent heavy rain and the large quantity of water used to fight the fire, so contaminated effluent had to be diverted to the River Forth. The FCC remained shut down for several weeks.</p>	
 <p>Credit: UK Health & Safety Executive</p>			
Incident Analysis		<p>Basic cause was loss of primary containment (LOPC) from a DN 150 x 80 (6" x 3" NS) reducing tee branch on the debutaniser to rerun column transfer line due to fatigue cracking and subsequent mechanical overload.</p> <p>Critical factors included: 1) The leak location was upstream of first isolation valve in transfer line (entire inventory of debutaniser system released), 2) High levels of cyclic stresses on transfer line pipework (numerous operational problems, multiple shutdowns/startups since FCC converter major revamp two years earlier), 3) Incorrect tee piece design (set-on instead of forged), 4) Inadequate pipework support (valve on redundant debutaniser pumpout line had been removed, leaving only the welded tee piece to provide support), 5) Inadequate inventory isolation within the USGP (extended duration of fire), 6) The prevailing wind blew much of the leaking vapour away from the most congested area of the plant (avoiding a potential vapour cloud explosion).</p> <p>Root causes included: 1) Failure to conduct management of change (MoC) review before redundant debutaniser pumpout line was disconnected from common DN 80 (3" NS) section of pipe shared by dewatering drain and hydrocarbon pumpout lines, 2) Inadequate pipework inspection (dead legs, redundant pipe/fittings), 3) Inadequate process design (FCC converter revamp, absence of remote-operated shutoff valves between USGP columns, insufficient storm water retention capacity), 4) Failure to learn (other vibration-related incidents at debutaniser not communicated or investigated).</p>	
Lessons Learned		<p>1) Process hazard analyses (PHAs) and management of change (MoC) reviews should take account of abnormal conditions created by operational instability resulting from process/equipment unreliability (e.g. high vibration). 2) Remotely operated shutoff valves can help minimise the impact of an uncontrolled leak.</p>	
More Information		<p>"Major Investigation Report – BP Grangemouth Scotland 29th May -10th June 2000", Health and Safety Executive (HSE) and Scottish Environment Protection Agency (SEPA), 2003: Major Investigation Report.</p>	
Industry Sector		Process Type	Incident Type
Oil & Gas		Fluid Catalytic Cracking	Fire
Equipment Category		Equipment Class	Equipment Type
Mechanical		Piping	Fittings (Reducing Tee)