

Incident Title		Xylene Column Reboiler Tube Rupture and Major Fire	
Incident Type		Fire	
Date		21 st August 2017	
Country		Netherlands	
Location		Rotterdam, ZH	
Fatalities		Injuries	Cost
0		0	Unknown
Incident Description		<p>The Powerformer (catalytic reforming) unit incorporates 6 furnaces which share a common waste heat boiler (WHB) and flue stack. On 21-Aug-17 at around 19:30 hrs, 1 of 2 running recycle gas compressors tripped and could not be restarted (it was later discovered this was due to a short-circuit in the compressor motor power cable). The unit was able to continue operating at reduced throughput. However, immediately afterwards, the WHB automatic bypass system activated, diverting flue gas directly to the stack (it was later discovered the short-circuit caused a voltage dip which tripped the WHB fan).</p> <p>The outside operator could find no obvious cause for the WHB bypass trip and eventually managed to reset the isolation dampers, enabling steam generation to resume. Shortly afterwards, a WHB high flue gas pressure trip initiated an automatic “heat off” shutdown of all 6 furnaces. After discussion between the control board operator and shift team leader, a decision was made to attempt a “hot restart” of the furnaces. The 3 reforming furnaces were successfully restarted by 19:50 hrs and the xylene column reboiler was restarted at 20:09 hrs; the other 2 furnaces followed. The xylene column reboiler circulation pump tripped on motor overload at 20:05 hrs, but unknown to the control board operator, the automatic standby pump was out for maintenance. The low flow trip protection system was manually over-ridden at the local panel and acknowledged by the control board operator, enabling restart of the xylene column reboiler at 20:29 hrs. A fire erupted in the reboiler at 21:22 hrs and quickly escalated as almost 110 t of hydrocarbons from the xylene column drained into the firebox and fuelled the fire. All the furnaces had to be demolished and rebuilt. The Powerformer was off-line for ~ 1 year.</p>	
 <p>Credit: Dutch Safety Board</p>			
Incident Analysis		<p>Basic cause was a xylene column reboiler radiant tube rupture due to overheating with burners operational in absence of reboiler circulation flow.</p> <p>Critical factors included: 1) The control board operator was distracted by a huge number of alarms (~250 alarms every 10 mins of which >60 were top priority), 2) Operators were not aware that the reboiler circulation pump was not available, 3) The safety-critical reboiler low flow trip was over-ridden.</p> <p>Root causes included: 1) Inadequate safeguarding system design (too many alarms, poorly prioritised), 2) Inadequate emergency operating procedures (simultaneous trip and hot restart of 6 furnaces), 3) Inadequate control of work (safety-critical reboiler low flow trip bypassed without formal risk assessment), 4) Inadequate maintenance management system (communication and documentation of maintenance status of standby reboiler circulation pump to ensure operator awareness), 5) Inadequate monitoring and oversight of operating conditions during abnormal operation.</p>	
Lessons Learned		<p>1) Safety-critical trips (eg. low furnace pass flow) should not be removed for any reason except for maintenance/testing, regardless of inconvenience.</p> <p>2) The total number of top priority alarms should be limited to a quantity that the control board operator can effectively monitor.</p> <p>3) Operators must always be aware of the maintenance status of safety critical equipment.</p>	
More Information		<p>1) “Fire at Esso, August 21, 2017”, Dutch Safety Board (OVV), July 2019.</p> <p>2) “Why is the recent ESSO fire investigation important for ergonomics?”, Ergos BV, 2019, EssoFireInvestigation_Ergonomics.pdf (ergos.nl).</p>	
Industry Sector		Process Type	Incident Type
Oil & Gas		Catalytic Reforming	Fire
Equipment Category		Equipment Class	Equipment Type
Mechanical		Heaters & Boilers	Direct-fired Heater