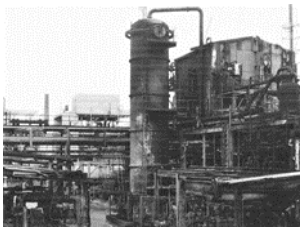
Incident Title	**Ethyl Chloride Recirculation Line Failure**	
Incident Type	Fire	
Date	1st February 1994	
Country	UK (England)	
Location	Ellesmere Port (Cheshire)	
Fatalities	**Injuries**	**Cost**
0	18	£ 6.1 m (2010) – Ref. 2

Incident Description



Credit: UK Health & Safety Executive

Ethyl chloride (EC) was being manufactured by a liquid phase reaction between ethylene (C_2H_4) and hydrogen chloride (HCl) with an aluminium chloride ($AlCl_3$) catalyst at around 3.1 barg (45 psig) and 50 °C (122 °F). EC was drawn off the top of the reactor and polymer (waste) oil was drawn off the bottom. Both were fed to a slops drum where liquids were separated and pumped back to the reactor. The slops recirculation pump stopped running. Around 20 minutes after the standby pump (a common spare for polymer oil and slop recirculation) was started, the discharge pipe of the standby pump failed causing a release of reactants and formation of large flammable and toxic vapour cloud. The vapour cloud eventually found an ignition source (believed to be an electrical control panel for a nearby compressor). An intense pool fire ensued directly below the reactor.

Incident Analysis

Basic cause was release and ignition of a flammable vapour cloud due to mechanical failure of a pump discharge pipe spool either at a corroded flange or at a PTFE bellows connection in a flexible pipe spool.

Critical factors included: 1) The common spare standby pump discharge flange had a history of severe corrosion, 2) The associated motor driver was not adequately anchored to the baseplate and the shaft coupling was misaligned (causing pipe vibration), 3) Visual alarms indicating a slop recirculation pump fault and a high liquid level in the slop drum were missed by control board operators on successive shifts for 11 hours (increased inventory of flammable slops), 4) Isolation valves required manual operation with poor access due to a complex piping arrangement in a congested space, 5) Fire fighters were initially unaware that the leaking fluids were flammable, 6) The off-site alarm indicating toxic gas release was only sounded ~ 30 minutes after the on-site fire alarm was initiated.

Root causes included: 1) Inadequate design (manual isolation valves, poor access), 2) Inadequate alarms (visual not audible), 3) Inadequate hazard awareness (EC flammability), 4) Inadequate preventative maintenance (reactive rather than proactive work orders and inadequate documentation of maintenance activity), 5) Inadequate inspection (corrosion monitoring), 6) Inadequate emergency response planning (toxic risk prioritised over fire risk), 7) Inadequate training (absence of emergency response drills), 8) Inadequate communication (informing the public).

Lessons Learned

1) Process hazard analysis (PHA) studies should consider public health and environmental impacts of all types of loss of primary containment events.
2) Remote-operated emergency block valves (EBVs) can be deployed to control large accidental releases of flammable materials.
3) The toxicity of products of combustion from plant fires should be assessed in advance to facilitate appropriate response by emergency responders and appropriate communications with public health officials and nearby residents.
4) Maintenance and inspection activity should be supervised by a competent, professionally qualified engineer to ensure plant integrity.

More Information

1) “A Report of the Investigation by the Health and Safety Executive into the Chemical Release and Fire at the Associated Octel Company, Ellesmere Port on 1 and 2 February 1994”, HSE Books (1996), ISBN 0 7176 0830 1.
2) “A Release of Chemicals followed by a Major Fire”; T. Fishwick, IChemE Loss Prevention Bulletins 214 & 215 [Parts 1 & 2 respectively] (2010).

Industry Sector	Process Type	Incident Type
Petrochemicals	Ethyl Chloride	Fire
Equipment Category	**Equipment Class**	**Equipment Type**
Mechanical	Piping	Flanged Joint

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