Facility	Flixborough (Nypro UK)
Date	1st June 1974
Consequences	28 fatalities and 36 injured. Offsite consequences resulted in 53 reported injuries.
Description of accident	The cyclohexane plant consisted of a train of six reactors in series. Prior to the explosion, on 27 March 1974, it was discovered that a vertical crack in reactor No.5 was leaking cyclohexane. The plant was subsequently shutdown for an investigation which identified a serious problem with the reactor. The decision was taken to remove it and install a bypass assembly to connect reactors No.4 and No.6 so that the plant could continue production. During the late afternoon on 1 June 1974, a 20 inch bypass system ruptured, which may have been caused by a fire on a nearby 8 inch pipe. This resulted in the escape of a large quantity of cyclohexane. The cyclohexane formed a flammable mixture and subsequently found a source of ignition. There was subsequently a massive vapour cloud explosion which caused extensive damage and started numerous fires on the site.
Key Lessons Learnt [1]	• Plant modification A plant modification occurred without a full assessment of the potential consequences. Only limited calculations were undertaken on the integrity of the bypass line. No calculations were undertaken for the dog-legged shaped line or for the bellows. No drawing of the proposed modification was produced. • Maintenance procedures No pressure testing was carried out on the installed pipework modification. • Plant layout Those concerned with the design, construction and layout of the plant did not consider the potential for a major disaster happening instantaneously. • Control room design Control rooms should be designed to withstand major hazards events. 18 fatalities occurred in the control room. • Operating procedures The incident happened during start up when critical decisions were made under operational stress. In particular, the shortage of nitrogen for inerting would tend to inhibit the venting of off-gas as a method of pressure control/reduction. • Limit inventory in plant The large inventory of flammable material in the plant contributed to the scale of the disaster. Limiting inventory is part of the inherently safer design principle.
Reports & Links	1) HSE website: COMAH incident reports 2) Lees' Loss Prevention in the Process Industries: Hazard Identification, Assessment and Control, ed. Mannan, S., 3rd edition, Elsevier Butterworth-Heinemann, 2005