Lessons Learned Database
Individual Incident Summary Report

IChemE
Safety & Loss Prevention
Special Interest Group

Incident Title	**Coke Drum Fire During Coker Unit Restart**
Incident Type	Fire
Date	25th November 1998
Country	USA
Location	Puget Sound, WA

Fatalities	**Injuries**	**Cost**
6	0	Unknown

Incident Description

Credit: US Chemical Safety Board

The Delayed Coker Unit (DCU) incorporates 2 large vertical coke drums ("A" and "B") which normally operate at ~ 496 °C (~ 925 °F) on a 15 or 16 hr cycle. A switchover valve diverts feed in the charge heater outlet (transfer) line from the first drum (when full) to the second (empty) drum. The full drum contains petroleum coke and unconverted oil which is removed by steam when taken off-line. The coke bed is then cooled by injecting water into the drum. After depressuring the drum to the blowdown system and venting to atmosphere, the top and bottom heads are removed and the solid mass of coke is cut with a high pressure water drill into chunks which fall into a pit below. The empty drum is then air-freed with steam and warmed ready for the next switchover.

A power outage at ~ 00:01 hrs on 24-Nov-98 resulted in a site-wide shutdown. Power was restored at ~ 02:00 hrs. Steam production resumed at ~ 12:30 hrs. DCU operations were interrupted ~ 1 hr into the normal charging cycle. Feed had switched to on-line drum "A" (now partially full) but did not have enough time to convert to coke, so it remained a hot liquid. Off-line drum "B" was full and being cooled. Tarry oil in the heater transfer and drum feed lines had solidified during the outage so operators were unable to cool drum "A" with steam and water. On the morning of 25-Nov-98, after more attempts to inject steam into drum "A", operators erroneously interpreted relatively low drum temperatures to mean its contents had cooled sufficiently. A work permit was issued to dehead the drum. The top head was removed without incident but when the bottom head was lowered, an eruption occurred expelling the drum contents in a few secs. The hot oil auto-ignited, engulfing 6 workers in flames.

Incident Analysis

Basic cause was an uncontrolled release and autoignition of unconverted hot oil due to premature deheading of the partially-full coke drum "A".

Critical factors included: 1) The control panel for the hydraulic lift used to lower coke drum bottom heads onto the deheading cart was located below the coke drums, 2) No operating procedure was available for cooling and emptying a partially-filled coke drum, 3) In 1996, while deheading a partially-full coke drum, a torrent of water and a gooey mixture of heavy oil and coke spewed out, requiring a major cleanup of the DCU, 4) Remembering this, the foreman decided ambient air cooling of coke drum "A" for just 37 hrs was sufficient to make it safe for emptying (post-incident analysis revealed several days would be required), 5) The plant manager failed to enlist technical expertise to determine the actual temperature of coke drum "A" contents.

Root causes included: 1) Failure to apply inherently safer design principles (hydraulic lift controls too close to coke drums), 2) Absence of operating procedure (cooling and emptying partially-full coke drum), 3) Lack of hazard awareness (residual heat in core of coke ball), 4) Failure to conduct management of change (MoC) review (air cooling versus steam and water cooling), 5) Inadequate job knowledge (insulating properties of coke, external skin temperature sensor limitations), 6) Inadequate training (operators and foreman), 7), Inadequate control of work (dehead work permit issued without verifying drum temperature), 8) Inadequate leadership (operations oversight).

Lessons Learned

1) Abnormal operations requiring deviation from approved procedures should be subjected to a rigorous management of change (MoC) review process.
2) Automatic deheading (slide) valves minimise operator exposure to hazard.

More Information

1) US Chemical Safety Board (CSB) Safety Bulletin 2001-04-SB: Case Study.

Industry Sector	**Process Type**	**Incident Type**
Oil & Gas	Coking	Fire
Equipment Category	**Equipment Class**	**Equipment Type**
Not equipment-related	Not applicable	Not applicable

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