High Learning Value Incidents

CSChE Process Safety Management Division

Date: September 2002

HLV Alert No: 2007-01

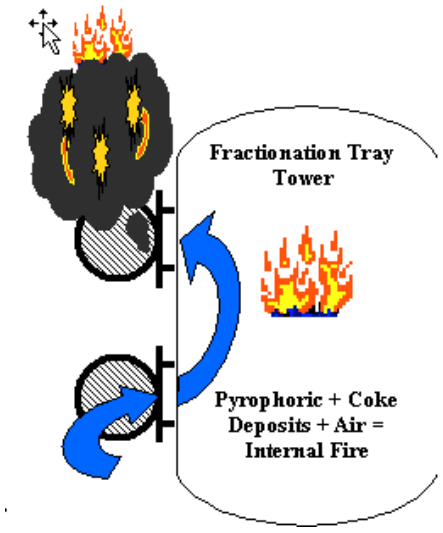
Fire Inside Fractionation Tower

Summary/ Description:

- Fractionator shutdown and hydrocarbons drained a few days before the incident. Steamed out 3 days prior to entry.
- 5 hours before incident, nearly all manways were opened up.
- 3 hours before fire discovered, sharp temperature rise (~ 170 C per hr) at gas oil off-take tray of the tower unnoticed by operators. Within 1 hr temp was off the scale.
- 2 hours later flames were seen issuing from two of the tower manways.
- ER crew did not have enough pressure to reach top manway. Used standby pump to try to increase pressure. Another problem - flowrate inadequate, recommissioned fire water pump to help.
- 3 hours after discovery of fire the fire is brought under control
- Quenching continued for another 3 hours and then nitrogen used to inert tower

Contributing Factors:

- With 4 out of the 5 manways open, there was a significant draught (chimney effect) resulting in intense heat that led to buckling of the tower in the region of the coke deposits
- Impossible to completely avoid accumulation of iron scale and its conversion to pyrophoric iron sulphide.
- If coke deposits are likely, opening manways to atmosphere exacerbates risk of fire
- Inadequate immediately available fire water supplies
- Shutdown procedure had been carried out correctly and same procedure had been used several times before without incident, thus illustrating the somewhat random nature of the problem



Cause(s) of the Incident:

- Auto-ignition of pyrophoric material which in turn ignited extensive coke deposits

High Value Learnings:

- These incidents are not always easily predicted with precision due to the "random nature of the problem" (See Contributing Factors above). The trigger for caution is basically "opening up to atmosphere a vessel, that has significant internals (e.g., high surface area internals) or deposit buildups, that has been in hydrocarbon service "
- Increase operator training, awareness and vigilance in minimizing effects of pyrophorics
- Consider use of water or dilute sodium carbonate for washing towers in preparation for maintenance (check chemical compatibility with materials of construction)
- Provide means of dealing rapidly with fires; e.g., replacing manhole covers safely & then introducing nitrogen
- Provide an installed, readily available, supply of water to "dampen down" the internals to prevent heat buildup that eventually leads to fire break-out
- Provide means of dealing with coking in regions of the tower where it occurs most predominantly; i.e., in flash zone where liquid loading on trays are low. Determine methods of monitoring tower performance to highlight low liquid loadings and to initiate controlling/ corrective action.
- Open towers/vessels to atmosphere only during day shifts when personnel numbers are at the highest levels. Monitor towers/ vessels closely while they are open.
- Consider taking samples of scale/ residue/ buildup after opening tower/vessel and preserving the samples in a container with an inert gas. Should a reactive event occur, the samples could be analyzed for chemical makeup.
- Adequate fire-fighting water and equipment should be available at all times. Fire water supplies and other emergency facilities must never be interrupted unless adequate alternatives are put in place first.

More Information & Data Sources:

- IChemE Loss Prevention Bulletin August 2002 – A fire in a Fractionator Causes Major Loss

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