



“CSB Investigation of BP Refinery Explosion and Fire”

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Gary Visscher
Board Member

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BP – Texas City, TX

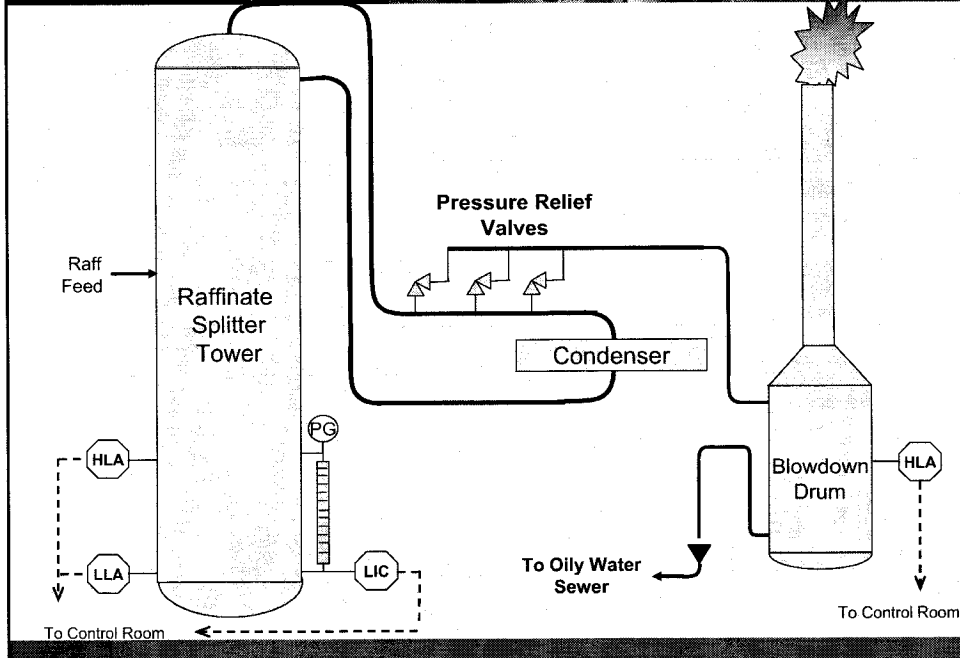
- March 23, 2005
- Flammable vapor cloud, explosions, and fire
- 15 deaths
- 180 injured
- Offsite property damage





Incident Summary

- Occurred during startup
- Tower and blowdown drum overfilled
- Liquid hydrocarbon released
- Vapor cloud formed and ignited
- Destruction included trailers close to blowdown drum





Post-Incident Investigation Timeline

- March 23, 2005 – Explosion occurred, at about 1:20 pm
- June 15, 2005 – Process and Operational Audit Review of the Texas City refinery, conducted by team of internal and external experts (Stanley Report), to assess overall safety condition of operations at Texas City, was issued.
- July 28 and August 10, 2005 -- two incidents at the Texas City refinery result in significant property damage and community shelter in place.
- August 17, 2005 – CSB issued recommendation to BP to convene an independent panel to assess safety and corporate oversight of US refinery operations.



Timeline (cont)

- September 21, 2005 – OSHA issued \$21.4 million fine against BP for violations found in investigation of March incident and 2 previous fatalities at the refinery. BP accepted citations and fines and agreed to a variety of conditions regarding future oversight.
- October 24, 2005 – BP announced formation of 11-member panel of experts, chaired by former U.S. Secretary of State James A. Baker III
- October 25, 2005 – CSB issued recommendation to API to develop new safety guidance for the placement of trailers away from hazardous process areas.



Timeline (cont)

- December 9, 2005 – BP's incident investigation team, headed by John Mogford, issued its report on the incident. (Mogford Report).
- June 30, 2006 – CSB released report on blast damage information from the March, 2005 explosion, showing damage to trailers at further distances than previous models would suggest.
- October 15, 2006 – CSB issued report and safety bulletin based on July 28, 2005 incident at the refinery, recommending better use of positive materials verification.



Timeline (cont)

- October 31, 2006 – CSB issued safety recommendation to oil industry to eliminate use of unsafe blowdown drums and recommending that OSHA conduct a special emphasis program for refineries to assure noncompliant drums and atmospheric discharge were replaced.
- January 16, 2007 – Baker panel issued its final report.
- March 20, 2007 – CSB issued its final report and recommendations



Baker Panel

- Established to assess and report on the effectiveness of BP North America's corporate oversight of safety management systems at its refineries and its corporate safety culture.
- Membership, in addition to Secretary Baker, included
 - Retired Admiral Frank Bowman, President and CEO of Nuclear Energy Institute
 - Glenn Erwin, United Steel Workers
 - Slade Gorton, former U.S. Senator and member of 9/11 Commission
 - Dennis Hendershot, Chilworth Technologies and CCPS
 - Dr. Nancy Leveson, Professor, MIT
 - Sharon Priest, former Arkansas Secretary of State
 - Irv Rosenthal, Wharton Center and former CSB Board Member
 - Paul Tebo, retired DuPont V-P for Safety, Health & Environment
 - Dr. Douglas Wiegmann, Mayo Clinic
 - Duane Wilson, retired V-P for refining, ConocoPhillips



Baker Panel (cont)

The Panel's assessment and recommendations focus on the following areas – BP's corporate safety culture, process safety management systems, and performance evaluation, corrective action, and corporate oversight, as they pertained to and affected U.S. refinery operations.



- “Although we necessarily direct our report to BP, we intend it for a broader audience. We are under no illusion that deficiencies in process safety culture, management, or corporate oversight are limited to BP. Other companies and their stakeholders can benefit from our work. We urge these companies to regularly and thoroughly evaluate their safety culture, the performance of their process safety management systems, and their corporate safety oversight for possible improvements. We also urge the same companies to review carefully our findings and recommendations for application to their situations.”

Panel Statement, Baker Panel Report



CSB Report

- Attempted to look at all factors that impacted on the March 23, 2005 accident. Report identified numerous errors and deficiencies, ranging from direct and immediate causes to corporate decisions and oversight, that played a role in this accident.



- **Errors in the immediate sequence**

- Pre Startup Safety Review not conducted
- Key equipment was identified as malfunctioning but not repaired prior to startup
- Check on functionality of alarms was not conducted.
- Items on startup checklist were not done but checked as completed
- Starting, stopping and restarting was not covered in procedures.
- Night operator did not record completed steps, leaving no record for next shift.
- Only one of two tower level alarms was working
- Procedures called for filling tower to 50%, but operator filled to 99% (indicated).



- **Immediate sequence errors (cont)**

- Night lead operator, who filled the tower, left an hour before shift ended. Only entry on log book was "ISOM: brought in some raff to unit, to pack raff with."
- Day Supr A arrived an hour late, no opportunity for shift turnover.
- Shift directors meeting determined that startup should not proceed. Message was apparently not communicated to ISOM crew or Day Supr.
- Unclear communications about feed and product. Inside op. thought heavy raff storage was full, so closed outflow. Outside op. thought light raff was full so closed that.
- Level control valve not operating correctly.
- Level transmitter gave incorrect readings.



- **Errors and factors in immediate sequence**

(cont)

- Sight glass was unusable
- Day Supr left at 10:47 for family emergency. No substitute experienced supr on hand.
- Temperature increases in the tower exceeded those specified in procedures
- Fully opening outflow superheated the inflow, creating bigger temperature spike in tower and overpressure
- Blowdown drum's high level alarm did not sound.



- **System deficiencies.** Investigation showed that these immediate errors did not occur in isolation, but were part of broader safety system deficiencies.

- Procedural deviations
- Ineffective communication
- Malfunctioning instrumentation and equipment
- Incident investigation deficiencies
- Vehicle control
- Equipment design
- Trailer siting
- Incomplete PHAs
- Audit items not closed in scheduled time.



- Additional items that may have affected operators' decision making and actions (human factors)
 - Control board layout
 - Lack of trained supervisors, additional staffing during startup
 - Fatigue
 - Training
 - Failure to establish safe operating limits



- **Corporate issues** – lack of PSM focus and leadership
 - Changes in safety organization led to diffusion in process safety expertise, accountability
 - Aggregation of reports to executive leadership resulted in less focus on individual facilities
 - Safety focus and financial incentives tied to OSHA recordables, less emphasis on process safety indicators.
 - Ineffective responses to warnings (2002-2004) about conditions at TC
 - Spending and investment was tied to what was necessary to address emergencies and compliance (environmental), and resulted in less process safety.



Summary and Conclusion

- Factors in this accident are mostly not new, but point to need for vigilant care and attention to process safety.
- CSB recommendations go to some of the broader issues raised by this accident:
 - Siting for trailers and other temporary structures
 - Continued use and safety of blowdown drums
 - Guidelines for operator fatigue in chemical/refinery operations
 - Quality of training, particularly for upset conditions
 - Reliance on injury rates as sole safety performance indicator, and development of consensus process safety performance indicators.



Summary and Conclusion (cont)

- Government role. Report points out the difficulty that OSHA has in applying a traditional inspection approach to complex operations with low-incident but potentially catastrophic hazards.



Is it time to consider new approaches?

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