

Air Emission Control and An
Explosion at the BP Refinery in
Texas City, Texas

On March 23, 2005 at approximately 1:20 p.m., an explosion occurred in the isomerization (ISOM) unit at the BP petroleum refinery in Texas City, Texas. That explosion and associated fires killed fifteen people and injured at least one hundred and eighty more (1.).

The purpose of this report is to review some of the facts related to the March 23rd incident in the context of a particular air emission control regulation administered by the State of Texas.

The Isomerization Unit

The ISOM unit is an integral part of the BP refinery at Texas City. Simply stated, the ISOM unit accepts a feed stream composed of a liquid mixture of n-pentane and n-hexane and converts that feed to isopentane and isohexane. Those two hydrocarbons are then used as raw materials in other parts of the refinery.

The part of the ISOM unit that was the source of the hydrocarbon release that ultimately exploded on March 23rd was the raffinate splitter (E-1101), the raffinate splitter reflux drum (F-1102), and the ISOM unit blowdown drum (F-20) (2.).

Note that the ISOM unit blowdown drum was equipped with a one hundred and thirteen foot stack that discharged directly to the atmosphere and a "goose-neck" outlet that discharged to the refinery sewer system (3., 4.).

Note also that the blowdown system at the ISOM unit has been judged to be antiquated and unsafe (5.).

The explosion occurred as a result of the inadvertent development of dangerously elevated pressure in the raffinate splitter (E-1101) and the raffinate splitter reflux drum (F-1102). The elevated pressures caused the uncontrolled flow of hydrocarbon vapors and liquids to the blowdown drum (F-20) and the subsequent release of those hydrocarbon vapors and liquids to the atmosphere, the ISOM unit concrete pad, and the refinery sewer system.

For a complete rendition of the details of this catastrophic accident, see reference documents 1. and 2.

The Construction – Operating Permit Process

In the early 1970's, the Texas Air Control Board (TACB), a state agency created for the purpose of developing, implementing, and enforcing air pollution control regulations, established a permit system meant to limit atmospheric emissions from new or modified industrial facilities. Originally, known as Regulation VI, the rule required that an entity that intended to construct any new facility or modify any existing facility that would emit an air contaminant into the atmosphere or change the nature of air contaminate emissions into the atmosphere (in the case of a modified facility) must first obtain a construction permit from the TACB.

In order to obtain a construction permit, the facility proponent had to file a permit application with the TACB. Among other things, the application had to detail the kind and quantity of air contaminants that the facility operator intended to emit into the atmosphere from each and every emission source in the proposed facility (6.). The primary purpose of that requirement was to generate the information needed to judge the impact of proposed air emissions on the health and welfare of the surrounding community.

Once a construction permit was issued, and the permitted facility was built and started up, then the facility proponent had to file an application for an operating permit.

In order to obtain an operating permit, the applicant had to demonstrate that the facility was built in a manner consistent with the relevant construction permit and associated application.

Air Emission Permits and the ISOM Unit

Over the last three decades, BP and the previous operators of the Texas City refinery have submitted numerous construction and operating permit applications to the State regulatory agency. Perhaps the first of those applications was designated C-3170 (7.). Construction permit application C-3170 involved the construction of a “heavy ultraformate fractionator” (E-1101), a “reflux drum” (F-1102), and various associated equipment in the No. 1 ultraformer unit of the refinery. There was no indication in the application that either E-1101 or F-1102 would be vented to a blowdown drum.

In 1985, an application was submitted to convert the heavy ultraformate fractionator to a “raffinate splitter” (the designated usage at the time of the explosion). That change was granted by the TACB under permit exemption X-16167 (8.).

In 1991, an application for continuance of Permit R-3170 (R designates an operating permit) was filed on behalf of the Texas City refinery operator (9.).

Neither the permit exemption X-16167, nor the application for continuance of permit R-3170 contains any apparent indication that the raffinate splitter (E-1101) or the reflux drum (F-1102) would or could be vented to the blowdown drum (F-20).

The failure to disclose the existence of the blowdown drum (F-20) and its association with the raffinate splitter (E-1101) and reflux drum (F-1102) apparently continued thru the day of the subject explosion including interactions with the TCEQ related to BP’s efforts to obtain a so-called flexible permit for the ISOM unit and other parts of the Texas City refinery.

It must be emphasized that those repeated failures to identify the blowdown drum (F-20) as an air emission source constituted violations (perhaps including criminal violations) of the rules and regulations of the State of Texas air emission control regulatory agency.

Some Technical Aspects of the Blowdown System

The blowdown drum (F-20) was first constructed in the 1950's. It was a vertical drum, ten feet in diameter, equipped with a one hundred and fifteen feet high stack (10.). The use of the blowdown drum was highly questionable in terms of good engineering practice. American Petroleum Institute standards indicate that similar systems can be safely operated if environmental regulations permit such discharges (emphasis added) and if careful attention has been paid to the air pollution consequences of said operating practice (11.). Refinery engineering specifications in place in 1992 stated that new blowdown systems which discharged directly to the atmosphere were not permitted (12.).

Furthermore it was documented by BP personnel that the blowdown drum (F-20) could have and should have been modified to discharge to a flare (instead of directly to the atmosphere) on at least two occasions. The first of those two occasions was 1995 when a new flare system was installed in the refinery Aromatics Unit No. 2. The second occasion was in 2002 when the refinery Naphtha Desulfurization Unit flare line was moved to a place in close proximity to the blowdown drum (F-20) (13.).

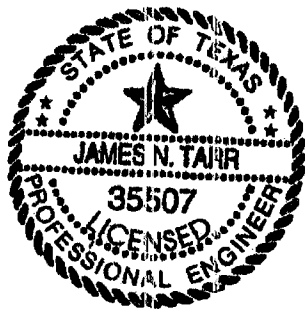
Finally, it must be noted that BP personnel clearly recognized that explosion and fire was an ongoing threat at the blowdown drum (F-20) (14.).

Conclusion

The blowdown drum (F-20) was apparently the source of the hydrocarbon emission that resulted in an explosion and fires at the BP refinery in Texas City on March 23, 2005. That piece of equipment was operated in violation of the State of Texas air

23, 2005. That piece of equipment was operated in violation of the State of Texas air emission control regulations for approximately thirty years prior to the incident. It was operated contrary to American Petroleum Institute standards. It was operated contrary to corporate engineering guidelines.

Given the numerous times that refinery personnel had an obligation to identify the blowdown drum (F-20) as an air emission source, and given the multiple failures of refinery personnel to modify the operation of the blowdown drum (F-20) to eliminate the hydrocarbon discharge to the atmosphere, it must be concluded that failure to reveal the existence of the blowdown drum (F-20), and its method of operation, to the responsible State of Texas air emission regulatory agency was a deliberate failure on the part of refinery decision makers.



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References

1. "Investigation Report – Refinery Explosion and Fire", Report No. 2005-04-1-TX, U.S. Chemical Safety and Hazard Investigation Board (CSHIB), March 2007, page 17.
2. "Fatal Accident Investigation Report – Isomerization Unit Explosion, Interim Report", John Mogford, May 12, 2005, page 32.
3. Drawing B-4550-G-2622-1, "Isomerization Unit P & ID, Raffinate Reflux Drum F-1102, 2-17-86.
4. Drawing C-4550-180, Ultraforming Unit #1, Engineering Flow Diagram, Relocation of Blowdown Drum, 10-18-55.
5. CSHIB, page 21.
6. Over the last thirty-five years, the name of the State of Texas regulatory agency and the applicable permit rule designation has changed several times. The current agency name is the Texas Commission on Environment Quality (TCEQ) and the current rule designation is 31 TAC 116.
7. "PI-1 General Application for a Permit to Construct a Heavy Ultraformer Fractionator at Ultraformer No. 1", Amoco Oil Company, Texas City, Texas, 2-27-75, Bates TCEQ00242-00252.
8. "Permit (R-3170) Continuance Application Fractionator/Splitter Unit, Submitted by Amoco Oil Company, Texas City, Texas, Prepared by Radian Corporation, May 1991, page 3.
9. Ibid, Bates BPISOM00302718-BPISOM00302764.

10. Mogford, page 10.
11. "Guide for Pressure-Relieving and Depressuring Systems", API Recommended Practice 521, Fourth Edition, American Petroleum Institute, March 1997, page 32.
12. "Evidence Building Blocks", no author, no date, Bates BPISOME00173831.
13. Mogford, page 21.
14. "Isomerization Unit HAZOP Item No. 14 Resolution", no author, no date, Bates BPISOME00331836-BPISOME00331850, see page 5 of 10.