

Incident Title		Fuel Gas Mix Drum Naphtha Release	
Incident Type		Fire	
Date		20 th September 2022	
Country		USA	
Location		Toledo, OH	
Fatalities		Injuries	Cost
2		13	US\$ 597 m (2024) – Ref. 1
Incident Description		Light virgin naphtha (LVN) from crude distillation unit #1 (CDU1) is normally routed to the naphtha hydrotreater (NHT) and the adjacent coker gas plant (CGP). Excess LVN is sent to storage. The CGP absorber/stripper (A/S) uses CDU1 LVN to absorb mercaptans from coker wet gas. A portion of the A/S bottoms is routed to a lean oil stripper (LOS) and the LOS bottoms is returned to the A/S. The remainder is routed to the NHT feed surge drum where it combines with naphtha from other units. Treated coker wet gas exits the A/S overhead and passes through a sour gas knockout drum (to remove entrained naphtha), an amine contactor (to remove hydrogen sulphide), and a sweet gas knockout drum (to remove entrained amine). It is then routed to a fuel gas mix drum (FGMD) where it combines with gas from multiple other process units and is burned in the refinery's gas-fired heaters and boilers. A CGP vapour bypass line allows coker wet gas to be routed directly to the FGMD. A series of 6 cascading operational upsets (including CDU1 instability, NHT emergency shutdown and CGP A/S liquid overflow) occurred in the 24 hrs preceding the incident. Liquid began to overflow from the FGMD into fuel gas lines feeding furnaces and boilers around the refinery. Four outside operators were dispatched urgently to drain the live FGMD to the refinery flare and oily water sewer systems from multiple drain points. Two operators then left the area to tackle another problem. The other two (possibly believing the liquid in the FGMD was entrained amine rather than flammable naphtha) opened drains direct to the ground. One of them removed a blind flange on the side of the FGMD and ~ 23,000 lb (10 tonnes) naphtha spilled to the ground. A vapour cloud formed and found an ignition source (probably CDU1 charge heater).	
Incident Analysis		Basic cause of the fire was ignition of a vapour cloud formed by operator(s) rapidly draining liquid naphtha to the ground from the pressurised FGMD. Critical factors included: 1) NHT and CGP outages removed the two main disposal routes for CDU1 naphtha, 2) Cascading operational upsets triggered > 3700 alarms in the 12 hrs preceding the incident (impaired control board operator's judgement), 3) Management team/operators did not invoke their "stop work authority" (e.g. CDU1 shutdown or placed on circulation), 4) Field operators were not fully aware of the flammable naphtha hazard in FGMD. Root causes included: 1) Inadequate process hazard analysis (potential for CGP A/S liquid naphtha overflow to FGMD not identified), 2) Inadequate process design (FGMD closed drain not sized for overflow), 3) Inadequate FGMD liquid overflow prevention/mitigation (relied on human intervention), 4) Inadequate alarm management (too many alarms, poorly prioritised), 5) Inadequate abnormal situation management (operator training, procedures, gun drills), 6) Failure to learn (similar near miss incident at FGMD in 2019).	
Lessons Learned		1) Refinery employees and contractors have the right and <u>responsibility</u> to stop any work they consider unsafe, 2) Operating limits should be defined beyond which abnormal situation management procedures (incorporating clearly defined corrective actions) should be followed, 3) Alarm prioritisation may be ineffective if alarm flood still delays control board operator response.	
More Information		1) "Fatal Naphtha Release and Fire at BP-Husky Toledo Refinery", US Chemical Safety and Hazard Investigation Board, Report No. 2022-01-I-OH (2024): https://www.csb.gov/bp---husky-oregon-chemical-release-and-fire/.	
Industry Sector		Process Type	Incident Type
Oil & Gas		Atmospheric Crude Distillation	Fire
Equipment Category		Equipment Class	Equipment Type
Not equipment-related		Not applicable	Not applicable