Factual Update

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U.S. Chemical Safety and Hazard Investigation Board

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The CSB is a scientific investigative organization, not an enforcement or regulatory body. Established by the Clean Air Act Amendments of 1990, the CSB is responsible for determining accident causes, issuing safety recommendations, studying chemical safety issues, and evaluating the effectiveness of other government agencies involved in chemical safety. More information about the CSB is available at www.csb.gov.

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Acronyms and Initialisms

API	American Petroleum Institute
CIMA	Channel Industries Mutual Aid
CSB	U.S. Chemical Safety and Hazard Investigation Board
DCS	Distributed Control System
EBV	Emergency Block Valves
EIV	Emergency Isolation Valves
EPA	Environmental Protection Agency
ERT	Emergency Response Team
HCFMO	Harris County Fire Marshal's Office
ISD	Independent School District
ITC	Intercontinental Terminals Company, LLC
OSHA	Occupational Safety and Health Administration
PSI	Pounds per square inch
PSM	Process Safety Management
RMP	Risk Management Plan
ROSOV	Remotely Operated Shutoff Valves
TCEQ	Texas Commission on Environmental Quality
USCG	U.S. Coast Guard

1.0 Incident Summary

On Sunday, March 17, 2019, at approximately 10:00 am, a large fire erupted at the Intercontinental Terminals Company, LLC (ITC) bulk liquid storage terminal located in Deer Park, Texas (**Figure 1**). The fire originated in the vicinity of Tank 80-8, an 80,000-barrel aboveground atmospheric storage tank that held naphtha, a flammable liquid, typically used as a feedstock or blend stock for production of gasoline. ITC was unable to isolate or stop the release of naphtha product from the tank, and the fire continued to burn, intensify, and progressively involved additional tanks in the tank farm. The fire was extinguished on the morning of March 20, 2019.

The incident did not result in any injuries to either ITC personnel or emergency responders. However, the local community experienced disruptions, including several shelter-in-place[a] notifications, which prompted local schools and businesses either to close or operate under modified conditions.

Figure 1. ITC Fire. This photo shows the ITC fire involving tank 80-8 on March 17, 2019. (Source: ABC13 Houston).

[a] A shelter-in-place is issued when it is safer for you to be sheltered indoors than for you to evacuate [20].

2.0 Background

2.1 Intercontinental Terminals Company, LLC

Intercontinental Terminals Company, LLC (ITC), a subsidiary of Mitsui & Co. USA, Inc., is a terminal operator and storage facility that specializes in servicing the petrochemical industry [1]. The company was founded on February 24, 1972 [1]. ITC participates in the American Chemistry Council's Responsible Care® program as a Partner Company [2]. ITC currently owns and operates two terminals near Houston, Texas that service its customers along the U.S. Gulf Coast, including ITC Deer Park and ITC Pasadena [1].

The ITC Deer Park Terminal, where the incident occurred, is a bulk liquid storage terminal that has been servicing customers in and around Houston, Texas since 1972 (**Figure 2**) [1]. The terminal is equipped with both rail and truck access, five ship docks, ten barge docks, and multiple pipeline connections [1]. At the time of the incident the ITC Deer Park terminal contained 242 storage tanks, which equated to an overall capacity of 13.1 million barrels [1]. These storage tanks, which ranged in size from 8,000 to 160,000 barrels, were reportedly used to store petrochemical liquids and gases, fuel oil, bunker oil and distillates [1]. According to statistics provided on the company's website, the ITC Deer Park Terminal handles approximately 770 ships, 3,700 barges, 12,000 rail tank cars, and 33,600 cargo tank trucks annually, with a total throughput of roughly 144-million barrels annually [1].

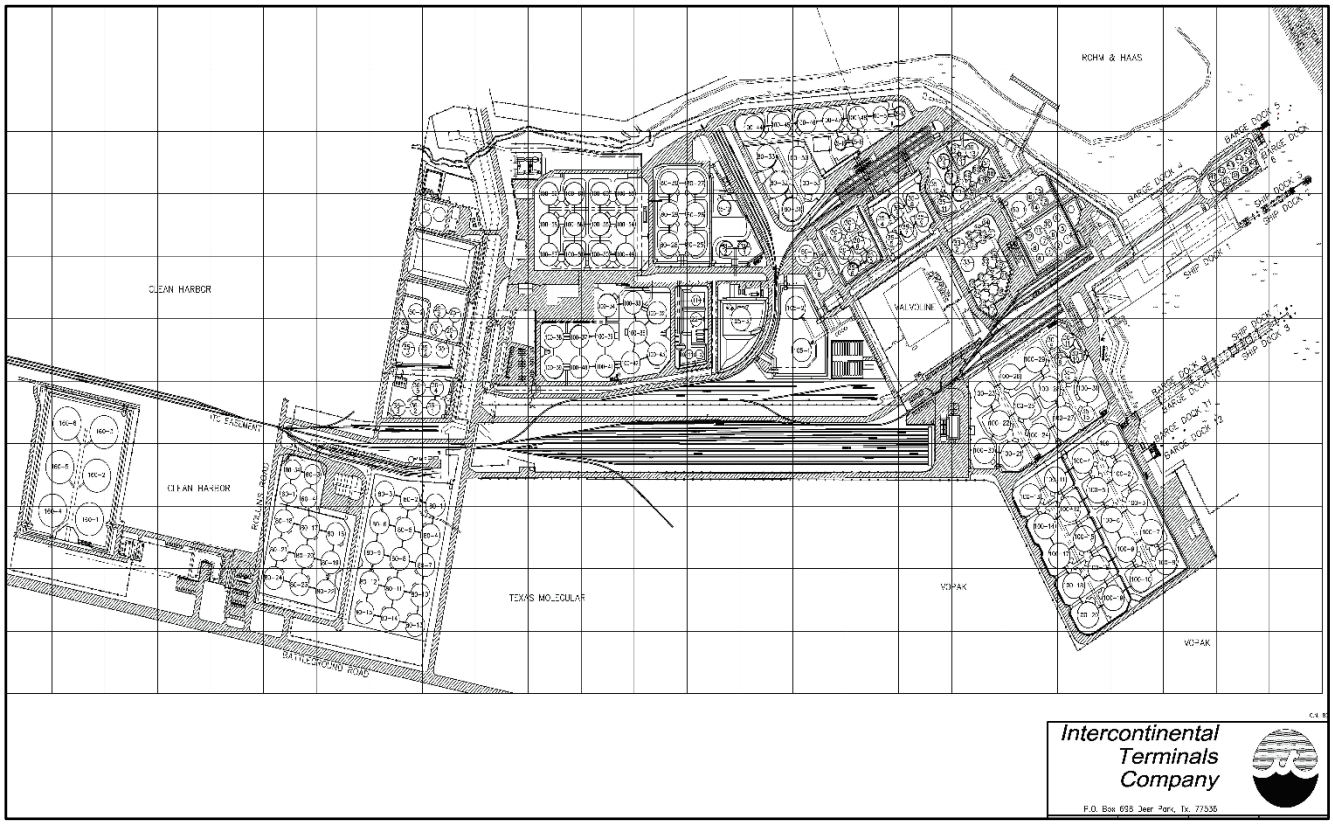

Figure 2. ITC Deer Park Terminal Overall Plot Plan. (Source: ITC).

2.2 Naphtha-Butane Blending Operation

Tank 80-8 was an 80,000-barrel aboveground atmospheric storage tank. The tank went into service in 1972 and was original to the ITC Deer Park Terminal. Tank 80-8 was leased to another company for naphtha storage and for naphtha-butane blending operations. ITC injects butane into the naphtha product using external piping and equipment (piping manifold) (**Figure 3**) to increase the octane level of the fuel product.

Figure 3. Tank 80-8 Piping Manifold. This image taken before 2016 shows Tank 80-8 and its piping manifold. (Source: ITC).

Butane is incorporated into Tank 80-8 via truck deliveries by way of a fixed butane injection system. The butane injection system originates at the truck loading rack, located south-west of the tank farm, and terminates at an injection point in the circulation line (piping manifold) at Tank 80-8. The control system is designed so that the butane injection operation cannot be started unless the Tank 80-8 pump is turned on to ensure that product is circulating. When this condition is met, an ITC operator can open an actuator valve by pressing the ON button at the truck loading rack to allow the butane unloading to begin. The butane is unloaded from the cargo tank truck, travels through 4-inch piping, which reduces to 2-inch piping, to the product circulation line where it combines with the existing naphtha product. The pump stays on throughout the unloading activity and for several hours afterward in order facilitate the mixing of naphtha and butane (**Figure 4**). ITC did not equip the Tank 80-8 piping manifold with

emergency or remotely operated isolation valves.[a] Such isolation valves could stop an uncontrolled release if for example, the pump or piping manifold were damaged. Instead, to isolate equipment such as the pump, ITC operators must manually close both the Tank 80-8 supply valve to the pump and the return valve from the pump back to the tank. Under a major fire scenario resulting from a leak near this equipment, neither ITC operators nor emergency responders could access the area to close these manually operated valves.

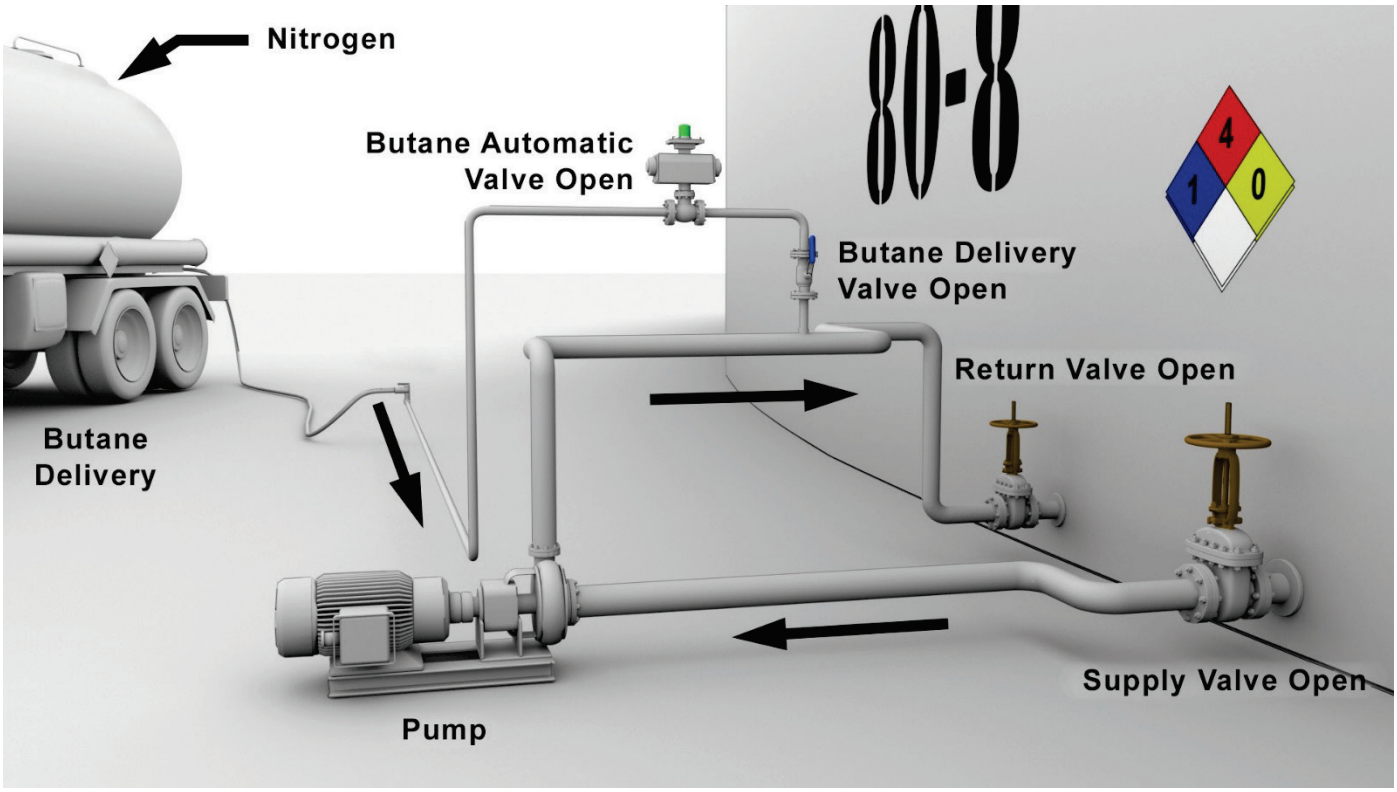

Figure 4. Simplified schematic showing ITC's butane blending system. The arrows in the figure show the butane flow direction and the naphtha product circulation path through the piping. (Source: CSB).

The butane injection system was installed in August 2014. In January 2016, a revision was made to the system whereby ITC replaced most of the 2-inch piping with 4-inch piping to reduce the time required to offload trucks.[b]

[a] Emergency or remotely operated isolation valves are sometimes referred to as a remotely operated shutoff valves (ROSOVs), emergency isolation valves (EIV), or emergency block valves (EBV) [18], [17], and [19]. These valves are equipped with actuators and are configured to be quickly and reliably operated from a safe location, such as a well-sited control room [17, p. 7].

[b] Both Figure 3 and Figure 4 show the Tank 80-8 piping manifold before the January 2016 revision, when ITC replaced some of the 2-inch piping with 4-inch piping.

3.0 Incident Description

On the evening of March 16, 2019, in preparation for two planned butane truck deliveries to Tank 80-8, the area operator assigned to the First & Second 80's tank farm (Operator 1) arrived at the Tank 80-8 piping manifold. Operator 1 aligned the piping manifold valves into the open or closed positions needed to prepare the pump for circulation. At approximately 6:54 pm, after confirming the valve positions were properly lined up, Operator 1 turned on the pump. The pump is situated within the Tank 80-8 piping manifold and must be manually turned on or off. After Operator 1 turned on the pump, he notified the operator at the truck loading rack (Operator 2) that the system was ready and that he could begin unloading butane. Following confirmation that the pump was operating, and the tank was lined up for receiving butane, Operator 2 initiated the unloading process at the truck loading rack, which allowed butane to flow from the truck into Tank 80-8 as shown in **Figure 4**.

The first of two scheduled butane deliveries began unloading at about 7:23 pm and was completed by about 8:15 pm, with approximately 170 barrels of butane added to Tank 80-8. The second butane delivery of roughly 193 barrels was unloaded between 9:29 pm and 10:29 pm. Following completion of these two butane deliveries, the pump remained on to circulate the product. ITC expected a ship to arrive the following day, and the company planned to transfer all the contents from Tank 80-8 to the ship.

On the morning of March 17, 2019, ITC distributed control system (DCS) data indicates a series of unanticipated changes to the monitored pump operating pressures and tank volume. These fluctuations suggest a mechanical problem developed in the pump circulation system. DCS data indicates that at approximately 7:25 am, the pump discharge pressure readings began to rise slowly; by around 8:45 am the pump discharge pressure reading had increased from 80 to 84 pounds per square inch (psi). Consistent with a naphtha product release, beginning at roughly 9:34 am, the recorded tank volume began to decrease steadily. At about the same time, the pump discharge pressure reading suddenly dropped back down to 80 psi. At about 9:45 am DCS data indicates a second sudden decrease in discharge pressure from 80 to 75 psi, and the recorded tank volume continued to decrease during this time. Between 9:34 and 10:01 am, the DCS data shows that the tank volume decreased by approximately 221 barrels. The tank farm was not equipped with a fixed gas detection system, so no alarms were activated to warn ITC personnel of a release. The reduction in tank level and volume that occurred as naphtha product released from Tank 80-8 did not trigger any alarms in the ITC control room. As a result, ITC personnel were unaware of the naphtha product release before the fire erupted.

At approximately 10:00 am, a large fire erupted in the vicinity of the Tank 80-8 piping manifold (**Figure 5**). Shortly thereafter, at 10:01 am, control system event logs indicate that the pump shut down, and then the Tank 80-8 equipment lost communication with the DCS. No further control system data for Tank 80-8 or the pump were available after this time.

Figure 5. Tank 80-8 Piping Manifold. This photo shows the post-incident condition of the Tank 80-8 piping manifold. (Source: ITC).

4.0 Incident Response and Fire Progression

Within minutes of the fire erupting, members of the ITC Emergency Response Team (ERT) responded to the blaze. Initial response efforts focused on directing several water sources towards the Tank 80-8 piping manifold. ITC was a member of Channel Industries Mutual Aid (CIMA), a non-profit organization that combines firefighting and other emergency response capabilities of the refining and petrochemical industry in the Greater Houston Metropolitan area [3]. As a result of its CIMA membership, several neighboring companies who were also members of the CIMA organization responded to the ITC tank farm fire with emergency response resources, including personnel, and firefighting equipment and supplies.

A Unified Command was set up to oversee the coordinated response. The Unified Command included representatives from ITC, the U.S. Environmental Protection Agency (EPA), the Texas Commission on Environmental Quality (TCEQ), and the Harris County Fire Marshal's Office (HCFMO). The response also included support from other federal, state, and local officials.

Tank 80-8 was situated in the center of the facility's "First & Second 80's" tank farm (**Figure 6**), surrounded by other 80,000-barrel storage tanks. ITC was unable to stop or isolate the naphtha being released from Tank 80-8, so the fire continued to rage and intensify. On the evening of March 17, 2019, an adjacent tank west of Tank 80-8, became fully

involved in the fire. Firefighters continued to apply water and firefighting foam to try to control the fire; however, wind changes caused the fire to continue to spread.

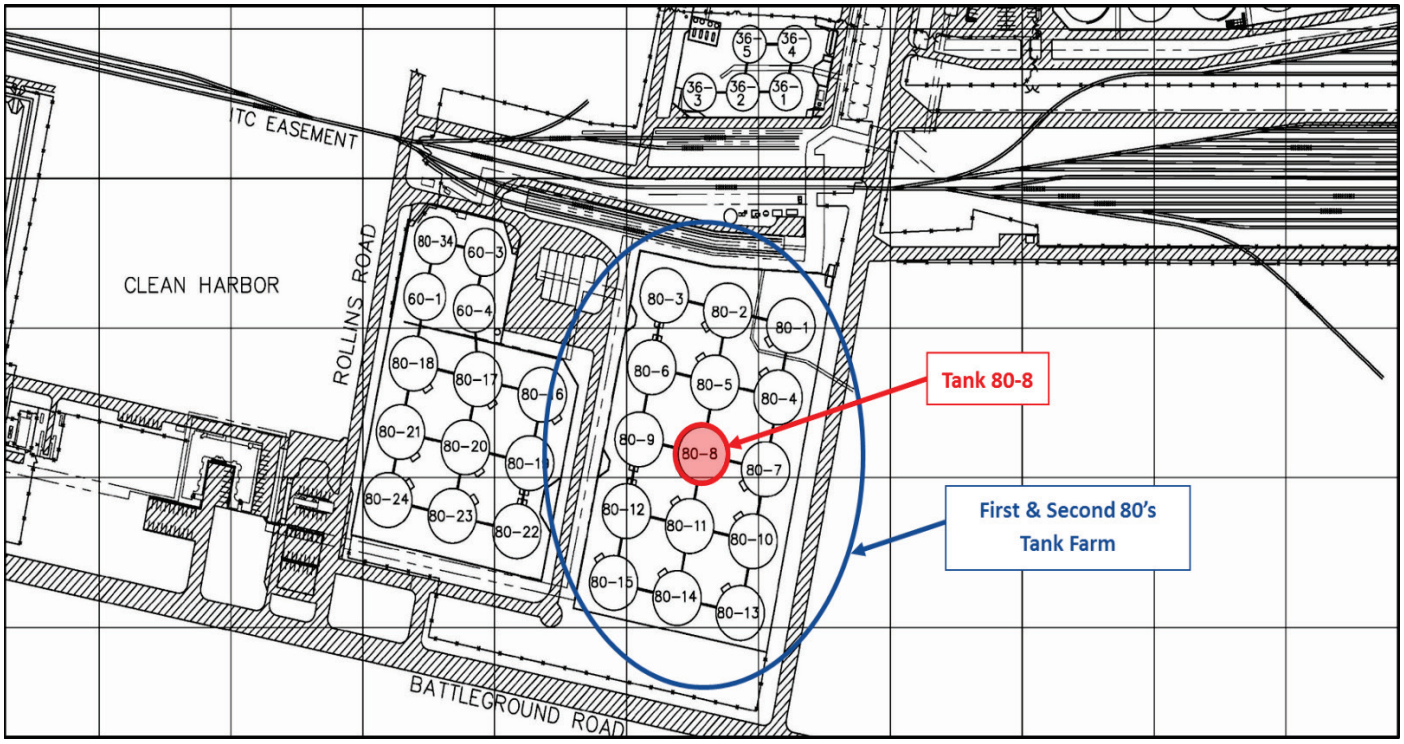

Figure 6. Plot Plan of Tank Farm. This image shows an excerpt from the overall plot plan for the ITC Deer Park, Texas terminal showing the location of the First and Second 80's Tank Farm. (Source: ITC).

By the morning of March 18, 2019, four more storage tanks were on fire. All four of these tanks were located to the west of Tank 80-8. At this point ITC reached out to a third-party emergency response services provider, US Fire Pump [4], for assistance in extinguishing the fire. Two more storage tanks caught fire later that evening. Emergency responders continued their efforts to control the fire by applying water and firefighting foam.

At about 12:13 am on the morning of March 19, 2019, ITC signed a formal Emergency Response Agreement with US Fire Pump, at which time US Fire Pump began mobilizing resources from its headquarters in Holden, Louisiana to the ITC Deer Park terminal. Later that morning, due to the extreme demand, a temporary reduction in water pressure was experienced, and two more storage tanks caught fire. At approximately 6:48 am, US Fire Pump arrived on-scene. After completing an initial scene assessment, US Fire Pump developed a response plan, and commenced firefighting activities by around 1:00 pm.

By approximately 3:03 am on Wednesday, March 20, 2019, ITC, with assistance from CIMA and US Fire Pump, had successfully extinguished the tank farm fire at the ITC Deer Park terminal (**Figure 7**). The fire did not spread outside the perimeter of the First & Second 80's tank farm.

On March 22, 2019, at approximately 12:15 pm, a section of the tank farm dike wall failed, releasing a mixture of chemicals from the tanks, water, and firefighting foam to the surrounding waterways, including the Houston ship channel. Additionally, a small secondary fire erupted in the tank farm at around 3:45 pm that day, which was extinguished within a couple of hours.

Figure 7. First & Second 80's Tank Farm. This photo shows the fire raging on Tuesday, March 19, 2019, and fully extinguished on Wednesday, March 20, 2019. (Source: KHOU 11 News).

5.0 Community Impact

The ITC incident impacted the local community [5]. These impacts included, but were not limited to the following:[a]

- Sunday, March 17, 2019
  - 11:21 am – City of Deer Park issued its first shelter-in-place [6] for a portion of the community.
  - 12:50 pm – City of Deer Park expanded the shelter-in-place to include the entire city.
  - 12:58 pm – Highway 225 closed in both directions between Beltway 8 and Independence Parkway.
- Monday, March 18, 2019
  - 6:00 am – Deer Park lifted the previous day's shelter in-in-place and reopened Highway 22.
  - School Districts closed: Deer Park Independent School District (ISD) and La Porte ISD [7].
- Wednesday, March 20, 2019
  - School Districts closed: Channelview ISD, Deer Park ISD, Galena Park ISD, La Porte ISD, Pasadena ISD, and Sheldon ISD. [8]
- Thursday, March 21, 2019
  - 4:49 am – City of Deer Park issued a second shelter-in-place due to reports of benzene and other volatile organic compounds (VOCs) within the city limits; shelter-in-place lifted at 11:40 am.
  - School Districts closed: Channelview ISD, Deer Park ISD, Galena Park ISD, La Porte ISD, Pasadena ISD, and Sheldon ISD.
- Friday, March 22, 2019
  - School Districts closed: Deer Park ISD, La Porte ISD, Pasadena ISD [9].
  - The U.S. Coast Guard (USCG) closed a seven-mile stretch of the Houston Ship Channel adjacent to the ITC Deer Park terminal following a breach in the containment wall surrounding the tank farm that allowed contaminants to enter the waterway [10].
  - Harris County Precinct Two closed eight waterfront parks [11].
  - City of La Porte closed all waterfront parks in La Porte.[b]
- Saturday, March 23, 2019
  - Independence Parkway, the San Jacinto Monument, Battleship Texas State Park, and Lynchburg Ferry crossing closed due to the detection of intermittent levels of VOCs.

[a] All times listed are approximate.

[b] La Porte waterfront parks remained closed until April 16, 2019.

6.0 Post-Incident Events

Following the incident, the Occupational Safety and Health Administration (OSHA) issued citations to ITC that included violations of the Process Safety Management (PSM) Standard [12].[a] The PSM Standard contains minimum requirements for the management of hazards associated with processing highly hazardous chemicals. The purpose of these requirements is to prevent or minimize the consequences of any catastrophic release of these chemicals. As defined by OSHA, a "process" is defined as "any activity involving a highly hazardous chemical including any use, storage, manufacturing, handling, or the on-site movement of such chemicals, or combination of these activities."[b]

Additionally, portions of the ITC Deer Park Terminal are subject to the U.S. Environmental Protection Agency (EPA) Risk Management Plan (RMP) Rule [13]. The RMP Rule requires facilities that use extremely hazardous substances to, among other things, develop a Risk Management Plan that identifies the potential effects of a chemical accident, identifies the steps the facility is taking to prevent an incident, and spells out emergency response procedures should an incident occur.

7.0 CSB Investigation Plans

The CSB is continuing to conduct its investigation of this incident. Components from the Tank 80-8 piping manifold were taken to a secure storage facility, where CSB completed an initial visual inspection of the piping and pump. Further testing will be conducted. Among the areas of interest, the CSB plans to identify potential naphtha product release points and ignition sources, determine why the naphtha product release was not detected prior to ignition and why the release was not isolated post-fire. The CSB will also look into the emergency response to determine why prolonged emergency response efforts were necessary to control and ultimately extinguish the fire. To accomplish this, the CSB still needs to collect additional emergency response evidence including various incident command records, photos, videos, and drone footage. The CSB also plans to look into the impact that this incident had on the local community. A detailed final report will be published at the conclusion of the investigation, which will include additional information, analysis, findings, and safety recommendations, as appropriate.

[a] 29 C.F.R. §1910.119.

[b] 29 C.F.R. §1910.119(b).

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