



INVISTA – Wilmington, NC

Investigation Report

Date of Incident: Sunday, May 30, 2010

Investigation Report Date: July 23, 2010

Investigation Executive Summary

At approximately 4:40 AM on Sunday, May 30, 2010, a fire occurred at the INVISTA – Wilmington, NC plant. The fire was centered on Tank T-6305 in the D-Line operating area of the site. Tank T-6305 contains crude Dimethyl Terephthalate (“DMT”) at a temperature of approximately 320°F. During the event, the top of T-6305 separated from the main body of the tank and landed on the ground approximately 175 feet northeast of T-6305. Vapors were released from the tank, ignited and caused the fire.

The INVISTA-Wilmington, NC site emergency brigade immediately responded to the incident and extinguished the fire. There were no injuries from the incident or the response. Outside emergency services also responded to the scene. The site appreciates the prompt response by all parties and is working with all parties to identify and address any learnings from the incident and response.

Immediately following the incident, an investigation team was assembled at the INVISTA – Wilmington, NC site. By employing Root Cause Analysis techniques, the investigation team identified two root causes, which are summarized below:

- A decrease in temperature of the tempered water system resulted in an increase in precipitation of DMT in the Methanol in Scrubber S-6305-3, which resulted in an inaccurate Methanol level reading in the Scrubber.
- The Methanol level increased in Scrubber S-6305-3 to the point that Methanol overflowed to Tank T-6305, where it accumulated, vaporized and ignited causing the fire.

The root causes, additional casual factors and recommended actions are discussed in more detail in the body of the report below.

Investigation Overview

The INVISTA – Wilmington, NC site investigation team was formed to evaluate the incident. This investigation team included personnel who were both knowledgeable in the process and also had the appropriate knowledge and experience to thoroughly investigate and analyze this

incident. The site investigation team met on a daily basis for several weeks following the incident gathering information and data and is continuing to meet, as needed, to address follow-up issues. By utilizing Root Cause Analysis techniques, the team determined that there were two root causes for this incident. Additionally, the investigation team identified causal factors and recommended actions.

Investigation Findings

The INVISTA – Wilmington, NC site investigation team has determined that Methanol being fed to Scrubber S-6305-3 from Tank T-6309 overflowed into Tank T-6305 via the tank's vent line due to the Scrubber level indicator not providing an accurate reading. The inaccurate reading was a result of the float on the level indicator becoming embedded in solids in the Scrubber, thus resulting in an inaccurate low level indication in the Scrubber tank. As discussed below, the excessive solids in the Scrubber resulted from a lower than normal temperature of the tempered water system.

To assist the reader, a simplified block "Diagram of Scrubber S-6305-3 and Tank T-6305" is included as Appendix A.

At the time of the incident, the INVISTA-Wilmington NC site was in the process of shutting down D-Line, one of the operating lines at the Wilmington site. Scrubber S-6305-3 and Tank T-6305 are included in the D-Line operating train. During the shut-down process, it was anticipated that DMT would continue to transfer in and out of Tank T-6305 in order to support normal plant operations. The investigation team considered the D-Line shut-down activities in evaluating the incident.

The investigation team determined that, as a consequence of the shut-down activities, the surface of the DMT in T-6305 had cooled, which created a crust over a pool of molten DMT. This crusting allowed the Methanol to accumulate on the surface of the crust when the Scrubber began overflowing into T-6305 via the vent line. When, in the course of supporting normal plant operations, molten DMT was transferred to T-6305, the integrity of the crust that had formed was compromised allowing the accumulated Methanol to come in contact with the molten DMT in T-6305. This interaction between the Methanol and the molten DMT resulted in the rapid vaporization of the Methanol thus increasing the pressure in T-6305. Due to this rapid rise in pressure, the roof became separated from T-6305, was projected approximately 175 feet, and the released Methanol vapors ignited resulting in a fire.

As mentioned above, the tempered water system ensures that the Methanol fed from T-6309 to the Scrubber is maintained at a high enough temperature to ensure the appropriate operating solubility of the DMT in the Methanol. If the temperature of the Methanol feed

liquid is lowered, more DMT will precipitate out of the Methanol solution. Increased precipitation of DMT can cause solids to build up in the Scrubber.

The investigation team evaluated the evidence and concluded that S-6305-3 plugged with solids thus causing the float on the level indicator to become stuck. The team concluded that the scrubber plugged because the tempered water temperature in D-line drifted down to approximately 50 degrees Celsius during shutdown activities.

There are two heat sources for the tempered water system: excess heat from the process carbon absorbers and low pressure steam. When the D-line shutdown began, the carbon absorber process/process heat exchanger was shut down as part of normal shutdown procedures. As a result, the absorber process/process heat exchange was no longer supplying heat to the tempered water pre-heater. When this occurred, the tempered water low pressure steam heater control valve opened to 100 %. Although the valve opened to 100%, the low pressure steam system did not maintain the set point (61 degrees Celsius) and the temperature of the tempered water system drifted outside of the normal range for approximately 40 hours. The cooling of the tempered water lowered the T-6309 Methanol feed temperature resulting in the precipitation of solids from the solution.

This high level of solids in the Methanol feed liquid resulted in the plugging of the scrubber tank. Because of the plugging in the Scrubber tank, the float on the level indicator became imbedded in solids resulting in an inaccurate low level reading to the Control Room Operator ("CRO").

The tempered water system in D-line is not equipped with a low temperature alarm, and the temperature of the tempered water system does not appear on the active Distributed Control System ("DCS") visual display for S-6305-S readily available to the CRO. The CRO is required to check the temperature of the tempered water system once a shift (*i.e.* once every 12 hours). In addition, there is a space on the CRO check sheet for the CRO to note that the tempered water temperature has been checked. There are no records, however, indicating that the CRO conducted the checks on the temperature of the tempered water system for the two days prior to, or including, the date of the incident. As a result, the CRO may not have had indication or information on the temperature of the tempered water system.

Root Causes

Based on the findings discussed above, the following root causes and causal factors were identified:

- The tempered water system did not adequately maintain the temperature of the T-6309 Methanol feed liquid to S-6305-3. This decrease in temperature resulted in increased

amounts of DMT precipitating out of the Methanol solution as a solid material and building up inside Scrubber S-6305-3. This excessive buildup of solids resulted in the level indicator float becoming imbedded in the solids. This, in turn, caused the level indicator inside of S-6305-3 to provide an inaccurately low Methanol reading.

- Methanol overflowed from S-6305-3 via the Scrubber vent line and entered T-6305. At this point in the shutdown process, the DMT in T-6305 had cooled resulting in a crust forming over the molten DMT. The Methanol accumulated on the solidified surface of the DMT. When molten DMT was transferred to T-6305 from C-Line, as part of a routine procedure, the integrity of the crust on the DMT was compromised. This allowed the accumulated Methanol to come into contact with the molten DMT, rapidly vaporizing the Methanol creating a rapid rise in pressure inside T-6305, and resulting in the release and ignition of vapors from the tank.

Causal Factors

- When the heat from the carbon absorbers was removed from the Tempered Water System and the low pressure steam heater control valve opened to 100%, the system did not maintain the set point;
- A low temperature alarm was not present on the D-Line tempered water system;
- Tempered water system temperature was not portrayed on the active visual display available to the CRO; and
- The once a shift check by the CRO of the temperature on the tempered water system was not recorded.

Investigation Recommendations

Based on the findings of the incident investigation, the investigation team makes the recommendations listed below. Because the D-Line assets involved in the incident are no longer operating, these recommendations address applying the findings of this investigation to the other ongoing operations at the Wilmington site.

- Review the design of scrubber systems and associated tanks in similar service at the Wilmington site against the findings of this incident investigation. As appropriate, include in these reviews scrubber instrumentation, interlocks, preventative maintenance and calibrations.



- Review operating procedures for scrubbers in similar service at the Wilmington site against the findings of this incident investigation. Conduct additional training in operating procedures as appropriate.
- Review tempered water systems for similar scrubbers in similar service at the Wilmington site against the findings of this incident investigation. As appropriate, include in these reviews the appropriate set point for low temperature alarms, the option of adding tempered water temperature to active displays, and the checking and recording of tempered water system temperature. Conduct additional training in operating procedures as appropriate.
- Review startup/shutdown procedures at the Wilmington site against the findings of this incident investigation.
- Review check sheet requirements with all CROs to ensure proper record keeping procedures are adhered to and that check sheets are retained for each shift.

Appendix A

Diagram of Scrubber S-6305-3 and Tank T-6305

