

Statement of CSB Lead Investigator Don Holmstrom Updating the Status of the Board's BP Texas City Refinery Investigation

[The following statement was issued to update the public in Houston, Texas, June 28, 2005, 10 a.m. For further information contact Daniel Horowitz, CSB Director of Public Affairs, at (202) 261-7613 / (202) 441-6074.]

Good morning. I am Don Holmstrom, CSB lead investigator for the BP Texas City refinery investigation. Last week marked the third full month since the tragic explosions on March 23 that killed 15 workers and injured more than 100.

The U.S. Chemical Safety Board has been continuing its independent, federal investigation to determine the root causes of this tragedy and make safety recommendations to save lives in the future.

This morning we will be releasing some important new information in this investigation. Specifically, investigators from the U.S. Chemical Safety Board have found evidence that several key pieces of process instrumentation malfunctioned on the day of the accident. Alarms that should have warned operators of abnormal conditions in the isomerization unit did not go off.

Before discussing these new findings, let me present some background information. The majority of our field investigation is now complete, and most of our field team has now returned to Washington, DC, where they are continuing to further the investigation. The team conducted approximately two hundred witness interviews, including re-interviews of key personnel. We have interviewed plant operators, contract workers, BP management staff, facility neighbors, and others.

We have filed more than 20 separate document requests with BP, and we have received thousands of documents which we are now in the process of analyzing. We have also submitted written interrogatories to BP. The company has continued to be cooperative and has furnished documents on a voluntary basis.

Our blast modeling experts have completed their field work and have left the site. They are now performing calculations to determine the precise nature of the explosions at the refinery. We have also retained several prominent experts in distillation technology who are assisting the team.

Our team is also in possession of electronic process control records from the isomerization unit, which was the site of the explosions. Those electronic records are the source of much of the information I will present today.

As most of you know, at approximately 1:20 p.m. on March 23, there was a sudden, geyser-like release of flammable hydrocarbon liquid and vapor from an atmospheric vent stack at the BP refinery's isomerization unit. This release created a flammable vapor cloud, which ignited, causing as many as five explosions. There were multiple possible

ignition sources on the ground, including vehicles, and the exact ignition source remains unknown and is not a principal focus of current work.

Temporary work trailers were located 100 to 150 feet away from the vent stack. Workers who were in and around these trailers were killed or injured when the explosions occurred.

I will now describe some of the key equipment involved in the accident, using the diagram here on the easel. This diagram is not drawn to exact scale, and it does not show all the equipment in the process.

On the morning of March 23, the raffinate splitter was being restarted after a maintenance turnaround. The raffinate splitter is the 164-foot tall distillation tower shown here on the left. This tower distills highly flammable hydrocarbons, such as pentane and hexane. When the tower is operating normally, vapor flows from the top of the tower into the condenser, condenses to a liquid, and is returned to the tower via a reflux drum, which is not shown.

If tower experiences excess pressure above 40 pounds per square inch, there are three emergency pressure-relief valves designed to vent the pressure. Material vented through the pressure-relief valves flows to a blowdown drum – a vertical tank shown here. The blowdown drum vents directly to the atmosphere through a 114-foot-tall stack shown here.

This vent system was of an antiquated design: it was originally installed in the 1950s, and it had never been tied in to a flare system to safely combust flammable vapors released from the process.

As we reported back in April, the March 23rd start-up was abnormal, and the tower became flooded with liquid hydrocarbons. Our current estimate is that the liquid inside the tower ultimately reached a height of 120 feet or more. Normally this tower operates with less than 10 feet of liquid at the bottom. The flood of liquid inside the tower is shown here in blue.

With the tower flooded, internal pressure rose sharply from about 20 pounds per square inch to about 60 pounds per square inch, causing the pressure-relief valves to open. The cause of this pressure spike remains under investigation.

When the relief valves opened, a large volume of liquid and vapor flowed rapidly to the blowdown drum. Accumulating liquid in the blowdown drum is shown here in blue. As we noted at the last briefing, some hydrocarbon flowed through a so-called “goose-neck” drain, shown here, and entered the process sewer, where it later caused a fire downstream.

The blowdown drum was overwhelmed by the volume of liquid and vapor released from the raffinate splitter, and large quantities of flammable hydrocarbon were expelled from the top of the vent stack. The relief valves remained open for a period of just six minutes.

I now draw your attention to some key instrumentation located on the tower and the blowdown drum. First, the raffinate splitter level indicator, shown here, is a sensor instrument that is supposed to measure the liquid level inside the tower. On our diagram, it is referred to as an LIC or level indicator control.

The level indicator is tied in to the tower at a height from three to ten feet from the bottom. It transmits a percentage value to operators in the control room. If the instrument was functioning as intended, a 100% reading would indicate a liquid level of ten feet (or greater). A 0% reading would indicate a level of three feet or less.

Under normal conditions, the reading from the level indicator should be 50%, meaning liquid is halfway between the three and ten foot points at the bottom of the tower. If the level rose too high in the tower an alarm would sound in the control room to alert operators to an abnormal condition.

Because of the importance of maintaining an appropriate liquid level in the tower, the level indicator had a back-up or “redundant” system in case of failure, with separate pipe connections. A high-level alarm or HLA switch was located just under ten feet up the tower. If functioning properly, when liquid rose above this point, another alarm would sound and also activate a separate display in the control room. By the same token, if the level sank below about three feet, a low-level alarm or LLA would sound.

The blowdown drum was also equipped with a high-level alarm, shown here in the diagram. If functioning properly, this switch would trigger an emergency alarm if liquid approached the height of the goose-neck drain and was therefore in danger of draining into the sewer system. This alarm would sound in the control room and alert operators to a potentially dangerous condition inside the blowdown drum.

Based on the CSB investigative team’s examination of the computerized records from isom unit control system, we have made several determinations. We found that the alarm from the raffinate splitter level indicator did in fact go off at 3:05 in the morning on March 23. The reading on sensor was 72%, indicating a level approaching the ten-foot mark. Within a short time, the level reading increased to 100%.

However, we also found that from 7:30 a.m. until the time of the incident at 1:20 in the afternoon, the readings from the level indicator actually drifted downward, from 100% to 79%. This downward trend would have erroneously indicated to operators that the liquid level in the tower was below 10 feet and was falling back toward a normal value. We now know that during this time period, the tower was actually flooding with liquid to a height of 120 feet or more.

Second, process records indicate that although the redundant high-level alarm was enabled, at no time did it go off during the startup on March 23. That alarm should have sounded as soon as the liquid reached the ten foot mark, warning control room operators of the accumulating liquid in the tower, but in fact the alarm did not sound even as the liquid flooded to more than 12 times that height.

Third, records indicate that the high-level alarm on the blowdown drum did not go off during the time the drum was flooding with liquid released from the splitter tower. Instrument readings from the oily water sewer indicate that the drum had indeed flooded, and liquid was flowing from the blowdown drum into the sewer. The high-level alarm did eventually sound, but only after the explosions had begun, likely as a result of the blast pressure. Had the alarm sounded properly as the blowdown drum was flooding, it could have alerted operators to the emergency situation.

Because of these circumstances, we have extended our field investigation at the BP site and have begun an extensive program of equipment testing within the isom unit. The initial phase of the testing will examine over 30 different instruments and pieces of equipment. The testing will help us understand why the three instruments I just discussed evidently failed to operate as intended. We also have requested that BP produce its maintenance records for these and other pieces of equipment associated with the process.

I emphasize that at this time, no root causes of the accident have been determined. Under federal law, no root cause will be assigned except by a vote of the full Chemical Safety Board. All possible causal factors including design flaws, additional equipment failures, and human performance remain under consideration. The investigation continues to focus on design issues involving the blowdown system as well as on the decision to site the trailers in proximity to a potentially hazardous process. We are also continuing to investigate the adequacy of the training, supervision, and oversight afforded to unit operators. Our objective is to understand why this tragedy occurred, and, we hope, to prevent similar occurrences in the future.

Over the coming weeks and months, we will be gathering and analyzing the results of the equipment testing, the blast modeling work, and the modeling of the distillation tower. We will be also be studying the many thousands of pages of witness interviews and documentary evidence. Investigators will likely be returning frequently to Texas City for additional interviews and evidence collection.

Early this fall, probably in September, the full Board will convene here in the Texas City area to review preliminary findings at a public meeting. We will be announcing an exact date and location in due course.

Thank you for your attendance, and we will now be happy to take some questions. I ask that you please state your name and affiliation as you begin your questions.

