

**Statement from CSB Chairperson Vanessa Allen Sutherland
and Team Lead Cheryl MacKenzie**

Factual Investigation Update on Loy Lange Explosion

May 25, 2017

Good morning and welcome to the CSB's news conference.

First allow me to express my sincerest condolences to the families, friends, and co-workers of those affected by this tragedy.

This morning, we are providing a factual update on our ongoing investigation of the April 3, 2017, explosion at the Loy Lange Box Company.

The CSB's three person investigation team arrived onsite to begin its assessment on Thursday April 6th. The team has visited all three sites damaged by the incident--Loy-Lange Box Company; Faultless Healthcare Linen; and Pioneer Industrial Corp.

On the day of the incident, there was a steam explosion inside the Loy Lange building. A steel vessel weighing about two thousand pounds--referred to as a Semi Closed Receiver or SCR--launched through the air. The damage caused by the force of the steam explosion left one Loy Lange Box Company worker fatally injured and another in critical condition.

The SCR pulled loose from all the piping and floor attachments, and rocketed up through the Loy Lange building. It went through the roof, traveling at almost 120 mph. It rose to about 425 feet above street level and traveled laterally across approximately 520 feet, and it remained airborne for over 10 seconds.

As it fell, the SCR crashed through the roof of Faultless Healthcare Linen's building fatally injuring three individuals.

A steam explosion of this type is extremely hazardous. The energy released was equivalent to about 350 pounds of TNT. Photos from the scene show that the power of the explosion was truly immense.

The investigative team has thoroughly documented the condition of the SCR after the incident, interviewed approximately a dozen people and has reviewed thousands of documents. Because the Loy-Lange building is still unsafe, the CSB has not yet fully assessed the incident scene. The CSB will pursue metallurgical testing of the pressure vessel, and continue its investigative activities.

Let me now introduce our investigation Team Lead, Cheryl MacKenzie, who will provide more detailed information.

Investigator MacKenzie

Thank you, Chair Sutherland.

The Loy Lange Box Company designs and manufactures packaging products, including corrugated boards. Steam heat is a key component in the production of high quality corrugated board. To produce the steam required, Loy Lange alternated between using one of two steam generators.

To my right, you can see a flow diagram of a typical steam system with an SCR.

Water from the SCR enters a generator, where it is heated and converted to steam. Steam and water then move from the generator to a piece of equipment where the steam and water are separated, and the steam is used in the corrugation process.

After the steam is used it condenses back into water, called condensate, which is still at a relatively high pressure and temperature. To conserve energy, the hot condensate is stored in the SCR, and is recirculated back to one of the steam generators. Using this already hot water reduces energy requirements for the system.

In 2012, the SCR was repaired when a leak was discovered in the bottom of the tank. It is important to emphasize that at that time the entire 30" diameter elliptical bottom portion of the tank was not replaced. Instead, a 24" center section was removed and

replaced with a custom-formed 24" diameter piece, called a tank circle.

The remaining 6 inch ring of the original part of the tank—left behind during the repair on the SCR—connected the new tank circle and the original SCR shell.

An area of continuing interest surrounds a proposal received by Loy Lange twenty five days after the repair was completed from the same contractor responsible for the leak repair work. The proposal suggested a replacement of the entire bottom of the SCR to provide additional thickness in order to protect against corrosion. This replacement ultimately did not occur, but we plan to conduct a more thorough examination of the details of that proposal.

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On Friday, March 31, 2017, three days prior to the incident, the employees again noticed a leak from the bottom of the SCR.

A cell phone was used to photograph that leak. The photo showed leaks coming from at least two distinct sections of the remaining 6 inch ring. The steam generation system was shut down after the photograph was taken, and Loy-Lange contacted a repair service provider. Plans were made for the repair technician to arrive in the afternoon on the next business day, Monday, April 3.

On Monday morning, Loy-Lange started up the steam generation system.

Based on the start-up schedule of approximately an hour and a half, it appears that the bottom of the tank catastrophically failed near the end of the start-up process.

The tank bottom suddenly and completely separated from the tank, causing pressure in the tank to rapidly drop. As a result, a portion of the water in the SCR instantaneously converted to steam causing an increase of volume of up to 75 times the volume of the SCR. The result was a powerful explosion of steam from the bottom of the SCR sufficient to launch it out of the Loy Lange property.

After the explosion, the SCR was removed and examined. Inside the upper portion of the SCR, the CSB found two metal artifacts. These artifacts were determined to be the entire 24 inch tank circle that had been added during the 2012 repair and a portion of the bottom piping. The tank circle had separated from the SCR in one piece. The weld between the tank circle and the remaining 6 inch ring of the original tank was still intact. The failure occurred within that 6 inch metal ring.

Remnants of the ring attached to the tank circle at the weld were found to be extremely thin. While the thickness of the metal should have been a quarter of an inch, following the explosion the remnants of the ring were found to be less than half that.

In the CSB's examination of the SCR, the team noticed extensive corrosion in the area where the vessel catastrophically failed.

Beyond the corrosion and metallurgical issues, the CSB is continuing to examine vessel inspection requirements and maintenance.

The current steam generators at Loy Lange Box Company were originally installed in 1999 and 2001. The SCR was installed with the first steam generator in 1999. It was designed and built to international codes and standards for pressure vessels, and was registered with the National Board of Boiler and Pressure Vessel Inspectors in February 1997.

Repairs to equipment such as the SCR are covered by a variety of state and local laws. In Missouri, the State requires repairs to be compliant to National Board standards. State inspectors must have commissions from the National Board.

The City of St. Louis, however, has opted out of the state requirements, which is permitted by State law. The City manages inspections and repairs by requiring compliance with a city specific ordinance, referred to as the Mechanical Code of the City of St. Louis.

Unlike state inspectors, City inspectors are not required to hold National Board commissions, and inspections do not have to

meet National Board code. They need only be conducted [quote] as thorough as circumstances permit [unquote].

The City of Saint Louis has jurisdictional authority for Loy Lange Box Company and is responsible for annual inspections of the SCR.

To date, the CSB has not received evidence that any formal inspections of the SCR occurred.

The investigative team has determined that the immediate cause of this incident is the sudden mechanical integrity failure of the entire 6 inch ring of the original bottom of the SCR. Broader causal factors are still under review and analysis.

I will now return the news conference back to Chair Sutherland.

Chairperson Sutherland

Thank you, Investigator MacKenzie.

There are still a number of issues that are of interest to our investigation. Among others, these include corrosion, inspection, and maintenance. Our investigations do not seek to assign blame but rather understand all of the critical steps that led to a specific disaster.

Determining why and how this occurred will be a focus of the CSB's investigation moving forward. Prevention of incidents is a critical part of our mission.

We do know that the unrecognized severe corrosion of the 6-inch ring left the SCR uniquely vulnerable to catastrophic failure.

Many of the CSB's investigations have found instances where a robust preventive maintenance program would have identified compromised equipment that ultimately led to an incident.

This is why preventive maintenance is one of the key issues featured on the agency's Critical Drivers of Safety Change List. A robust preventive maintenance program includes inspections of all operating equipment. Equipment must be properly inspected and maintained.

Moving forward the CSB will provide more information as it becomes available.

With that, I would be happy to take your questions.