Quinn Newcomb | Script 1

Thank you all for joining us today.

My name is Quinn Newcomb. I am the interim Vice President, Human Resources, Learning & Engagement at Technical Safety BC, and I lead our public relations team.

I am joined by two of my colleagues – Janice Lee, Director of Safety Oversight and Jeff Coleman, Director of Risk and Safety Knowledge, which includes Engineering and Incident Investigations.

Today, we are releasing Technical Safety BC's Investigation Report into the tragic incident that occurred on October 17, 2017 at the Fernie Memorial Arena which resulted in three fatalities.

Before we begin, I would like to take a moment on behalf of Technical Safety BC to offer our deepest sympathies to all those affected by this devastating incident.

Our thoughts are with the families and friends of Wayne Hornquist, Lloyd Smith, and Jason Podloski, as well as with the whole community of Fernie.

As background, Technical Safety BC is mandated to oversee the safe installation and operation of technical systems and equipment across the province of British Columbia.

Under our mandate we deliver safety services for a broad range of technologies including:

- Electrical equipment and systems;
- Natural gas and propane appliances and systems;
- Elevating devices, such as elevators and escalators;
- Passenger ropeways, such as aerial trams and ski lifts;
- Railways, including commuter rail;
- Amusement devices; and
- Boilers, pressure vessels and refrigeration systems, which is the subject of today's press conference.

In addition to issuing permits, licenses and certificates, we work with industry to reduce safety risks through assessment, education and outreach, enforcement, and research.

We work collaboratively with industry stakeholders to ensure those responsible for safety have access to information and services that help prevent incidents and mitigate hazards.

The objective of today's press conference is to provide an overview of our investigation into the Fernie incident, outline our key findings, and present our recommendations moving forward so that, as an industry, we can prevent similar incidents from ever happening again.

We will also discuss actions taken by Technical Safety BC to deal proactively with safety issues identified through the investigation process.

We will then open the floor to questions.

I will now invite Janice Lee to speak about our role in the investigation and actions taken while the investigation was ongoing.

Janice Lee | Script 2

Thank you, Quinn.

In my role I oversee the management of technical safety programs across seven technologies.

Technical Safety BC is responsible for overseeing the design, construction, installation and operation of boilers, pressure vessels and refrigeration units throughout British Columbia.

As this incident involved a refrigeration system, we conducted a thorough investigation to determine the incident's cause and contributing factors and make recommendations to improve safety.

Our investigation is not aimed at assigning blame or culpability.

Instead, it is focused on understanding what happened and providing recommendations to improve safety and prevent similar incidents.

My colleague Jeff Coleman will provide more in-depth information about the investigation, its findings and the recommendations we will release today.

However, it is important to note that since the tragic incident in October last year, we have made the safety of ammonia refrigeration facilities a key focus.

To our knowledge, this incident was the first of its kind in which a small leak of ammonia into a secondary coolant – in this case brine – led to pressurization of the secondary system and a rapid release of ammonia into an enclosed mechanical room.

The incident resulted from practices that existed in the industry at that time.

Therefore, during the investigation process, we took a number of proactive steps to improve safety immediately.

We worked with ammonia facilities to raise awareness of the dangers of uncontrolled ammonia release incidents.

We also educated facility operators on practical ways to prevent them.

As part of our oversight, we conduct onsite installation inspections on refrigeration facilities and conduct periodic inspections throughout the operating life of the equipment.

However, following the Fernie incident, we dedicated additional resources to inspect ammonia ice rinks in the province of British Columbia.

To date, we have completed inspections of over 95% of 185 sites, with the remaining sites to be completed in the coming weeks.

In addition to our inspections, we issued a Safety Order on November 29, 2017 that required owners of ammonia refrigeration plants to test secondary coolants for the presence of ammonia and report the results to Technical Safety BC.

All 185 facilities in British Columbia have now fulfilled the obligations contained in the Safety Order. And, most importantly, all facilities are in compliance.

While we have conducted our investigation, the RCMP and WorkSafe BC are also conducting their own independent investigations.

At times, Technical Safety BC has collaborated with and shared its information and findings with the other investigating organizations.

Both organizations have received copies of today's report.

After our incident investigation, we made 18 recommendations to further improve safety in ice rink refrigeration systems.

Technical Safety BC will take a leadership role in working with industry and other agencies to move our recommendations forward and implement safety improvements for ice rink refrigeration systems across British Columbia.

I want to emphasize that at Technical Safety BC, we strongly believe that safety is a shared responsibility.

We will be meeting with stakeholder groups including plant owners, maintenance contractors, training providers, municipalities and the Canadian Standards Association to present and discuss our recommendations and work to implement them.

By collaborating with relevant stakeholders, we can best mitigate hazards to prevent these incidents from happening again.

I will now hand over to my colleague Jeff Coleman, who will discuss the detailed findings and recommendations of the report.

Jeff Coleman | Script 3

Thank you, Janice.

I am Technical Safety BC's Director of Risk and Safety Knowledge. My responsibilities include incident investigation and engineering.

I will provide an overview of our investigation, findings and recommendations.

The report we issued today is based upon the evidence presented and available at the time of our investigation, which took place between October 2017 and July 2018.

Our investigation explored factors that caused and contributed to the ammonia release and factors that contributed to the impact of the incident following the release.

We inspected, tested and analyzed the refrigeration system and components at Fernie Memorial Arena to determine the equipment that failed.

We identified relevant organizational and operational decisions that may have contributed to the equipment failure.

And, we inspected and tested the ammonia detection, alarm, ventilation and discharge systems.

We organized our report and findings into **three** areas that reflect our conclusions regarding the causes, contributing factors and impact of this incident.

1. The equipment failure
2. Operational and management decisions
3. Post incident ventilation and discharge

The **first** was the failure of the refrigeration system equipment.

The refrigeration system at the Fernie Memorial Arena was typical of many systems in the industry. The ice floor was cooled by a brine solution. This brine solution was kept cold by circulating it through a heat exchanger, where liquid refrigerant chilled the brine solution. The heat exchanger is commonly called a “chiller” and the refrigerant used at the Fernie Memorial Arena was ammonia. Warm brine is pumped into the chiller where its flow is split through many smaller tubes. These brine tubes sit in a bath of liquid ammonia, which is much colder. The brine is therefore chilled before being pumped back out to the curling ice floor.

During normal operation, there is no mixing of the liquid ammonia and the brine solution. Cooling is achieved by ammonia contact with the steel walls of the tubes.

Ammonia was detected within the curling brine system during routine maintenance and testing in the spring and summer of 2017.

Our investigation later found that the ammonia had leaked into the brine through a small hole in a tube within the curling system chiller. The hole was measured to be approximately 2.2mm by 0.2mm and was located at a welded seam in a chiller tube. The hole was determined to be caused by corrosion pitting.

The chiller however, was returned to operation on October 16, 2017, the day before the incident.

Shortly after returning to operation, ammonia leaked into the brine and was then released from the brine into the mechanical room through the brine expansion tanks. This led to an ammonia alarm at 3:53 a.m. on October 17.

In response to the ammonia leak, the brine system and curling chiller were isolated and the refrigeration and brine system shut down.

This shut down configuration was significant for two main reasons:

One, liquid ammonia was isolated within the leaking chiller and,

Two, the brine system was isolated so that expansion and ventilation of the brine was impeded.

Ammonia continued to leak into the brine over the five-hour period that followed.

As the leak continued, ammonia concentration rose in the brine close to the hole and the temperature of the brine and the chiller increased. This temperature increase led to elevated pressure within the brine system and chiller.

The brine system was not designed to be a pressure retaining system. Rising pressure within the brine system eventually exceeded the strength of a pipe joint and a coupling separated within the mechanical room.

The coupling's separation suddenly depressurized the brine system and caused the ammonia in the brine and piping to rapidly release into the mechanical room. As ammonia was released, it quickly expanded in the room, reaching estimated concentrations above levels that are considered to be rapidly fatal.

The **second key area** we investigated to help understand this incident relates to **operational decisions**.

In October 2010, seven years prior to the incident, the City of Fernie's maintenance contractor recommended that the aging curling chiller be replaced as it had reached the end of its estimated service life.

The City of Fernie scheduled funding to replace the chiller in 2013.

In 2013, that funding for the replacement was deferred to 2014 and then subsequently deleted from capital plans.

In the years that followed, the curling chiller replacement is represented as an objective rather than a scheduled expense.

As mentioned previously, ammonia was discovered in the brine during the summer of 2017, indicating a leak within the chiller. In the summer of 2017 a decision was made to monitor the leaking chiller. The leaking chiller was put back into operation on October 16, 2017.

Once the leaking chiller returned to operation, additional actions and decisions associated with the shut-down configuration were a response to cascading failures beyond the scope of training and situational understanding of those involved.

While the equipment failures originated from a small hole in a chiller tube, Technical Safety BC concluded that the cause of the incident was the decision to operate the leaking chiller.

There were many contributing factors identified that led to the decisions and condition of the equipment.

These contributing factors are itemized on page 34 of the report and include:

- insufficient hazard awareness of leaking chillers and
- ineffective maintenance of aging equipment.

The **third** key area that we investigated does not deal with cause but rather the systems that are intended to minimize the impact following a refrigerant release.

The mechanical room's ventilation system configuration and capacity could not have prevented the extremely high levels of ammonia from accumulating within the mechanical room due to the rate of ammonia release.

We found that use of the emergency discharge system following discovery of the incident did not reduce the risk of continued ammonia release into the mechanical room.

Our investigation makes recommendations to improve ventilation and emergency discharge systems to reduce the potential impact of refrigerant releases.

Based on the investigation findings and conclusions, Technical Safety BC made a total of 18 recommendations to improve management of safety risks related to refrigeration systems.

These recommendations relate to findings associated with hazard awareness, maintenance, system configuration, training, management and operation of refrigeration systems.

Broadly speaking however, there are two main areas where improvements can enhance prevention:

First, improved arena maintenance programs. Maintenance plans did not consider component wear-out or component end-of-service procedures. All arena maintenance plans should reflect an understanding and consideration of the increased safety risk that comes with aging equipment.

Maintenance programs should incorporate strategies to safely manage equipment as it approaches its wear-out phase of operational service.

Second, improvements are required around hazard awareness of leaking chillers. As an industry, we must recognize a leaking chiller as a failed component. We need to implement clear procedures and guidance to safely remove leaking chillers from service once a leak is discovered.

Thank you.

I will now turn the microphone over to Quinn Newcomb.

Quinn Newcomb

Thank you, Jeff.

We will now open up the press conference to questions.

Technical Safety BC employees have microphones and will move around the room for the Q&A.

Please raise your hand, and they will bring the microphone to you.

We request that you ask one question and a follow-up question only at this point.

Once everyone in the room has had a chance to ask a question, we will then invite reporters calling into the event to ask a question.

Please state your name and the news organization you work for prior to asking your question. And please direct all questions to me so we can determine the best subject matter expert to answer.

At this point, please raise your hand if you have a question to ask.

Thank you.

To conclude:

On behalf of Technical Safety BC, I would like to thank you for attending our press conference today.

Copies of the materials, including the press release, our scripts, a fact sheet and the report itself are available in hardcopy. They will also be made available on our website shortly.

If you require anything further, please talk to Laura McLeod or Roy Siojo, or email Technical Safety BC's media relations team at: media@technicalsafetybc.ca.

Thank you and have a good day.