Alberta Government

Investigation Report

Worker Fatally Injured When Entering Confined Space

April 27, 2016

The contents of this report

This document reports Occupational Health and Safety's (OHS) investigation of a fatality due to nitrogen asphyxiation in April 2016. It begins with a short summary of what happened. The rest of the report covers this same information in greater detail.

Incident summary

A tower mechanic was entering a fractionation vessel at a gas facility to prepare a final inspection of the vessel. The interior of the vessel was under a nitrogen purge, and the worker was using supplied air. Shortly after entering the vessel, the worker went into distress. The on-site emergency response team extracted the worker and provided first aid. The incident resulted in a fatality.

Background information

Williams Energy Canada ULC (Williams) was the owner of the Williams Redwater fractionation facility. Williams gathered, produced and processed natural gas and natural gas liquid. Additionally, Williams processed oil sands. The company operated facilities in Alberta and British Columbia. The company was founded in 2002 and was based in Calgary, Alberta, Canada. Williams operated as a subsidiary of Williams Energy Canada LP. As of September 23, 2016, Williams operated as a subsidiary of Inter Pipeline Ltd. Williams employed 25 people. Williams was a registrant of the Corporate Registries System (CORES).

Pembina Pipeline Corporation (Pembina) was hired by Williams and was assigned the role of prime contractor at the worksite. Pembina was Calgary based, and they owned and operated an integrated system of pipelines that transported various hydrocarbon liquids including conventional and synthetic crude oil, heavy oil, oil sands products, condensate (diluent) and natural gas liquids produced in western Canada. Pembina also owned and operated gas gathering and processing facilities and an oil and natural gas liquid infrastructure and logistics business. Pembina employed approximately 1250 people.

At the time of the incident, Pembina contracted the work for the pressure vessel confined space entry to Sulzer Chemtech Canada Incorporated. Pembina was a registrant of CORES.

Sulzer Chemtech Canada Incorporated (Sulzer) was the contractor for this job. Sulzer was a leading employer in the fields of process technology and separation towers, as well as 2-component mixing and dispensing systems. Sulzer was hired to clean and inspect the pressure tank. In Alberta, the company employed approximately 42 people. Sulzer was a registrant of CORES.

The tower mechanic had been employed by Sulzer to perform confined space entries and to carry out maintenance in the vessel pre and post inspection. The tower mechanic had been employed on a casual/irregular basis by Sulzer since May 29, 2012. The tower mechanic was deemed a competent worker by Sulzer and was in possession of all required courses and certification. The tower mechanic had completed the required training by Sulzer to work at the Williams Redwater fractionation facility.

The superintendent, at the time of the incident, had been employed by Sulzer for approximately 5 years and had a total of 22 years of relevant experience in this industry. The superintendent was supervising the confined space entry and had completed all of the pre-requisite job tasks such as the permits, pre-job meeting, bump tested air monitoring instruments and reviewed the equipment to be used for the job.

The spotter had been employed on a casual/irregular basis by Sulzer since April 2015, and this was their second such employment. The spotter had approximately 18 years' experience as a tower mechanic. At the time of the incident, the spotter was feeding the airline to the tower mechanic and then followed and observed the tower mechanic into the pressure vessel.

The first emergency response team member (ERT 1) that responded to the incident had been employed by Sulzer for approximately 4 years and had a total of 12 to 15 years of related experience in this industry. At the time of the incident, ERT 1 was part of a 2 person emergency response team and was situated approximately 5 metres (m) from the entrance to the confined space.

The second ERT member (ERT 2) that responded to the incident had been employed by Sulzer for approximately 4.5 years and had a total of 7 years of related experience in this industry. At the time of the incident, ERT 2 was part of the 2 person emergency response team and was situated approximately 5 m from the entrance of the confined space.

Equipment and Materials

The cascade system that was used to supply air to the workers was owned by Sulzer; however, the cylinders were filled through a contract with Air Extreme. The system consisted of 2 air banks of 4300 cubic foot (ft^3) cylinders that were initially filled to approximately 2250 pounds per square inch (PSI) (Figure 1). The last air analysis was conducted on April 13, 2016, by AGAT Laboratories and met the standards as per the CS z180.1-13 Breathing Air Analysis.

The cascade system that was in use at the time had approximately 1700 psi in each of the 4 cylinders and was operating at the first stage at 105 psi (Figure 2).

Figure 1. (A) The supplied air cascade system included a first stage regulator, which reduced the cylinder pressure of 2250 psi down to an operating pressure which varied depending on the workers' regulators and masks. The manifold (B) linked all of the cylinders together and equalized the cylinders to one pressure. Each of the cylinders, (C) when filled to operating capacity, contained 300 ft^3 of air at 2250 psi. This was the system that provided air to the workers including the tower mechanic.

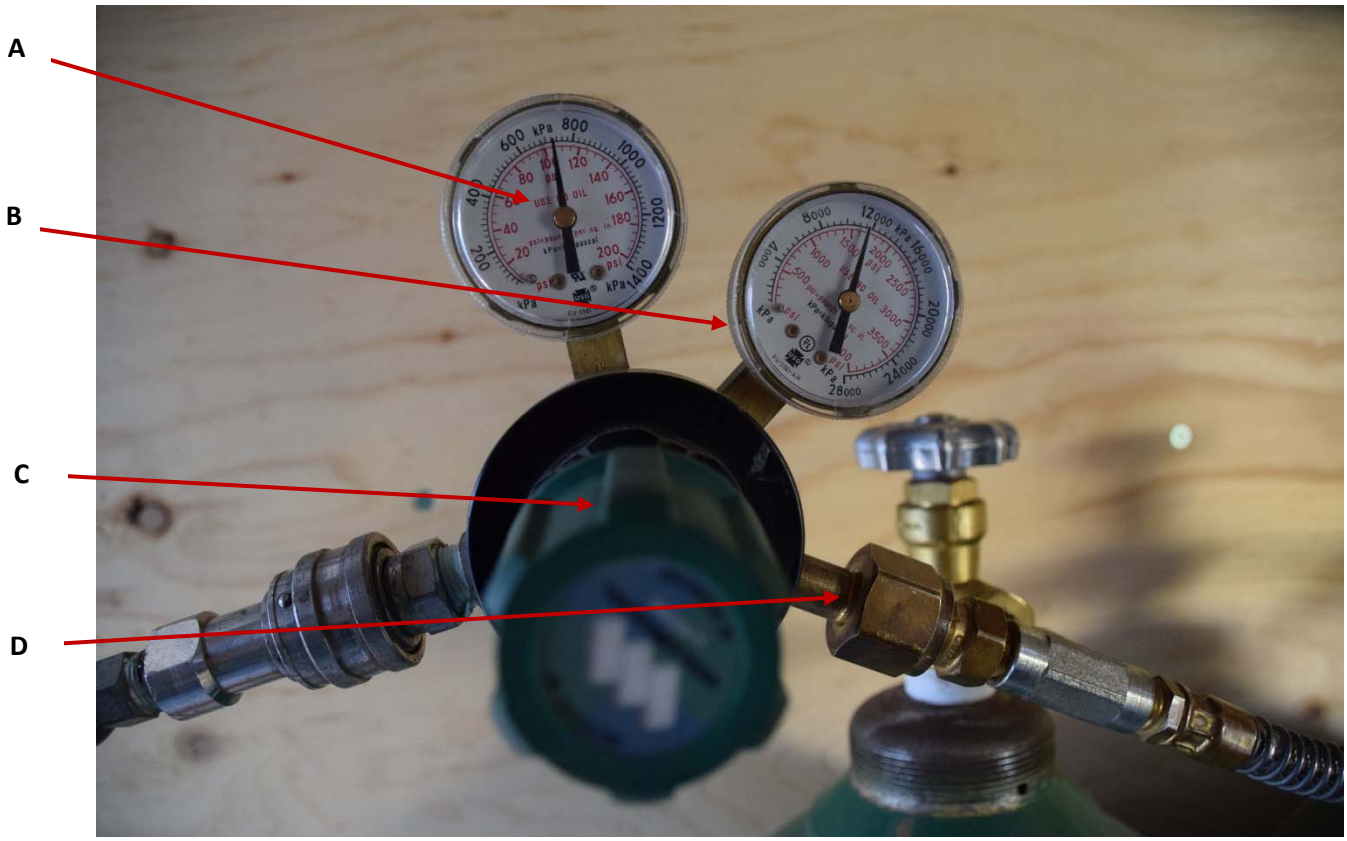

Figure 2. The first stage regulator system consisted of an operating pressure gauge (A) and cylinder pressure gauge (B), and the operating pressure regulator (C) which was used to adjust the flow being delivered to the worker. The cylinder inlet to the first stage regulator (D) and the outlet airline delivered the air to the worker's second stage on the full face mask (Note – double action quick disconnect coupling).

The airlines, which connected the cascade system to the worker, were in approved 100 foot increments and connected using positive, double action, quick disconnect couplings.

The full face mask (Figure 3), which was used by the workers, was the Draeger R52972 Panoram Nova. The mask was made from ethylene propylene diene monomer (EPDM) rubber with a polycarbonate visor and chloroprene rubber head strap. In this job, the mask was part of the supplied air breathing apparatus (SABA) system.

The Draeger PAS Colt was the emergency escape unit (Figure 3). The PAS Colt was a hip mounted unit constructed of anti-static material and was inert to chemicals and oils and impervious to most acids and alkalis. The carrying system met the requirements of the

National Institute for Occupational Safety and Health (NIOSH) and European Standards (EN137). The carrying system was used to accommodate the emergency escape cylinder, which was integral to the system providing up to five minutes of air. The carrying system had various loops and fasteners to keep the hoses contained and for ease of accessibility for the airline connections and the emergency escape cylinder.

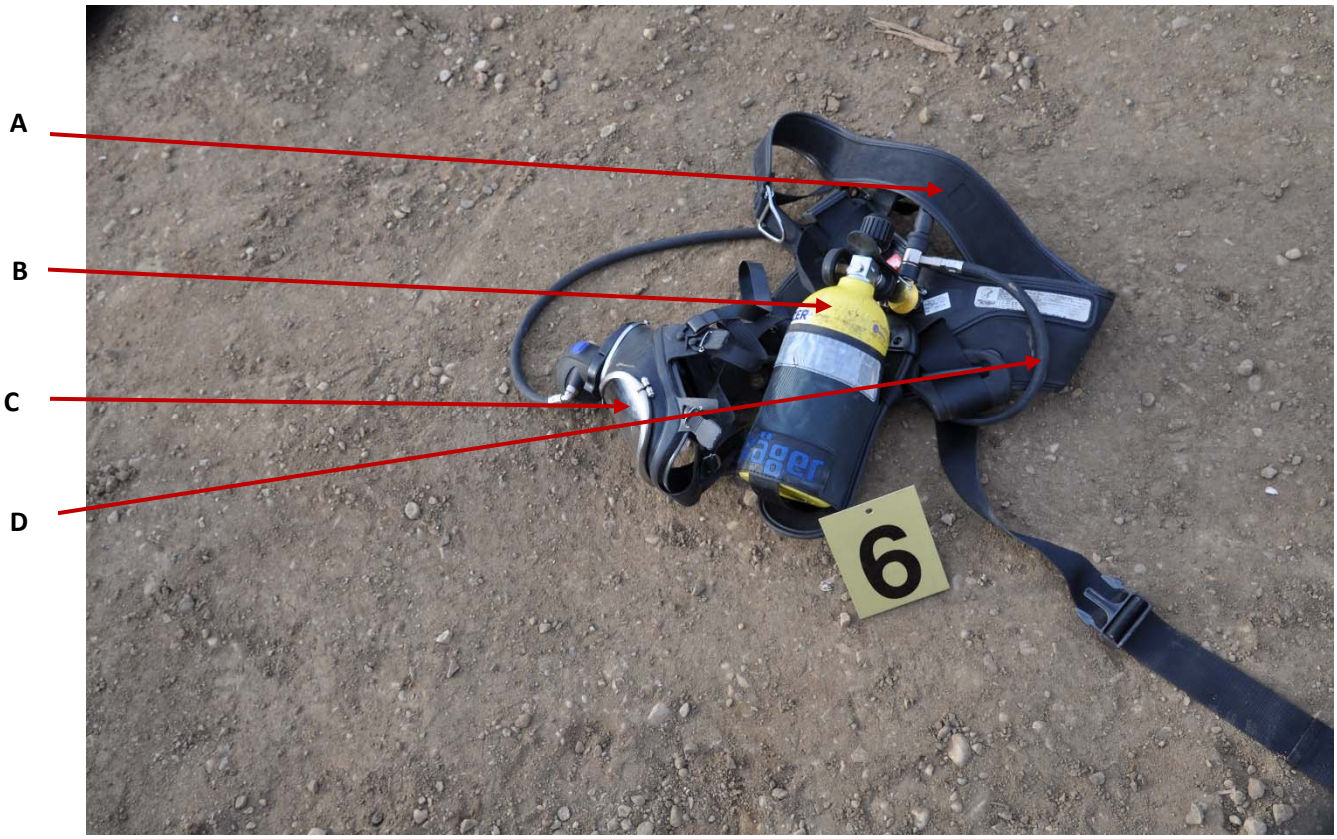

Figure 3. The carrying system (A) provided a means in which to contain the emergency breathing air cylinder (B) and as well provided loops and fasteners to contain the air hose, which connected to the supplied air (D). The full face mask (C) was integral to the system when connected to the second stage regulator.

The pressure vessel 403 (PV-403) (Figure 4), which was the vessel being cleaned and inspected, was used to fractionate propane from propylene. Propylene was second in importance to ethane as a lefin raw material for petrochemical manufacture of plastics, fibres, lubricants and gels. The pressure vessel used the process of distillation via heat and an internal mechanical design to provide a high grade product. PV-403 was 94 m in height. The entrance to the manway was located 40 m above ground level.

Figure 4. PV-403 (A) was the fractionation vessel where the incident took place. The manway into the confined space was located at (B), and (C) was the crane used to raise and lower the manbasket.

Sequence of events

Sulzer had been contracted to conduct tower maintenance in the PV-403 fractionation tower operated by Pembina at the Williams Redwater fractionation facility. Work on PV-403, which was under a 100% nitrogen blanket, comprised of entry into the vessel by the workers wearing SABA to remove, clean, and re-install trays. The trays were part of the integral design for fractionation (Figure 5).

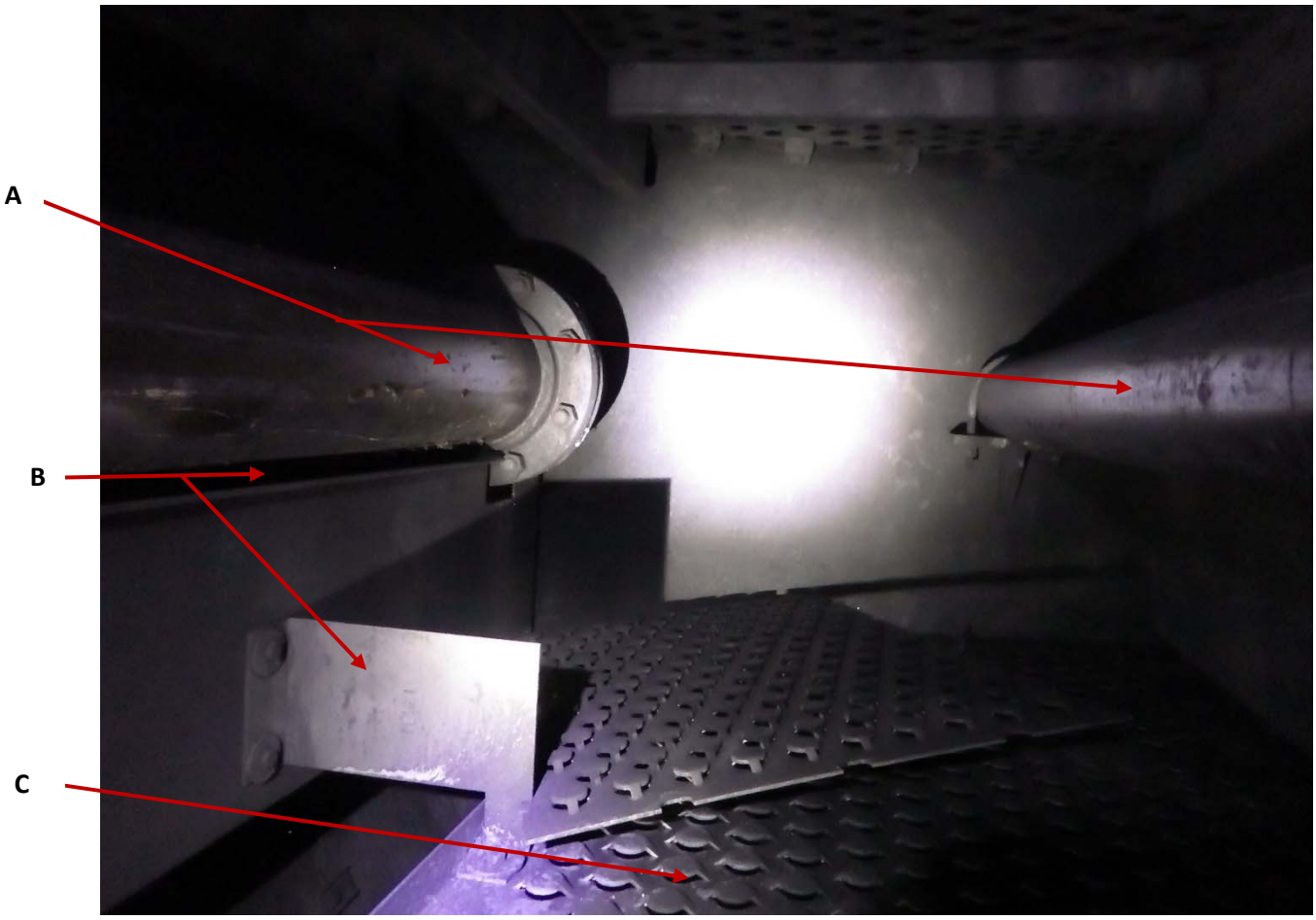

Figure 5. Interior of the fractionation vessel showing various components. (A) Examples of transverse pipes. (B) Examples of protrusions and sharp edges. (C) An example of a tray; the raised portions were colloquially known as "mushroom caps" and posed a snag hazard.

On April 27, 2016, workers arrived for work and attended the daily safety meeting with all of the involved crews. The workers obtained the work permit from Pembina personnel and reviewed the Sulzer confined space package documentation.

The tower mechanic and the two ERT personnel were hoisted in a manbasket to the working platform by the crane.

The atmosphere around the manway was tested with a 4-head gas monitoring instrument. A call was made to the cascade system watch worker (monitored pressure and airflow) to verify the supplied air pressure and air pressure in the system.

The two ERT personnel stood in the safe zone while the tower mechanic and the spotter donned the SABA and unbolted the four bolts securing the tower manway. The tower mechanic opened the manway and entered the vessel while the spotter fed the airline in after the tower mechanic.

The spotter fed the airline into the confined space and then entered the vessel. The spotter saw that the tower mechanic was slumped over a 20 centimetre (cm) pipe; the spotter called out and tapped the tower mechanic on the foot. The spotter did not get a response from the tower mechanic and immediately radioed emergency and called out to the ERT personnel.

The spotter remained inside the PV-403 vessel and attempted to free the tower mechanic. The spotter noted that the tower mechanic's mask was off. Once ERT 1 had donned the SABA, they replaced the spotter in the vessel. ERT 1 managed to extricate the tower mechanic from the confined space and on to the tower platform. The tower mechanic was not breathing at that time.

The superintendent responded to the emergency and ascended the exterior tower ladders to the working platform; the superintendent donned a self-contained breathing apparatus and assisted in the rescue.

ERT 1 and the superintendent applied a Genesis II oxygen system, which automatically provided cardiopulmonary resuscitation (CPR) once applied.

Bravo Target Rescue personnel were hoisted to the platform with a stretcher. The tower mechanic was secured to the stretcher and lowered to the ground.

Rescue efforts continued until emergency medical services (EMS) arrived at the incident site, and the tower mechanic was transferred to an ambulance. The tower mechanic was pronounced deceased at the incident site.

The Royal Canadian Mounted Police (RCMP) and Alberta OHS officers were called and attended the worksite.

Completion

A review for enforcement action was completed May 3, 2017, and it was determined that the file would be referred to Alberta Justice for review. The entire file was sent to Alberta Justice on August 24, 2017. Charges were laid on April 5, 2018. On February 4, 2019, Sulzer Chemtech Canada Inc. pled guilty to Section 12(d) of the OHS Code, failure to ensure that equipment was operated in accordance with a professional engineer or manufacturer's specifications. They were fined $15,000 inclusive of the 15% Victim Fine Surcharge and placed on Enhanced Regulatory Supervision (similar to Corporate Probation). In addition, they were ordered under *OHS Act* Section 75 to pay $130,000 in favour of Energy Safety Canada (ESC) for the proposal by ESC and the Alberta Construction Safety Association (ACSA) for the creation and delivery of a standardized confined space training program designed for frontline workers with an emphasis on hands-on practical exercises. Sulzer Chemtech Canada Inc. were also ordered to pay, under *OHS Act* Section 75, $30,000 to fund a conference for industry stakeholders in which they will present and be involved as an organizer. All other charges were withdrawn.

This investigation was closed on August 7, 2019.

Signatures

ORIGINAL REPORT SIGNED	April 9, 2019
Lead Investigator	Date
ORIGINAL REPORT SIGNED	April 9, 2019
Manager	Date
ORIGINAL REPORT SIGNED	August 1, 2019
Director	Date