

Workers fatally injured from frac sand bin collapse  
May 7, 2019

## **The contents of this report**

This document reports the Alberta Occupational Health and Safety (OHS) investigation of a fatal incident that occurred in May 2019. It begins with a short summary of what happened. The rest of the report covers this same information in much greater detail.

## **Incident summary**

Workers were testing the frac sand handling system for a sand bin when the structure collapsed trapping the two workers in the frac sand where they succumbed to their injuries.

## **Background information**

### **Owner/Prime Contractor - Source Energy Services Canada Holdings Ltd. (Source)**

Beginning in 1998, Source was a fully integrated producer, supplier and distributor of Northern White frac sand, which was a preferred proppant used to enhance hydrocarbon recovery in the hydraulic fracturing of oil and natural gas wells. Source sold frac sand, primarily to customers operating in the Western Canadian Sedimentary Basin (WCSB). Source had the capability to produce approximately 4.8 million metric tonnes per annum of Northern White frac sand across its Sumner, Weyerhaeuser, Blair and Preston Facilities. Source's fully integrated logistics platform enabled it to transport high volumes of frac sand from its facilities in Wisconsin to its customers in the WCSB.

Source was the prime contractor as there were two or more employers on the construction site. Source implemented steps to coordinate, organize, and oversee the completion of the work project. There were two Source workers for the project, a Director of Construction and a Crew Supervisor. The other Source workers at the site conducted regular duties for the frac sand side of the business. Source was regularly onsite ensuring morning safety meetings were held.

Source collected safety meetings, hazard identification reports and safety related incident reports on a regular basis from their contractors.

### **Supplier - AG Growth International Inc. (Westeel)**

AG Growth International Inc. (AGI) was a Canadian company which owned a number of divisions, Westeel being one of them. Westeel designed and manufactured storage bins mostly being for grain. Westeel had a number of plants and facilities across Western Canada with its head office being in Winnipeg, Manitoba. AGI had supplied frac sand bins to Source.

### **Contractor - Corr Grain Systems Ltd. (Corr Grain)**

Based in Regina, Saskatchewan, Corr Grain quoted and sold storage bins, mostly for grain.

There was a sales manager representative in Trochu, Alberta, who hired crews for installing the bins. No Corr Grain workers were involved in the erection of the bins.

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### **Employer - Herman 123 Ltd. (Herman)**

Based out of Burdett, Alberta, Herman had been erecting bins for 11 years. Herman was hired by Corr Grain to assemble the frac sand bins. Herman had gone to the Westeel fabrication shop in Winnipeg the previous year to learn how assemble a 48 foot circumference bin. They had also taken an assembling crew to the Vancouver, BC piers to assemble 18 grain bins.

### **Employer - 2019269 Alberta Ltd.**

Based out of Grassy Lake, Alberta, 2019269 Alberta Ltd. was started in 2014 to erect grain bins. The employer had seven workers with them to assemble the frac sand bins. 2019269 Alberta Ltd. had been hired by Herman. 2019269 Alberta Ltd. had taken its crew to the Vancouver, BC piers the month prior to assemble 18 bins.

### **Employer – Independent employer**

Based out of Grassy Lake, Alberta, the independent employer sub-contracted to 2019269 Alberta Ltd. to assemble the frac sand bins. The independent employer had three other workers under their direction which were family members. Two were assemblers and one was the cook. The previous month the crew had first learned to assemble 48 foot diameter bins in Vancouver with 2019269 Alberta Ltd.

### **Contractor - Kaynic Construction Ltd. (Kaynic)**

Founded in 2011, Kaynic specialized in industrial construction and maintenance, including wood product, oilfield and agricultural services. Based in Grande Prairie, they also provided fabrication services, picker/cranes and trucking services and agricultural services. With four workers on site, Kaynic was hired by Source as the mechanical installation contractor. Their duties were to assemble the conveyors, bucket elevators, stairwell, etc. and erect the bins.

### **Contractor – Tarpon Energy Services Ltd. (Tarpon)**

With the primary office being in Calgary, Alberta, Tarpon offered design, engineering, installation, project management and maintenance expertise for emission reduction projects. They had industry experience with wind power plant construction, solar pv (photovoltaic) system design and installation, vent gas recovery solutions, low to zero bleed instrumentation, combustion optimization and alternative power solutions. With five workers, their role at the frac site was to install the electrical circuit system.

### **Contractor - 4G Construction and Consulting (4G)**

4G had been contracted by Kaynic to act as their Supervisor during the construction of the frac sand bins. 4G had been functioning since 2014 and had been contracting to Kaynic for the past

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four years. At the time of the incident, the Kaynic Supervisor was under bin 2 testing the unloading of the frac sand onto a conveyor belt and into a loader bucket.

## **2086816 Alberta Ltd.**

2086816 Alberta Ltd. was founded in March of 2018 by two siblings, one of them the deceased worker. They had been contracted by Kaynic as Welders and Ironworkers. They had started working at the frac sand site in March of 2019.

## **Welder (one of the deceased workers)**

The Welder was part owner of 2086816 Alberta Ltd. The Welder was under bin 2 when it collapsed.

## **Millwright (one of the deceased workers)**

The Millwright was contracting to Kaynic. The Millwright was also under bin 2 when it collapsed.

## **Director of Construction**

The Director of Construction was a professional engineer who started working for Source on January of 2018. The Director of Construction had 25 years of total relevant experience. The Director of Construction was standing near bin 1 when bin 2 collapsed.

## **Supervisor**

The Supervisor was a contracted worker to Kaynic who directed operations of the building of the bins. The Supervisor had been with Kaynic for approximately four years and had a total relevant experience for approximately 27 years.

## **Loader Operator**

The Loader Operator was working directly for Source when the incident occurred. The Loader Operator had a total of four months of relevant experience when the incident occurred.

## **MMC operator (junior systems integrator) (Operator)**

A junior systems integrator is a programmer that takes information from devices in the field that at the Source site controlled the conveyors, the lift bucket and filling and emptying of the bins. The Operator had a total relevant experience of one year. The Operator had their own business who sub-contracted to an electrical company.

## **Equipment and materials**

### **Westeel Model 4815H45 Externally Stiffened Bins (bins)**

Source had purchased from Westeel, two identical frac sand bins that were to be erected at the same time. Westeel had designed and manufactured the bins (Figure 1). The premise of the bins was to load trucks easier of frac sand for delivery to clients. The project began in October

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2018 and was to be completed by April 2019. At the time of the incident, bin 1 held approximately 3000 tons of 100 mesh frac sand and bin 2 held approximately 4600 tons of 40/70 frac sand. Bins 1 and 2 were built exactly alike.

The bins measured 29.96 metres (m) from the top of the cement pad to the top of the roof with a diameter of 14.55 m.

Specifications:

Volume – 3429 cubic metres (m<sup>3</sup>)

Capacity – 5493 metric tonnes (MT) based on: 100 pounds/cubic foot bulk density

Bin weight – 47 926 kilograms (kg)

Hopper weight – 58 060 kg

Roof angle – 30° from horizontal

Hopper angle – 45°

Added plans for the bins by CWA Engineers were the conveyors, walkway, service stair tower, scales and cement pads.

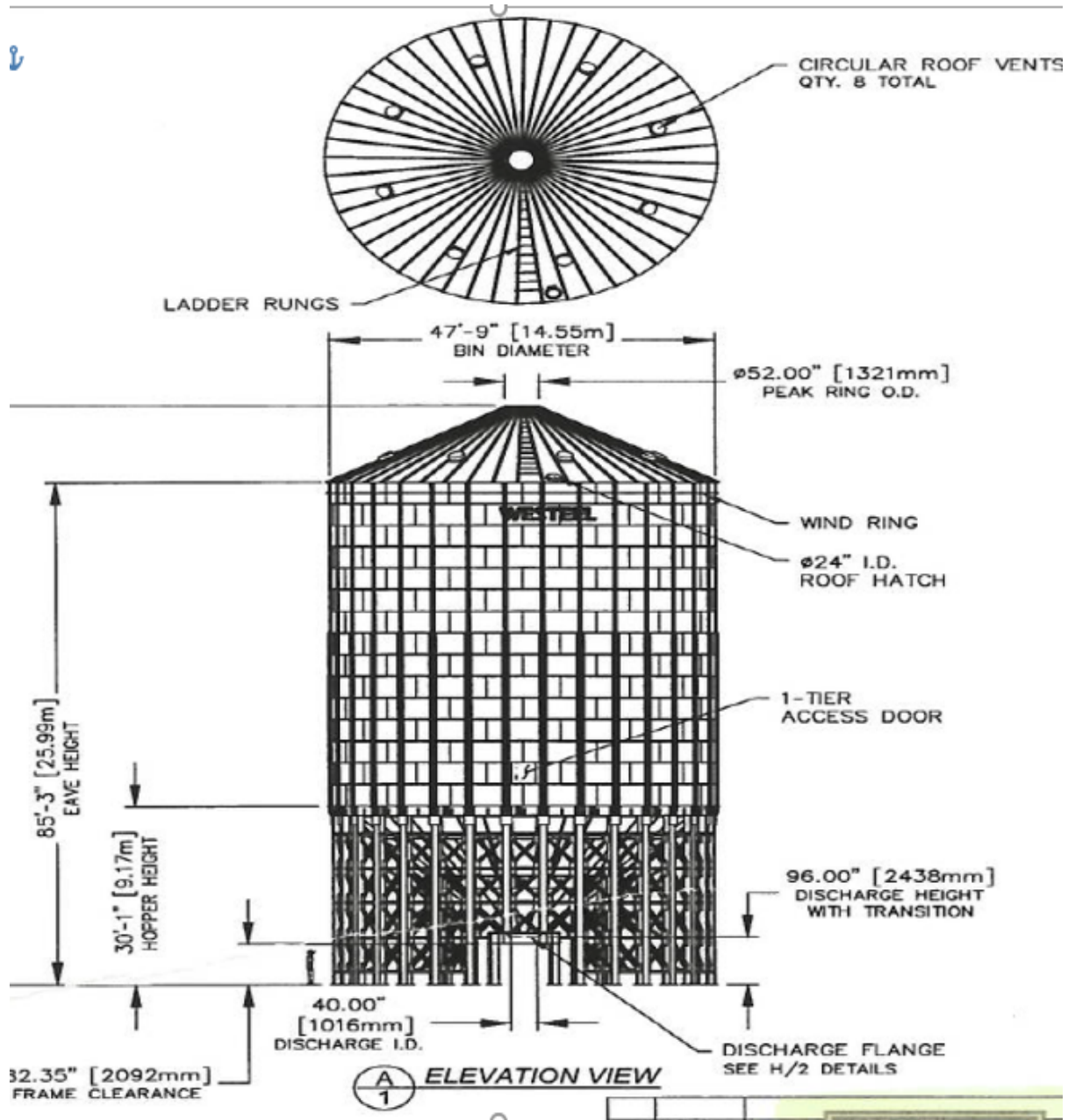


Figure 1. Drawing taken from AGI/Westeel. Drawings of bin 1 and bin 2.

## **Frac sand**

Frac sand is a naturally occurring crystalline silica (quartz) sand that is processed from high-purity sandstone. In its make-up, frac sand differs only slightly from other types of sand, as grains of quartz silica are a major constituent of most inter-coastal sands. The difference is that other sand is a mixture of several minerals and rocks types, which are less durable than quartz.

Frac sand plays an important role in the process of fracturing the shale to release natural gas, oil, and natural gas liquids from pores in the rock. When the high-pressure water stream forces the small perforations to become larger fractures, frac sand holds these fractures open to continue releasing fossil fuels. Frac sand (or any other type of natural or synthetic substance), when used to prop open these fractures, are called a “proppant.” The 100 mesh sand would be a finer proppant and heavier in volume.

## **Sequence of events**

In 2017/2018, Source decided to expand their Fox Creek Full Service Terminal (Fox Creek Terminal) as there were potential opportunities in the area for the distribution of frac sand.

August 2018, Source engaged CWA Engineers Inc. (CWA) to conduct a Front End Engineering Design (FEED) study for the anticipated new storage facility at their Fox Creek Terminal.

September 2018, Source was awarded a contract from Shell to supply hydraulic fracturing (frac) sand from the Fox Creek Terminal. The contract specified the requirement for a dedicated storage facility comprised of sand bins and load out scale, which Source would build.

October 2018, CWA provided Source with a draft FEED study report, which included basic design and estimated timeline to complete the project.

October 2018 to April 2019, Source hired contractors for the multiple components of the construction project which included AGI/Westeel (Westeel) who would design, manufacture and deliver the bins. Construction and additional work relating to the project were being completed by the contracted companies.

Westeel approached Source with a new design option for the sand bins. The new design would:

- Improve the product reclaim percentages and operational improvement.
- Have an angled hopper bottom rather than a traditional flat bottom.

Westeel’s bin design was for grain product, but Westeel engineers assured Source that with material upgrades, the angled hopper design could be used for the sand bins. From the

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information provided and the recommendation by Westeel, Source agreed to the new bin design. The sand bin's maximum capacity was 5493 MT.

April 25, 2019, Kaynic started the commissioning portion of the project. Kaynic's standard procedure for commissioning bins was used for this phase. Kaynic would complete regular surveys of the project during the commissioning phase. This included structural movement during the filling process.

Prior to work beginning, Kaynic led a tailgate/safety meeting with Kaynic, Source and Tarpon workers. Workers were required to notify Kaynic if they observed any structural defects during the filling of the bins.

The bins were filled with frac sand at a rate of five rail cars over a one hour period. Bin 1 was filled with 100 mesh sand. Bin 2 was filled with 40/70 frac sand. Kaynic employees immediately stopped the fill procedure of bin 2 due to workers noticing pinhole leaks on the hopper.

Source reported to Westeel and Corr Grain of the sand leakage. Corr Grain came to the work site the next day, (April 26, 2019) to rectify the pinhole leaks by using caulking to seal the holes. Kaynic was able to continue with the commissioning procedures.

Kaynic conducted a survey of the bin legs to monitor for structural movement after every series of five rail cars were loaded into a bin. No concerns arose from the surveys.

Evening of May 3, 2019, bin 1 contained 3104 MT of 100 mesh sand (approximately 32 rail cars). Bin 2 contained 3600 MT of 40/70 sand (approximately 37 rail cars).

May 3, 2019 at end of the day, Kaynic workers noticed bulging in the hopper sheets of both bins. The Kaynic Supervisor stopped filling the bins and reported the bulging to Source and Westeel (Figures 2 and 3).

May 4, 2019, Kaynic contacted Source who then contacted Westeel. Westeel followed up with their engineering team.

May 6, 2019, Source conducted telephone conversations with Westeel regarding the bulging and received assurance from Westeel by email that it was safe to continue with the commissioning. No Westeel representative had come to the site to visually inspect the bins.

Kaynic was instructed by the Director of Construction to continue to fill the bins. No additional concerns regarding the bulging of the bins were reported to Source.



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Sixteen more rail cars of frac sand were loaded into bin 2. They filled the bin to test the high-level sensors. Bin 2 contained 5152 MT of 40/70 frac sand (below the maximum capacity of 5493 MT).

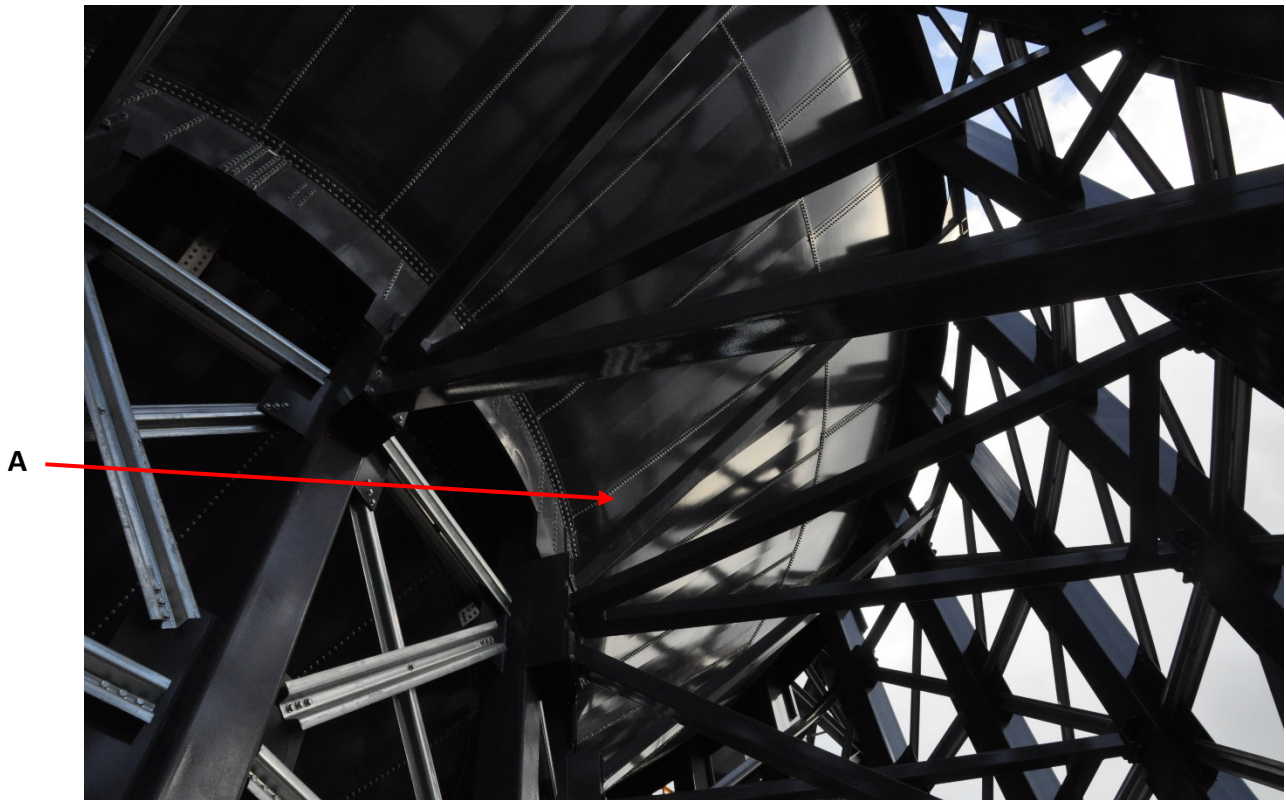


Figure 2.

A. *Bulging to the hopper sheets from bin 1.*

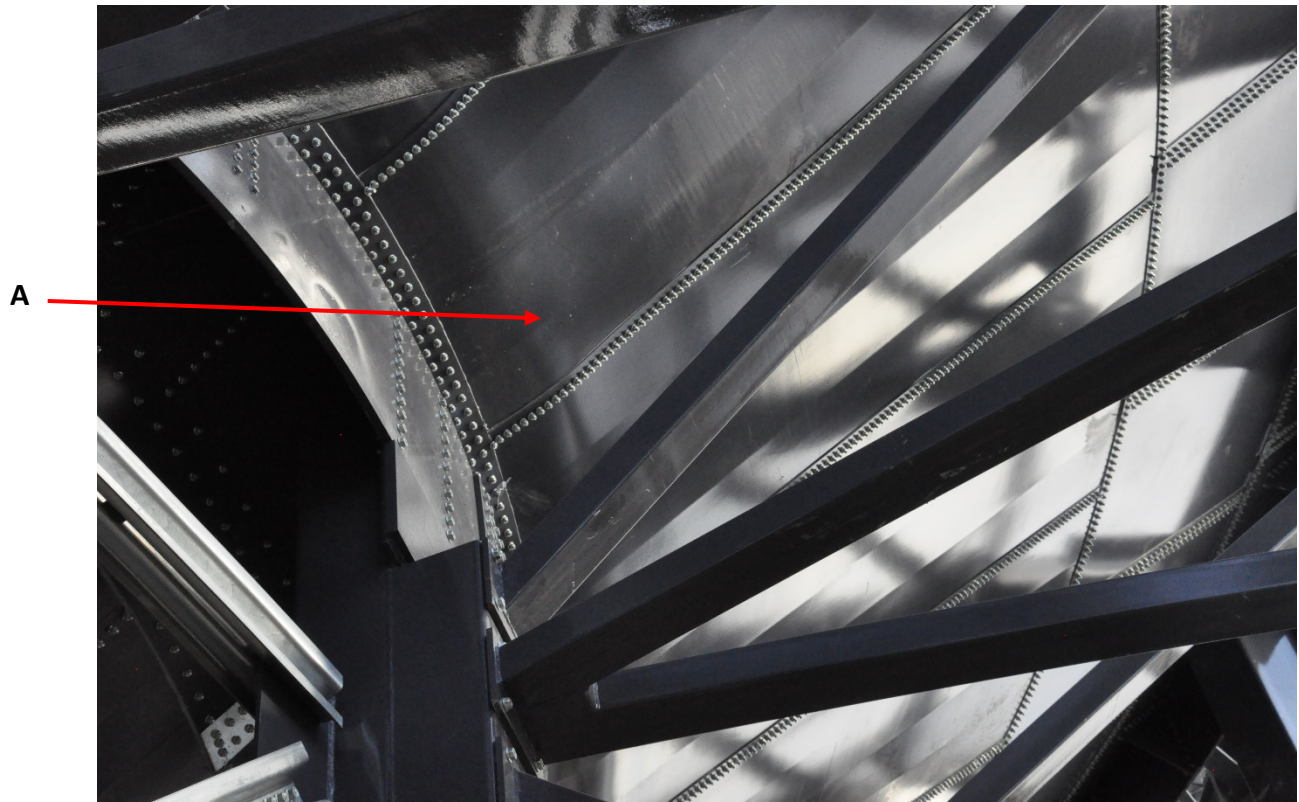


Figure 3.

A. *Bulging to the hopper sheets of bin 1.*

All equipment had been function tested without sand running through it (i.e. conveyors, slide gates, and bucket elevators) (Figure 4).

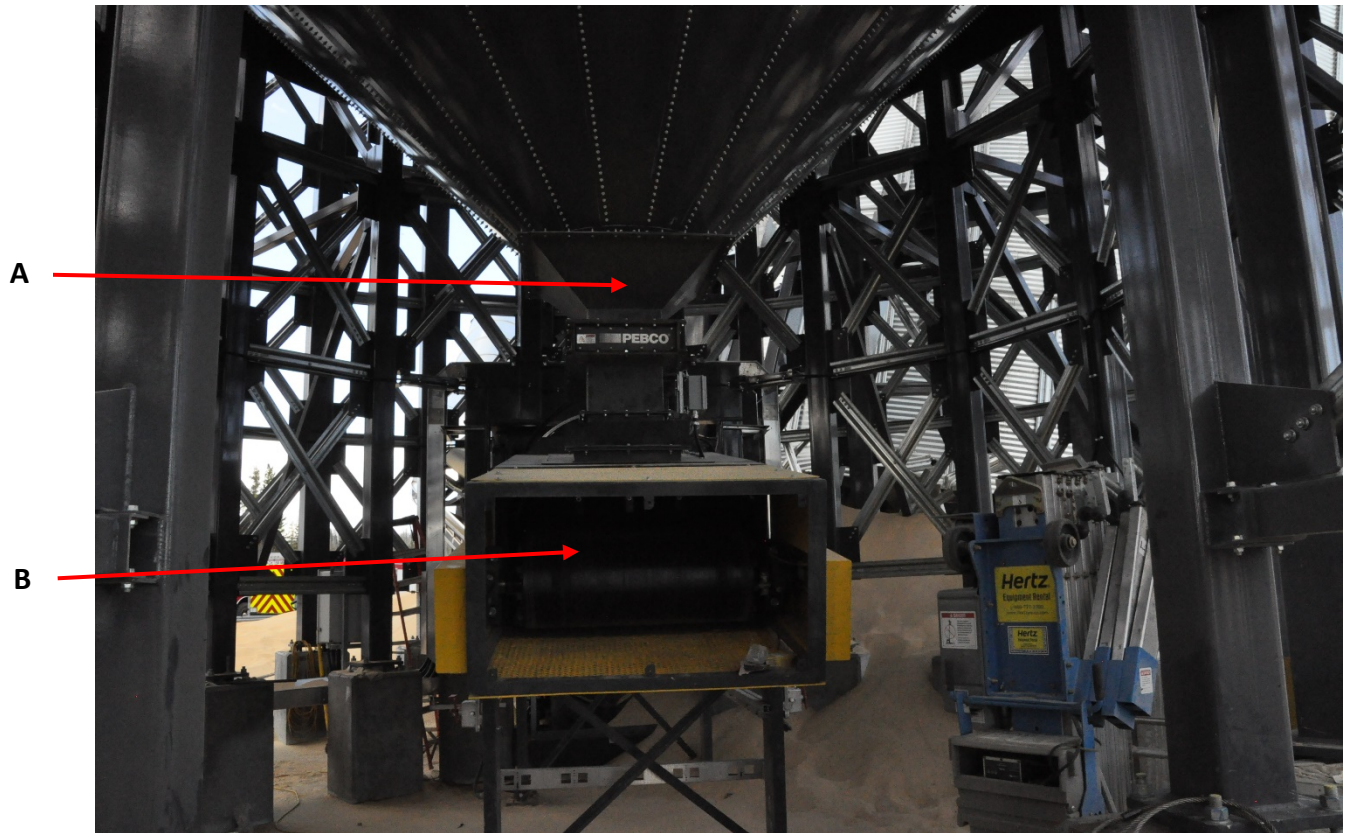


Figure 4. Underneath bin 1 which would have been the same as bin 2.

- A. Chute of bin 1 where the contents of the bin would flow out of
- B. Conveyor belt of bin 1 where it was designed to transport the frac sand into a waiting truck

Kaynic prepared for the initial load-out of 40/70 sand from bin 2 into a loader bucket situated on the load-out scales.

Kaynic planned to visually inspect the slide gate and conveyor belt function while in radio communication with a programmer who was located in the MCC building and operating the controls based on the Kaynic Supervisor's communicated instructions over the radio.

May 7, 2019, at approximately 10:00 a.m., the Operator positioned a loader onto the scales underneath a load-out chute to receive frac sand.

Once the loader was in place, the Kaynic Supervisor tasked two workers, a Millwright and a Welder to go underneath bin 2. The Millwright was to visually confirm the operation of the slide gate while the Welder was to confirm the operation of the outbound conveyor. At

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approximately 10:15 a.m., the Kaynic Supervisor was positioned between the outer and inner rings of the bin 2 structure. The outbound conveyor was started. Next, the slide gate opened electronically by the MCC programmer to allow frac sand to flow from bin 2 into the loader bucket.

The frac sand flowed from bin 2, through the slide gate, onto the conveyor and into the loader bucket for approximately 5-10 seconds when workers stated they heard a loud noise and the structure was collapsing (Figures 4 and 5).



*Figure 5. Collapse of bin 2.*



*Figure 6. Collapse of bin 2 where the sand ejected through to the bottom hopper panels.*

The Kaynic Supervisor was thrown from between the inner and outer rings, and someone yelled out “run”. All those in the area ran from the bin 2 structure. The frac sand ejected through the bottom hopper panels and bin 2 walls partly fell down while a portion of the roof collapsed inwards (Figure 6).

After the collapse of bin 2, workers completed a headcount and identified that the Millwright and the Welder were unaccounted for. At approximately 10:15 a.m., a 911 call was made.

Emergency services arrived on site at 10:51 a.m.

May 11, 2019, the Millwright and the Welder were recovered from the collapsed frac sand storage bin 2.

### **Completion**

A review for enforcement action was completed on August 5, 2020, 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 28, 2020. After a thorough review, Alberta Justice advised OHS on April 14, 2021, charges were not recommended.

This investigation was completed on June 2, 2021.

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## Signatures

ORIGINAL REPORT SIGNED

Lead Investigator

June 7, 2021

Date

ORIGINAL REPORT SIGNED

Manager

June 7, 2021

Date