WORKER CRUSHED IN CONVEYOR
Type of Incident: Fatality
Date of Incident: December 6, 2012

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SECTION 1.0 DATE AND TIME OF INCIDENT

1.1 The incident occurred on December 6, 2012 at approximately 3:29 p.m.

SECTION 2.0 NAME AND ADDRESS OF PRINCIPAL PARTIES

2.1 Prime Contractor / Employer

2.1.1 Hammerstone Corporation
2681 Hochwald Court SW
Calgary, Alberta
T3E 7M3

2.2 Workers

2.2.1 Lead Crusher Hand (****** *******)
** ***** ****
********** *******
*** ***

2.2.2 Crusher Hand 2 (****** ********)
** **** **** ****
***** ******** **** ******
*** ***

2.2.3 Crusher Hand 3 (**** *******)
*** **********
******* **** *******
*** ***

2.2.4 Tower Operator (*** **********)
** * ********
******* ******* **** ******

SECTION 3.0 DESCRIPTION OF PRINCIPAL PARTIES

3.1 Prime Contractor / Employer

3.1.1 Hammerstone Corporation is the owner and operator of the Muskeg Valley Limestone Quarry north of Fort McMurray. The quarry produces limestone aggregate in a variety of sizes which is used in road construction and regional infrastructure developments across the oil sands region.

3.2 Workers

3.2.1 The Lead Crusher Hand (****** *******), had been employed by Hammerstone Corporation to direct crusher workers, monitor the crushing operations and to communicate with the tower operator.

3.2.2 Crusher Hand 2 (****** ********) had been employed by Hammerstone Corporation to maintain and monitor the operation of the crushing system and to communicate with the tower operator.

3.2.3 Crusher Hand 3 (**** *******) had been employed by Hammerstone Corporation to maintain and monitor the operation of the crushing system and to communicate with the tower operator.

3.2.4 The Tower Operator (*** **********) had been employed by Hammerstone Corporation to operate the control panel, manage the electrical energy distribution and monitor the operation of the crushing system.

SECTION 4.0 LOCATION OF INCIDENT

4.1 The incident occurred at Hammerstone Corporation's Muskeg Valley Quarry located 60 km north of Fort McMurray, Alberta (Refer to Attachment A – Map).

SECTION 5.0 EQUIPMENT, MATERIAL AND OBSERVATIONS

5.1 Equipment and Material

5.1.1 **Muskeg Valley Quarry**

5.1.1.1 The Muskeg Valley Quarry is an active mine where limestone is exposed and then trucked to on-site primary crushing facilities. If required, limestone can then be moved to secondary crushing facilities for further processing. Both processes produce limestone aggregate which is used primarily in road construction and

regional infrastructure development.

5.1.2 **Andreas Crushing System (Spread)**

5.1.2.1 The Andreas system is the highest capacity crushing spread at the Muskeg Valley Quarry with an estimated crushing output of 1500 tonnes per hour of limestone. The system produces crushed limestone primarily in 25, 40 and 75 mm sizes (see Attachment B, Diagram).

5.1.2.2 All electrical power to the system is provided by two 1.3MW diesel generators. There is a motor control centre (MCC) and control tower located in a nearby trailer which provides power for all motors on the system. The main control panel located in the control tower is hard wired to the motor starters (Attachment C, Photograph #1). The control room operator (tower operator) monitors product flow throughout the system and maintains contact with the ground crusher personnel by means of wireless hand-held radios. The tower operator has controls which can shut-down individual components of the crushing system as well as an emergency stop button which can shut-down the entire crushing operation (Attachment C, Photograph #2). The radios that the crushing personnel all carry are equipped with emergency stop buttons which, when depressed, shut down the entire crushing system.

5.1.2.3 Limestone is blasted in the mine area and transported to the Andreas system where it is dumped into the receiving hopper. At the bottom of the hopper, a vibrating grizzly feeder (VGF) facilitates delivery of the product into the horizontal shaft impactor (primary crusher) which is located immediately adjacent to the VGF. Limestone is crushed to 15-25 cm diameter and then falls onto the Andreas discharge conveyor below (conveyor 88) which, in turn, feeds onto the adjacent stacker conveyor (conveyor 25/26). The stacker conveyor builds a conical mound of crushed limestone known as a surge pile (Attachment C, Photograph #3).

5.1.2.4 Limestone from the surge pile is removed through the reclaim tunnel system which is located underneath the pile itself. The tower operator monitors and controls the rate at which the limestone is reclaimed. The reclaimed limestone is fed onto a series of screen boxes (screeners) which distribute the crushed limestone according to size. Coarse product is directed to the surge bin by way of the secondary crusher, optimally sized product is transported directly to the surge bin and fine product is sent to a waste stockpile (Attachment C, Photographs #3 and #4).

5.1.2.5 The surge bin feeds the limestone to a second set of screeners which either direct product to the tertiary crusher (Canica), to the finished product stockpile or to the waste stockpile.

5.1.2.6 Finished product is transported by multiple conveyors to radial motorized stackers (Thors) which stockpile the limestone accordingly for distribution to customers.

5.1.3 **Andreas Discharge Conveyor - #88**

5.1.3.1 Once the limestone is processed by the primary crusher, it is discharged by gravity onto conveyor 88. The conveyor transports the crushed limestone along its length in a westerly direction towards the adjacent stacker conveyor 25/26.

5.1.3.2 Conveyor 88 is powered by a 60 horsepower electric motor located on the head (west) end of the conveyor. The conveyor is 30.5 m in length and the belt is 137 cm in width and runs at a rate of 107 m per minute. The unit was custom built for Hammerstone specifically for its purpose. At each end of the conveyor there is a shaft, or pulley, which is used to reverse the direction of the belt. The shaft located closest to where the limestone is received is the tail pulley and the shaft closest to the stacker conveyor is known as the head pulley (Attachment C, Photograph #5).

5.1.3.2 Approximately 2 m from the head pulley on the return belt, there is a belt gravity tower take-up mechanism comprised of two bend pulleys which bend the bottom belt down towards a single, lower gravity tower pulley (these are commonly referred to as S-rollers by crushing personnel). The lower gravity tower pulley floats on a frame and is weighted with concrete and steel which enables it to keep tension on the belt itself. Proper tension on the conveyor belt is critical for conveyor drive purposes (Attachment C, Photograph #6).

5.1.3.3 The two bend pulleys are located approximately 2.6 m from ground level. They are partially guarded by a steel frame as per manufacturer's specifications. The lower gravity tower pulley is guarded by a steel mesh frame which extends from the bottom of the bend pulleys to ground level.

5.1.3.4 Occasionally, pulleys on the conveyor belt can become coated with limestone mud which, if left to build up, causes shaking and disruption of proper conveyor belt operation. Hammerstone crusher hands routinely use a shovel or steel metal bar known as keystock to clean the debris off pulleys (Attachment C, Photograph #7). The conveyor is de-energized and locked out prior to performing any maintenance activity.

5.2 Observations

5.2.1 At the time of the initial investigation on December 6, 2012 at approximately 7:38 p.m. Occupational Health and Safety Investigators found the scene barricaded with tape and secured by the RCMP and Albian Sands Emergency Medical Technicians. A handover meeting with the RCMP was conducted and the scene was released to the

Occupational Health and Safety investigators at 8:00 p.m.

5.2.2 The Occupational Health and Safety investigators observed two conveyors (conveyor 88 and conveyor 25/26) which were not operational and confirmed to be locked out. Conveyor 88 ran from a hopper towards the tail end of conveyor 25/26 which then fed an adjacent stockpile. Near the head pulley of conveyor 88, there were two rollers (pulleys) separated by a horizontal structural steel beam. Directly below these two rollers, there was a third pulley with a partially removed steel mesh guard. The conveyor belt had been cut adjacent to these pulleys and the resulting two sections of belt were lying on the ground underneath conveyor 88 (Attachment C, Photograph # 6).

5.2.3 A blue hard hat was observed to be trapped between the western pulley and the structural steel beam. The hard hat was broken in several places. Adjacent to the hard hat, a bend steel rod was observed protruding from the bottom of the pulley resulting in a semi-circular shape. A build-up of limestone mud was observed on the rollers (Attachment C, Photograph #7).

5.2.4 The tail pulley guard of conveyor 25/26 was located underneath the head pulley of conveyor 88. Standing on the tail pulley of conveyor 25/26 provided easy access to the roller where the hard hat and steel bar were trapped (Attachment C, Photograph #6).

5.2.5 The outside ambient temperature was recorded to be -16^{o}C. There was light snow accumulation on the ground.

5.2.6 Occupational Health and Safety issued a stop work order at 7:50 p.m. on December 6, 2012.

SECTION 6.0 NARRATIVE DESCRIPTION OF THE INCIDENT

6.1 On December 6, 2012 at 6:00 a.m. the Lead Crusher Hand (****** *******) commenced his regular dayshift at the Muskeg Valley Quarry. The Lead Crusher Hand (****** *******) was working as part of the Andreas ground crew for the balance of the shift. The ground crew is responsible for monitoring the operation of the crushing system, including the conveyors, secondary and tertiary crushers, screeners and stackers and to communicate with the tower operator who is also monitoring the Andreas crushing system.

6.2 In the afternoon of December 6, 2012 shortly before 3:25 p.m., the Lead Crusher hand (****** *******) was observed by the Tower Operator (*** **********) to be performing cleaning activities underneath conveyor 88 adjacent to, and immediately east of, the belt gravity take-up mechanism. The conveyor was

operational at the time (Attachment C, Photograph #4).

6.3 The Tower Operator (*** **********) observed the Lead Crusher Hand (****** *******) cleaning built-up limestone mud off the roller on the east end of the belt gravity take-up with a metal bar (Attachment C, Photograph #7). The Lead Crusher Hand (****** *******) continued to clean the roller in this manner for a short period of time, then proceeded behind the belt gravity take-up mechanism on the south side of conveyor 88. At this point, the Lead Crusher Hand (****** *******) was not within the line of sight of the Tower Operator (*** **********).

6.4 At approximately 3:29 p.m., conveyor 88 suddenly stopped. The Tower Operator (*** **********) observed a worker lodged between the return belt and the S-roller on the west side of the belt gravity take-up mechanism. The Tower Operator (*** **********) believed that worker to be the Lead Crusher Hand (****** *******).

6.5 The Tower Operator (*** **********) initiated emergency response procedures and shut-down conveyor 88.

6.6 Crusher Hand 2 (****** ********), who was operating a skid-steer on the other side of the Andreas crushing system, responded to the emergency call from the Tower Operator (*** **********). Crusher Hand 2 (****** ********) arrived at the scene and identified the trapped worker as the Lead Crusher Hand (****** *******).

6.7 A number of Hammerstone workers began to arrive at the incident scene and attempts were made to remove the Lead Crusher Hand (****** *******). Crusher Hand 3 (**** *******) cut the conveyor belt on the east side of the belt gravity take-up in order to relieve tension on the belt.

6.8 Albian Sands emergency responders arrived at conveyor 88 at approximately 3:45 p.m. and took control of the scene. The conveyor belt was cut a second time in between the belt gravity take-up and the head pulley. The Albian emergency responders were then able to remove the Lead Crusher Hand (****** *******). All efforts to revive the Lead Crusher Hand (****** *******) were unsuccessful and he was pronounced deceased at the scene.

SECTION 7.0 FOLLOW-UP/ ACTION TAKEN

7.1 Industry

7.1.1 Hammerstone provided evidence to Occupational Health and Safety on February 11, 2013 of engineering controls and improvements which had been made to the conveyor system to ensure work would be carried out in a healthy and safe

manner. Occupational Health and Safety lifted the stop work order on February 11, 2013.

7.1.2 Hammerstone conducted an investigation in the circumstances surrounding the incident and made the report available for review by Occupational Health and Safety on February 19, 2013.

7.2 Additional Measures

7.2.1 Alberta Justice reviewed the results of the investigation and considered whether any occupational health and safety charges were appropriate. Charges were not recommended.

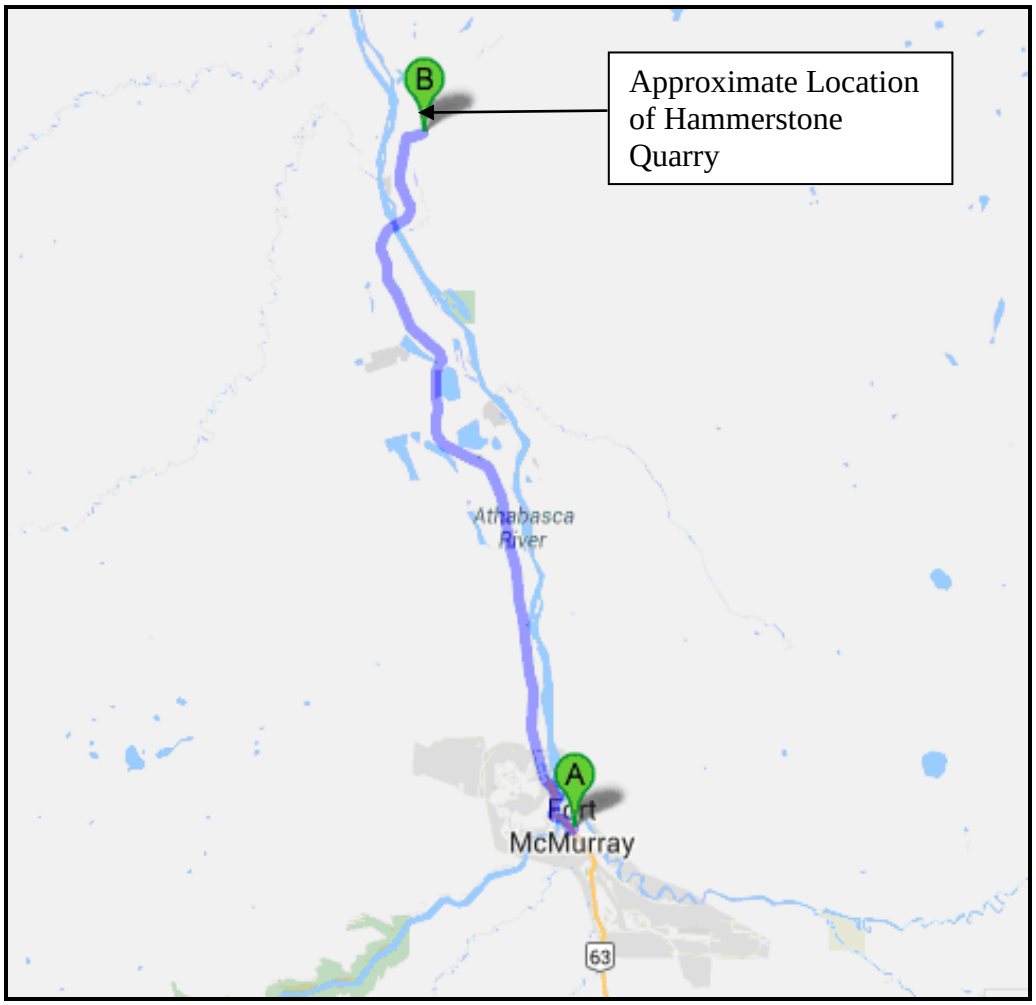
SECTION 8.0 SIGNATURES

Original Report Signed Investigator	March 13, 2015 Date
Original Report Signed Manager	March 13, 2015 Date
Original Report Signed Director	March 18, 2015 Date

SECTION 9.0 ATTACHMENTS:

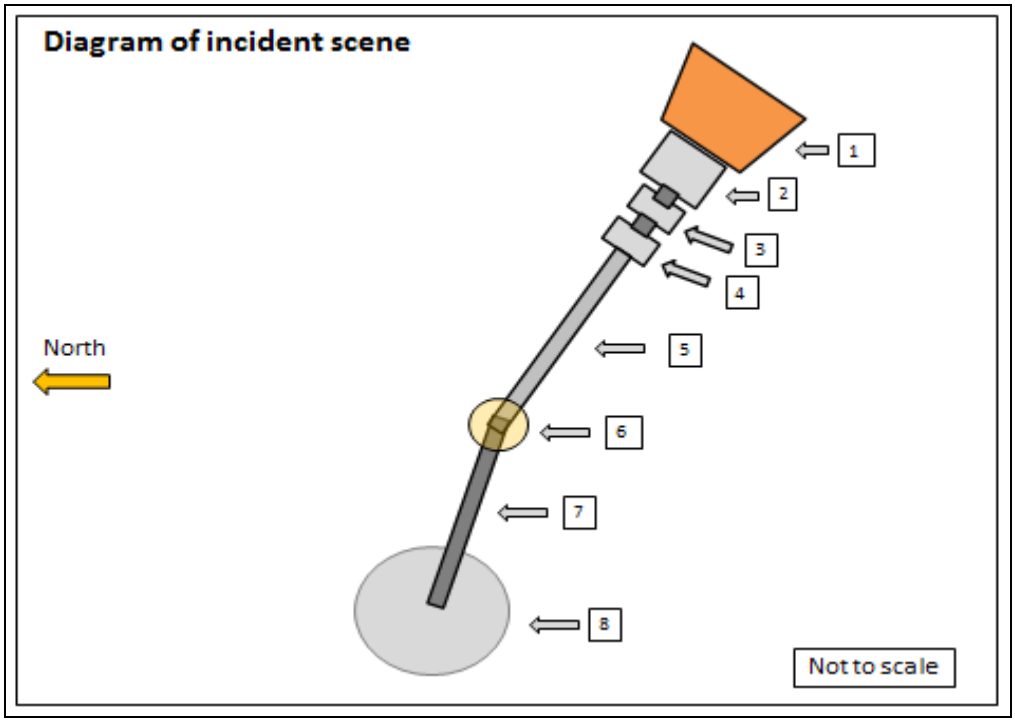
Attachment A	Map
Attachment B	Diagrams or Sketch
Attachment C	Photographs

Attachment A – Map



Map – Shows the location where the incident occurred (Hammerstone Quarry located approximately 61 km north of Fort McMurray).

Attachment B – Scene Diagram



The incident scene diagram was developed by Occupational Health and Safety. The diagram demonstrates the layout of the equipment at the time of the incident.

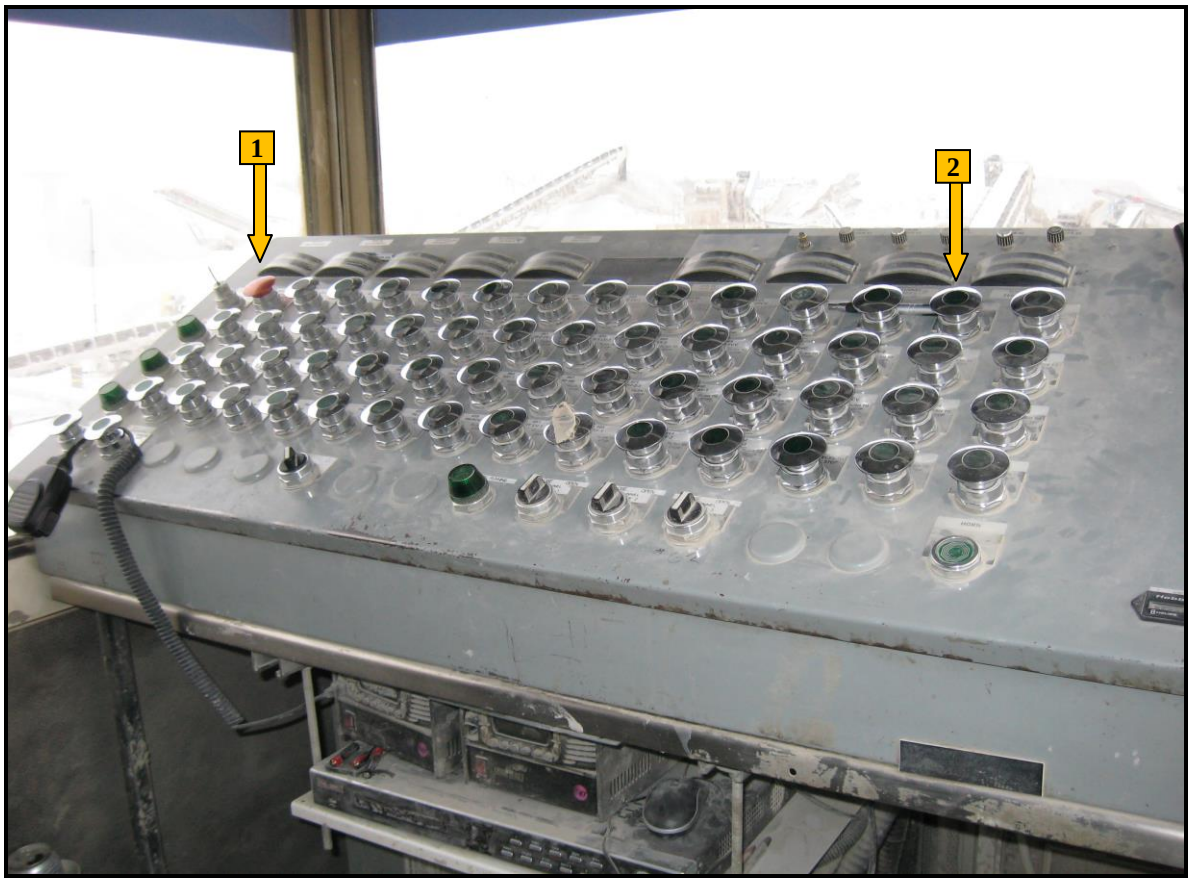
1. Dump area
2. Dump hopper
3. Vibrating grizzly feeder
4. Impactor
5. Conveyor 88
6. Incident scene
7. Conveyor 25/26
8. Surge pile

Attachment C – Photographs

Photograph #1

This is a photograph facing northeast of the Andreas Crushing System's control tower. Note: this photo was taken from the belt gravity take up on conveyor 88 where the incident happened.

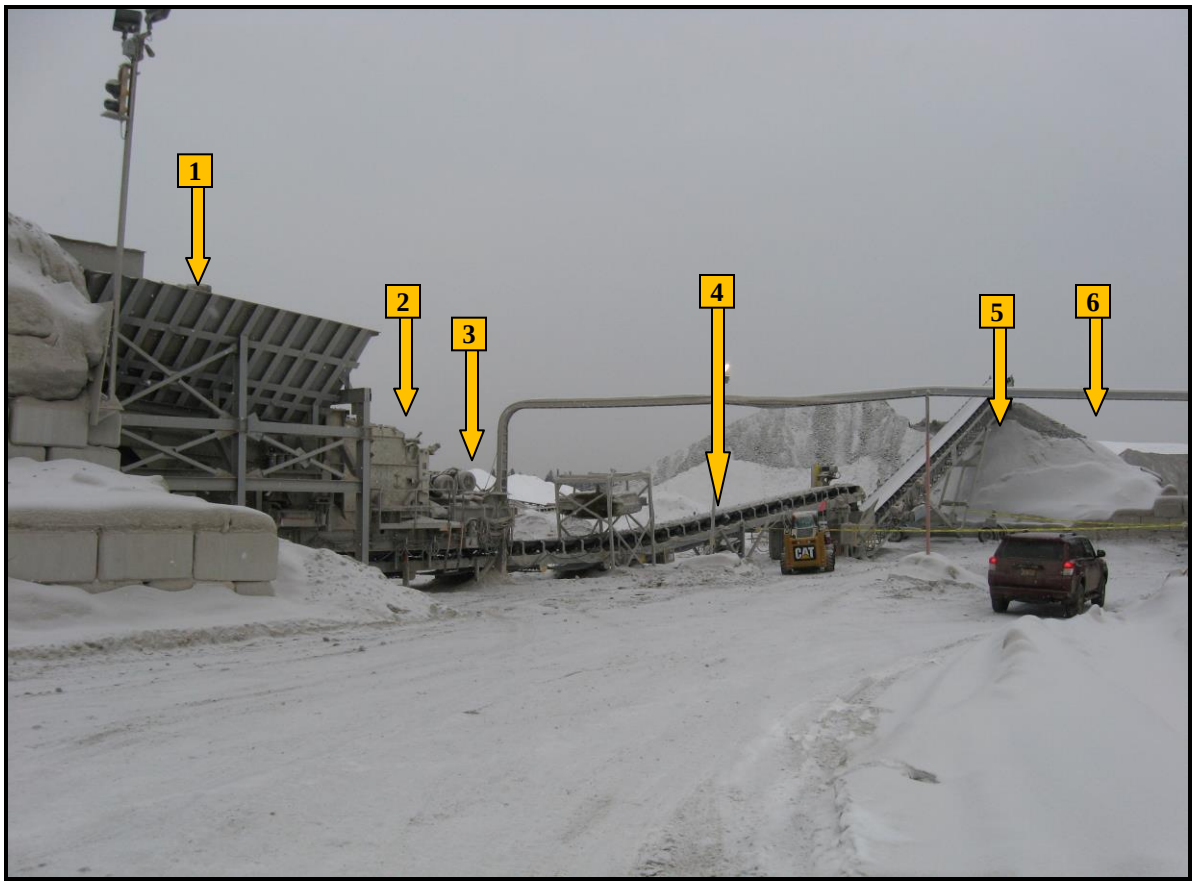
1. Control tower



Photograph #2

This is a photograph of the control panel located in the Andreas control tower with stop buttons for the various pieces of equipment contained within the Andreas Crushing Spread.

1. Emergency stop button
2. Conveyor 88 stop button



Photograph #3

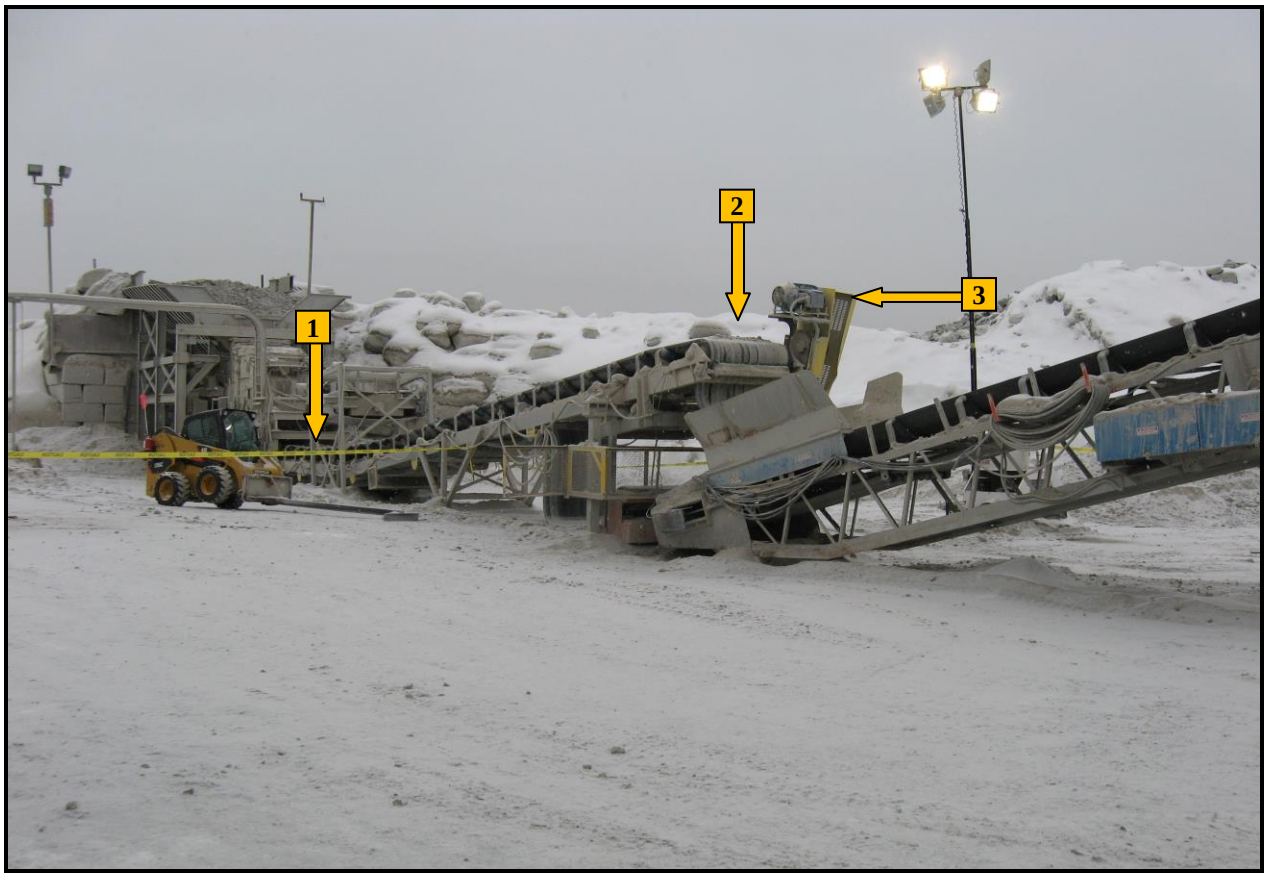
This is a photograph facing southwest of the primary Andreas Crushing Spread.

1. Dump hopper
2. VGF
3. Impactor
4. Conveyor 88
5. Conveyor 25/26
6. Limestone reclaim surge pile

Photograph #4 (picture provided by Hammerstone Corporation)

This is a photograph facing southwest of the Andreas Crushing Spread from the control tower. This is the view the tower operator had at the time of the incident.

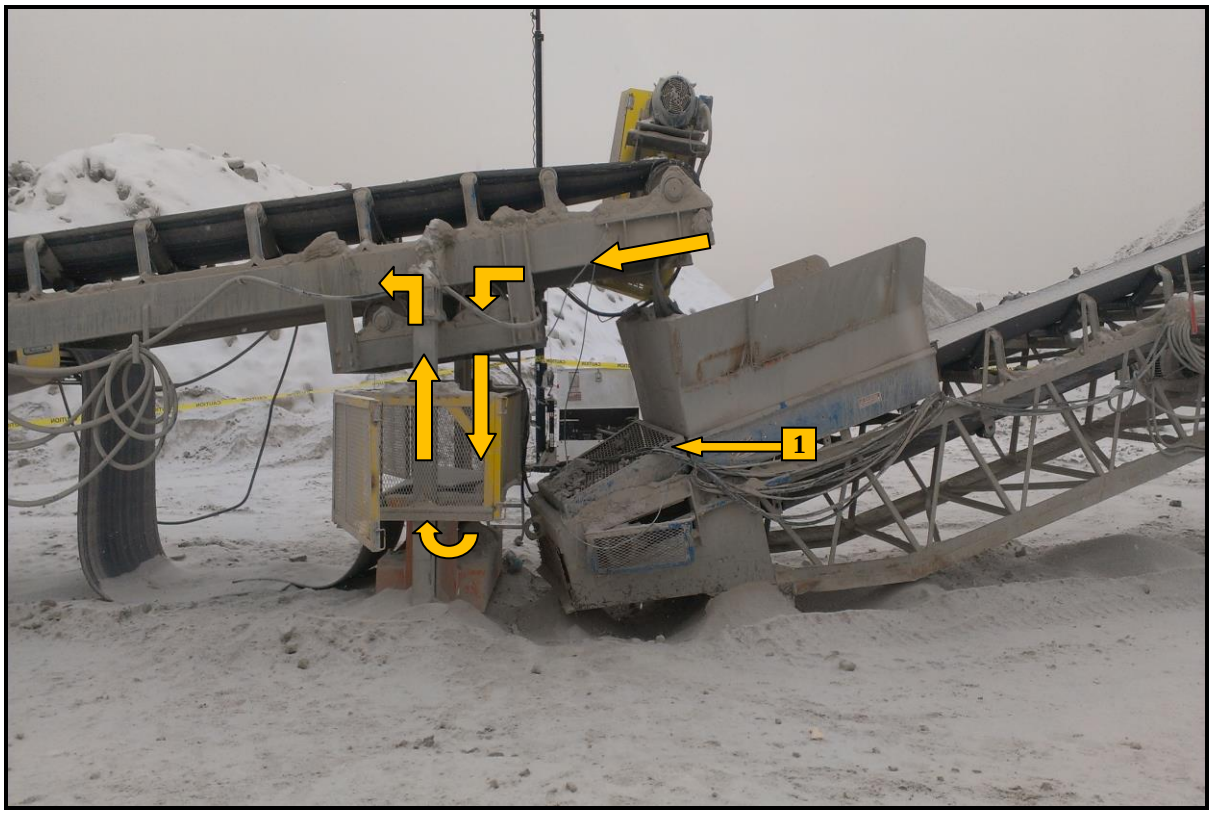
1. Incident scene



Photograph #5

This is a photograph facing southwest of the primary Andreas Crushing Spread.

1. Incident scene
2. Head pulley
3. 60 Horsepower electric motor



Photograph #6

This is a photograph facing south of the belt gravity tower take-up mechanism located on conveyor 88. The belt gravity tower consists of two upper bend pulleys and a lower gravity tower pulley. Note the arrows identifying the direction the conveyor belt would normally travel around these pulleys.

1. Tail pulley guard of conveyor 25/26

Photograph # 7

This is a photograph underneath the bend pulleys. Note the broken, blue hard hat lodged between the bend pulley and the frame as well as the bent piece of steel bar known as keystock. Also note the accumulation of limestone on the bend pulleys.