FLOORHAND STRUCK BY ROTATING DRILLING EQUIPMENT
Type of Incident: Fatality
Date of Incident: December 12, 2010

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SECTION 1.0 DATE AND TIME OF INCIDENT

1.1 The incident occurred on December 12, 2010 at approximately 9:45 a.m.

SECTION 2.0 NAME AND ADDRESS OF PRINCIPAL PARTIES

2.1 Owner

2.1.1 Novus Energy Inc.
3500, 855-2 Street SW
Calgary, Alberta
T2P 4J8

2.2 Prime Contractor

2.2.1 Novus Energy Inc.
3500, 855-2 Street SW
Calgary, Alberta
T2P 4J8

2.3 Contractor

2.3.1 NBC Technologies Inc.
820, 407 – 2nd Street SW
Calgary, Alberta
T2P 2Y3

2.4 Employer

2.4.1 Precision Drilling Corporation
4200, 150-6 Avenue S.W.
Calgary, Alberta
T2P 3Y7

2.5 Workers

2.5.1 Floorhand #1 [redacted]

2.5.2 The Driller [redacted]

SECTION 3.0 DESCRIPTION OF PRINCIPAL PARTIES

3.1 Novus Energy Inc. is a junior oil and gas exploration and production company. The company headquarters are located in Calgary with production operations located in both Alberta and Saskatchewan. Novus Energy Inc. retained NBC Technologies Inc. to provide well planning and wellsite supervision services. Precision Drilling Corporation was also retained by Novus Energy Inc. to provide equipment and manpower to drill the well near Grande Prairie, Alberta.

3.2 NBC Technologies Inc. is a petroleum operations consulting business and is based in Calgary, Alberta. Novus Energy Inc. retained NBC Technologies Inc. to provide well planning and wellsite supervision to oversee the daily drilling operations at the Novus Energy Inc.'s work site.

3.3 Precision Drilling Corporation is a large oil and gas service provider. The company provides drilling, well servicing and strategic support services to the oil and gas industry. In Canada, the company maintains a fleet of over 200 drilling rigs. The company headquarters are located in Calgary and the technical and operation support center is located in Nisku, Alberta. Precision Drilling Corporation was contracted to Novus Energy Inc. and supplied them with a drilling rig and crew to drill the well near Grande Prairie, Alberta.

3.4 The Floorhand [redacted] had been working on and off with Precision Drilling Corporation since 2004. Prior to arriving at Precision Drilling Corporation's rig 212 on Dec. 8, 2010, the Floorhand [redacted] had not worked on the drilling rigs since May 2010. The Rig Manager [redacted] conducted a site specific rig orientation on Dec. 8, 2010 and the Floorhand [redacted] commenced his duties on Precision Drilling Corporation's rig 212 on Dec. 9, 2010.

3.4.1 The Driller [redacted] had 11 years of experience in the drilling industry. Nine of those years were with Precision Drilling Corporation.

SECTION 4.0 LOCATION OF INCIDENT

4.1 The incident took place at LSD 11-01-072-07W6 approximately 30 km west of Grande Prairie (Attachment A, Map 1).

SECTION 5.0 EQUIPMENT, MATERIAL AND OBSERVATIONS

5.1 Equipment and Material

5.1.1 **Double Telescopic Drilling Rig 212** (Attachment C, Photograph 1)

5.1.1.1 The Precision Drilling Corporation's Rig 212 is a conventional drilling rig that was originally manufactured in 1997. The drilling rig had recently been refurbished and both the telescopic mast and substructure were re-certified on Nov. 16, 2010.

5.1.1.2 Conventional drilling rigs were traditionally used for drilling vertical bore holes. With modifications to the bottom hole assembly, conventional drilling rigs have been adapted to drill directional well bores (Attachment B, Diagram 1). Downhole mud motors with a bent housing use hydraulic power from the circulating drilling mud to rotate the drill bit without having to rotate the entire drill string from the surface. This process is known as slide drilling and causes the bit to drill at an angle off the vertical. Once the desired angle is achieved, then the entire drill string is rotated from surface and the drill bit drills straight by conventional drilling means.

5.1.1.3 Part of the mechanical drilling process with a conventional drilling rig is accomplished by a rotating system that is made up of the following equipment: rotary table, kelly drive, swivel and drill string (Attachment B, Diagram 2). The rotary table provides the initial rotational movement which is transmitted to the square or hexagonal shaped kelly drive. The kelly drive then transmits the rotation to the drill string as it is attached to it by a threaded connection. The swivel allows the kelly drive and drill string to rotate without rotating the hook or other equipment. This process transmits the rotation to a drill bit which bores the hole.

5.1.1.4 Once the desired hole depth is achieved, the drilling process is complete and all the drill pipe is taken back out of the hole. To do this, the kelly is removed from the drill string and each length of drill pipe is hoisted out of the hole. This process is referred to as tripping out of the hole. To initially break the connection between the kelly and the drill pipe or to break the drill pipe connections, the floorhands will use power hydraulic tongs. Once the initial connection is broken, the driller will use the rotary table to completely unscrew the connection.

5.1.1.5 The action of using the rotary table to unscrew the pipe from the kelly connection causes the entire drill string to rotate down hole. Pipe connections are quickly unscrewed, however, there is always potential to build up and trap torque in the drill string when this method is used. On a directional hole, there is greater resistance between the drill string and the well bore. Higher torque values can develop on a directional hole since the torque applied by the rotary table at surface is less likely to dissipate through the length of the drill string down hole. When the rotary table brake is engaged, this torque becomes trapped/stored in the drill string. The torque in the drill string can be released in a controlled manner by releasing the rotary table break prior to hoisting the drill string.

5.1.2 The Pason Sidekick

5.1.2.1 The Pason Sidekick is an electronic recorder that monitors a number of different drilling parameters. The monitor is positioned on the rig floor at the drillers consol. This monitor displays the hole and bit depth, the hook load, pressures, drilling RPM and torque. The data acquired by the Pason system is logged onsite then stored on a data hub which can be accessed by the system users.

5.1.2.2 The Pason Sidekick displays real time data. When the system displays a value for torque, it is the measurement of the amount of torque applied by the drive to the rotary table at the surface. As soon as there is no drive applied to the rotary table, the torque value displayed on the Pason Sidekick will read zero. If there is torque trapped/stored in the drill string, the Pason Sidekick will not read this value. The driller must remember there is torque in the drill string and release it in a controlled manner prior to allowing personnel into the area.

5.2 Observations

5.2.1 Occupational Health and Safety (OHS) Investigators arrived on the Novus Energy Inc. work site at 1:00 p.m. on Dec. 12, 2010.

5.2.2 Precision Drilling Corporation's Rig Manager [redacted] informed OHS Investigators that following the incident, the well had to be secured and the immediate scene was disturbed to protect workers and the well. To do this, the drilling crew put the kelly back onto the drill string and secured the well (Attachment C, Photograph 2).

5.2.3 The driller's control panel was examined. The control for the rotary table brake, hoisting clutch and rotary clutch were identified. (Attachment C, Photograph 3).

5.2.4 The Pason Sidekick was observed near the driller's consol and indicated the hole depth was 2416 m, the drill bit depth was 2413 m and the torque reading was zero (Attachment C, Photograph 4).

5.2.5 The Precision Drilling Corporation's crew was aware of the hazard of trapped torque. Precision Drilling Corporation demonstrated through training and job safety analysis, the topic of trapped torque had been indentified. The Rig Manager [redacted] indicated Precision Drilling Corporation has had several incidents involving trapped torque and provided Occupational Health and Safety Investigators copies of Incident Alerts that had been recently distributed.

5.2.6 Occupational Health and Safety Investigators reviewed documentation with respect to Precision Drilling Corporation's incident history involving trapped torque. There were at least 20 incidents over a 6 year period. Three of these occurred six months prior to the fatal incident.

5.2.7 Anderson and Associates Consulting Engineers Inc. was retained by Occupational Health and Safety Investigators to examine the drilling data from the Pason, to evaluate the hazard of trapped torque using conventional drilling rigs for horizontal drilling and to determine the feasibility of using engineering controls to reduce or eliminate the hazard of trapped torque.

SECTION 6.0 NARRATIVE DESCRIPTION OF THE INCIDENT

6.1 On the morning of Dec. 12, 2010 the Precision Drilling Corporation's daylight crew were drilling the last 3-4 m to the completed depth of the hole (2416 m) for Novus Energy Inc.

6.2 Once the hole was drilled to the competed depth, the crew prepared to pull the drill pipe out of the hole (tripping out). A safety meeting was held to discuss the tripping out process. The Safety Meeting Report dated Dec. 12, 2010 at 9:30 a.m. documented the following points: good communication between all crew members, stay out from under suspended loads, watch out for overhead equipment and lines, pinch points and to use proper lifting techniques.

6.3 The crew proceeded to the rig floor and the Driller [redacted] hoisted the drill string and brought the kelly connection to working height on the rig floor. The crew set the pipe slips around the drill pipe and into the rotary table. The Driller [redacted] set the weight of the drill string into the slips.

6.4 Floorhand # 1 [redacted] and Floorhand #2 [redacted] used 2 sets of hydraulic tongs to break the connection between the kelly and the drill pipe assembly (Attachment C, Photograph 5).

6.5 The Driller [redacted] engaged the rotary table, turning it to unscrew the drill pipe from the kelly. This action caused the drill string assembly below the connection to rotate, and put torque into the 2413 m length of drill string. At 9:35 a.m. the connection was unscrewed and the Driller [redacted] engaged the rotary table brake. This trapped the torque that was put into the drill string when it was rotated.

6.6 The kelly was removed and Floorhand # 1 [redacted] and Floorhand #2 [redacted] guided the kelly into the kelly sock to secure it (Attachment C, Photograph 6). The Driller [redacted] lowered the traveling blocks to the rig floor and the Motorman [redacted] and Floorhand # 1 [redacted] and Floorhand #2 [redacted] installed the bails and elevators onto the travelling block and attached the elevators around the drill pipe.

6.7 Floorhand # 1 [redacted] and the Motorman [redacted] were ready to pull the pipe slips by positioning themselves near the rotary table and were waiting for the Driller [redacted] to start hoisting the drill pipe (Attachment C, Photograph 7).

6.8 At 9:44 a.m. the Driller [redacted] engaged the hoisting clutch and started to pull the drill pipe up out of the slips. As soon as the Driller [redacted] started to hoist the drill pipe, the torque that had been trapped in the drill string, released. When the torque released, the drill pipe and the equipment latched onto it rotated unexpectedly (Attachment C, Photograph 8).

6.9 The Motorman [redacted] realized the drill pipe was rotating and jumped back away from it, while Floorhand #1 [redacted] was struck in the head as the assembly rotated uncontrollably. Floorhand #1's [redacted] hard hat came off as he was knocked backwards and fell to the rig floor.

6.10 The crew saw Floorhand #1 [redacted] fall and rushed to assist him. The Motorman [redacted] went to notify the Rig Manager [redacted] of the incident. The Rig Manager [redacted] called 911 while the crew administered first aid to Floorhand #1 [redacted].

6.11 When the ambulance arrived, Floorhand #1 [redacted] was rushed to the nearest hospital.

6.12 Floorhand #1 [redacted] sustained a massive head injury and passed away in hospital on Dec. 12, 2010.

SECTION 7.0 ANALYSIS

7.1 Direct Cause

7.1.1 The Floorhand was fatally injured while positioned near the rotary table when the drill string and hoisting assembly rotated unexpectedly and struck him in the head.

7.2 Contributing Factors

7.2.1 When the Driller [redacted] used the rotary table to unscrew the drill pipe from the kelly, torque was transferred to the length of the drill string. This torque was trapped or kept in the drill string when the Driller [redacted] applied the rotary table brake. As soon as the weight of the drill string was picked up out of the slips, the entire drill string unwound, releasing the trapped torque and caused the hoisting assembly latched onto the pipe to rotate with it.

7.2.2 The Driller [redacted] did not release the trapped torque from the drill string prior to Floorhand #1 [redacted] and the Motorman [redacted] positioning themselves near the rotary table. Although the crew was aware of the hazard of trapped torque, neither of the workers recognized that the Driller [redacted] did not release the rotary table brake.

7.2.3 The Driller [redacted], missed a step in the tripping out process by not disengaging the rotary table brake to release the trapped torque in the drill string. There was no means on the control panel to warn the Driller [redacted] that there was trapped torque in the drill string. The Pason digital screen would not have shown any torque at the time the Driller [redacted] engaged the hoisting clutch since the torque reading would have cleared to zero when Driller [redacted] stopped the rotation of the rotary table (Attachment B, Diagram 2).

7.2.4 The Driller [redacted] did not inform the crew of the torque he put into the drill string when he used the rotary table to unscrew the drill pipe from the kelly. The Motorman and Floorhands [redacted] and [redacted] were unaware of this condition at the time and the Driller [redacted] did not ensure they were clear of the hoisting assembly before he engaged the hoisting clutch.

7.2.5 Precision Drilling Corporation has had numerous incidents involving trapped torque. The method of controlling this hazard was an administrative control which required workers to have good communication. Precision Drilling Corporation did not explore the possibility of controlling the hazard through the use of engineering controls.

7.2.6 Using the rotary table to unscrew connections, puts torque into the drill string. When rotation occurs above the pipe connection there is no potential for torque to be stored in the drill string. The use of top drive units, and kelly/pipe spinners apply rotation above the pipe connection. The Precision Drilling Corporation's rig 212 was a conventional design not equipped with a top drive but was equipped with a pipe/kelly spinner. The pipe/kelly spinner did not have the ability to rotate in reverse to unscrew the connections.

SECTION 8.0 FOLLOW-UP/ ACTION TAKEN

8.1 Human Services; Occupational Health and Safety

8.1.1 OHS Investigators issued a stop work order to Precision Drilling Corporation with respect to repeating the hazard assessment. The hazard assessment specific to the task of tripping out of the hole did not identify trapped torque as a potential hazard.

8.1.2 The existing hazard assessment for tripping out of the hole did not have a date to demonstrate when the assessment was prepared or revised. An order was issued to Precision Drilling Corporation to develop a method to ensure the date on which the assessment was prepared or revised is recorded on the assessment as required.

8.1.3 Precision Drilling Corporation was also issued an order by Occupational Health and Safety Investigators to determine the practicality of eliminating or controlling the hazard of trapped torque through the use of engineering controls.

8.1.4 Occupational Health and Safety Investigators issued a Notice to Produce to Precision Drilling Corporation requesting documentation with respect to worker training, safe work procedures, equipment specifications and certifications, safety meeting records and a list of past incidents involving trapped torque.

8.1.5 Occupational Health and Safety Investigators issued a Notice to Produce to Novus Energy Inc. requesting documentation with respect to contracts, training records, well license, drilling program and a copy of the incident investigation report.

8.2 Industry

8.2.1 Precision Drilling Corporation complied with the stop work order and developed a revised Job Safety Analysis and a detailed Safe Work Procedure for tripping out of the hole.

8.2.2 Precision Drilling Corporation developed a means of ensuring hazard assessments are repeated and dated as required.

8.2.3 Precision Drilling Corporation determined it was practical to control the hazard of trapped torque through the combination of engineering controls, administrative controls and personal protective equipment. An interlock system was designed to prevent the hoisting clutch from being engaged while the rotary table brake is in the locked position. A hoisting alarm system was also developed as a secondary control to warn the crew the potential of trapped torque exists. This secondary alarm would be used when the driller must work the drill string with trapped torque during a directional drill. Precision Drilling Corporation committed to installing this system on all their conventional drilling rigs within their fleet.

8.2.4 Precision Drilling Corporation submitted the requested documentation to Occupational Health and Safety as requested by the Investigator.

8.2.5 Novus Energy Inc. submitted the requested documentation and conducted an investigation into the circumstances surrounding the incident. The investigation report detailing the circumstances and measures to prevent recurrence was submitted to Occupational Health and Safety as requested.

8.3 Additional Measures

8.3.1 Anderson and Associates Consulting Engineers Inc. researched the use of engineering controls employed by other oilfield drilling contractors. It was determined that other conventional rotary drilling rigs have accomplished this. Others have also used a visual alarm system to indicate to the crew the rotary table brake is engaged. The intent of the device is to inform crew members the rotary table brake is engaged and the potential of trapped torque exists.

8.3.2 Precision Drilling Corporation presented the incident and measures of prevention to the Canadian Association of Oilfield Contractors, Rig Safety and Technical Committee.

SECTION 9.0 SIGNATURES

[redacted], Lead Investigator — April 19, 2012 Date

[redacted], Investigator — April 19, 2012 Date

[redacted], Manager — April 18, 2012 Date

[redacted], Regional Director, Central — April 18, 2012 Date

SECTION 10.0 ATTACHMENTS:

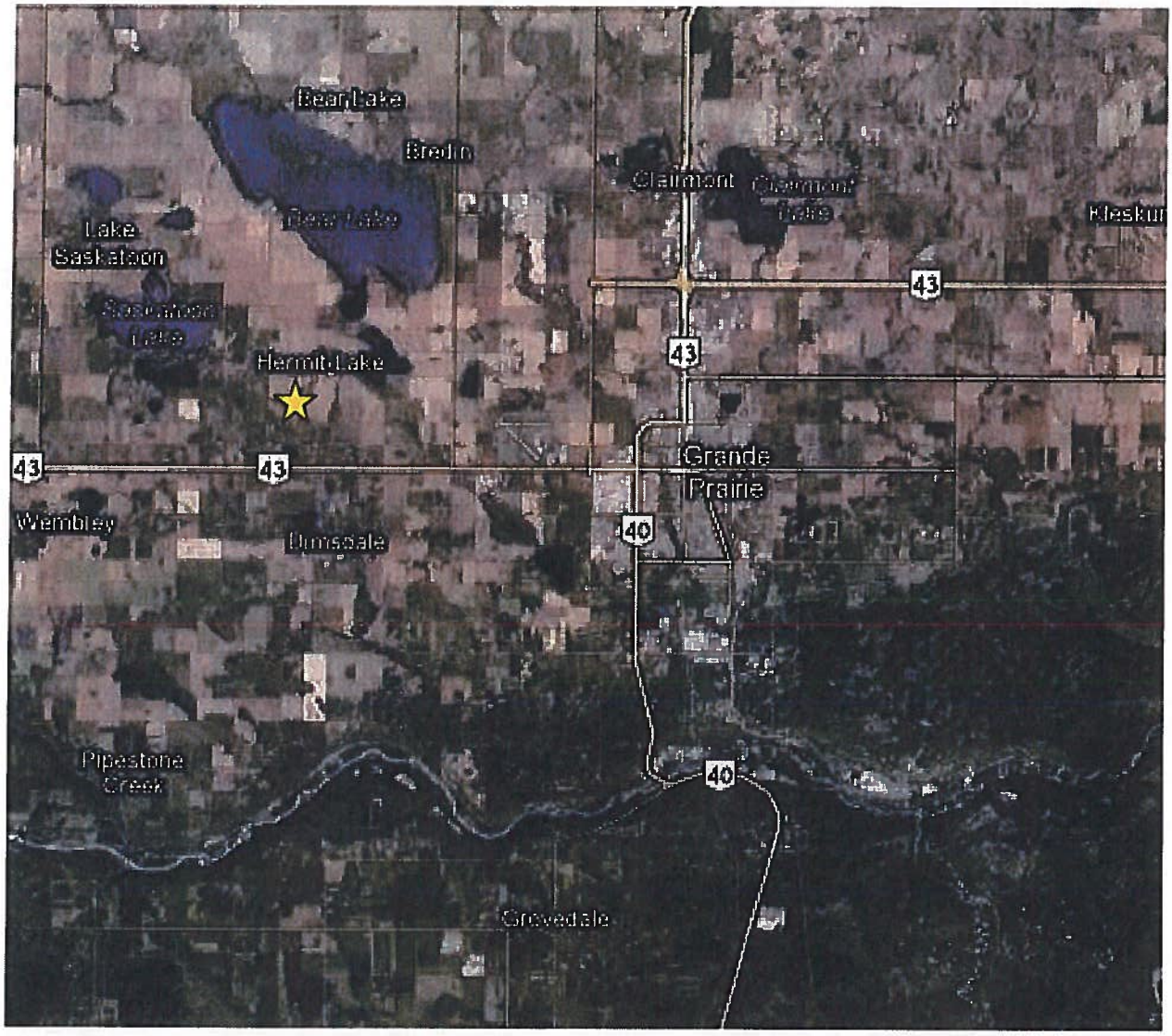
Attachment A	Map
Attachment B	Diagrams or Sketch
Attachment C	Photographs

ATTACHMENT A

Government of Alberta

Human Services

File: F-399123
Attachment "A" Map
Showing Incident Location



Map

The yellow star shows the approximate location of Novus Energy Inc.'s work site LSD 11-01-072-07W6.

ATTACHMENT B

Diagram 1 – Directional or Slant Drilling

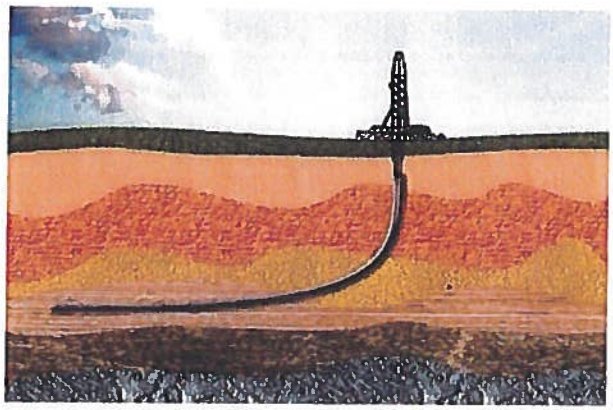
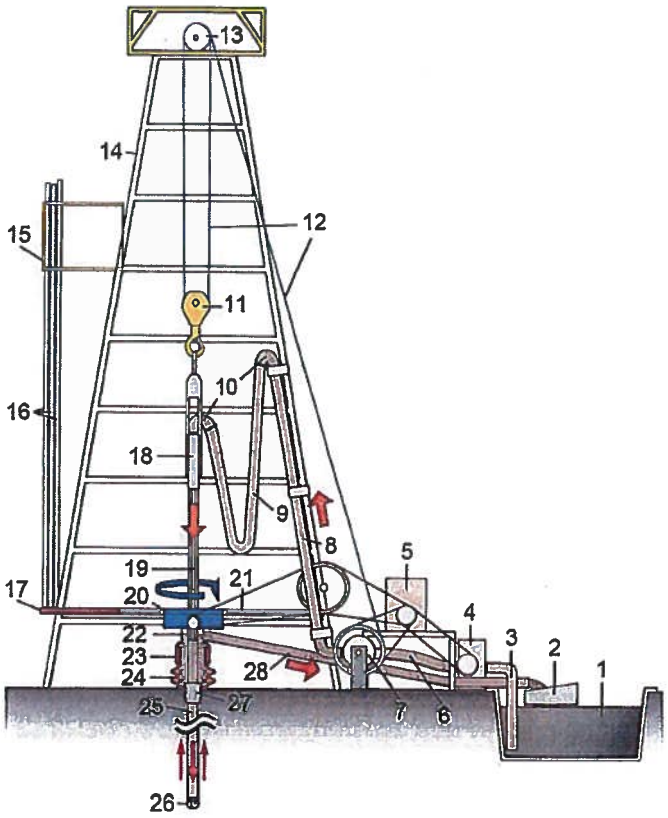
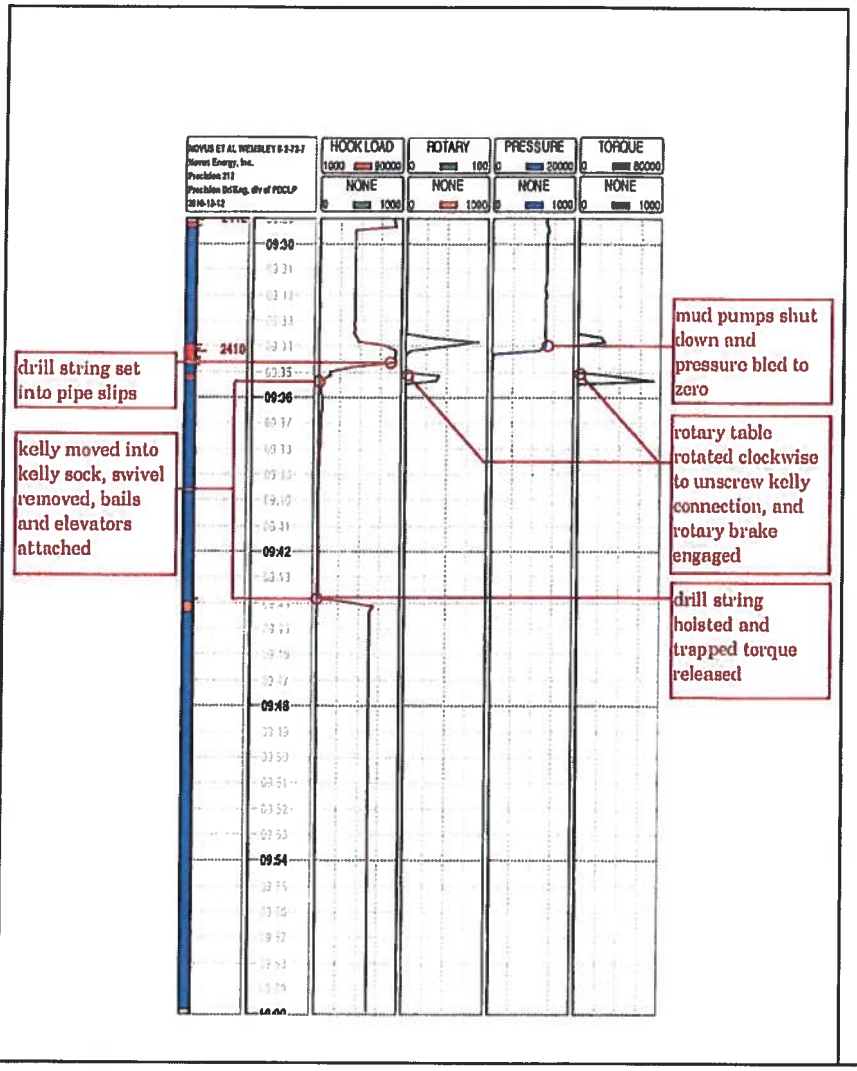


Diagram 2 – Conventional Rotary Drilling Rig Components

1. Mud tank
2. Shale shakers
3. Suction line (mud pump)
4. Mud pump
5. Motor or power source
6. Vibrating hose
7. Draw-works
8. Standpipe
9. Kelly hose
10. Goose-neck
11. Traveling block
12. Drill line
13. Crown block
14. Derrick
15. Monkey board
16. Stand (of drill pipe)
17. Pipe rack (floor)
18. Swivel
19. Kelly drive
20. Rotary table
21. Drill floor
22. Bell nipple
23. Blowout preventer (BOP) Annular type
24. Blowout preventer (BOP) Pipe ram & blind ram
25. Drill string
26. Drill bit
27. Casing head or Wellhead
28. Flow line



Source:
http://en.wikipedia.org/wiki/Drilling_rig



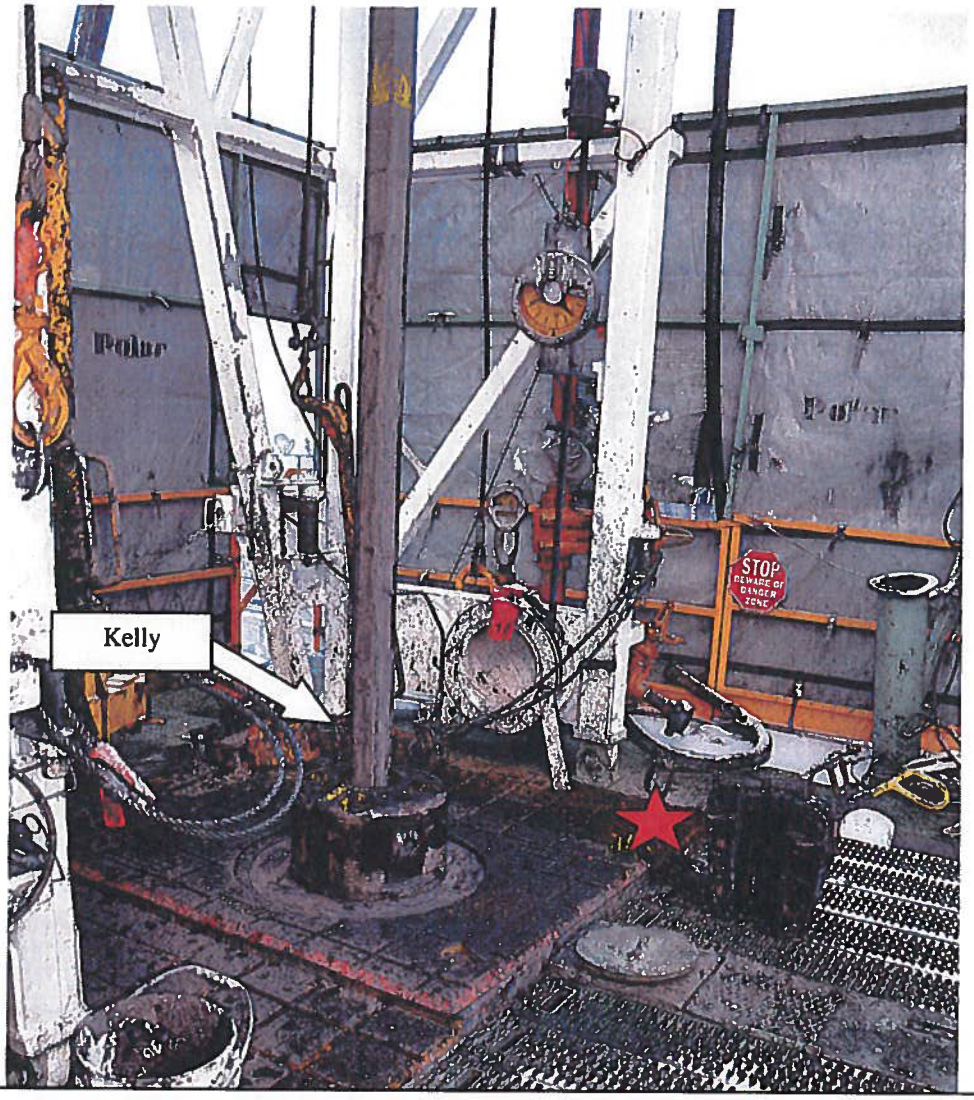
Select Pason data from Novus Energy Directional Drilling Rig 212.

Diagram 3

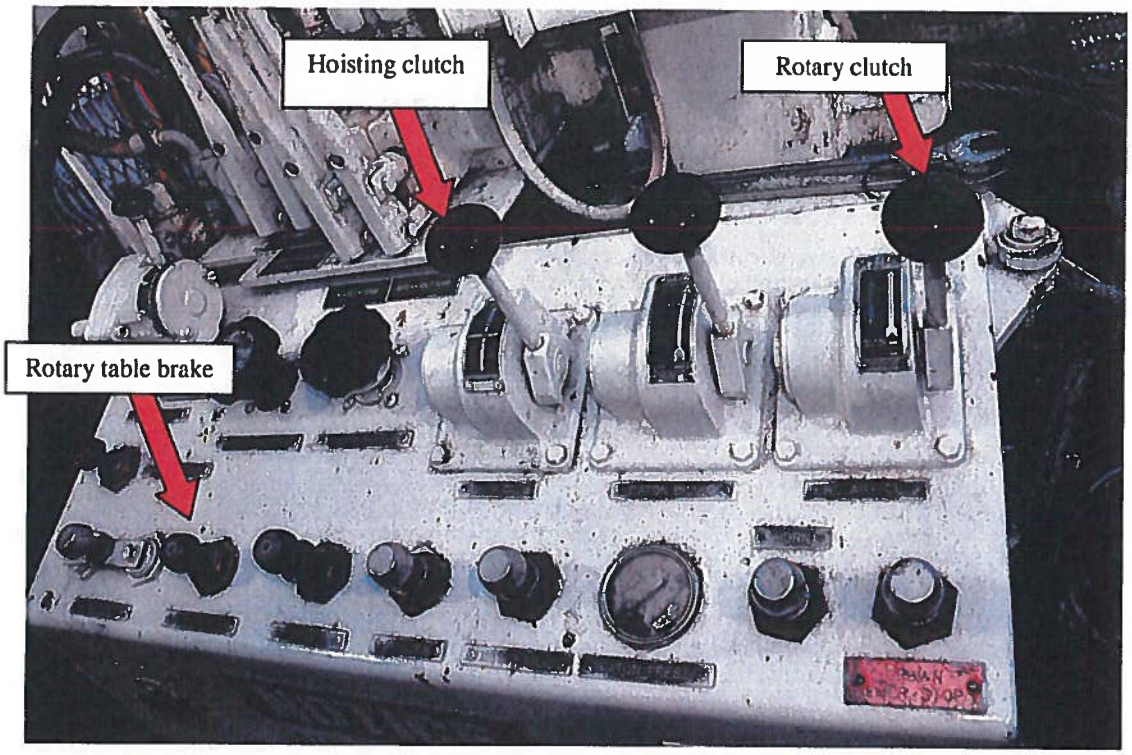
Shows the Pason data extracted from the Novus Energy Inc.'s drilling operations around the time of the incident. The data shows that the Driller engaged the rotary table to unscrew the pipe from the kelly sub at 9:35 a.m. At that time, the torque reading peaked at 73,075 ft-lbs., then cleared to zero once the rotary table brake was engaged just before 9:36 a.m. At 9:44 a.m., the Driller engaged the hoisting clutch, lifted the drill pipe and the trapped torque was released from the drill string.

ATTACHMENT C

Photograph 1
Shows Precision Drilling Corporation's double telescopic conventional drilling rig # 212. This photograph was provided by Precision Drilling Corporation and was taken on Dec. 13, 2010.

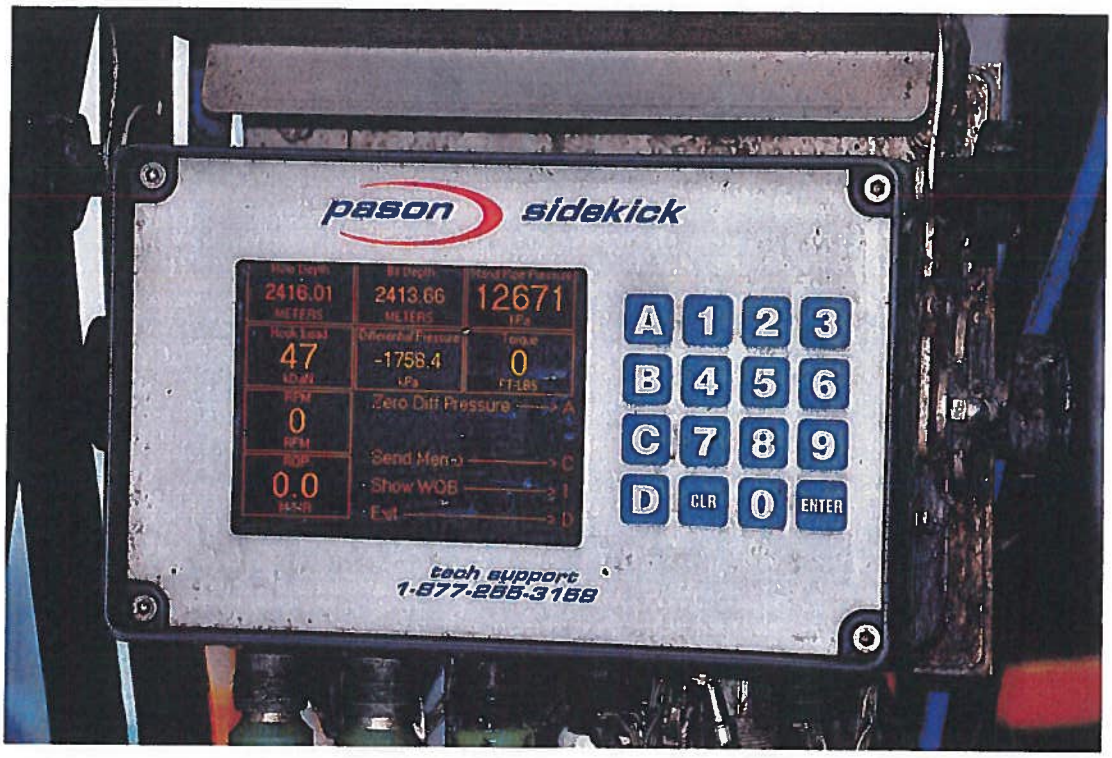


Photograph 2
Shows the scene of the incident observed by Occupational Health and Safety Investigators upon arrival at the worksite on Dec. 12, 2010. The area shown is the rig floor on Precision Drilling Corporation's drilling rig #212. The kelly had been placed back onto the drill string to secure the well. The red star shows where the Floorhand [redacted] was located immediately following the incident.



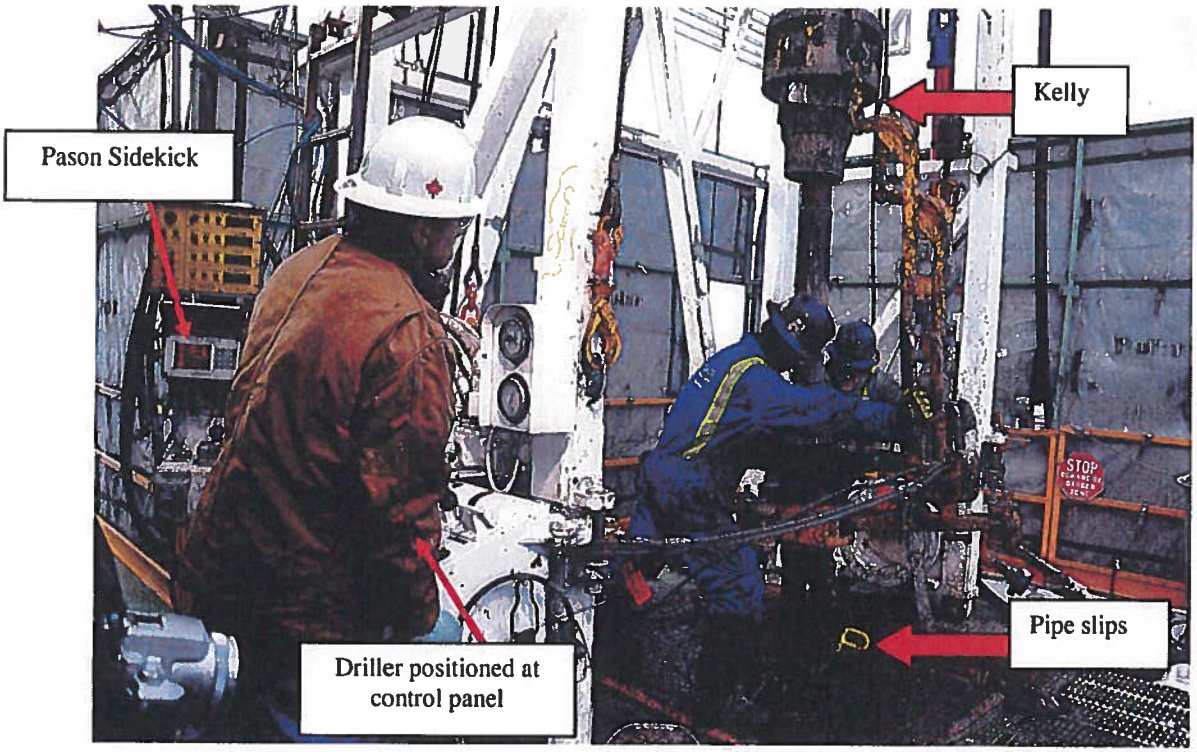
Photograph 3

Shows the driller's consol on Precision Drilling Corporation's rig #212. The rotary clutch controls the rotation of the rotary table. The rotary table brake, when engaged, locks the rotary table and prevents rotational movement. The hoisting clutch shown above, allows the driller to raise and lower the drill string.



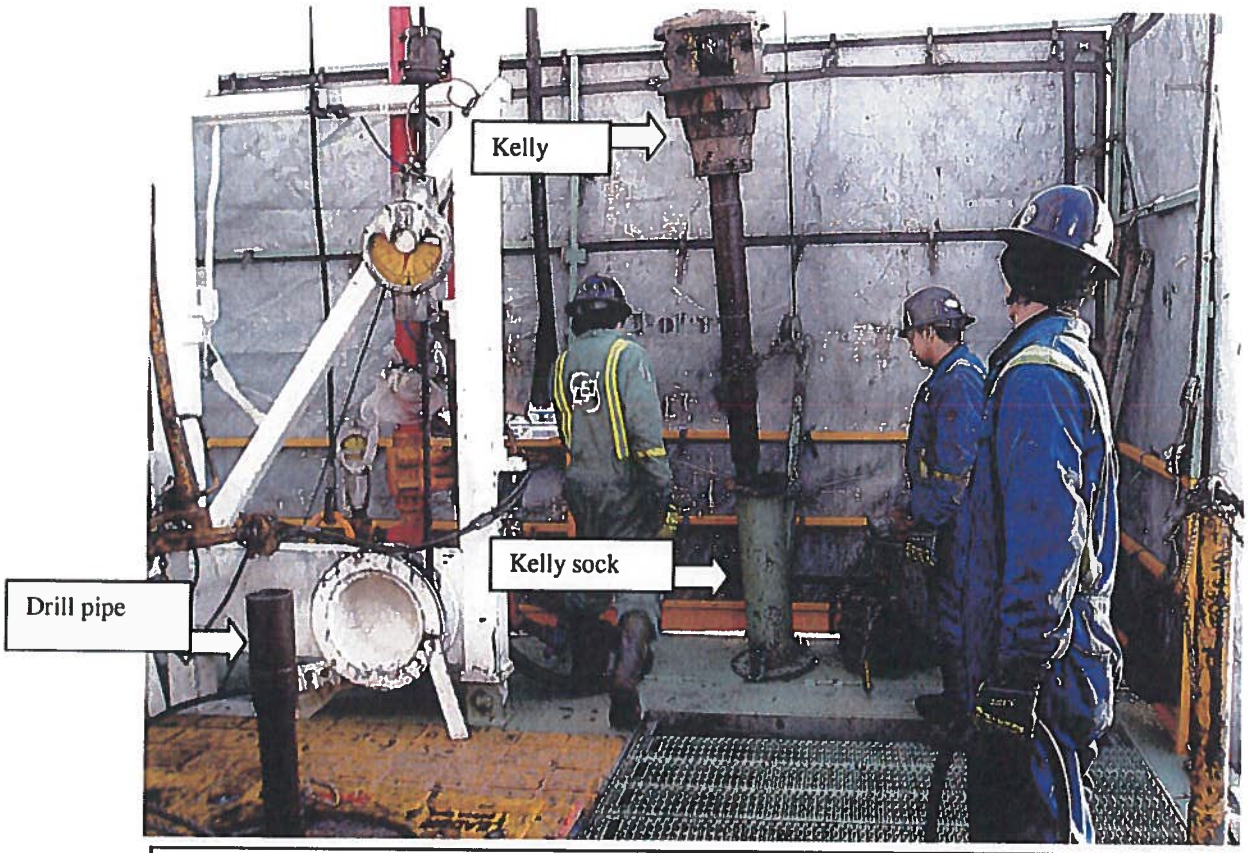
Photograph 4

Shows the Pason Sidekick display which was located to the upper left of the driller's consol on Precision Drilling Corporation's rig 212 (See Photograph # 5). The display shown here indicates the drill bit is located 2413 m down hole and the total hole depth is 2416 m. The torque reading displays zero foot-pounds. The torque value is displayed when the driller applies drive to the rotary table. The amount of drive transferred to the drill string is measured as torque in foot-pounds.



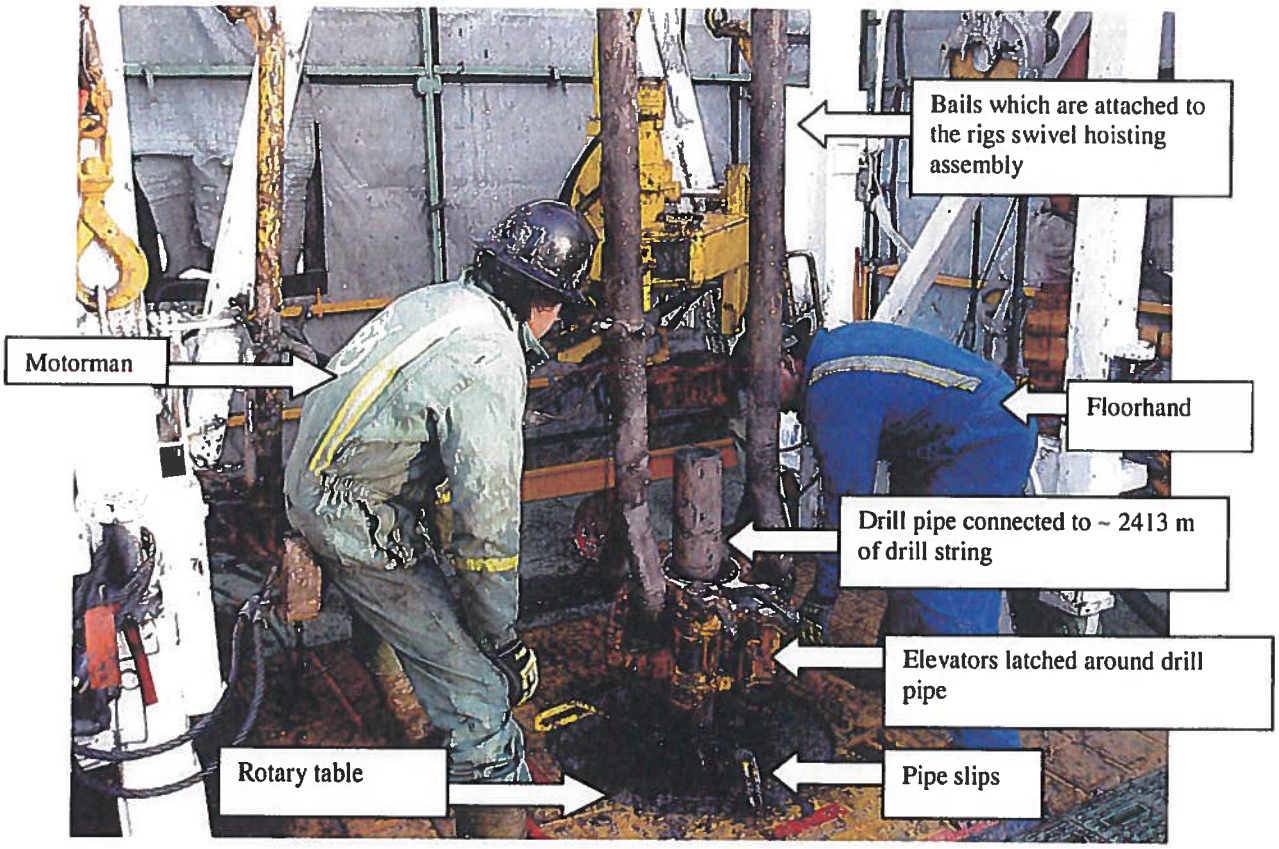
Photograph 5

Shows a re-enactment of the floorhands using power tongs to break the connection between the kelly and the drill pipe and location of the Pason Sidekick.



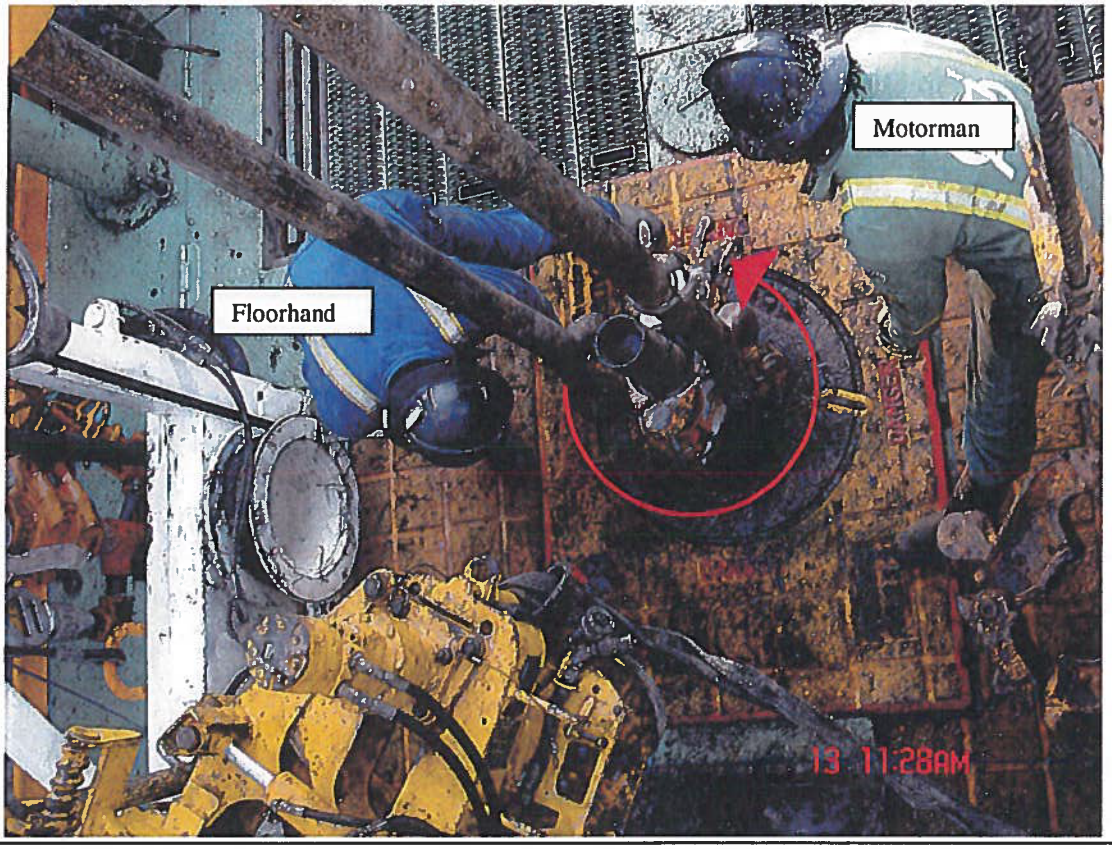
Photograph 6

Shows the drill pipe sitting in the slips after the kelly has been removed. The kelly, once removed, is guided over to the kelly sock and secured.
Photograph provided by Precision Drilling Corporation.



Photograph 7

Shows the re-enactment of the Motorman [redacted] and the Floorhand [redacted] as they prepared to lift the pipe slips. The scene shows the rig's hoisting system latched onto the drill pipe. When the pipe is lifted out of the pipe slips, the weight of the drill string is taken on by the rigs swivel hoisting assembly. Photograph provided by Precision Drilling Corporation.



Photograph 8

Shows an overhead view of the approximate positions of the Floorhand [redacted] and the Motorman [redacted] as they were prepared to pull the pipe slips. When the Driller engaged the hoisting clutch and began to lift the pipe, the hoisting assembly attached to the drill pipe rotated and struck the Floorhand.
Photograph provided by Precision Drilling Corporation.