Daylight Energy Ltd.
Well Blowout
10-31-046-10W5M
March 4, 2011

ERCB Investigation Report

August 12, 2011

Energy Resources Conservation Board

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Published by

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1 Description of Incident

On March 4 at about 10:28 a.m., an uncontrolled release occurred while a Daylight Energy Ltd. (Daylight) contractor was conducting a work-over operation on an oil well. The well's surface location is in Legal Subdivision (LSD) 10, Section 31, Township 46, Range 10, West of the 5th Meridian (10-31), about 11 kilometres (km) southwest of the Hamlet of Lodgepole, while the bottomhole is located in LSD 7-31-046-10W5M.

The crew evacuated the site, and the release, consisting of water, oil, and gas containing hydrogen sulphide (H_2S), ignited destroying the service rig. Daylight contracted well control specialists and used a caterpillar to remove the remains of the service rig from the well site. The specialists then used a crane to lift the polish rod 4 m above the surface of the wellbore, where it was clamped in place, cut, and allowed to drop down the well. Subsequently, Daylight was able to close the master valve on the well and extinguish the fire at 3:00 a.m. on March 5.

The 10-31 well was licensed for 15.82 per cent H_2S, but a recent gas analysis indicated that the well contained 12.5 per cent H_2S at the time of the release. An air monitoring program was initiated using the Energy Resources Conservation Board's (ERCB's) air monitoring unit (AMU), contracted AMUs, and Alberta Environment's mobile air monitoring laboratory. The highest one-hour average for H_2S recorded during the incident was 10.7 parts per billion (ppb) and the highest peak reading was 81.6 ppb. The highest one-hour average for sulphur dioxide recorded during the incident was 28.5 ppb and the highest peak reading was 89.7 ppb. These readings were taken 1.4 km northwest of the 10-31 well site.

A helicopter was used to do an aerial search for any members of the public in the area and road blocks were set up to control access to the site. ERCB staff attended the site until the release was controlled and the incident was called down on March 5 at 9:30 a.m.

The incident was designated a level-2 emergency[1] using the ERCB Risk Assessment Matrix for Classifying Incidents. The incident occurred in a rural wooded area with no residents within the 0.2 km emergency planning zone, no injuries were recorded, and there was minimal environmental impact. There was an ERCB press release and the incident received media attention.

Well History

The 10-31 well was licenced by Kick Energy Corporation on October 6, 2006, as a critical sour oil well. Shortly thereafter, it was acquired by Highpine Oil & Gas Limited (Highpine), and by May 2007, it was reclassified as a noncritical sour well. In October 2009, Daylight acquired the well through its takeover of Highpine.

[1] A level-2 emergency is defined as an incident where there is no immediate danger outside of the licensee's property or the right-of-way, but there is the potential for the emergency to extend beyond the licensee's property. Outside agencies must be notified. Imminent control of the hazard is probable, but there is a moderate threat to the public and/or the environment. There may be local and regional media interest in the event.

The incident occurred while Daylight was conducting work-over operations to suspend production from the Nisku Formation since enhanced recovery schemes were not considered viable based on well performance. The last day the well produced was February 13, 2010.

2 Pertinent Daylight Activities at the Well

Daylight was conducting work-over operations to kill the inactive well and suspend the Nisku Formation, as required by ERCB *Directive 013: Suspension Requirements for Wells*.

3 Cause of the Loss of Well Control

The ERCB concludes that the following sequence of events led to the gas release and fire and subsequent loss of well control:

1) During routine well kill operations, after the rig crew unseated the rod string and pump, they were unable to pump kill fluids down the tubing as the pressure in the tubing immediately climbed to 11 megapascal (MPa) during their attempt. It was suspected that this was due to a hydrate in the tubing or a frozen wellhead.

2) The wellhead was covered with a tarp, steam heat was applied, and operations were suspended for the night.

3) The next day, the shut-in tubing pressure remained at 11 MPa and the shut-in casing pressure was at 16 MPa. A decision was made to bullhead[2] down the annulus to kill the well.

4) After pumping about 40 cubic metres of kill fluids (treated water at 25 degrees Celsius) down the annulus at a rate of 350 to 450 litres per minute at a pressure of 21 MPa, a gas leak was detected coming out of the stuffing box around the polish rod. The leak was caused by a failure of the stuffing box packing.

5) Within seconds of the gas leak, the well ignited. The suspected source of ignition was the rod clamp slipping on the polish rod, which slid down about 0.6 m. The movement of the rod string may have been caused by the pressure differential between the tubing (11MPa) and the annular pressures (21 MPa) as the suspected hydrate or frozen wellhead thawed. The sudden surge of pressure against the stuffing box packing was the most likely cause of its failure.

6) Shortly after the initial gas release and fire at the stuffing box, the service rig's 50.8 millimetre hose tied into the tubing spool (from the rig's manifold and pump) caught fire and failed, causing the well to flow and burn from the annulus out of the tubing spool. Shortly thereafter, the rig caught fire and control of the well was lost.

4 Root Cause Analysis

[2] The bullhead procedure is to pump fluid into the well from surface and force the fluid down the wellbore by pump pressure back into the formation.

The ERCB has determined that the failure of the stuffing box was the root cause of this well control incident.

5 Investigation Findings

Initial failure of the stuffing box packing around the polish rod allowed gas to flow from the well, and the movement of the polish rod sliding down through the rod clamp was the most likely source of ignition. Further investigation revealed that although the stuffing box packing failed, the stuffing box was undamaged.

No noncompliances were noted in the sequence of events that led to the release, fire, and loss of well control.

Daylight's Violet Grove Area Emergency Response Plan was activated and appropriate actions were taken.

The air monitoring conducted during this incident ensured that no member of the public was in danger and public safety was not jeopardized.

The ERCB Drayton Valley Field Centre did not receive any public complaints relating to the incident.

A post-incident assessment conducted on March 29 included representatives from the ERCB, Daylight, Alberta Environment, the Alberta Emergency Management Agency, Alberta Health Services, RCMP, local authorities (Town of Drayton Valley and Brazeau County), and the Pembina Area Operators Group. The assessment determined that the incident response by Daylight was well run, but minor areas of improvement for Daylight and the ERCB were noted, including the following:

- Timely incident notification of Brazeau County by Daylight.
- Timely press release to provide accurate information to local residents by Daylight.
- Daylight incident command system structure that clearly defines where the incident command post is located and where the decision-making authority resides.
- Clear understanding by the ERCB Emergency Response Group (ERG) and field staff on when an incident is downgraded versus called down.[3]

6 ERCB Follow-up

The Emergency Management Group and the Field Incident Response Support Team will follow-up with Daylight and the ERG on the areas for improvement identified in the post-incident assessment.

[3] To downgrade an incident means to reduce the level of emergency (e.g., from a level 2 to a level 1 or an alert) based on the changing elements of the incident. To call down an incident means that the emergency phase of the incident is over.