

**CAMECO RESOURCES  
CROW BUTTE OPERATION**



**86 Crow Butte Road  
P.O. Box 169  
Crawford, Nebraska 69339-0169**

**(308) 665-2215  
(308) 665-2341 – FAX**

---

January 24, 2018

**USPS PRIORITY MAIL  
SIGNATURE CONFIRMATION**

Marty Link, Water Quality Division Administrator  
Nebraska Department of Environmental Quality  
P.O. Box 98922  
Lincoln, NE 68509-8922

Class I UIC Permit NE0211670  
Deep Disposal Well #1 (DDW #1) Well Workover

Dear Ms. Link:

In accordance with Part II, F (1) of Class I UIC Permit NE0211670, Crow Butte (CBO) is submitting for approval, a well workover procedure to be performed on DDW #1. Since July, 2017, CBO has experienced three incidents of significant annulus pressure loss in this well, and this submittal includes a description of the first two events as well as corrective actions taken to provide context for the most recent (January 1, 2018) event.

During the evening of July 8, 2017, the annulus pressure reading and seal pot fluid level on DDW #1 began to decrease. Over a twelve hour period the fluid level in the seal pot went from 28" to zero. During this same time period although the annulus pressure decreased it remained 150 psi above the injection pressure. As a result of the lost fluid in the seal pot, on July 9, 2017, at 8:30 a.m., the well was shut in until a third party consultant could mechanically integrity test the well. From July 12-15, 2017, various mechanical integrity tests were performed on the well. Based on these tests, it was determined that the packer in this well had failed.

The following actions were taken:

July 12, 2017: Ran plug into tubing profile below the packer via electric line; conducted successful internal tubing pressure test from 875.5 to 857.3 psi for 1 hour (2% loss)  
Conducted annulus pressure test from 866.0 to 540.2 psi for 1 hour (37.6% loss); retrieved plug from profile.

July 13, 2017: Rigged-up workover rig; released packer and pulled 28 joints injection tubing.



# CROW BUTTE RESOURCES, INC.



July 14, 2017: Pulled remaining tubing; picked-up workstring and casing scraper, ran scraper to 3,518' KB; Picked-up retrievable bridge plug (RBP) and work packer.

July 15, 2017: Ran in with RBP and packer and tested the following intervals with various tool configurations (note all casing pressure tests passed);

- Test 1 - retrievable bridge plug (RBP) set at 3,418' KB; Packer not set; Test all casing above 3,418' KB; Lost 6.7% after 60 min (test passed) with an observed leak at the power swivel connection (rig equipment)
- Test 2 - RBP set at 3,424' KB; Packer not set; Test all casing above 3,424' KB; gained 0.4% after 65 min (test passed)
- Test 3 - RBP set at 3,424' KB; Packer set at 3,320' KB; Test casing between 3,424' and 3,320' KB; Lost 0.6% after 40 min (test passed)
- Test 4 - RBP set at 3,424' KB; Packer set at 3,015' KB; Test casing between 3,424' and 3,015' KB; Gained 0.2% after 20 min (test passed)
- Test 5 - RBP set at 3,424' KB; Packer set at 3,015' KB; Test casing above 3,015' KB; Lost 1.0% after 30 min (test passed)

## Test Result Summary

Test #	1
RBP Depth (ft KB)	3,418
Packer	na
Note: Leak in swivel	
dt	Pressure
(min)	(psi)
1	925
60	862.8
% loss	6.7

Test #	2
RBP	3,424
Packer	na
Removed swivel	
dt	Pressure
(min)	(psi)
1	961.8
65	965.3
% loss	-0.4

Test #	3
RBP	3,424
Packer	3,320
dt	Pressure
(min)	(psi)
1	907
40	901.4
% loss	0.6

Test #	4
RBP	3,424
Packer	3,015
dt	Pressure
(min)	(psi)
1	868
20	869.4
% loss	-0.2





<b>Test #</b>	<b>5</b>
<b>RBP</b>	<b>3,424</b>
<b>Packer</b>	<b>3,015</b>
<b>Backside test</b>	
<b>dt</b>	<b>Pressure</b>
<b>(min)</b>	<b>(psi)</b>
<b>1</b>	<b>922</b>
<b>30</b>	<b>912.9</b>
<b>% loss</b>	<b>1</b>

Test 2 is the most representative of the required MIT for casing pressure test as the RBP was set one foot below the last packer setting depth and was run for more than 1 hour with no leaks observed at surface (as with Test 1). The test was passed with no net pressure loss observed thus demonstrating casing integrity.

From this information, it was determined that the MIT failure mechanism must have been the packer.

July 16, 2017: Scanned out tools/equipment; sent the crews home; equipment was put on standby.

Crow Butte scheduled a tubing and packer replacement that began on July 19, 2017. The work was supervised by Petrotek (consultant) and completed by Key Energy Services (vendor).

The following items were completed:

1. Ran in with workstring and pulled the RBP.
2. Ran in with new nickel-coated packer (7" Baker Hornet) on 4 1/2" 11.6# casing ran as injection tubing to 3,423' KB.
3. Some of the existing joints on the pulled injection string along with some uncoated joints were used and will be replaced with 4 1/2" 11.6 lb/ft L-80 LTC casing (run as tubing) coated with TK-99 and KC couplings as soon as the materials are available. (Estimated 4-8 weeks)
4. Displaced annulus with packer fluid; set the packer at 3,423' KB.
5. Successfully performed a MIT in accordance with Part B, Section 6 on the Class I UIC Permit (NE0211670).
6. On July 21, 2017, returned the well to service following NDEQ approval.

On July 23, 2017 at 10:23 a.m. the well was operating at an annulus pressure of 606.6 psi and a seal pot reading of 17 5/8". At 10:46 a.m., the annulus pressure had decreased to 574.4 psi and the seal pot





had declined to 15 3/4" as a result of these decreases the well was shut in at 12:10 p.m. The NDEQ was notified on July 24, 2017, that the well had been shut in.

On July 25, 2017, a third party consultant ran a plug into the injection tubing profile below the packer via electric line and conducted a successful internal tubing pressure test and annulus pressure test. When the pressure was released from the injection tubing it caused a drop in the annulus pressure indicating that when the well is operating under a vacuum annulus fluid is being pulled into the injection tubing through a leaking joint.

The following actions were taken:

July 26, 2017

1. Spotted drilling rig and rigged up to the well.
2. Released the packer, tripped out the injection tubing string.

July 27, 2017

1. Ran the packer into the well.

July 28, 2017

1. Ran in the well with new uncoated injection tubing.
2. Set the packer at 3,416 feet and made up the wellhead.
3. Performed a MIT in accordance with Part B, Section 6 on the Class I UIC Permit (NE0211670).
4. Connected the surface piping
5. Put the well back into service upon NDEQ approval.

A technical report detailing the workovers that were performed on this well was submitted on August 15, 2017.

On September 17, 2017 at 6:00 p.m. the well was operating at an annulus pressure of 474 psi and a seal pot reading of 23.5". On September 18, 2017 at 1:00 p.m. the annulus pressure had decreased to 319 psi and the seal pot had declined to 14.5". As a result of these decreases the well was shut in and the NDEQ and NRC notified.

Crow Butte replaced the uncoated injection tubing with coated injection tubing during the week of September 25, 2017. The work was supervised by Petrotek (consultant) and completed by Key Energy Services (vendor).

Following the replacement of the injection tubing CBO did an acid treatment on the well through the following procedure:

Treatment Procedure

1. Conducted a safety meeting and JSA Review; rigged up QES on the well and pressure tested the lines.





2. Treated the well with approximately 3,000 gallons of 15% hydrochloric acid with additives.
3. The stimulation fluids were pumped into the well using vendor equipment.
4. The acid contained 4 gal/1,000 gallons corrosion inhibitor, 10 gal/1,000 gallons Fe control and 2 gal/1,000 gallons non emulsifier.
5. The acid treatment was followed by approximately 1,000 gallons of flush water fortified with clay stabilizer for clay control and biocide.
6. Upon completion of the acid treatment and subsequent flush, the well was shut-in for approximately 2 hours to allow the acid to work at the well/formation interface.
7. After the shut-in, normal injection flow was re-established in order to push the acid and any solubilized material away from the wellbore face before it had an opportunity to re-precipitate. The injection pressure transducer was isolated from the acid to eliminate the potential for any instrument damage. This caused continuous monitoring to be off-line for a short period while the acid was being added. This procedure was similar to that which was used to successfully treat the well in 2014.

The treatment was supervised by Petrotek (consultant) and was completed on September 29, 2017 using QES (vendor). The treatment was conducted after successful MIT following the workover operations.

On January 1, 2018, at 2:20 p.m. the well was operating at an annulus pressure of 385 psi and a seal pot reading of 27.0". On January 1, 2018 at 2:25 p.m. the annulus pressure had decreased to 282 psi and the seal pot had declined to 0". As a result of these decreases the well was shut in at 3:15 p.m. and the NDEQ and NRC notified by phone the following morning. During this time period, although the annulus pressure decreased it remained at least 150 psi above the injection pressure until the well was shut in. CBO contracted with Integrated Petroleum Technologies

January 12, 2018: Northern Lights wire line unit tested the tubing. The test was unsuccessful because they were unable to attain a seal in the profile nipple. A work over rig was ordered.

January 17, 2018: The packer was tested to see if it was set. The test was successful.

January 18, 2018: All 4.5" injection tubing was pulled, laid down and visually inspected. There was no evidence of exterior damage. Twelve joints were removed from the string due to thread damage on the couplings. The packer was also visually inspected and no visual damage was evident, but it was suspected to be the source of the leak because of the three sealing elements, only the center sealing element showed expansion. With only one sealing element engaging with the casing wall, it is suspected that the packer was able to slip.



## CROW BUTTE RESOURCES, INC.



January 19, 2018: The 2 7/8" work string was picked up and tripped into the hole with a bit and scraper to 3585'. No drag was encountered, indicating there was no scale or corrosion inside the well casing. The bit and scraper were tripped out and the packer and bridge plug were tripped in. The bridge plug was set at 3455'. The hole was loaded and pressure tested to 850 psi on the annulus. The pressure of 850 psi was held for 20 minutes, and dropped to 790 psi at 30 minutes.

January 22, 2018: Two attempts were made to pressure test the casing. The tests were unsuccessful due to equipment issues with the pressure test equipment. The decision was made to install a new style packer that will better engage the inside of the well casing.

The failed packer was a Baker Hornet. The rubber seating elements in this style packer have a hardness of 80-90 durometers. The new packer is an Aero ASX 1. The hardness of the seating elements is 70 durometers, and the three seating elements are thicker than the elements in the Baker Hornet. This will provide more surface area to contact the inside of the well casing and hold the packer in place. The softer rubber will engage the surface of the well casing better, especially if the inside wall of the casing is not smooth. The packer will be set with 40,000 lbs. of down pressure and 30,000 lbs. of upward force to ensure the seating elements fully engage the casing wall. When the Baker packer was set, only 16,000 lbs. of force was used to set the packer (minimum force for this packer is 15,000 lbs.) which may explain why it appeared that only one seating element expanded and engaged the casing.

Following the installation of the packer, an MIT will be performed on the well. The well will not be returned to service until a successful MIT has been completed and NDEQ approves start-up.

If you have any questions regarding this submittal, please feel free to contact me at (308) 665-2215, ext. 122.

Sincerely,  
Cameco Resources  
Crow Butte Operation

Bob Tiensvold  
Restoration Manager

cc: **Ron Burrows - NRC**  
CBO - File  
ec: CR - Electronic File  
Dave Miesbach - NDEQ Groundwater Unit Supervisor  
Kory Winters - NDEQ Field Office  
Amanda Jones - NDEQ Program Coordinator