

Abstract

The Colorado Oil and Gas Conservation Commission (COGCC) currently has several rules, policies and procedures that, when implemented properly, are intended to result in wellbore integrity. "Wellbore integrity" is a system configuration, including casing, cement, annular fluid, and surface appurtenances (e.g., valves, piping, and emission control devices) to protect against infiltration and prevent the migration of oil, gas or water from one geologic horizon to another, that may result in the degradation of ground water.

COGCC has an active pre-construction and post-construction wellbore review process. The engineering staff performs a pre-construction review of the casing and cement design to verify that the wellbore will be able to isolate fresh water from hydrocarbons. Field inspections occur during the drilling and completions phase to monitor and observation well drilling and completion phases through unannounced and random inspections. Post construction, the engineering staff perform a review of the as constructed casing and cement to verify that the approved permit to drill design was built and meets the criteria to isolate both fresh water and hydrocarbons zones. Wellbore integrity monitoring continues throughout well's productive life through bradenhead and mechanical integrity testing.

COGCC takes wellbore integrity very seriously. The current rules contain approximately 22 rules related to assuring the well's cement and casing can properly constructed to isolate and protect the fresh waters. Along with rules to monitor and maintain a well mechanical integrity, there are 11 policies several studies and defined procedures.

Introduction

The Colorado Oil and Gas Conservation Commission (COGCC) currently has several rules, policies and procedures that, when implemented properly, are intended to result in wellbore integrity. As discussed herein, "wellbore integrity" is defined as the ability of a wellbore system configuration, including casing, cement, annular fluid, and surface appurtenances (e.g., valves, piping, and emission control devices) to protect any potential oil or gas bearing horizons penetrated during drilling against infiltration of injurious waters from other sources, and to prevent the migration of oil, gas or water from one horizon to another, that may result in the degradation of ground water. These objectives of wellbore integrity are provided for in Rule 317.d.

An oil or gas well may be subjected to various stresses through the life of the well, and wellbore integrity must be maintained as these stresses are applied to the well. In general, there are four phases in the life of a well: drilling, completion, production and abandonment. COGCC has rules, policies and procedures to address wellbore integrity during each phase. The drilling phase commences after approval of a Form 2 (Application for Permit to Drill). COGCC engineering staff review Form 2's to verify that casing and cementing plans satisfy wellbore integrity criteria defined by Rule 317 and common industry practices specific to individual areas of the state.

CURRENT COGCC RULES RELATED TO WELLBORE INTEGRITY:

This section provided a list of most of the current COGCC rules related to wellbore integrity.

- 207. TESTS AND SURVEYS
- 301 RECORDS, REPORTS, NOTICES-GENERAL
- 303 REQUIREMENTS FOR FORM 2, APPLICATION FOR PERMIT-TO-DRILL, DEEPEN, RE-ENTER, OR RECOMPLETE, AND OPERATE; FORM 2A, OIL AND GAS LOCATION ASSESSMENT.
- 308A COGCC Form 5. DRILLING COMPLETION REPORT
- 308B COGCC Form 5A. COMPLETED INTERVAL REPORT
- 309 COGCC Form 7. OPERATOR'S MONTHLY PRODUCTION REPORT
- 311 COGCC Form 6. WELL ABANDONMENT REPORT
- 314 COGCC Form 17. BRADENHEAD TEST REPORT
- 316A COGCC Form 14. MONTHLY REPORT OF NON-PRODUCED WATER FLUIDS INJECTED
- 316B COGCC Form 21. MECHANICAL INTEGRITY TEST
- 316C NOTICE OF INTENT TO CONDUCT HYDRAULIC FRACTURING TREATMENT
- 317 GENERAL DRILLING RULES
 - a. Blowout prevention equipment ("BOPE").
 - c. Requirement to post permit at the rig and provide spud notice
 - d. Casing program to protect hydrocarbon horizons and ground water.
 - e. Surface casing where subsurface conditions are unknown.
 - f. Surface casing where subsurface conditions are known
 - g. Alternate aquifer protection by stage cementing
 - h. Surface and intermediate casing cementing.
 - i. Production casing cementing.
 - j. Production casing pressure testing.
 - k. Protection of aquifers and production stratum and suspension of drilling operations before running production casing.
 - m. Protection of productive strata during deepening operations.
 - n. Requirement to evaluate disposal zones for hydrocarbon potential
 - o. Requirement to log well
 - p. Remedial cementing during recompletion.
- 317A SPECIAL DRILLING RULES - D-J BASIN FOX HILLS PROTECTION AREA
 - a. Surface Casing - Minimum Requirements for Well Control.
 - b. Surface Casing - Aquifer Protection.
 - c. Exploratory Wells.
- 319 ABANDONMENT
- 321 DIRECTIONAL DRILING
- 325 UNDERGROUND DISPOSAL OF WATER
- 326 MECHANICAL INTEGRITY TESTING
- 327 LOSS OF WELL CONTROL
- 341 BRADENHEAD MONITORING DURING WELL STIMULATION OPERATIONS
- 404 CASING AND CEMENTING OF INJECTION WELLS
- 603 DRILLING AND WELL SERVICING OPERATIONS AND HIGH DENSITY AREA RULES
- 608e. COALBED METHANE WELLS Bradenhead testing.

CURRENT COGCC POLICIES:

1. COGCC Policy for Bradenhead Monitoring During Hydraulic Fracturing Treatments in the Greater Wattenberg Area, dated May 29, 2012
2. Practices and Procedures, UIC Mechanical Integrity Tests, dated March 17, 2011
3. Notice to Operators Drilling Williams Fork Formation Wells in Garfield County, Surface Casing Depth and Modification of Leakoff Test Requirements, revised June 23, 2006
4. Notice to Operators Drilling Mesaverde Group or Deeper Wells in the Mamm Creek Field Area in Garfield County, Well Cementing Procedure and Reporting Requirements, revised February 9, 2007
5. Notice to Operators Drilling Wells in the Buzzard, Mamm Creek, and Rulison Fields, Garfield County and Mesa County, Procedures and Submittal Requirements for Compliance with COGCC Order Nos. 1-107, 139-56, 191-22, and 369-2, dated July 10, 2010
6. Notice to All Oil and Gas Operators Active in the Denver Basin, Colorado Oil and Gas Conservation Commission Approved Wattenberg Bradenhead Testing and Staff Policy, dated December 16, 2009
7. Drilling Completion Report - Cement Documentation Policy, February 17, 2009
8. Clarification on Procedures for Filing Changes to Applications for Permit-to-Drill, revised January 18, 2011
9. Conductor Pipe Setting Policy, April 6, 2006
10. Approval of Casing Repairs Policy
11. Northwest Colorado Notification Policy, Effective for Notices Received On or After January 1, 2010, Revision No. 3, May 10, 2012

COGCC STUDIES:

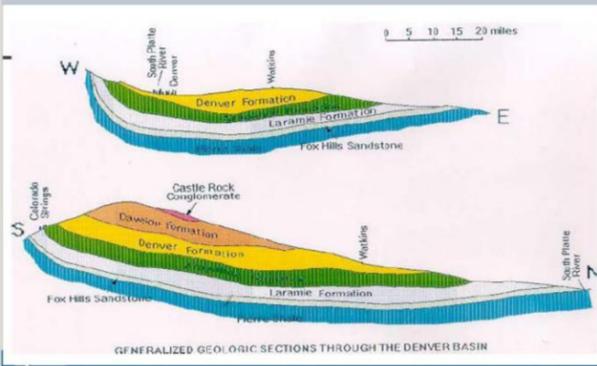
1. COGCC Mamm Creek Area Cementing and Bradenhead Pressure Monitoring Practices, staff presentation to Commission dated September 19, 2011
2. COGCC Response to the conclusions and recommendations in the June 20, 2011 East Mamm Creek Project Drilling and Cementing Study, memorandum dated September 19, 2011
3. East Mamm Creek Project Drilling and Cementing Study, consultant report dated June 20, 2011

Colorado Oil and Gas Conservation Commission

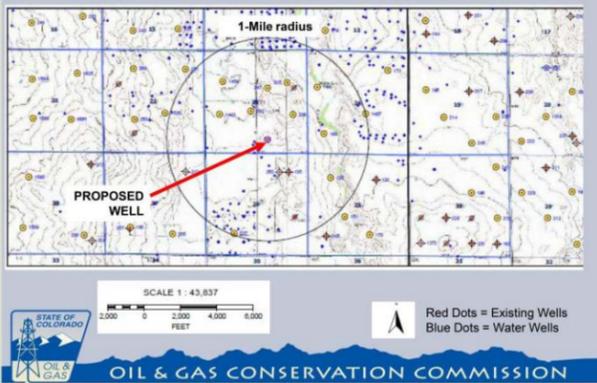
DOWN-HOLE PROTECTION & WELLBORE INTEGRITY



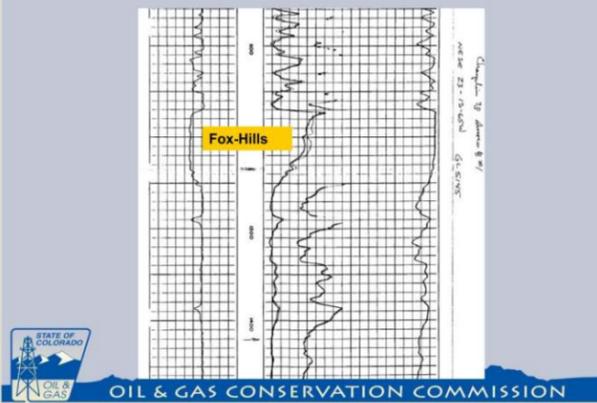
Colorado Geologic Survey Aquifer Reports



CDWR Water Well Data



Geophysical Logs Review



Exposure Assessment

- Source Characteristics: media, chemical concentration
- ~~Distribution: depth, media~~
- ~~Transport Pathway: INCOMPLETE~~
- NO RECEPTOR EXPOSURE when downhole transport pathway is incomplete



317: GENERAL DRILLING RULES

- a. Blowout prevention equipment ("BOPE").
- b. Bottom hole location.
- c. Requirement to post permit at the rig and provide spud notice.
- d. Casing program to protect hydrocarbon horizons and ground water.
- e. Surface casing where subsurface conditions are unknown.
- f. Surface casing where subsurface conditions are known.
- g. Alternate aquifer protection by stage cementing.
- h. Surface and intermediate casing cementing.
- i. Production casing cementing.
- j. Production casing pressure testing.
- k. Protection of aquifers and production stratum and suspension of drilling operations before running production casing.
- l. Flaring of gas during drilling and notice to local emergency dispatch.
- m. Protection of productive strata during deepening operations.
- n. Requirement to evaluate disposal zones for hydrocarbon potential.
- o. Requirement to log well.
- p. Remedial cementing during recompletion.



341. BRADENHEAD MONITORING DURING WELL STIMULATION OPERATIONS

- The placement of all stimulation fluids shall be confined to the objective formations during treatment to the extent practicable.
- During stimulation operations, bradenhead annulus pressure shall be continuously monitored and recorded on all wells being stimulated.
- If at any time during stimulation operations the bradenhead annulus pressure increases more than 200 psig the operator shall verbally notify the Director as soon as practicable, but no later than twenty-four (24) hours following the incident. Within fifteen (15) days after the occurrence, the operator shall submit a Sundry Notice, Form 4, giving all details, including corrective actions taken.
- If intermediate casing has been set on the well being stimulated, the pressure in the annulus between the intermediate casing and the production casing shall also be monitored and recorded.
- The operator shall keep all well stimulation records and pressure charts on file and available for inspection by the Commission for a period of at least five (5) years. Under Rule 502.b.(1), an operator may seek a variance from these bradenhead monitoring, recording, and reporting requirements under appropriate circumstances.



CEMENT BOND LOG

317.o. Requirement to log well. For all new drilling operations, the operator shall be required to run a minimum of a resistivity log with gamma-ray or other petrophysical log(s) approved by the Director that adequately describe the stratigraphy of the wellbore. **A cement bond log shall be run on all production casing or, in the case of a production liner, the intermediate casing, when these casing strings are run.** These logs and all other logs run shall be submitted with the Well Completion or Recompletion Report and Log, Form 5. Open hole logs shall be run at depths that adequately verify the setting depth of surface casing and any aquifer coverage. These requirements shall not apply to the unlogged open hole completion intervals, or to wells in which no open hole logs are run.

