Colorado Oil and Gas Conservation Commission

AQUIFER PROTECTION, WELLBORE INTEGRITY & SETBACK MITIGATION

August 2013
COGCC MISSION

FOSTER THE RESPONSIBLE DEVELOPMENT OF COLORADO’S OIL AND GAS NATURAL RESOURCES.

• Ensure: exploration and production of oil and gas resources are conducted efficiently.
• Mineral owners’ rights are protected.
• Oil and gas production is conducted in a manner consistent with protection of public health, safety, and welfare, including the environment & wildlife resources.
PERMITTING PROCESS

APPLICATION FOR PERMIT TO DRILL

– APD
– FORM 2
– Provides information regarding the permitting of the wellbore and its construction.
  • Surface & bottom hole location
  • Casing
  • Cementing

OIL AND GAS LOCATION ASSESSMENT

– OGLA
– FORM 2A
– Provides an assessment of surface location.
  • Area of disturbance
  • Environmental review
  • Hydrology
    – Groundwater
    – Surface water
  • Inter-agency consultation
PROTECTING WATER

• Technical reviews of casing and cementing plans.
• Review of surrounding area hydrology, water wells and surface waters.
• Baseline water sampling; post-drilling sampling.
• Review of operator-provided Best Management Practices to protect water, contain potential spills.
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.
Colorado Geologic Survey
Aquifer Reports

GENERALIZED GEOLOGIC SECTIONS THROUGH THE DENVER BASIN
Geophysical Logs Review

Fox-Hills
CDWR Water Well Data

Red Dots = Existing Wells
Blue Dots = Water Wells

PROPOSED WELL

1-Mile radius
COGCC RULES PREVENT WATER/GAS/OIL MIGRATION

1. ENSURE SURFACE CASING IN ALL WELLS IS SET AT LEAST 50 FEET BELOW THE DEPTH OF THE DEEPEST WATER WELL OR AQUIFERS

2. ENSURE PRODUCTION CASING ISOLATES ALL HYDROCARBON BEARING ZONES
WELL BORE DIAGRAM
DRILL OUT FOR SURFACE CASING
With fresh water to protect the aquifers

GROUND SURFACE
CEMENTED CONDUCTOR
AQUIFER(S)
SURFACE CASING HOLE
DRILLING FLUID (FRESH WATER)
HYDROCARBON FORMATIONS

Surface Casing Hole
driller below the aquifer

Figure 1
WELL BORE DIAGRAM
PLACE & CEMENT SURFACE CASING
To Protect Aquifers

Per COGCC Rules 317.e, f, g, & h

Figure 2
WELL BORE DIAGRAM

DRILL OUT FOR PRODUCTION HOLE

Fluid inflow control by drilling fluid weight

Per COGCC Rules 317.e, f, g, & h

Production Hole
Driller to the producing formation

GROUND SURFACE
CEMENTED CONDUCTOR
AQUIFER(S)
CEMENT SURFACE CASING
DRILLING FLUID (MUD)
HYDROCARBON FORMATIONS
WELLBORE

Figure 3
WELL BORE DIAGRAM
SET PRODUCTION CASING

GROUND SURFACE

CEMENTED CONDUCTOR

AQUIFER(S)

CEMENTED SURFACE CASING

DRILLING FLUID (MUD)

NIOBRARA FORMATION

WELLBORE PRODUCTION CASING

15
WELL BORE DIAGRAM
PLACE & CEMENT PRODUCTION
CASING
Fluid inflow prevented by cement

Per COGCC Rules 317.i, j, & k and verified per Rule 308A

Figure 4
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.
Cement Bond Logs to verify placement of cement

Per COGCC Rule 317.o requires cement bond logs for all wells.

Figure 5
COGCC Hydraulic Fracturing Rules

- **Rule 205** Inventory chemicals.
- **Rule 205A** Disclosure.
- **Rule 305.e.(1)A** Landowner Notice of intent to hydraulic fracture treatment at time of permitting.
- **Rule 316C** 48-Hour notice of treatment to Local Governmental Designee and the Landowner.
- **Rule 317** Well casing and cementing; Cement bond logs.
- **Rule 317B** Setbacks and precautions near surface waters and tributaries that are sources of public drinking water.
- **Rule 341** Monitor pressures during stimulation.
- **Rule 608** Special requirements for CBM wells.
- **Rules 903 & 904** Pit permitting, lining, monitoring, & secondary containment
- **Rule 906** Requires Commission, CDPHE and the landowner of any spill that threatens to impact any water of the state.
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.
**Per COGCC Rule 341**

Bradenhead valve monitoring during stimulation treatment per Rule 341

Figure 7
HYDRAULIC FRACTURING

• More than 90% of oil and gas wells today are hydraulically fractured.

• As of April 1, 2012 operators must disclose all fracturing ingredients and concentrations to FracFocus.org. Operators must file paperwork to certify proprietary claims.

• Rules require cement bond logs and pressure monitoring to ensure integrity of well and cement work.
GROUND WATER PROTECTION

- Properly drilling, completing, operating, and abandoning to ensure and maintain isolation of productive zones from groundwater & surface water.
- Properly storing, treating, reusing/recycling, transporting, and disposing of wastes.
- Properly installing and maintaining associated equipment & E&P waste management facilities.
- Rapid response to and thorough remediation of impacts from spills and releases.
- Blue – water samples
- Green – oil/gas well samples
MITIGATION MEASURES
Combined, these six complaint types represent 1,277 complaints of 2,729 complaints, or 46%, recorded by COGCC from 2001 - 2012.
Issues That Can Addressed

- Multiwell Pads
- Safety and Fire
- Traffic
- Noise
- Air Impacts
- Odors
- Lights
- Pits
Temporary sound wall mitigating rig noise – Hay Bales
Temporary sound wall mitigating rig noise – Sound Blankets
Permanent sound wall surrounding production equipment
LIGHTING - DARK SKY
Rig lighting has limited offsite glare, down casting lights, and lights are shielded for reduced night impact yet maintain worker safety.
Closed-loop Drilling

Flowback to Closed Tanks
Select organics that are typically O&G-related.

NOTE:
Average methane levels for March 2012:
CAMP = 1780 ppb
Platteville = 2535 ppb
Enclosed Combustion Devices

Used at tank battery locations to comply with AQCC Regulation 7.
October 25, 2012

PUBLIC ANNOUNCEMENTS

Statewide Water Sampling and Monitoring Rulemaking (10/16/2012)
New and amended rules for statewide water sampling and monitoring. (600 Series)

Statewide Setbacks and Aesthetic and Noise Control Rulemaking (10/16/2012)
New and amended rules for statewide setbacks and aesthetic and noise control. (100, 200, 300, 500, 600, 800, 900, 1100, and 1200 Series)

Broomfield & Greater Wattenberg Area Rulemaking (07/13/2012)
Consider amendments to Rule 318A, concerning horizontal/infill wells in GWA in Broomfield & 100-Series Rules for definition of “horizontal well”.

Hearing Dates November through January Updated New
Commission Hearing dates and times for November through January updated.

Jim Milne Named Environmental Manager (10/17/2012)
Jim Milne named Environmental Manager, effective November 1, 2012. Click here to see his Bio.

Water Sampling Data Now Available (08/19/2012)
The data contains information from the COGA voluntary sampling program. The database is under construction and will continue to have historical information added in the coming months.

Form 41 Requirements and Instructions (04/24/2012)
Form 41, Trade Secret Claim of Entitlement instructions can be found on the Forms page.

Form 41, Trade Secret Claim Form Now Available (04/23/2012)
Form 41, Trade Secret Claim of Entitlement is now available to be filed through eForm. A paper version can be found on the Forms page.

HOT TOPICS

Setback Review Stakeholder Group (03/23/2012)
The COGCC Setback Review Stakeholder Group documentation web pages

Hydraulic Fracturing Information (06/07/2011)
With the public’s interest in and concern about the potential impacts of fracking on public health and the environment, the COGCC has compiled information for the public’s review.
Mapped microseismic height for Niobrara

- Top: shallowest microseism; Bottom: deepest microseism
- Aquifers: USGS deepest water well levels by county
Pressure Chart
Where do the fractures go?

- They stay in the formation of interest.

- Typical fracture:
  
  “Half” Length: 300’ to 1500’.
  Height: 20’ to 300’.
  Width: 0.1” – 0.3”.

- Energy Force: less than -1 on Richter Scale
Highest Decibel Reading - Drilling Rig at 350 feet
(Field Measurements for 2006 Noise Rulemaking)

Light Industrial Level at 70 dB
Control Equipment

- Thermal Oxidizer and Flare
  - Combustion of VOC waste stream
  - Emissions of $\text{NO}_x$, CO, and $\text{CO}_2$
- Vapor Recovery Unit
  - Recirculation of VOC waste to product lines for reprocessing
  - Zero emissions when operating, VOC emissions during downtime
Multi-well pads cause less total surface disturbance; however, they result in creation of an industrial site with concentrated oil and gas activity for longer time periods possibly generating greater impacts which may require mitigations.
DUST

Due to traffic and construction activities dust is generated. This can be managed by applying water to dirt roads.

Silica dust mitigation can be managed by using a dust filter during sand handling.
A traffic plan shall be coordinated with local jurisdiction prior to commencement of move in and rig up, which is to include coordination of the access route and local roadway conditions. An effective traffic plan can reduce the number of truck trips, congestion, and dust impacts.
EMISSION CONTROL SYSTEMS.

CDPHE Eastern Colorado monitoring for ozone precursor showed an emission decline due to emission controls added per Metro-Denver ozone non-attainment regulations seen through CDPHE air monitoring.