COLORADO
Oil & Gas Conservation Commission
Department of Natural Resources

COGCC OPERATOR GUIDANCE
RULE 408.r – REQUIREMENT TO LOG A WELL

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Rule 408. General Drilling Rules

408.r Requirement to Log Well. For all new drilling operations, the Operator will 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, capable of generating a variable density display, will be run on all production casing or, in the case of a production liner, the intermediate casing, when these casing strings are run. The Operator will submit these Logs and all other Logs run with the Form 5. The Operator will run open-hole Logs or equivalent cased-hole Logs at depths that adequately verify the setting depth of surface casing and any Groundwater coverage. These requirements will not apply to unlogged open-hole completion intervals.

Purpose of Rule

Rule 408.r requires every new Well to be logged with a minimum of open-hole resistivity and gamma-ray logs, and a cement bond Log on the casing. It also includes a provision for “other petrophysical Log(s) approved by the Director.”

Given the challenges (both mechanical and economic) of running open-hole Logs, and the rule’s provision for “other Logs,” operators may request approval of an alternative logging program to achieve compliance with this rule in those settings where stratigraphy is or will have been fully described.

This guidance clarifies the requirements for acceptable logging programs.

Rule 408.r Guidance

The minimum required logging program of an open-hole resistivity Log with gamma-ray satisfies these three requirements of Rule 408.r:

1. It adequately describes the stratigraphy of the wellbore.
2. It adequately verifies the setting depth of surface casing.
3. It adequately verifies Groundwater coverage.

There are multiple ways these requirements may be met, however.

NOTE: For all Horizontal Wells

1. To apply the below logging program guidance to a horizontal Well, substitute "kick-off point" for "TD."
2. In addition, the horizontal portion of a Well from kick-off-point to TD:
    a. Will be logged-while-drilling with a gamma-ray tool.
    b. The measured-while-drilling (MWD) gamma-ray Log will be listed on and attached to the Form 5.
    c. This applies to all Wells on a multi-well pad for all logging programs.

Basic Rule 408.r Logging Program

1. Logging Program:
    a. The Well will be logged with open-hole resistivity and gamma-ray Logs from TD into the surface casing. A cement bond Log will be run on production casing or on intermediate casing if production liner is run.
2. How this logging program satisfies the requirements of Rule 408.r:
    a. Running the open-hole resistivity and gamma-ray Logs and the cement bond Log satisfies all the requirements of Rule 408.r for the Well.
3. Logging Program approval requirements for the Form 2:
    a. Logging program description provided as a Drilling/Completion Operations BMP on the Form 2.
4. Logging reporting requirements on the Form 5 (Drilling Completion Report)
    a. The Form 5 will list all Logs run in the Well and have those Logs attached. See Form 5 guidance for further information.

An Alternative Logging Program may be proposed on the Form 2 for Wells, provided it meets the three requirements of Rule 408.r. Alternative logging programs will be evaluated on a case-by-case basis and approved via the approval of the Form 2.

Alternative Logging Program: Multi-Well Pad

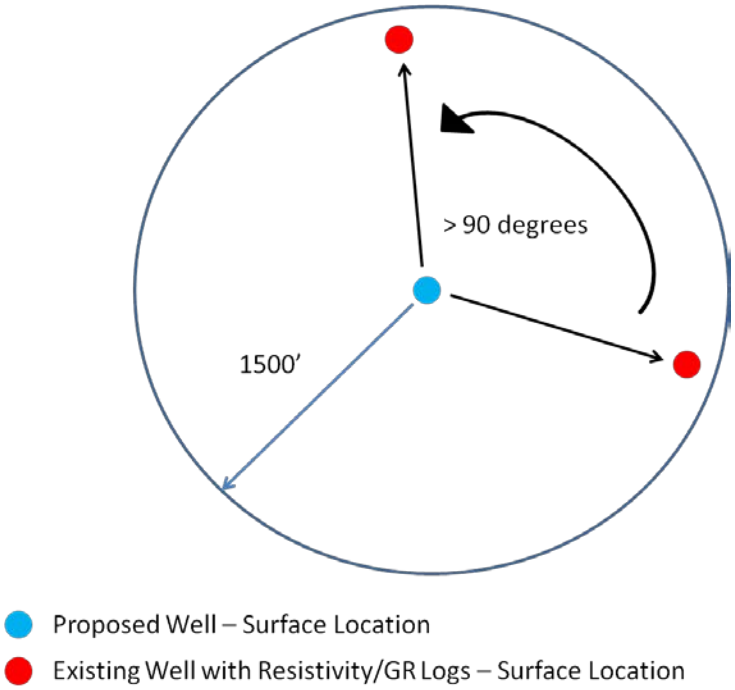
1. Logging Program:
    a. An existing Well drilled on a multi-well pad has been logged with open-hole resistivity and gamma-ray Logs from TD into the surface casing, **OR** one of the first Wells drilled on the multi-well pad during the first rig occupation will be logged with open-hole resistivity and gamma-ray Logs from TD into the surface casing, **AND**
    b. A cement bond Log has been/will be run on production casing or on intermediate casing if production liner is run on that Well, **AND**
    c. All other Wells on this multi-well pad will be logged with only a cement bond Log with cased-hole gamma-ray Log from TD into the surface casing.
2. How this logging program satisfies the requirements of Rule 408.r:

   a. Running the open-hole resistivity and gamma-ray Logs and the cement bond Log satisfies all the requirements of Rule 408.r for the one Well in which they are run.
   b. The stratigraphy in the Wells logged with only a cement bond Log with cased-hole gamma-ray Log can be described by correlating the cased-hole gamma-ray Log run in each of those Wells with the open-hole resistivity and gamma-ray Logs run in the one Well with open-hole Logs.
   c. The depth of the surface casing in the Wells logged with only a cement bond Log with cased-hole gamma-ray Log can be verified by the attenuation of either/both of the cement bond Log and cased-hole gamma-ray Log at the surface casing shoe.
   d. The coverage of Groundwater in the Wells without open-hole Logs can be verified through the combination of the description of the stratigraphy and the verification of the depth of surface casing.
3. Logging Program approval requirements for the Form 2:
   a. Alternative Logging Program description provided as a Drilling/Completion Operations BMP on every Form 2 on the multi-well pad, including a description of the Form 5 requirements.
4. Logging reporting requirements on the Form 5 (Drilling Completion Report) on every Well on the multi-well pad:
   a. The Form 5 "List All Logs Run" text box will identify the type of open hole Logs run; for any Well without open-hole Logs, this text box will also identify the Well(s) (by API#) in which open-hole Logs were run.
   b. The Form 5 for a Well without open-hole Logs will clearly state, "Alternative Logging Program – No open-hole logs were run" in the Submit tab comment box.
   c. The Form 5 will have all Logs run in the subject Well attached to the form.
5. Restrictions on the use of this Alternative Logging Program:
   a. The Well selected as "one of the first wells on the pad" in which Logs will be run **must** be one of the stratigraphically deepest Wells on the pad.
   b. If the Top of Productive Zone (TPZ) location of any wellbore on the multi-well pad will be more than 1500' in map view from the TPZ of the Well in which open-hole Logs will be run, logging only one Well may not be acceptable. The logging program for a location with this situation must be discussed with COGCC permitting staff prior to the submission of the Form 2s.

An Alternative Logging Program With Open-Hole Logging Exception may be proposed on the Form 2 for Wells for which open-hole resistivity and gamma-ray Logs in offsetting Wells provide sufficient control to satisfy the three requirements of Rule 408.r. The actual Logs that were run and the level of control provided by the proximity of the offsetting Wells must meet the following criteria to be considered for use:

1. Criteria for **adequate Well Logs** in offsetting Wells:

   a. An open-hole resistivity Log with an open-hole gamma-ray Log run over the stratigraphic section and the true vertical depths equivalent to the wellbore interval from TD into surface casing in the proposed Well, **AND**
   b. The open-hole resistivity Log and open-hole gamma-ray Log are in the COGCC well file, **AND**
   c. The Logs are of good quality.
2. Criteria for adequate **Well Log control** in offsetting Wells:
   a. A single nearby Well with a surface hole location within 750' if the proposed Well surface hole location, which has adequate Well Logs, **OR**
   b. Multiple surrounding Wells with surface hole locations within 1500' of the proposed Well's surface hole location and with a difference in bearing from the proposed Well of greater than 90 degrees, which have adequate Well Logs. (See diagram below.)



The approval of an alternative logging program that does not have any open-hole Logs run on the location may be requested via an Open-Hole Logging Exception to Rule 408.r with the Form 2.

Alternative Logging Program: Single Well with Adequate Well Log Control in Offset Wells

1. Logging program:
   a. The Well will be logged with cased-hole neutron, gamma-ray, and cement bond Logs from TD into the surface casing.
2. How this logging program satisfies the requirements of Rule 408.r:

   a. The stratigraphy in the proposed Well can be described by correlating the cased-hole neutron and gamma-ray Logs with existing open-hole resistivity and gamma-ray Logs in the offsetting Well(s).
   b. The depth of the surface casing in the Well can be verified by the attenuation of either or both the cement bond Log and cased-hole gamma-ray Log at the surface casing shoe.
   c. The coverage of Groundwater in the Well can be verified through the combination of the description of the stratigraphy and the verification of the depth of surface casing.
3. Logging Program approval requirements for the Form 2:
   a. Open-Hole Logging Exception program description provided as a Drilling/Completion Operations BMP on the Form 2, including a description of Form 5 requirements.
   b. Rule 408.r Open-Hole Logging Exception Request Letter attached to the Form 2. (See pages 7 and 8 for attachment guidance.)
4. Logging reporting requirements on the Form 5 (Drilling Completion Report):
   a. The Form 5 "List All Logs Run" text box will identify the type of open-hole Logs and the Well(s) (by API number) in which they were run and approved for the exception.
   b. The Form 5 will clearly state, "Open-Hole Logging Exception – No open-hole Logs were run" in the Submit tab comment box.
   c. The Form 5 will have all Logs run in the subject Well attached to the form.

<u>Alternative Program: Multi-Well Pad with Adequate Well Log Control in Offsetting Wells</u>

1. Logging program:
   a. One of the first wells drilled on the multi-well pad during the first rig occupation will be logged with cased-hole neutron, gamma-ray, and cement bond Logs from TD into the surface casing.
   b. The other Wells on the multi-well pad will be logged with only a cement bond Log with cased-hole gamma-ray Log from TD into the surface casing.
2. How this logging program satisfies the requirements of Rule 408.r:
   a. The stratigraphy in the Well logged with cased-hole neutron and gamma-ray can be described by correlating the cased-hole Logs with existing open-hole resistivity and gamma-ray Well Log control in offsetting Wells.
   b. The stratigraphy in the Wells logged with only a cement bond Log with cased-hole gamma-ray Log can be described by correlating the cased-hole gamma-ray Log with the cased-hole neutron and gamma-ray Logs.
   c. The depth of the surface casing in all Wells can be verified by the attenuation of either or both the cement bond Log and cased-hole gamma-ray Log at the surface casing shoe.
   d. The coverage of Groundwater in the Wells can be verified through the combination of the description of the stratigraphy and the verification of the depth of surface casing.
3. Logging Program approval requirements for the Form 2:

   a. Open-Hole Logging Exception program description provided as a Drilling/Completion Operations BMP on the Form 2, including a description of Form 5 requirements.
   b. Rule 408.r Open-Hole Logging Exception Request Letter attached to the Form 2. (See pages 7 and 8 for attachment guidance.)
4. Logging reporting requirements on the Form 5 (Drilling Completion Report):
   a. The Form 5 "List All Logs Run" text box will identify the type of open-hole Logs and the Well(s) (by API number) in which they were run.
   b. The Form 5 "List All Logs Run" text box will identify the Well on the pad in which the cased-hole neutron and gamma-ray Log was run by API number.
   c. The Form 5 will clearly state, "Open-Hole Logging Exception – No open-hole logs were run" in the Submit tab comment box.
   d. The Form 5 will have all Logs run in the subject Well attached to the form.
5. Restrictions on the use of this Alternative Logging Program:
   a. The Well selected as "one of the first wells on the pad" in which cased-hole Logs will be run, must be one of the stratigraphically deepest Wells on the pad.
   b. If the Top of Productive Zone (TPZ) location of any wellbore on the multi-well pad will be more than 1500' in map view from the TPZ of the offsetting Well(s) in which open-hole Logs were run, the selected offsetting Wells may still be inadequate. The logging program for a multi-well pad with this situation must be discussed with COGCC permitting staff prior to the submission of the Form 2s.

General Notes

1. Injection Wells (UIC)
   a. Logging requirements for UIC Wells are as per Rule 803.h.(2); namely openhole resistivity and neutron/density logs. An alternative logging program for a Well being drilled for injection purposes may be discussed with COGCC UIC staff; any potential exception must be approved verbally prior to submission of the Form 2.
   b. The offset Well Log must cover from the intended TD of the injection well up to the top of the injection interval to be completed in the proposed injection Well.
   c. The Form 2 for an injection Well will have a BMP with detailed logging requirements.

2. Logging Conditions of Approval (COAs)
   a. COGCC staff may apply a logging Condition of Approval to an individual Form 2 that is more stringent than the rule.
   b. Conditions of Approval may relate to Commission Order requirements or specific geologic formation isolation concerns in a particular area

3. Enforcement and Compliance
   a. In order to ensure Rule 408.r compliance, every APD must include a description of the logging program for the subject Well in an operator-proposed Drilling/Completion Operation BMP. (Suggested BMP Language on Pages 10 and 11).
   b. Lack of compliance with logging program BMPs and COAs on an approved Form 2 will be enforced.
   c. Per Rule 308.d, any logging program change requires prior approval via a Form 4, Sundry Notice.

4. Unable to Run Logs
   a. In the event borehole conditions prevent running open-hole Logs in accordance with Rule 408.r, or a logging BMP or COA on the Form 2, the operator must request an Open-Hole Logging Exception via a Form 4, Sundry Notice.
   b. An Open-Hole Logging Exception Request letter must be attached to the Form 4, Sundry Notice.
   c. Logging tool failure is not an acceptable reason for a lack of compliance with Rule 408.r or a logging BMP or COA.
   d. For a multi-well pad, if borehole conditions prevent the running of open-hole Logs on one of the first Wells on the pad,it is expected an open-hole Log will be run on one of the remaining Wells.

408.r Requirement to Log a Well Guidance Summary

<table>
<tr><th colspan="3">A. Basic Rule 408.r Logging Program</th></tr>
<tr><th>Logging Program Description</th><th>Form 2 Requirements</th><th>Form 5 Requirements</th></tr>
<tr><td>Open-hole resistivity Log with gamma-ray Log run from TD* into the surface casing</td><td rowspan="2">Operator BMP describing logging program and Form 5 requirements.</td><td rowspan="2">List all Logs run in the Well
Attach all Logs run</td></tr>
<tr><td>Cement Bond Log run on production casing or on intermediate casing if production liner is run</td></tr>
<tr><th colspan="3">B. Alternative Program: Multi-Well Pad</th></tr>
<tr><th>Logging Program Description</th><th>Form 2 Requirements</th><th>Form 5 Requirements</th></tr>
<tr><td>An existing well or one of the first wells drilled on the pad: Logged with open-hole resistivity Log and gamma-ray Log from TD* into the surface casing; cement bond Log run on production casing or on intermediate casing if production liner is run.</td><td rowspan="2">Operator BMP describing logging program and Form 5 requirements.</td><td>List all Logs run in the Well.
Attach all Logs run.</td></tr>
<tr><td>All other wells on the pad: Cement bond Log with cased-hole gamma-ray run into the surface casing on production casing or on intermediate casing if production liner is run.</td><td><u>List all Logs run in the Well</u>: Identify type of Log and Well (by API #) in which open-hole Logs were run.
<u>Comment</u>: “Alternative Logging Program - No open-hole logs were run”
<u>Attach</u> all Logs run.</td></tr>
<tr><th colspan="3">C. Alternative Program: Single Well with Adequate Well Log Control in Offsetting Wells</th></tr>
<tr><th>Logging Program Description</th><th>Form 2 Requirements</th><th>Form 5 Requirements</th></tr>
<tr><td>Cased-hole neutron Log with gamma-ray Log run from TD* into the surface casing.</td><td rowspan="2">Rule 408.r Exception Request Letter attached and Operator BMP describing logging program and Form 5 requirements.</td><td rowspan="2"><u>List all Logs run in the Well</u>: Identify type of Log and Well (by API #) in which open-hole Logs were run.
<u>Comment</u>: “Open hole logging exception - No open-hole logs were run”
<u>Attach</u> all Logs run.</td></tr>
<tr><td>Cement bond Log run on production casing or on intermediate casing if production liner is run.</td></tr>
<tr><th colspan="3">D. Alternative Program: Multi-Well Pad with Adequate Well Log Control in Offsetting Wells</th></tr>
<tr><th>Logging Program Description</th><th>Form 2 Requirements</th><th>Form 5 Requirements</th></tr>
<tr><td>One of the first wells drilled on the pad: Logged with cased-hole neutron Log with gamma-ray Log from TD* into the surface casing; cement bond Log run on production casing or on intermediate casing if production liner is run.</td><td rowspan="2">Rule 408.r Exception Request Letter attached and Operator BMP describing logging program and Form 5 requirements.</td><td rowspan="2"><u>List all Logs run in the Well</u>: Identify type of Log and Well (by API #) in which open-hole Logs were run <u>and</u> identify Well (by API #) on the pad in which the cased-hole neutron Log was run.
<u>Comment</u>: “Open hole logging exception - No open-hole logs were run”
<u>Attach</u> all Logs run.</td></tr>
<tr><td>All other wells on the pad: Cement bond Log with cased-hole gamma-ray run into the surface casing on production casing or on intermediate casing if production liner is run.</td></tr>
<tr><th colspan="3"><u>NOTES</u></th></tr>
<tr><td colspan="3">*<u>Horizontal Wells</u>: To apply the guidance above to a horizontal Well, substitute “kick-off point” for “TD.” The horizontal portion of a Well from kick-off-point to TD will be logged-while-drilling with a gamma-ray tool.</td></tr>
</table>

Logging Conditions of Approval (COAs): COGCC staff may apply a logging Condition of Approval to an individual Form 2 that is more stringent than the rule. Conditions of Approval may relate to Commission Order requirements or specific geologic formation isolation concerns in a particular area.
Enforcement and Compliance: In order to ensure Rule 408.r compliance, every APD must include a description of the logging program for the subject Well in an operator-proposed Drilling/Completion Operation BMP. Logging program BMPs and COAs on an approved Form 2 will be enforced. Per Rule 308.d, any logging program change requires prior approval via a Form 4, Sundry Notice.

Suggested BMPs

A. Basic Rule 408.r Logging Program	
For a Vertical or Directional Well	For a Horizontal Well
Open-hole resistivity log with gamma-ray log will be run from TD into the surface casing. A cement bond log with gamma-ray will be run on production casing, or on intermediate casing if a production liner is run. The Form 5, Completion Report, will list all logs run and have those logs attached.	Open-hole resistivity log with gamma-ray log will be run from the kick-off point into the surface casing. A cement bond log with gamma-ray log will be run on production casing, or on intermediate casing if a production liner is run. The horizontal portion of the wellbore will be logged with a measured-while drilling gamma-ray log. The Form 5, Completion Report, will list all logs run and have those logs attached.
B. Alternative Program: Multi-Well Pad	
For Directional Wells	For Horizontal Wells
SELECT CORRECT WORDING in [ ]: Alternative Logging Program: **[**An existing well on the pad was**]** ***OR*** **[**One of the first wells drilled on the pad will be**]** logged with open-hole resistivity log with gamma-ray log from TD into the surface casing. All wells on the pad will have a cement bond log with gamma-ray run on production casing (or on intermediate casing if production liner is run) into the surface casing. The Form 5, Completion Report, for each well on the pad will list all logs run and have those logs attached. The Form 5 for a well without open-hole logs will state "Alternative Logging Program - No open-hole logs were run" and will clearly identify the type of log and the well (by API#) in which open-hole logs were run.	***SELECT CORRECT WORDING in [ ]:*** Alternative Logging Program: **[**An existing well on the pad was**]** ***OR*** **[**One of the first wells drilled on the pad during the first rig occupation will be**]** logged with open-hole resistivity log with gamma-ray log from the kick-off point into the surface casing for one of the stratigraphically deepest wells on the pad. All wells on the pad will have a cement bond log with gamma-ray run on production casing (or on intermediate casing if production liner is run) into the surface casing. The horizontal portion of every well will be logged with a measured-while-drilling gamma-ray log. The Form 5, Completion Report, for each well on the pad will list all logs run and have those logs attached. The Form 5 for a well without open-hole logs will state "Alternative Logging Program - No open-hole logs were run" and will clearly identify the type of log and the well (by API#) in which open-hole logs were run.
C. Alternative Program: Single Well with Adequate Well Log Control in Offsetting Wells	
For a Vertical or Directional Well	For a Horizontal Well

Open-Hole Logging Exception: A cased-hole neutron log with gamma-ray log will be run from TD into the surface casing. A cement bond log with gamma-ray will be run on the production casing (or intermediate casing if the production liner is run). The Form 5, Completion Report, for this well will list all logs run and have those logs attached. The Form 5 will state "Open-hole logging exception - No open-hole logs were run" and will clearly identify the type of log and the well (by API#) in which open-hole logs were run.	Open-Hole Logging Exception: A cased-hole neutron log with gamma-ray log will be run from the kick-off point into the surface casing. A cement bond log with gamma-ray will be run on the production casing (or intermediate casing if the production liner is run). The horizontal portion of the wellbore will be logged with a measured-while-drilling log with gamma-ray. The Form 5, Completion Report, for this well will list all logs run and have those logs attached. The Form 5 will state "Open-hole logging exception - No open-hole logs were run" and will clearly identify the type of log and the well (by API#) in which open-hole logs were run.
D. Alternative Program: Multi-Well Pad with Adequate Well Log Control in Offsetting Wells	
For Directional Wells	For Horizontal Wells
Open-Hole Logging Exception: One of the first wells drilled on the pad will be logged with cased-hole neutron log with gamma-ray log from TD into the surface casing. All wells on the pad will have a cement bond log with gamma-ray run on production casing (or on intermediate casing if production liner is run) into the surface casing. The Form 5, Completion Report, for each well on the pad will list all logs run in that well and have those logs attached. The Form 5 for each well will state "Open-Hole Logging Exception - No open-hole logs were run" and will clearly identify the type of log and the well (by API#) in which open-hole logs were run.	Open-Hole Logging Exception: One of the first wells drilled on the pad during the first rig occupation will be logged with cased-hole neutron log with gamma-ray log from the kick-off point into the surface casing. All wells on the pad will have a cement bond log with gamma-ray run on production casing (or on intermediate casing if production liner is run) into the surface casing. The horizontal portion of every well will be logged with a measured-while-drilling gamma-ray log. The Form 5, Completion Report, for each well on the pad will list all logs run in that well and have those logs attached. The Form 5 for each well will state "Open-Hole Logging Exception - No open-hole logs were run" and will clearly identify the type of log and the well (by API#) in which open-hole logs were run.

Document Change Log

Change Date	Description of Changes
3/20/2015	Revised: Describe requirements for alternatives.
12/18/2017	Revised: Add scenario for existing well on pad with logs. Add numbering for large sections of document.
12/26/2016	Revised: Clarified Form 5 requirements.
1/29/2018	Revised: Add scenario for unable to run open-hole logs.
2/19/2019	Revised: Added restrictions for alternative logging programs. Revised Form 5 Operator Comments requirements. Updated BMP language.
12/16/2020	Revised: Updated for Mission Change Rules.

8/16/2022	Finalized.