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### 30.1. APPLICABILITY

- ☐ Distribution
- ☐ Transmission / Regulated Onshore Gathering
- ☐ Liquefied Natural Gas (LNG)
- ☒ Storage (NG)

### 30.2. PURPOSE / SCOPE

On December 19, 2016, the Pipeline and Hazardous Materials Safety Administration (PHMSA) issued an interim final rule (IFR) revising federal pipeline safety regulations to address issues concerning safe operation of underground natural gas storage facilities. The IFR incorporates *American Petroleum Institute (API) Recommended Practice (RP) 1171(First Edition - 2015) - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs* into the pipeline safety regulations. The IFR further states that operators will be required “to assess the operational safety of their underground natural gas storage facilities and document the implementation of identified safety solutions.”

The following documentation is Black Hills Energy’s (the Company’s) policy to implement the practices outlined in API RP 1171 into its procedures for underground natural gas storage facilities, covering all phases of a facility’s lifespan, including assessment, design, construction, operations, and closure.

The Company considers all vertically oriented well head valves to fall under Storage O&M. Wing valves and horizontally oriented valves are part of the transmission system and fall under [O&M 131: TIMP-Transmission Integrity Management Plan](#).


### 30.3. CORE INFORMATION AND REQUIREMENTS

#### 30.3.1. INVENTORY TRACKING

Transmission and Storage Measurement Department is responsible for tracking and updating each reservoir’s total inventory. Adjustments to a field’s total inventory may only be made with approval from Engineering and according to a third-party consultant’s recommendation.

#### 30.3.2. ANNUAL LOST & UNACCOUNTED FOR GAS (L&U) ACCOUNTING

At the end of each year and effective December 31st of every year, a reduction to each field’s total inventory will be made based on engineering formulation. This adjustment shall be made to account for minor, unmeasured gas losses resulting from storage field wellhead and surface Operations & Maintenance (O&M) activities. This adjustment is not meant to imply, infer, or account for subsurface gas migration.

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### 30.3.3. SEMI-ANNUAL BOTTOM HOLE PRESSURE (BHP) TESTING

To facilitate inventory verification, semi-annual bottom hole pressure (BHP) surveys shall be conducted after the pseudo stabilized injection and withdrawal seasons. Field Operations will work with Gas Control to schedule the surveys according to acceptable seasonal load and supply conditions. Storage field injection and withdraw activity will be suspended for a minimum of 72 hours prior to conducting the pressure survey. At a minimum, and conducted consistently each semi-annual period, one well will be surveyed using a downhole pressure recording device at the conclusion of the 72-hour shut-in period. Additionally, at a minimum, surface pressures will be recorded for all remaining wells. Testing all wells with downhole pressure recorders is preferred. Send the results of all BHP surveys to Storage Support Engineering for Inventory versus BHP/Z-Analysis (also known as a 'Hysteresis Performance Analysis').

### 30.3.4. INVENTORY VERIFICATION

Every three years, or more frequently as necessary, based on accounting or audit requirements, a third-party storage reservoir consulting firm will be engaged to verify all reservoir inventory levels.

### 30.3.5. PHMSA INTERIM RULE REQUIREMENTS


Existing underground natural gas storage facilities (constructed and in service prior to July 18, 2017) that use a depleted hydrocarbon reservoir or an aquifer reservoir for storage reservoirs shall follow API RP 1171 Sections 8, 9, 10, and 11. These new rule requirements need to be in place on or before January 18, 2018. Storage facilities must meet the operations, maintenance, integrity demonstration and verification, monitoring, threat and hazard identification, assessment, remediation, site security, emergency response and preparedness, and recordkeeping requirements recommended in API RP 1171. Any new underground natural gas storage facilities (constructed and in service after July 18, 2017) that use a depleted hydrocarbon reservoir or an aquifer reservoir for storage reservoirs shall follow all requirements and recommendations in API RP 1171.

## 30.4. INTRODUCTION

The Company stores its natural gas in depleted hydrocarbon reservoirs.

### 30.4.1. DEPLETED HYDROCARBON RESERVOIRS

Underground zones containing porous and permeable rock may be suitable for natural gas storage. In their native state, these zones typically contain fluids in the form of hydrocarbons and/or water.

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The depleted reservoir formation is readily capable of holding injected natural gas. Using such a facility is economically attractive because it allows the re-use, with suitable modification, of the extraction and distribution infrastructure remaining from the productive life of the gas field, which reduces the start-up costs. Depleted reservoirs are also attractive because their geological and physical characteristics have already been studied by geologists and petroleum engineers and are usually well known. Consequently, depleted reservoirs are generally the cheapest and easiest to develop, operate, and maintain of the three types of underground storage.

Each reservoir requires a site-specific evaluation to determine its suitability for natural gas storage. The trapping mechanism varies depending on the porosity and permeability of the rock, hydrodynamics, and other geological factors. The reservoir is sealed at the top by a barrier of impervious rock known as the “caprock”. The bottom and lateral boundaries are sealed by structural closure, decrease of porosity and permeability, or hydrodynamic forces. Facility and operational controls can also be used as needed.

The reservoir is accessed through wells drilled vertically or directionally from the surface. These can be new wells constructed specifically for underground storage of natural gas or existing wells converted for this use. New wells must be designed to withstand the necessary conditions, and existing wells must undergo safety evaluations prior to conversion for use in the underground storage process.

Once they are in service, both the reservoirs and wells must be monitored and maintained over their operating lifetime to evaluate functional integrity and containment capability. The operator must develop a risk management program to identify potential threats and determine their relative likelihood and severity, as well as the preventative and mitigative measures for each.


At time of abandonment of an underground storage facility in a depleted hydrocarbon reservoir, the wells must be plugged for long-term isolation of the storage zone.

All work will be done in accordance with the Black Hills Energy Safety and Health Standards, which are posted on the Black Hills Energy [“BEN” Safety and Health webpage](#).

### **30.5. WELL REMEDIATION**

#### *API RP 1171 - Section 6.6*

When an existing well is identified as having compromised mechanical integrity, the Company shall evaluate it and implement responsive action within a timeframe and by method(s) determined by the Company corresponding to the severity of the integrity risk.

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### 30.5.1. EVALUATION AND RESPONSIVE ACTION

The Company shall review logs, including casing inspection logs and other integrity assessments, prior to planning and conducting well remediation activities.

When planning the remediation work, the Company shall assess the risk associated with working on a well at various reservoir pressures.

If a well is planned to be kept out of active service for a length of time (as determined by the Company) before remediation occurs, but could otherwise act as a conduit for communication, the Company shall continue to monitor the well.

Before placing a well back in service after remediation, the Company shall:

- Reassess the well's integrity
- Address any newly identified threats

### 30.6. ENVIRONMENTAL, SAFETY, AND HEALTH

*API RP 1171 - Section 6.8*


The Company shall incorporate safeguards to the environment and to the safety and health of workers and the public into well design and well work activities.

These safeguards shall include:

- Actions taken to protect surface water and groundwater resources during the design, drilling, and servicing of a well
- Conducting an environmental impact review prior to drilling a well
- Monitoring of worksite conditions during well construction and work activities

In well design and well work activities, the Company shall account for the long-term viability and functional integrity of the well. The Company shall provide operation and maintenance safeguards that are consistent with applicable environmental regulations and provide for worker and public safety over the life of the well.

The Company has an emergency response plan as outlined in *O&M Procedure OM116 – EMERGENCY PLAN and WELL CONTROL EMERGENCY PLAN*, which are located in ["BEN" under the Underground Gas Storage webpage](#).

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### 30.7. TESTING AND COMMISSIONING

*API RP 1171 - Section 6.9*

#### 30.7.1. TESTING METHODS

If a well is new or has had its production casing modified during a workover, the Company shall perform an integrity assessment to verify mechanical integrity and record the results in the database. The Company shall use one of the following tests:

- For existing production casing, pressure test after setting a retrievable plug as close to the top of the storage formation as practical.
- For a well completed with tubing and packer, pressure test the tubing-casing annulus.

The Company shall design the test so that the maximum pressure on the packer seat and the pressure at any point in the wellbore during the test does not compromise the mechanical integrity of the well. This shall be accomplished by using an industry standard parameter for integrity assessment.

**Note:** *A commonly used test parameter is an initial test pressure of 1.1 times the maximum allowable operating pressure, with test duration of at least 30 minutes and a pressure drop not exceeding 10% of the initial test pressure. Applicable regulations may stipulate other parameters.*

#### 30.7.2. CASING INSPECTION LOGGING

The Company shall perform baseline casing inspection logging on production casing of an existing well that has been converted for underground gas storage.

#### 30.7.3. RESOLUTION OF ISSUES


The Company shall monitor and address issues or problems that are encountered during the construction of the well and resolve them in a manner that maintains the functional integrity of the well and storage reservoir.

If the resolution of an encountered issue results in a deviation from the original design or changes in the procedures for the well, the Company shall document the changes and retain the documentation of these changes in the well records.

The Company shall determine whether the resolutions to identified issues will need to be incorporated into the design of future wells.

The Company shall evaluate geologic or engineering data gathered during the construction or remediation process to determine whether any new information could require changes in the geologic characterization of the depleted reservoir.



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### 30.8. RESERVOIR INTEGRITY MONITORING

*API RP 1171 - Section 7.3*

The Company shall perform the following for depleted reservoirs:

- Evaluate as soon as practical any unexpected conditions that are identified through integrity monitoring and correct them to avoid an incident or loss.
- Monitor the average reservoir pressure versus inventory and compare to expected conditions to allow for the discovery and correction of any unexpected conditions. The pressure-inventory relationship can be obtained from a shut-in indicator well(s) or observation well(s). Take fluid level into account when using observation wells.
- Monitor observation wells in strategic locations in the vicinity of spill points and above the caprock for the purpose of detecting the presence or movement of gas using methods that may include reviewing the following:
  - Fluid level records
  - Well pressures
  - Geophysical logging
  - Gas composition
- Company should perform monitoring for unexplained flow or pressure changes in offset hydrocarbon production or disposal operations, including those in zones above and below the storage reservoir, as well as laterally offset locations.
- Obtain subsurface correlation and gas identification logs such as gamma ray and neutron log suite as needed to confirm the location of gas being injected into the intended storage reservoir.

### 30.9. MECHANICAL INTEGRITY MONITORING

*API RP 1171 - Section 7.4*


The Company shall monitor wells and related facilities to detect and correct any abnormal operating conditions.

#### 30.9.1. SURFACE MONITORING METHODS

The Company shall inspect the following for operability, leaks, and mechanical or other faults using the [Well Annulus Pressure Form 3538 18](#):

- Wellheads
- Well safety systems
- Well piping
- Site locations



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The Company shall monitor the following for unexpected changes indicative of a mechanical fault using the [Well Annulus Pressure Form 3538 18](#):

- Wellhead injection pressure and flow rate
- Observation well pressures or fluid levels
- Pressures in well annulus or vents

### 30.9.2. SUBSURFACE MONITORING METHODS

The Company shall perform surveys of subsurface pressure or temperature as needed to locate suspected flow anomalies. These surveys may be augmented with more sophisticated logging tools, such as spinner surveys or noise logs, if necessary.

The Company shall obtain subsurface correlation and gas identification logs, such as gamma ray and neutron log suite, as needed to locate suspected anomalous gas accumulations above or below the reservoir.

## 30.10. INTEGRITY DEMONSTRATION, VERIFICATION, AND MONITORING PRACTICES

*API RP 1171 - Sections 9.2, 9.3*

The Company shall maintain the functional integrity of its storage wells and reservoirs. The approaches used in demonstrating, verifying, and monitoring the integrity may differ based on the unique characteristics of different wells.


The Company shall use the risk assessments as the basis for developing the tasks to be performed for integrity demonstration, verification, and monitoring and for evaluating their required frequency. The results of these assessments shall be used to develop procedures to address integrity monitoring practices, either through one system-wide program, or through separate programs for individual facilities or covering multiple sites. The program(s) covering integrity monitoring shall incorporate a means of annual reevaluation by the BHE Integrity Team specific to the monitoring tasks and reconsidering the conclusions regarding various risks.

### 30.10.1. WELL INTEGRITY EVALUATION

The Company shall evaluate the integrity of each active well that penetrates the storage reservoir and buffer zone or any areas influenced by storage operations using the [Third Party Well Evaluation Form 3535 18 Form](#).

Methods to be used for well integrity evaluation may include but are not limited to:

- Review of records related to well work, design, and completion
- Wellhead and downhole inspection
- Monitoring of well pressure
- Gas sampling

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For any third-party wells, the Company shall request well integrity evaluation data from the third-party owners/operators annually.

The Company shall determine the requirements for subsequent evaluations of an active well based on the results of the initial mechanical integrity evaluation and the conclusions of the risk assessment.

### 30.10.2. WELL INTEGRITY MONITORING

The Company shall perform the following actions to monitor well integrity:

- Monitor for the presence of annular gas every three months, not to exceed four and a half months, by recording measurements of pressure and/or gas flow in the annulus using the [Well Annulus Pressures Form 3538 18](#). Record and report these measurements to the Integrity Coordinator designated for your region, if applicable.
- Evaluate each occurrence of annular gas that exceeds the determined operator- or regulatory-defined threshold levels.
- Annually, at an interval not to exceed 15 months, perform a visual inspection of each wellhead assembly for leaks using the [Atmospheric Corrosion & Valve Inspection Form 3536 18](#) to record the inspection. The following tasks shall be performed in these inspections:
  - Check for new developments around the well.
  - Check for new hazards or obstructions around the well (if there is fencing, check that it is not damaged).
  - Inspect for leaks at all connections and surface equipment.
  - Inspect for surface corrosion (e.g., badly rusted, bolts worn out).
  - Make sure signage is visible and correct.
  - Check access road condition.
  - Verify that valves are locked and secured as appropriate.
- Annually, at an interval not to exceed 15 months, test the operation of the master valve and wellhead pipeline isolation valve for correct function and ability to isolate the well. Use the [Atmospheric Corrosion & Valve Inspection Form 3536 18](#) to record the test.
- Follow the Company's valve maintenance program for isolation valves when maintaining, repairing, or replacing the valves.
- Where surface and subsurface safety valve systems are installed, function test them at least annually, at an interval not to exceed 15 months, with tests performed in conformance with the Company's procedures and the manufacturer's recommendations.
- After an inspection, reopen a closed storage well safety valve system manually at the site of the valve, not from a remote location.

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#### 30.10.2.1. CORROSION MONITORING AND EVALUATION

The Company shall:

- Evaluate the impact of corrosion on well integrity and operating pressure.
- Evaluate tubular integrity and identify defects caused by corrosion or other chemical or mechanical damage.

#### 30.10.2.2. BASELINE GAS DETECTION LOG

The Company shall run a baseline gas detection log on each new well. The baseline established by this log will be used over the life of the well to detect changes in gas indications behind the casing throughout the wellbore.

#### 30.10.2.3. PLUGGED WELL SITE INSPECTIONS

The Company shall:

- Identify recorded locations of plugged wells that penetrate the storage reservoir, the buffer zone, or areas influenced by storage operations using the [Storage Inspection form 3537 18](#).
- Inspect each of these wells for evidence of gas or other fluids flowing to the surface.
- Review data from the plugging records to augment these inspections.

The frequency of subsequent inspections on known plugged wells will be annually, not to exceed 15 months.


The frequency of subsequent inspections on newly plugged wells shall be annually, not to exceed 15 months unless the frequency is changed based on:

- Results of the initial inspection
- Determinations of the risk assessment

#### 30.10.2.4. OTHER MONITORING ACTIVITIES

The Company shall:

- Monitor active and plugged well sites for any encroachment activities that may impact well integrity.
- Monitor trends in shut-in well pressure for indications of a loss in well integrity.
- Monitor pressure on adjacent active wells to verify that integrity has been maintained during or after a stimulation or hydraulic fracturing if fracture gradient has been exceeded.

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### 30.11. RESERVOIR INTEGRITY

*API RP 1171 - Section 9.4*

#### 30.11.1. GEOLOGICAL CHARACTERIZATION

To identify the limits of the gas and any spill points, the Company shall update the reservoir geological characterizations and mapping if:

- New data becomes available, or
- There is evidence of changes in the pressure in the reservoir or the location of the gas.

#### 30.11.2. BUFFER ZONE

Whenever additional operational or geological data become available, the Company shall review the lateral and vertical boundaries of the buffer zone to determine whether the boundaries continue to preserve the integrity of the storage reservoir.

#### 30.11.3. THIRD-PARTY ACTIVITY


The Company shall monitor activities by third parties that could potentially compromise the integrity of the storage reservoir, such as:

- Drilling
- Completion
- Plugging and abandonment
- Production
- Mining

The Company shall determine preventive and mitigative (P&M) measures to handle these situations. Third-party or regulatory agencies shall be contacted to implement these P&M measures.

The Company shall request that any new third-party wells that are located within the identified buffer zone laterally or vertically are to be drilled and completed in a manner that preserves isolation of the storage reservoir as recommended by state agencies.

Any third-party wells within the lateral and vertical buffer zone that are being plugged and abandoned by the third party are to be plugged in a manner that isolates the storage reservoir so that its integrity is not compromised as recommended by state agencies.

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The Company shall:

- Require the third party to use sufficient cement across the storage interval.
- Have the third party run a bond log across the storage formation.
- Confirm there is a quality bond 200 feet above and below the storage formation.
- For a dry hole, require a cement plug 250 feet below and above.
- Request access to third party's open-hole logs and mud logs.
- Request access to the site while the third party is drilling and cementing through the formation.
- Request copy of the third party's plugging affidavit.

#### 30.11.4. OBSERVATION WELLS

Where applicable, the Company should use observation wells to monitor pathways around, above, or below the storage reservoir that could potentially allow hydraulic communication and/or migration between the reservoir and surrounding areas.

#### 30.11.5. OBSERVATION WELLS

The Company shall perform compositional analysis of gas samples taken from shallower zones or casing annuli and compare them to analysis of gas samples from the storage reservoir to identify potential gas leakage or gas migration pathways.

### 30.12. GAS INVENTORY ASSESSMENT

*API RP 1171 - Section 9.5*

#### 30.12.1. TOTAL INVENTORY


The Company shall include the following in the total inventory for the reservoir when performing inventory verification analyses:

- Estimated remaining native gas at time of conversion
- The injected base gas
- The working gas on the date of the gas test

#### 30.12.2. DATA QUALITY

The Company shall investigate factors that may contribute to uncertainty in data collected for inventory assessment purposes or that may similarly cause uncertainty in the analysis of that data, including but not limited to:

- Calculations
- Gas measurement procedures
- Shut-in pressure stabilization time

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### 30.12.3. HYDROCARBON RESERVOIR METHODOLOGY

For a storage reservoir converted from a depleted hydrocarbon reservoir, the Company shall use methods of inventory assessment based on reservoir operating characteristics, including but not limited to the following:

- Conducting annual high and low inventory storage pressure surveys to obtain a representative reservoir pressure at respective inventories
- Performing material balance studies using the reservoir pressure and inventory data collected during the annual surveys
- Monitoring shut-in well pressure for trends indicating gas migration
- Using key indicator wells to monitor the pressure relative to inventory
- Calculating gas pore volume

### 30.12.4. ADDITIONAL ACTIONS


The Company shall account for measured and unmeasured storage gas inventory changes, including but not limited to:

- Injections
- Withdrawals
- Fuel
- Operations
- Losses

The Company shall:

- Calibrate the pressure gauges and document the calibrations in conformance with the Company's procedures.
- Account for wellbore liquid levels, where wellbore liquid levels are suspected to be present, by making necessary corrections for elevation and fluid gradients when analyzing wellhead and/or bottom-hole pressure data for reservoir integrity. Review current calculations to verify this is factored in.
- Perform pressure-inventory relationship comparison to the design relationship as a means of monitoring reservoir integrity. Review and update this pressure-inventory relationship annually in the BHP and Back Pressure Analysis spreadsheet.
- Monitor the injected and withdrawn gas composition as necessary to allow updates to the characterization of the gas in place.

**Note:** *Create inventory analysis reports and analysis procedures that are specific to each field.*

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### **30.13. FLOW AND PRESSURE MONITORING**

*API RP 1171 - Section 9.6*

The Company shall:

- Monitor the injection and withdrawal flow rates and pressures at each storage reservoir to assist in evaluating the facility's functional integrity.
- Monitor well pressure and/or flows for deviations from expectations that may indicate potential wellbore integrity issues. The frequency and type of monitoring required shall be reviewed during the annual storage integrity meeting.

### **30.14. INTEGRITY NONCONFORMANCE AND RESPONSE**

*API RP 1171 - Section 9.7*

The Company shall maintain a SIMP (Storage Integrity Management Plan) program (see O&M 133) outlining a means of documenting and addressing nonconformance with regard to design criteria related to the functional integrity of the storage reservoir and well(s).

The Company shall include requirements in the program for documenting:

- Abnormal operating conditions or anomalies
- Actions taken to address each occurrence

### **30.15. PLUGGED WELL SITE MONITORING PROCEDURE**

*API RP 1171 - Section 7.4*


- Perform a visual inspection for signs of gas leakage (bubbles, dead vegetation).
- Check for new construction (development) around the site.
- Perform a leak survey.

### **30.16. BIOCIDES PROCEDURE**

*API RP 1171 - Section 11.3*

- Safety/Tailgate meeting – daily activities.
- Isolate well.
- Connect pump truck hoses to well.
- Pressure test hoses/hardline.
- Open well for pumping – make sure correct valving on tree.
- Pump fluid in well per plan – follow chemical company procedures for handling.
- Shut in well.
- Bleed hose/hardline from all pressure.



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- Disconnect hose/hardline from wellhead.
- Reconfigure well for normal operations or as directed by field staff.
- Clean location of tools and secure location.

### **30.17. FLARING AND VENTING PROCEDURE**

#### *API RP 1171 - Section 11.3*

The Company shall account for gas that is flared or vented during workovers of wells. When possible, the gas shall be flared. If flaring is not possible, the volume of vented gas shall be estimated.

#### **30.17.1. GAS SAMPLES**

- As applicable, gas samples shall be taken at the time of flaring or venting and sent to a Company-approved facility.
- One sample must be taken per month.


#### **30.17.2. FLARING**

To estimate the quantity of gas flared, the following data shall be gathered:

- Initial pressure (psig)
- Final pressure (psig)
- Choke size
- Flaring time (minutes)

A variable choke shall be used when flaring, but the permitted choke settings are limited based on the choke coefficients used in calculations. Only the following choke settings shall be used:

- 1/8-inch
- 3/16-inch
- 1/4-inch
- 5/16-inch
- 3/8-inch
- 7/16-inch
- 1/2-inch
- 5/8-inch
- 3/4-inch

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### 30.17.3. VENTING

To estimate the quantity of gas vented, the following data shall be gathered:


- Initial pressure (psig)
- Final pressure (psig)
- Internal diameter and length of piping (to be used to calculate the volume)
- The volume of the vented space (in either cubic feet or cubic inches)
- The number of times the volume was vented

### 30.18. BLOWOUT PREVENTION EQUIPMENT PROCEDURE

*API RP 1171 - Section 11.5*

The Company shall perform the following actions during drilling or well servicing operations where there is indication that the well will flow:

- Install and test Blowout Prevention (BOP) equipment.
- Verify the rig has a safety valve (stabbing valve) with connections suitable for use with each size and type of tool joint or tubing connection that will be used on the job.
- Install, operate, and maintain BOP equipment in conformance with the requirements of API RP 53.
- Require designated rig personnel to have adequate knowledge to operate the BOP system.
- Train new personnel as soon as practical in the operation of the BOP system.
- In the pre-job meeting, address whether or not to use BOP controls, including remote control stations.
- Inspect the BOP equipment daily while it is in service.
- Perform a preventer actuation test on each round trip, but not more than once in a 24-hour period. Note these actuation tests on the daily report.
- Test the annular BOPs in conformance with the manufacturer's recommendations.
- When heavy weighted drilling fluids are used, flush choke and kill lines as needed to prevent plugging.
- During cold weather conditions, flush choke and kill lines as needed to prevent freezing.
- Use components with working pressure ratings equal to or greater than the anticipated well surface pressure for all pipe fittings, valves, and unions placed on or connected with BOP equipment, casing, casing head, drill pipe, or tubing that is exposed to well pressure.
- Check bolts on the BOP stack and related riser connections to verify that they are properly torqued and not short bolted (less than three threads showing).

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- Make sure that all BOP control lines and valves are clearly identified.
- If ram-type BOPs are used, at least one ram preventer needs to be sized to fit the tubulars in use.
- Pressure test the BOP equipment system before drilling out any string of casing, with the exception of conductor pipe or drive pipe. Before starting drilling operations, test the BOP equipment. Only proceed with drilling after the BOP equipment is determined to be serviceable.
- Have personnel stay clear of BOPs when they are under well or testing pressures.
- Have personnel stay clear of the rotary table when the BOP is operated.
- If the blind ram preventer is closed for any reason, bleed off pressure by opening the valves on the choke lines or relief lines located below the blind rams before opening the rams.
- Install BOP equipment with remote control systems to prevent failure of one set of controls from affecting operation of the backup system.
- Anchor, tie, or otherwise secure the choke line(s) and kill line(s) to prevent whipping as a result of pressure surges.
- It is not recommended for rig personnel to heat or weld on the BOP equipment.
- During kill operations, shut down unnecessary engines and motors that are not critical to the operation.

### **30.19. MANAGEMENT OF CHANGE PROCEDURE (see also O&M 155)**

*API RP 1171 - Section 11.11*

The following are examples of the types of changes in procedures and processes which the Company has deemed are significant enough to require a Management of Change (MOC) process:

- A new piece of equipment is acquired that allows the Company to perform work which would normally be contracted out.
- A new industry method for a task is adopted that has not been used in the past, which requires additional training (including engineering calculations, approaches, and evaluations).
- A replacement piece of equipment is acquired that requires training.
- A task is no longer performed, or a piece of equipment is no longer used, because that task is now contracted out.

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### 30.20. WELL RECORDS RETENTION PROCEDURE

*API RP 1171 - Section 6.11.1*

The Company shall maintain the following records of well construction and well work activities for the life of the facility, as applicable and available:

#### **Wellhead Equipment and Valves**

- Material and test records
- Design evaluations
- Emergency shutdown valve evaluation
- Inspection and repair records

#### **Well Casing**


- Material and test records
- Design evaluations
- Setting depths of all strings of casing
- Connection design evaluation

#### **Casing Cementing Practices**

- Blends, additives, and volumes pumped
- Volume of cement circulated to surface
- pH of mix water and water temperature
- Pump and displacement rates and displacement times
- Preflush type and volume pumped
- Type of float and centralization equipment and location in string
- Theoretical and actual displacement volumes
- Detail of remedial cementing work performed
- Cement service company's field report and log of job
- Logged cement placement and any evaluation of quality of seal

#### **Completion and Stimulation Considerations**

- Service company field reports and job logs
- Location and description of stimulation treatments
- Composition and volumes of any fluid used
- Cementing reports
- Type of equipment used and location in well
- Cased hole correlation logs
- Post-treatment monitoring data and analysis

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### **Well Remediation**

- Cementing reports
- Type of equipment used and location in well
- Well logs
- Workover and recompletion reports

### **Well Closure**

- Equipment removed from well
- Cementing reports
- Plugging records filed with local regulatory authorities

### **Testing and Commissioning**

- Integrity assessment data
- Pressure test data
- Type and amount of fluid in annulus of tubing and packer completion
- Casing inspection logs

### **Monitoring of Construction Activities**

- Received equipment and material specifications
- Changes in well construction from original well design
- Rig and service company field tickets and job logs
- Daily drilling and servicing reports, geolograph records, and driller's log
- Mud records
- Wireline logs and mud logs


The Company shall retain records relating to permitting, procedures, personnel, and equipment for the amount of time required by regulation, or, where no regulatory requirements exist, for the life of the well. These records shall include, as applicable and available, the following:

### **Environmental, Health, and Safety**

- On-site safety meeting records

### **Monitoring of Construction Activities**

- Supervisor qualifications
- Contractor personnel qualifications
- Equipment suitability records

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<b>Arkansas Appendix – State Plugging and Abandonment Regulations</b>			

## ARKANSAS APPENDIX – STATE PLUGGING AND ABANDONMENT REGULATIONS

Arkansas Oil and Gas Commission Form 11 – Notice of Intent to Plug can be found [here](#).


Arkansas state requirements concerning plugging and abandoning wells are covered under Arkansas Administrative Rule B-7 – When Wells Shall Be Plugged and Abandoned and Notice of Intention to Plug and Abandon Wells. The most current version can be found at the [Arkansas Secretary of State website](#).

In summary, this rule requires all new wells to be properly cased with production casing. If the well is an uncased well or a dry hole, it shall be plugged and abandoned. Prior to commencing plugging and abandonment activities, the permit holder or other party responsible for drilling operations shall give notice of the intent to plug and abandon, as follows:

- For uncased wells and dry holes, notice shall be provided via verbal or facsimile communication to the Commission Regional Office where the well is located, as soon as possible, but no less than 8 hours prior to commencement of plugging operations.
- For cased wells, written notice on a form prescribed by the Director shall be provided to the Commission Regional Office where the well is located at least 72 hours prior to the commencement of plugging operations.

Upon receipt and review of such verbal or written notice, the Commission Regional Office shall authorize the commencement of plugging operations and may send a duly authorized Commission representative to the well location to witness the plugging.

Authorization for plugging and abandoning the well is not granted unless appropriate notice has been provided to the Oil and Gas Commission by the permit holder or other responsible person. Plugging the well without providing proper notice can result in the Permit Holder being required to drill out the well plugs and replug the well under observation by the Commission.

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<b>Colorado Appendix – State Plugging and Abandonment Regulations</b>			

## COLORADO APPENDIX - STATE PLUGGING AND ABANDONMENT REGULATIONS

The Colorado Oil and Gas Conservation Commission (COGCC) is responsible for regulating oil and gas activities in Colorado. Rules for plugging and abandoning wells are covered under Rule 311, which discusses the requirements for filing [COGCC Form 6 – Well Abandonment Report](#). The full wording of this rule can be found [here](#) under 300 Series – Drilling, Development, Production and Abandonment. The requirements for Form 6 are summarized below:

**Notice of Intent to Abandon** - A Well Abandonment Report, Form 6 – Notice of Intent to Abandon, shall be submitted to, and approved by, the Director (of COGCC), prior to abandonment of a well. This form shall be completed with attachments providing a full description of the proposed abandonment method including:

- Proposed depths of mechanical plugs and casing cuts
- Proposed depths and volumes of all cement plugs
- Amount, size, and depth of casing and junk to be left in the well
- Volume, weight, and type of fluid to be left in the wellbore between cement or mechanical plugs
- The nature and quantities of any other materials to be used in the plugging

Along with Form 6, the operator shall provide a current wellbore diagram and a wellbore diagram showing the proposed plugging procedure.

If the well is not plugged within six months of approval, the operator shall file a new Form 6.


**Subsequent Report of Abandonment** - Within 30 days after abandonment, the Well Abandonment Report, Form 6 - Subsequent Report of Abandonment, shall be filed with the Director. The following will be included:

- An account of the manner of performing the abandonment or plugging work
- Copies of any casing pressure test results and downhole logs run during plugging and abandonment
- Plugging Verification Reports detailing all procedures (one report for each person or contractor setting the plugs)

The Form 6 - Subsequent Report of Abandonment and the Plugging Verification Reports shall include:

- The depths of mechanical plugs and casing cuts
- The depths and volumes of all cement plugs
- The amount, size, and depth of casing and junk left in the well
- The volume and weight of fluid left in the wellbore



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- The nature and quantities of any other materials used in the plugging


Plugging Verification Reports shall conform to the operator's report and both shall show that plugging procedures are at least as extensive as those approved by the Director.

**Re-Plugging.** A Well Abandonment Report, Form 6 – Notice of Intent to Abandon, shall be submitted to, and approved by, the Director prior to the re-entry of a plugged and abandoned well for the purpose of re-plugging the well.

A Well Abandonment Report, Form 6 - Subsequent Report of Abandonment shall be filed with the Director within 30 days of the completion of the re-plugging operations. These forms shall be submitted with all the information required above and any additional information required by current policy.

**As-Drilled Location.** For all wells being plugged, the latitude and longitude coordinates of the “as drilled” well location shall be reported on the Form 6.

- When plugging a well for which this data has been obtained and submitted to the Commission previously, the Operator shall submit this data on the Form 6 – Notice of Intent to Abandon.
- When plugging a well for which this data has not yet been obtained and submitted to the Commission, the Operator shall determine the “as drilled” location prior to plugging and submit the location on the Form 6 – Subsequent Report of Abandonment.
- The latitude and longitude coordinates shall be in decimal degrees to an accuracy and precision of five decimals of a degree using the North American Datum (NAD) of 1983.
- If GPS technology is utilized to determine the latitude and longitude, all GPS data shall meet the requirements set forth in Rule 215 and the following shall also be reported on the Form 6:
  - Position Dilution of Precision (PDOP) reading
  - The GPS instrument operator's name
  - The date of the GPS measurement

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## WYOMING APPENDIX - STATE PLUGGING AND ABANDONMENT REGULATIONS

Wyoming state regulations concerning plugging and abandoning wells can be found on the Wyoming Oil & Gas Conservation Commission (WOGCC) [website](#). For the full text of the Rules, consult the website. The following summarizes these requirements:

**Notice of Intent to Abandon Well** (Chapter 3, Section 15): Form 4 – Notice of Intent to Abandon shall be filed with the Supervisor and approval obtained as to method of abandonment before the abandonment work is started. The notice must include:


- Reason for abandonment
- Detailed statement of proposed work, including kind, location, and length of plugs (by depths)
- Plans for mudding, cementing, shooting, testing, and removing casing
- Any other pertinent information

The approval shall be valid for a period of one year. If the abandonment has not been performed by that time, a new Notice of Intent to Abandon will be required.

If the well or hole to be plugged may be used safely as a fresh water well, the well does not need to be filled above the required sealing plug set below fresh water, provided that the Owner/Operator submits a request for such use executed by the landowner. This notarized request must assume responsibility for plugging the well upon its abandonment as a water well. For further details on this scenario, see Chapter 3, Section 15 (b) in the WOGCC Rules.

**Subsequent Report of Abandonment (SRA)** (Chapter 3, Section 17): A notarized Subsequent Report of Abandonment (Form 4, Sundry Notice) must be filed with the Supervisor within thirty (30) days of the date of plugging. The reverse side of the SRA (Form 4, Affidavit of Plugging) must be signed and notarized. The SRA shall give a detailed account of how the abandonment or plugging work was carried out, including the following:

- Weight of mud
- Nature and quantities of materials used in plugging
- Location and extent (by depths) of the plugs of different materials
- Job log or cement verification report from the plugging contractor specifying:
  - The type of fluid used to fill the wellbore
  - Type of slurry volume of API Class cement used
  - Date of Work
  - Depth of plugs placed
- Records of any test or measurement made
- Records of the amount, size, and location (by depths) of casing

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Site reclamation must be initiated within one year of permanent abandonment of a well and must be completed in as timely a manner as possible based on climate conditions.

- For just cause, the Supervisor may grant an administrative variance allowing additional time to complete the reclamation.
- Reclamation must be completed in accordance with the landowner's reasonable requests and/or resemble the original vegetation and contour of adjoining lands.
- Where practical, topsoil must be stockpiled during construction to be used in the reclamation.
- All disturbed areas on state lands will be re-contoured and reseeded unless otherwise approved by the Wyoming Office of State Lands and Investments.

When rehabilitation of the surface has been completed, the Operator or Owner shall advise the Supervisor by submitting a Sundry Notice (Form 4) marked to indicate this completion. The SRA will be approved only after a Commission staff member has inspected the site and recommended it for bond release. This inspection will only be performed after receiving the notice that the rehabilitation is complete.

**Well Designations and Markers** (Chapter 3, Section 19): Plugged and abandoned wells shall be marked with a permanent monument consisting of a piece of pipe that is at least four inches in diameter and no less than ten feet in length, four feet of which shall be above ground level with the remainder embedded securely in cement. The top of the pipe must be permanently sealed. The following information must be shown on this monument:

- The Operator name
- The lease
- The well number
- Location of the well

**Well Records and Reports** (Chapter 3, Section 20): The Owner/Operator shall keep accurate and complete records of all well operations including plugging and abandonment. These records shall be on the leased premises, the Operator's headquarters in the field, or otherwise conveniently available to the Supervisor.