



Enbridge
5400 Westheimer Court
Houston, Texas 77056

February 18, 2020

Robert Burrough
Director, Eastern Region
Pipeline and Hazardous Materials Safety Administration
840 Bear Tavern Road
Suite 300
West Trenton, NJ 08628

**RE: Texas Eastern Transmission, LP Response
Notice of Amendment
CPF 1-2019-1023M**

Dear Mr. Burrough,

From August 20, 2019 to August 22, 2019, an inspector from the Pipeline and Hazardous Materials Safety Administration (PHMSA) pursuant to Chapter 601 of 49 United States Code (U.S.C.), inspected portions of Texas Eastern Transmission, LP's (TETLP)¹ Accident Underground Natural Gas Storage facility in Garrett County, MD.

On December 19, 2019, PHMSA issued a Notice of Amendment (NOA)² alleging two (2) inadequacies found within TETLP's plans or procedures. The following is a brief summary of PHMSA's finding and TETLP's response.

The following is a brief summary of PHMSA's findings and Texas Eastern Accident UGS's response.

1. §192.12 Underground natural gas storage facilities.

PHMSA Finding

Texas Eastern's written procedures for implementing the requirements of API RP 1171 were

¹ Texas Eastern Transmission, LP, is a subsidiary of Enbridge

² TETLP requested a time extension on January 17, 2020 to enable TETLP fully review the issue and prepare a comprehensive response the NOA. PHMSA granted the time extension on January 17, 2020.

inadequate. Specifically, Texas Eastern's procedures did not adequately define annular gas threshold levels, as required by API RP 1171, Section 9.3.2.

Section 9.3.2 states in part:

The operator shall evaluate each annular gas occurrence that exceeds operator or regulatory-defined threshold levels determined from well integrity evaluation and from risk assessment.

Texas Eastern's method for calculating annular gas threshold levels resulted in some threshold levels exceeding the MAOP of the field.

TETLP Response

TETLP acknowledges that revisions are required to TETLP's Standard Operating Procedure, SOP-11-5020, Annulus Pressure Management, to include the definition to adequately define annular gas threshold levels, as required by API RP 1171, Section 9.3.2. TETLP has since made revisions to this procedure to include the method for calculating the annular gas threshold levels to ensure the annular gas threshold levels do not exceed the MAOP. A copy of a redline version is enclosed. The revisions to address this NOA are in Section 2.3.5, page 4 of 8.

2. §192.12 Underground natural gas storage facilities.

PHMSA Finding

Texas Eastern's written procedures for implementing the requirements of API RP 1171 were inadequate. Specifically, Texas Eastern's procedures did not adequately address how it would monitor for the presence of annular gas, as required by API RP 1171, Section 9.3.2.

Section 9.3.2 states in part:

The operator shall monitor for presence of annular gas by measuring and recording annular pressure and/or annular gas flow.

Texas Eastern's procedure for monitoring gas in an annulus open to the atmosphere required measuring the pressure buildup after a 5-minute shut-in time. Texas Eastern did not include subsequent actions if gas is detected in the annulus. The process is inadequate due to the lack of follow-up actions if gas is detected.

TETLP Response

TETLP acknowledges that revisions are required to TETLP's Standard Operating Procedure, SOP-11-5020, Annulus Pressure Management and SOP 11-5330, Well Site and Wellhead Visit and Inspection – Reservoir Storage Fields, to adequately address how it would monitor for the presence of annular gas, as required by API RP 1171, Section 9.3.2. TETLP has since made revisions to these procedures to clarify the monitoring of gas in an annulus open to the atmosphere and subsequent follow-up actions if gas is detected. Copies of the redline versions are enclosed. The revisions to address this NOA are in Section 4.0 and 5.0, page 4 to 6 of SOP 11-5020 and section 3.0, page 5 of SOP 11-5330.

We trust that the revisions to SOP 11-5020 and SOP 11-5330 adequately address the issues noted in the NOA, and TETLP respectfully requests PHMSA to close this NOA.

Please call me at (713) 627-5008 if you need additional information to consider this request.

Sincerely,



Nathan Atanu

Manager, Operational Compliance

Spectra Energy Transmission

Procedure Name: <i>Annulus Pressure Management</i>	Procedure Number: 11-5020	
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Description	<p>This procedure describes the process by which the Maximum Allowable Annulus Surface Pressure (MAASP) is calculated, and how annulus pressures are monitored and managed. The regular monitoring of annuli during well operations enables early detection of threats to, or a potentially compromised, well casing.</p> <p>The SOP contains the following sections:</p> <ol style="list-style-type: none"> 1.0 General 2.0 Calculation of Maximum Allowable Annulus Surface Pressure (MAASP) 3.0 Annulus Pressure Monitoring 4.0 Management of Annulus Pressure <u>Closed Annulus Management</u> 5.0 <u>Open Annulus Management</u>
Frequency	<p>Monthly monitoring; see per <u>SOP 11-5330 “Well Site and Wellhead Visit and Inspection - Reservoir Storage Fields”</u></p> <p>MAASP calculated as required (see procedure herein)</p>
Responsibility	Storage Area Management and US Underground Storage, unless otherwise noted.
Safety Warnings	None
Documentation and Recordkeeping	Storage Monitor
Related Procedures	<p><u>SOP 11-5150 “Records, Records Retention and Reporting Requirements”</u></p> <p><u>SOP 11-5330 “Well Site and Wellhead Visit and Inspection - Reservoir Storage Fields”</u></p> <p><u>SOP 10-2170, “Maximum Allowable Operating Pressures – US Underground Storage”</u></p>
Related API RP 1171 Sections and Industry Standards	<p>API RP 1171: 7.4.2, 9.3.2</p> <p>ISO 16530 – 1.2 Petroleum and Natural Gas Industries – Well Integrity – Life Cycle Governance</p>

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Procedure Name: <i>Annulus Pressure Management</i>	Procedure Number: 11-5020	
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Possible AOCs	<ul style="list-style-type: none">Anomalous high pressure <u>or flow rate</u>
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Procedure

1.0 General

- 1.1 Enbridge monitors the production casing annulus pressures as part of the overall well integrity monitoring program.
- 1.2 Enbridge has established the Maximum Allowable Annulus Surface Pressure (MAASP) for each well annulus to ensure that mitigations are taken if a well annulus were ever to exceed the established MAASP.
- 1.3 Refer to Figure 1 herein for a diagram of a typical wellbore cross-section.

2.0 Calculation of Maximum Allowable Annulus Surface Pressure (MAASP)

2.1 The calculated maximum allowable annulus surface pressure (MAASP) is the highest pressure that an annulus is permitted to contain, as measured at the wellhead, without potentially compromising the integrity of any well barrier element (WBE) of that annulus.

2.2 The MAASP should be determined for each B annulus.

2.3 ~~Determination of MAASP is calculations are~~ based on the following ~~potential failure modes~~ calculations.

2.3.1 Formation Fracture/Breakdown

2.3.1.1 The formation fracture breakdown pressure of the Maximum Allowable Wellhead Operating Pressure (MAWOP) for the annulus being evaluated is determined by the following:

2.3.1.2 Formation fracture breakdown component = $0.8 * \text{Depth to Casing Seat} * \text{Formation Fracture Gradient}$

2.3.1.3 A safety factor of 80% is used

2.3.2 Wellhead Component Rating

2.3.2.1 The wellhead rating component of the MAWOP for the annulus being evaluated is determined by the following:

2.3.2.2 Wellhead component rating = $0.8 * \text{Rated Working Pressure}$

2.3.3 Burst Pressure of Outer Casing

2.3.3.1 $\Delta P_{\text{annulus.v.csg}}$ is the pressure differential from the inside to the outside of the casing at worst case depth (psi). This is calculated as (inside fluid gradient \times TVD) – (outside fluid gradient \times TVD plus annulus surface pressure). MAASP calculations for Burst are made within the Storage Monitor.

2.3.3.2 If other well configurations are encountered, Burst Pressure should be calculated for its effect on MAASP.

2.3.4 Collapse Pressure of Production Casing

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2.3.4.1 $\Delta P_{\text{annulus.v.csg}}$ is the pressure differential from the outside to the inside of the casing at worst case depth (psi). This is calculated as (outside fluid gradient \times TVD) – (inside fluid gradient \times TVD plus annulus surface pressure). As this SOP is for dry gas wells, Collapse Pressure will not factor in to MAASP calculations.

2.3.4.2 If other well configurations are encountered, Collapse Pressure should be calculated for its effect on MAASP.

2.3.5 Field Injection MAOP

2.3.4.2.3.5.1 In addition to considering the above calculations, the MAASP on each B annulus shall not exceed the field Injection MAOP. Refer to SOP 10-2170, “Maximum Allowable Operating Pressures – US Underground Storage”.

2.4 The MAASP value to select for operational usage is the lowest value obtained from each of the calculations.

2.5 The MAASP should be re-determined if:

2.5.1 There are changes in WBE performance standards,

2.5.2 There are changes in the service type of the well,

2.5.3 There are annulus fluid density changes,

2.5.4 Loss of tubing and/or casing wall thickness has occurred,

2.5.5 There are changes in reservoir pressures outside the original load case calculation.

2.6 The current MAASP is calculated and maintained in the Storage Monitor.

These steps represent a generalized outline of work flow. Each well should be individually analyzed based on well characteristics, well equipment and other well-specific information.

3.0 Annulus Pressure Monitoring

3.1 Refer to SOP 11-5330 “Well Site and Wellhead Visit and Inspection - Reservoir Storage Fields” individual facility Monthly Wellhead SOPs for monitoring method in use.

4.0 Closed Annulus Management

MAASP: Maximum Allowable Annulus Surface Pressure

AOC-P: Abnormal Operating Condition – Pressure

TRC-P: Threshold Range Condition - Pressure

4.1 Measure annular pressure per SOP 11-5330 “Well Site and Wellhead Visit and Inspection - Reservoir Storage Fields”.

4.2 If pressure is below TRC-P, continue pressure monitoring as established per SOP 11-5330.

4.3 If pressure is above TRC-P and below AOC-P:

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4.3.1 Make Storage and Area notifications.

4.3.2 Increase frequency of pressure monitoring to twice monthly and record two months.

4.3.3 If pressure is increasing or is above AOC-P, notify Storage and Area and proceed to Step 4.4.

4.3.4 If pressure is not increasing, revert to established pressure monitoring per SOP 11-5330.

4.4 If pressure is above AOC-P:

4.4.1 Make Storage and Area notifications.

4.4.2 Check and re-energize wellhead seals as possible.

4.4.2.1 If wellhead seal holds pressure, proceed to Step 4.4.3.

4.4.2.2 If wellhead seal has failed, set plug(s) in well, develop plan and execute wellhead repair or WHCO.

4.4.3 Bleed pressure below TRC-P and document build-up. Bleed-down and build-up durations to be determined by observation of pressure behavior.

4.4.4 Monitor pressure, repeat bleed-down/build-up at intervals to be determined.

4.4.5 Measure annular pressure

4.4.5.1 If pressure is below TRC-P and is stable (i.e. not increasing or slowly increasing), revert to established pressure monitoring per SOP 11-5330.

4.4.5.2 If pressure is above TRC-P and below AOC-P and stable, revert to established pressure monitoring per SOP 11-5330.

4.4.5.3 If pressure is trending above AOC-P or above AOC-P, open annulus and go to [Section 5.0, Open Annulus Management Flow Management Chart](#).

5.0 Open Annulus Management

AOC-F: Abnormal Operating Condition – Flow

TRC-F: Threshold Range Condition – Flow

5.1 Measure flow rate per SOP 11-5330 “[Well Site and Wellhead Visit and Inspection - Reservoir Storage Fields](#)”.

5.2 If the flow rate is below the TRC-F, continue monitoring per SOP 11-5330 “[Well Site and Wellhead Visit and Inspection - Reservoir Storage Fields](#)”.

5.3 If the flow rate is between the TRC-F and the AOC-F:

5.3.1 Notify Storage and Area notifications.

5.3.2 Review well records, logs, and offset well records.

5.3.3 Increase frequency of flow rate testing to twice monthly and record two months.

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5.4 If the flow rate is not increasing, revert to established testing interval per SOP 11-5330.

5.5 If the flow rate is above the AOC-F, complete State (within 24 hours), Storage and Area notifications.

5.6 If the flow rate is still increasing or is above AOC-F:

5.6.1 Check and re-energize wellhead seals as possible.

5.6.2 If the wellhead seal has failed,

5.6.2.1 Set plug(s) in well,

5.6.2.2 Develop plan, and

5.6.2.3 Execute wellhead repair or WHCO.

5.6.3 If the wellhead seal has not failed, perform the following steps:

5.6.3.1 Perform well diagnostics.

5.6.3.2 Perform build-up/bleed down test. Build-up and bleed-down durations to be determined based on observation of pressure behavior.

Do not exceed TRC-P

5.6.3.3 Repeat build-up/bleed down test as necessary.

5.6.3.4 Run GNT, HRV, caliper logs.

5.6.4 If there is a breach in the production casing, set plug in well below breach and develop plan; execute re-line, P&A or other workover.

5.6.5 If there is no breach in the production casing, perform the following tasks:

5.6.5.1 Capture gas sample and perform isotopic test.

5.6.5.2 Evaluate possible source, mechanism and risk of behind-casing flow.

5.6.5.3 Prepare plan to re-establish annulus integrity.

5.6.5.4 Load well with fluid or set plug above storage zone.

5.6.5.5 Develop plan and execute milling/underreaming/remedial cement or other workover.

~~4.0 Management of Annulus Pressure~~

~~4.1 The upper threshold limit for annulus pressure is 80% of MAASP.~~

~~4.1.1 When the annulus pressure reaches the upper threshold limit, an email notification will be sent to US Underground Storage and Storage Area Management via the Storage Monitor for continued monitoring until the pressure is again within operating range.~~

~~4.1.2 If the annulus pressure continues to rise and approaches or has exceeded the MAASP, it should be bled off to a pressure within the operating range.~~

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- ~~4.1.2.1 The type and total volume of the fluid recovered, all annulus pressures and the time to bleed down should be documented for each bleed down.~~
- ~~4.1.2.2 The frequency of bleed downs and the total volume of fluids recovered from the bleed downs should be monitored and recorded.~~
- ~~4.1.3 A review will be conducted to investigate the cause of the pressure excursion.~~
- ~~4.2 A review may also be based on deviations from the historical observations for the following:~~
 - ~~4.2.1 Frequency of annulus pressure bleed downs.~~
 - ~~4.2.2 The presence of abnormal pressure trends (indicating leaks to/from an annulus).~~
 - ~~4.2.3 Length of time of annulus bleed downs.~~
 - ~~4.2.4 Type of fluid used or recovered.~~
- ~~4.3 Results of the review are stored in the Storage Monitor.~~

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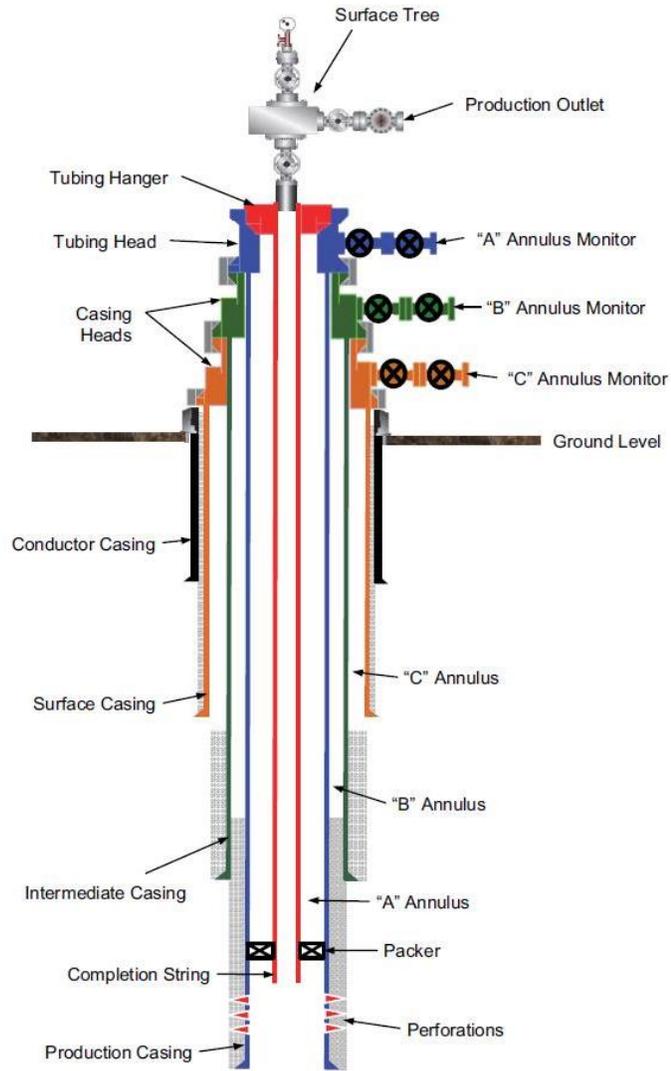


Figure 1 - Typical Wellbore Cross-Section

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Procedure Name: <i>Well Site and Wellhead Visit and Inspection – Reservoir Storage Fields</i>	Procedure Number: 11-5330	
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Description	<p>This procedure describes the requirements for the wellhead and well location inspection, and includes the required form.</p> <p>This SOP contains the following sections:</p> <ol style="list-style-type: none"> 1.0 General 2.0 Category 1 - Site Conditions Data 3.0 Category 2 – Flow Valve Position 4.0 Category 3 – Well Status Data 5.0 Category 4 – Storage Readings 6.0 Category 5 – Annulus Readings 7.0 Category 6 – Methanol Usage 8.0 Recordkeeping
Frequency	Each Site Visit, at a minimum of one visit per calendar month.
Responsibility	Storage Area Management, unless otherwise noted.
Safety Warnings	None
Related Sections of API RP 1171	API RP 1171 9.3.2
Documentation	Storage Monitor
Related Procedures	<p><u>SOP 11-5020 Annulus Pressure Management</u></p> <p><u>SOP 11-5190 Risk Management</u></p> <p><u>SOP 11-5360 Data Collection – Reservoir Storage Fields</u></p> <p>SOP 11-5020 Annulus Pressure Management</p> <p>SOP 11-5190 Risk Management</p> <p>SOP 11-5360 Data Collection – Reservoir Storage Fields</p>
Possible AOCs	<ul style="list-style-type: none"> • Evidence of a leak • Evidence of corrosion

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	<ul style="list-style-type: none">• Exceedance of maximum allowed storage <u>or annulus</u> pressures <u>or flows</u>• Access to site restricted
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Procedure

1.0 General

- 1.1 Periodic physical visits, at a minimum of once per calendar month, will be made to each well site for the purpose of monitoring the well site status and the wellhead integrity.
 - 1.1.1 Visits or site inspection of well sites shall include a visual inspection of the well site, wellhead assembly, wellsite surface equipment and other observable field conditions.
 - 1.1.2 Additionally, data can be collected from remote devices without visiting and be recorded by following the steps in this SOP.
 - 1.1.3 The attached form will be used to record information from the site visit.
 - 1.1.4 Information is permanently recorded by entry into the Storage Monitor – Site Visit screen.
 - 1.1.5 The collected data will be used, as applicable, in the assessment of threat and hazard interaction.
- 1.2 Abnormal Operating Conditions observed during the site visit will be documented and tracked in the Storage Monitor system.
- 1.3 The conditions related to the following categories shall be observed and recorded during each site visit inspection:
 - 1.3.1 Site Conditions
 - 1.3.2 Flow Valve Position
 - 1.3.3 Wellhead Status
 - 1.3.4 Storage Gas Pressure and Temperature
 - 1.3.5 Annulus Valve Position and Annulus Gas Pressure
 - 1.3.6 Methanol Usage

2.0 Category 1 - Site Conditions Data

- 2.1 If this data was collected by an actual physical visit to the well site, check the box “Site was Visited”
- 2.2 Document the status of site security by checking the boxes for “Site Was Secure” and “Well Was Chained & Locked”.
- 2.3 If the signage needs repair, check “Has a Problem” and describe in the “Comments” box. Otherwise, check “Good”.
- 2.4 Leaks and Corrosion Observations

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- 2.4.1 If a gas leak was observed, document the occurrence by checking the appropriate box: “Leak-Wellhead”; “Leak-Meter Run”; “Leak-Other”.
- 2.4.2 If corrosion on the wellhead was observed, document by checking the appropriate box: “Wellhead-Rust”; “Wellhead-Corrosion”.
- 2.5 If access to the well site was restricted, note that AOC by checking the box “No Access to Site”.
- 2.6 If the information recorded was not obtained by an actual physical visit, check the box “Not Visited”.
- 2.7 Record any comments in the “Comments” box.
- 3.0 Category 2 – Flow Valve Position
 - 3.1 “Flow Valve” is the valve used in normal storage injection and withdrawal operations to allow to and from the well.
 - 3.1.1 Check the appropriate box: “Flow Valve is Open”; “Flow Valve is Closed”; “Flow Valve was left Unchanged”.
 - 3.2 Record any comments in the “Comments” box.
- 4.0 Category 3 – Well Status Data
 - 4.1 If the well is available for normal storage injection and withdrawal operations (independent of flow valve position), check the box “Well is Available”.
 - 4.2 If the well is not available for normal storage injection and withdrawal operations (independent of flow valve position), check the box “Well is not Available”.
 - 4.3 Document the reason the well is not available:
 - 4.3.1 If the well is classified as an Observation Well, check the box: “Is an OBS Well”.
 - 4.3.2 If the well and wellbore are blown down, check the box: “Blown Down”.
 - 4.3.3 If there is a freeze or hydrate in the well, check the box: “Frozen in Well”.
 - 4.3.4 If there is a freeze or hydrate in the field line to the well, check the box: “Frozen in Line”.
 - 4.3.5 If the well is shut-in for Field Maintenance, check the box: “SI for Field Maintenance”.
 - 4.3.6 If the well is shut-in for well logging, check the box: “SI for Well Logging”.
 - 4.3.7 If the well is shut-in for the SAPT Semi-Annual Pressure Test, check the box: “SI for Semi-Annual Test”.

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4.3.8 If the well is Temporarily Abandoned, check the box: “Temp Abandoned”. An example is a well with bridge plugs in the wellbore.

4.3.9 If the well is shut-in for a reason not listed, check the box: “Other”.

4.4 Record any comments in the “Comments” box.

5.0 Category 4 – Storage Readings

5.1 This Category documents gas pressure and gas temperature (if temperature was collected) gathered at the wellhead gauging point most directly related to the gas storage zone.

5.2 Enter the wellhead gas pressure in psig. Only enter a zero reading “0” when the wellhead storage pressure is zero at the surface.

5.3 During withdrawal operations, the flowing temperature of the gas is an important data point to help diagnose and locate freeze-offs. Enter the wellhead gas temperature in Fahrenheit. Only enter a zero reading “0” when the wellhead storage temperature is 0°F at the temperature measuring location.

5.4 Record any comments in the “Comments” box.

6.0 Category 5 – Annulus Readings

6.1 This Category documents the status of the annular space directly outside of the casing holding the storage zone gas. Generally this is known as the “B Annulus”. Some wells have an additional “C Annulus”.

6.2 Frequency:

6.2.1 Accident Gas Storage – inspect annuli at least once per quarter.

6.2.2 Early Grove Storage - inspect annuli at least once per month.

6.2.3 Steckman Ridge Storage - inspect annuli at least once per month.

6.2.4 Refer to SOP 11-5020 Annulus Pressure Management for additional instructions on inspecting well annuli.

6.3 Annulus Inspection:

6.3.1 If the annulus is open, the flow rate will be measured and recorded.

6.3.2 If the annulus is shut in, record the annulus pressure.

~~6.3.1 If the annulus is normally open, shut in and record 5 minute shut in pressure; re-open the annulus.~~

~~6.3.2 If the annulus is normally closed, record the annulus pressure.~~

6.4 Record any comments in the “Comments” box.

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- 7.0 Category 6 – Methanol Usage
 - 7.1 Record the amount of methanol in gallons put into the bottle or tank.
 - 7.2 Record the amount of methanol in gallons put into the well.
 - 7.3 Record any comments in the “Comments” box.
- 8.0 Recordkeeping
 - 8.1 Enter the data collected into the Storage Monitor.

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Record of Well Site Visit and Inspection

Field:	Well:	Date/Time:	
Category 1: Site Conditions	<input type="checkbox"/> Site was visited	<input type="checkbox"/> No access to site	<input type="checkbox"/> Not visited
<i>Site Security</i>	<input type="checkbox"/> Site was secure	<input type="checkbox"/> Well was chained & locked	
<i>Signage Condition</i>	<input type="checkbox"/> Good	<input type="checkbox"/> Has a Problem	
<i>Corrosion</i>	<input type="checkbox"/> Wellhead - Rust	<input type="checkbox"/> Wellhead - Corrosion	Explain:
<i>Leak</i>	<input type="checkbox"/> Leak - Wellhead	<input type="checkbox"/> Leak - Meter Run	<input type="checkbox"/> Leak - Other
<i>Comments</i>			
Category 2: Flow Valve Position	<input type="checkbox"/> Flow Valve is Open	<input type="checkbox"/> Flow Valve is Closed	<input type="checkbox"/> Flow Valve was left Unchanged
	Comments:		
Category 3: Well Status	<input type="checkbox"/> Well is Available	<input type="checkbox"/> Well is not Available	<input type="checkbox"/> Is an OBS Well <input type="checkbox"/> Blown Down <input type="checkbox"/> Frozen in Well <input type="checkbox"/> Frozen in Line <input type="checkbox"/> SI for Field Maintenance <input type="checkbox"/> SI for Well Logging <input type="checkbox"/> SI for Semi-Annual Test <input type="checkbox"/> Temp Abandoned
	Comments:		
Category 4: Storage Readings	Wellhead Gas Pressure:	psig	Wellhead Temperature:
	Comments:		

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Category 5: Annulus Readings	For primary annulus (B Annulus) and, if present, secondary (C Annulus):	
<i>Annulus is Open</i>	5 min SI Pressure <u>Measure and record the flow rate:</u>	
<i>Annulus is Closed</i>	SI Pressure:	Comments:
Category 6: Methanol Usage	Gallons put in Bottle/Tank:	Gallons put in Well:
	Comments:	