

DRAFT FOR TAB DISCUSSION PURPOSES ONLY
DEPARTMENT OF ENVIRONMENTAL PROTECTION
Office of Oil and Gas Management

DOCUMENT NUMBER: 800-0810-003

TITLE: Guidelines for Development of Operator Pressure Barrier Policy for Unconventional Wells

EFFECTIVE DATE: Upon publication of notice as final in the *Pennsylvania Bulletin*

AUTHORITY: The 2012 Oil and Gas Act (58 Pa.C.S. §§ 3201–3274)
The Clean Streams Law (35 P.S. § 691.1 *et seq.*)
Solid Waste Management Act (35 P.S. § 6018.101 *et seq.*)
Oil and Gas Conservation Law (58 P.S. § 401 *et seq.*)
25 Pa. Code §§ 78a.54-78a.58 and 78a.60-78a.61, 78a.71, 78a.72, 78a.74, 78a.76, 78a.84, 78a.87, 79.12

POLICY: Unconventional operators should follow these guidelines to develop a *Pressure Barrier Policy* (PBP) prior to the commencement of well drilling. The PBP should consider when and what type of pressure barriers are needed to control *fluids* in a manner that will reasonably ensure well control and protection of public health, public safety and the environment.

PURPOSE: The purpose of these guidelines is to assist unconventional operators developing the PBP component of a Preparedness, Prevention and Contingency (PPC) plan. Recommendations relevant to maintaining compliance with the requirements of Chapter 78a, including associated American Petroleum Institute (API) Standards or Recommended Practices incorporated therein, and any additional requirements set forth in The Clean Streams Law, Solid Waste Management Act, the 2012 Oil and Gas Act and other applicable laws and regulations are summarized. These guidelines have been developed to facilitate appropriate *well control incident* risk mitigation.

APPLICABILITY: This guidance document applies to unconventional operators drilling wells in the Commonwealth of Pennsylvania.

DISCLAIMER: The policies and procedures outlined in this guidance are intended to supplement existing requirements. Nothing in the policies or procedures shall affect regulatory requirements.

The policies and procedures herein are not an adjudication or a regulation. DEP does not intend to give this guidance that weight or deference. This document establishes the framework, within which DEP will exercise its administrative discretion in the future. DEP reserves the discretion to deviate from this policy statement if circumstances warrant.

PAGE LENGTH: 12 pages

I. BACKGROUND

Section 78a.55 (relating to control and disposal planning; emergency response for unconventional wells) outlines the requirements for the development and maintenance of Preparedness, Prevention and Contingency (PPC) plans for unconventional well sites. *See* 25 Pa. Code § 78a.55. DEP developed this guidance and audit process/model plan, set forth below, to address certain requirements of this section relating to the maintenance of well control. Specifically, Section 78a.55(d) requires unconventional well operators to develop a *Pressure Barrier Policy* (PBP). *See* 25 Pa. Code § 78a.55(d). DEP interprets this provision as requiring unconventional operators to consider and identify when and what type of pressure barriers are needed during oil and gas operations; including, but not limited to, drilling (casing and cementing), hydraulic fracturing, completion, alteration, plugging, workover activities and maintenance and/or repair of associated equipment. Further, and in accordance with 25 Pa. Code § 78a.72(i), at least two *mechanical pressure barriers* are required between the open formation and the atmosphere that are capable of being tested during well drilling and completion operations. Related requirements can be found in Sections 78a.71 (relating to use of safety devices – well casing), 78a.72 (relating to use of safety devices – blow-out prevention equipment) and associated API Standards or Recommended Practices incorporated by reference, 78a.74 (relating to venting of gas), 78a.84 (relating to casing standards), 78a.76 (relating to drilling within a gas storage reservoir area), 78a.87 (relating to gas storage reservoir protective casing and cementing procedures) and 79.12 (relating to waste prevention).

An operator may find that a PBP prepared for one well is applicable to another well. Subsurface conditions, as evaluated by the operator, dictate whether or not that is the case. When applicable, the operator may use one PBP for more than one well, but should clearly identify the wells at which the PBP applies and also provide justification for the applicability of the plan to multiple locations. The PBP may also exist under a separate cover and be referenced in the PPC plan, but must be available at the well site during drilling and completion and should be available at the well site during any other identified operations that require a pressure barrier.

Finally, the guidelines that follow should be considered by the operator when developing a PBP, but requirements need not be addressed in the specific format presented in the audit process or model plan. Further, in some cases, DEP has recommended that other information be assembled in the PBP either as a best management practice (BMP) or for clarifying purposes, but it is not required that such information be included if no specific regulatory or statutory provision exists, or if the regulatory or statutory provision that is referenced is not directly applicable to the corresponding unconventional well or well operation.

II. DEFINITIONS

This section of the document provides the definitions of terms from the 2012 Oil and Gas Act and Chapter 78a, as well as terms used in this guidance. The terms defined in this section are italicized throughout the document.

Coal operator – A person that operates or proposes to operate a coal mine as an owner or lessee. 58 Pa.C.S. § 3203. For the purpose of these guidelines, *coal operator* refers only to the person that operates or proposes to operate an underground coal mine.

DRAFT FOR TAB DISCUSSION PURPOSES ONLY

Fluids – Natural gas, including coal bed methane; condensate; oil; brine; or other liquids associated with geologic formations.

Kick – A flow of formation *fluids* into the well bore during drilling operations (adapted from Schlumberger Oilfield Glossary).

Mechanical pressure barriers – A subset of physical barriers that feature mechanical equipment which are capable of being tested; this does not include cement or a hydrostatic fluid column, which would also be considered pressure barriers. Examples of mechanical barriers include ram-type blow-out preventers (BOPs) and annular-type BOPs (adapted from API RP 65-2, 3.1.34, 2016).

Pressure barrier policy – A plan developed by an unconventional operator prior to the commencement of well drilling identifying the combination of *well barrier elements* that together constitute a method of containment of *fluids* within a well that prevents uncontrolled flow of *fluids* into another formation or to escape at the surface to be used during identified operations (adapted from International Well Control Forum (IWCF) Well Control and Barrier Definitions).

Reservoir protective area – The area surrounding a storage reservoir boundary, but within 2,000 linear feet of the storage reservoir boundary, unless an alternate area has been designated by the Department of Environmental Protection, which is deemed reasonably necessary to afford protection to the reservoir, under a conference held in accordance with section 3251 (relating to conferences). 58 Pa.C.S. § 3203.

Sensitive offset environment – Local facilities, infrastructure, and other designated areas that could potentially be impacted more significantly by a *well control emergency* or *well control incident/loss of well control*. In the context of these guidelines, such facilities and infrastructure include, but may not be limited to: underground coal mines (note that it may also be important to consider proximity to underground, non-coal mineral mines); underground gas storage fields; public water supplies; schools; churches; hospitals; residential areas; flood zones; active fault areas; threatened and endangered or protected species habitats; wetlands; and archeological, recreational, biological or scenic areas.

Well barrier element or *barrier element* – Barrier component of a well designed to prevent *fluids* from flowing unintentionally from a formation into another formation or to escape at surface (adapted from IWCF Well Control and Barrier Definitions). *Well barrier elements* include, but are not limited to, casing, cement, and well heads.

Well control emergency – An incident during drilling, operation, work-over or completion that, as determined by DEP, poses a threat to public health, welfare or safety, including a loss of circulation *fluids*, *kick*, casing failure, blowout, fire and explosion. 58 Pa.C.S. § 3203.

Well control incident/loss of well control – A scenario where the treatment pressure, producing pressure, and/or annular pressure of the well being treated deviates from anticipated pressures in a manner that indicates mechanical integrity has been compromised and continued operations pose a risk to personnel safety, equipment integrity, or the environment (adapted from API RP 100-1, 9.4.5, 2015).

III. OPERATIONS ADDRESSED IN PRESSURE BARRIER POLICY

This guidance identifies the following operations to be addressed in a PBP:

- (1) Drilling a well that is intended to produce natural gas from an unconventional formation.
- (2) Drilling out solid core hydraulic fracturing plugs to complete a well.
- (3) Operations on wells when well head pressures or natural open flows are anticipated at the well site that may result in a *loss of well control*.
- (4) Drilling in an area where there is no prior knowledge of the pressures or natural open flows to be encountered.
- (5) Operations associated with wells regulated by the Oil and Gas Conservation Law (58 P.S. §§ 401—419).
- (6) Drilling within 200 feet of a building.
- (7) Drilling within a gas storage reservoir or within the gas storage *reservoir protective area*.
- (8) Other identified operations requiring a pressure barrier, as determined by the operator.

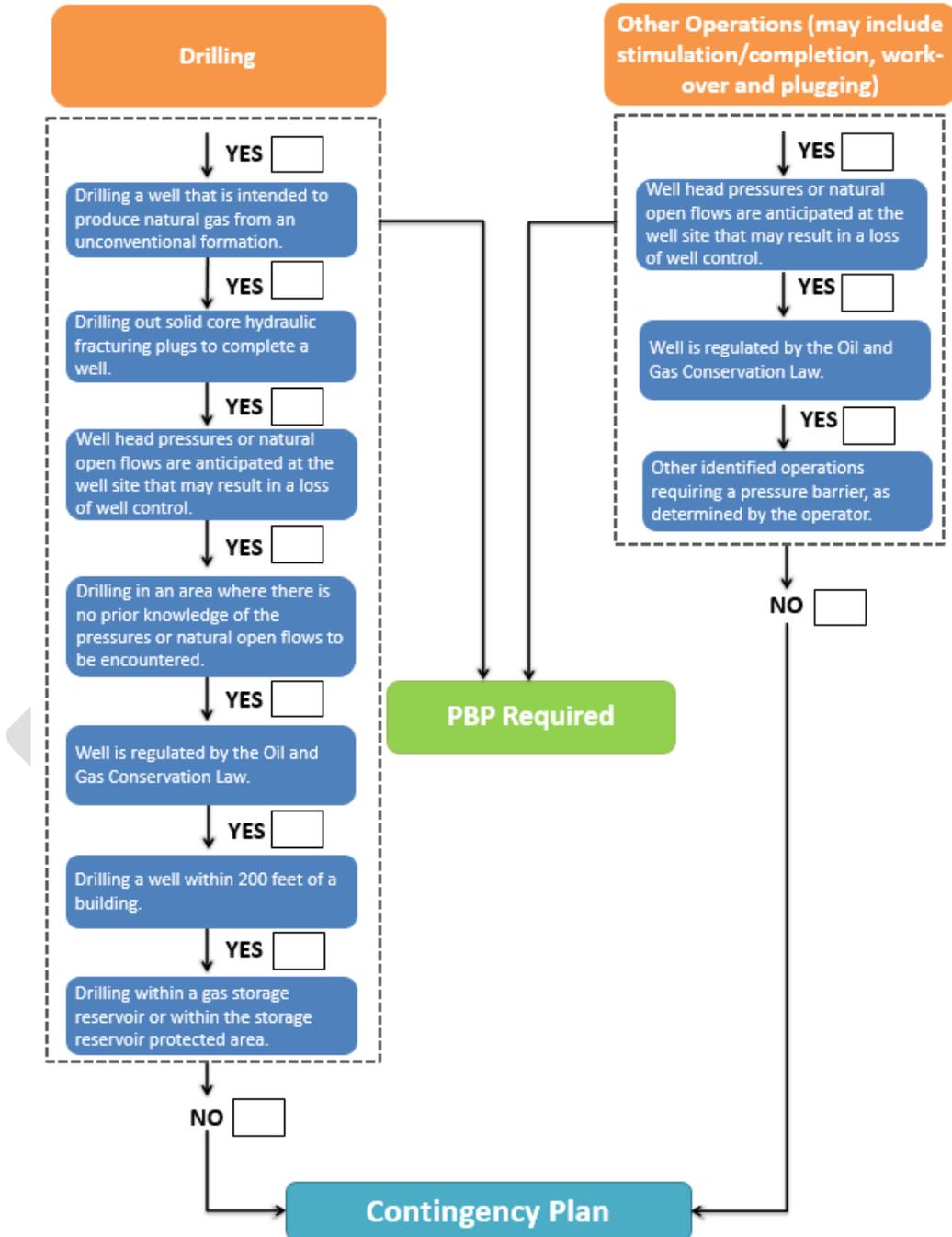
The operator should reference all information contained in this document to develop the required PBP for identified operations. The operator should also consider how to address situations when primary pressure barriers or other *barrier elements* in a well fail unexpectedly.

Note that since several stages are involved in well development activities, there may be instances when the operator determines a pressure barrier is not necessary (e.g., installing conductor pipe or drilling the surface-hole section of an unconventional well and installing surface casing). For stages not included in the PBP, DEP recommends that the operator develop a contingency plan. For example, an operator drilling shallower hole sections of an unconventional well that penetrate gob or other zones capable of flow may specify what measures are in place to effectively mitigate an unanticipated *well control emergency* or *well control incident/loss of well control* through use of a contingency plan in lieu of the use of *mechanical pressure barriers* during the operation. Please also note that when an operator determines its PBP does not need to cover certain operations tied to production activities or wells on inactive status, DEP recommends that a contingency plan be available to address any potential casing and/or equipment failures that could result in a *well control emergency* or *well control incident/loss of well control*. Finally, while DEP recommends that an operator address all items in the applicable sections of this document associated with relevant, specific regulatory citations in its PBP; DEP may determine, on a case-by-case basis, that other items should be considered to safely drill, complete, alter, or plug a well. DEP also acknowledges that existing regulations and laws only require development of a PBP for identified operations, but do not indicate in a prescriptive manner what should be included in the PBP. This document establishes reasonable guidelines for what should be included in a PBP, when it is required.

IV. PROCESS CHART FOR IDENTIFYING OPERATIONS

The following process chart is meant only to serve as guidance to aid in determining what operations require a PBP. If an operator responds affirmatively to any of the items, the PBP should contain information about the pressure barriers that will be used at the well during the identified operation.

Figure 1. Process Chart for Identifying Operations



V. AUDIT PROCESS AND MODEL PLAN

The audit process is designed to lead the operator through a series of questions relevant to well control and the appropriate use of *well barrier elements*. The questions posed and information solicited, if addressed in an operator's PBP, ensure compliance with DEP regulatory and statutory requirements pertaining to well control and the use of pressure barriers in a well. However, the audit process and accompanying model plan serve only as one example that an operator may reference in order to develop a PBP. They do not take the place of a complete PPC plan under a separate title and heading which is prepared for and kept at the well site during well site activities.

DEP recommends that operators follow the audit process or implement a suitable alternative in order to develop a PBP. Operators may maintain this information under a separate cover and make it available to DEP at the well site in order to provide clarity for DEP Oil and Gas Inspectors assessing for compliance with all applicable rules, regulations, and laws concerning well control and the appropriate use of *well barrier elements*. If the model plan format is used, a separate worksheet should be considered for each operation requiring a pressure barrier, provided the mechanism for maintaining well control is different for the operation. The operator should also consider the use of separate worksheets on a hole-section basis, as equipment ratings and functionality may change with respect to the depth interval of the well.

If an operator chooses not to follow the model plan, but their operations still require the use of pressure barriers, they are responsible for complying with all applicable laws and regulations, including those specific to well control and *well barrier elements* addressed in these guidelines.

VI. RECOMMENDED PRACTICES ASSOCIATED WITH SENSITIVE OFFSET ENVIRONMENTS AND INCIDENT RESPONSE AND NOTIFICATION

The following subsection (A) outlines recommended practices relating to *well control incident* prevention proximal to areas that may require unique planning and coordination. Subsection B covers recommended practices associated with *well control incident* response and notification. It is important to emphasize that these subsections predominantly cover DEP recommendations, although a few regulatory requirements are presented.

A. Special Considerations for Sensitive Offset Environments During Drilling and Completions Activities

Site Definition

During the well planning stage, a review for *sensitive offset environments* should be completed. The review should be conducted within a technically justified, pre-determined distance from the well location. Distances to consider include the *reservoir protective area* for underground gas storage facilities in 58 Pa.C.S. § 3203 (i.e., 2,000 feet), the area of

DRAFT FOR TAB DISCUSSION PURPOSES ONLY

review wellbore path buffer distance in § 78a.52a(a) (i.e., 1,000 feet), and/or the gas migration site investigation distance specified in § 78a.89(e)(3) (i.e., 2,500 feet).

Well Design

Casing plans and well design should be developed and completed in consideration of proximity to underground coal mine workings, underground gas storage facilities, and the protection of other *sensitive offset environments*. More specifically for the underground coal mine environment, an assessment of mining operations, including sealed/unsealed status, should be conducted for any mine within a technically justified, pre-determined distance prior to completions activity.

To ensure safety regarding material selection, the operator must utilize equipment and safety devices in compliance with § 78a.71 and § 78a.72 in order to equip the well in a manner which will withstand the more severe environmental conditions expected in association with unconventional development, including higher formation pressures and the presence of larger quantities of free hydrogen, the latter which may be liberated during high-volume hydraulic fracturing and which can contribute to hydrogen stress cracking of casing and other steel *barrier elements* (Kane and Greer, 1977; Burns and Buehler, 2010). Workable coal seams and mine intervals must also be protected with dedicated coal protective casing; as specified in § 78a.83(g) and (h), and § 78a.85.

Pre-Frac and Post-Frac Well Operations

Prior to hydraulic fracturing operations, a shallow geology review assessing fracture propagation directions and formations should be undertaken to understand zones susceptible to flow and confining zones. All pertinent data, including all known operator wells, nearby known active underground coal mining operations, and essential emergency contacts, should be captured in a mapping/data system that allows for quick retrieval in the event of an emergency situation associated with well control. Such information should include:

- (1) Location of drill site.
- (2) Location of active underground coal mines (sealed and unsealed workings).
- (3) Details and findings of shallow geology review.
- (4) Safety/emergency point-of-contact for *coal operator*.
- (5) Safety/emergency point-of-contact for offset oil and gas operators and underground gas storage facilities.
- (6) Safety/emergency point-of-contact for unconventional operator completing hydraulic fracturing.
- (7) Safety/emergency point-of-contact for other offset sensitive environments.
- (8) Contact information for well control contractor. Note that during the response to a *well control incident* or *well control emergency*, the operator may need to relinquish,

DRAFT FOR TAB DISCUSSION PURPOSES ONLY

to the extent necessary, control of certain aspects of the unconventional asset to the well control contractor and that the well control contractor may find it necessary to implement actions in accordance with national standards and best management practices. Further, DEP or an agent of DEP shall be granted free and unrestricted access during *well control emergencies*. See 58 Pa.C.S. § 3258(b).

In addition to the emergency response requirements of 25 Pa. Code § 78a.55, a contact protocol and emergency contact numbers should be established and maintained at all times by the operator conducting hydraulic fracturing. The protocol should include contacts with applicable regulatory agencies, *coal operators*, offset oil and gas and underground gas storage operators, and those responsible for other *sensitive offset environments*, as appropriate, during all phases of completions activity when operations are proximal (see predetermined distance in Site Definition subsection).

The operator should provide pre-frac notifications to the *coal operator*, offset oil and gas and underground gas storage operators, and the point-of-contact for other *sensitive offset environments*, as appropriate, in an agreed-upon timeframe when completions activity will be taking place proximal (see predetermined distance in Site Definition subsection) to an active underground mine, other oil and gas or gas storage operations, or other *sensitive offset environments*.

During completions activity, an unconventional operator should provide a daily progress update to the *coal operator*, other oil and gas or gas storage operators, or the point-of-contact for other *sensitive offset environments*, as appropriate, when proximal (see predetermined distance in Site Definition subsection).

During the production stage of the well, the production annulus should have passive production relief valves so that in the event of a failure, the relief valves would discharge into existing well site facilities and/or pipelines. Pressure thresholds should be known and sufficient to manage any flows that may occur.

Well Control During Stimulation

The production annulus of unconventional wells should not be cemented through underground coal mining horizons. As a precautionary measure to manage the potential loss of control at a well where gas could travel up the annulus to the surface during stimulation, the operator should install equipment prior to the completion operation for safely directing and managing any fluid flows. Examples include choke manifolds, flare stacks and tanks.

An operator should utilize solid core frac plugs at a distance sufficient to ensure safety and well control of every stage during completions activity that are proximal to *sensitive offset environments* (see predetermined distance in Site Definition subsection). The recommendation to optimally place solid core frac plugs is intended to manage the size of the cumulative stimulated reservoir as a multi-stage well is being completed.

In the event of a *well control incident/loss of well control or a well control emergency* during completions activity, simultaneous response plans should be implemented for non-essential well site personnel and for miners at an underground mine when operations are proximal (see predetermined distance reference in Site Definition subsection). The operator conducting

DRAFT FOR TAB DISCUSSION PURPOSES ONLY

hydraulic fracturing should notify, maintain regular contact, and provide timely updates to proximal *coal operators* and regulatory agencies until the incident is resolved. Notifications should occur within 2 hours of discovery, or sooner if practicable.

Until such time that a *well control incident/loss of well control*, or a *well control emergency*, is resolved, the well should not be shut in or otherwise be operated in a manner that causes a loss of fluid into the surrounding strata prior to completion of a risk assessment that addresses the potential inundation to the atmosphere of proximal underground mines.

B. General Incident Response and Notification

Any incident response to address reportable releases must comply with § 78a.66. In addition, potential related issues, such as lost circulation (25 Pa. Code § 78a.83b), defective casing and cementing (25 Pa. Code § 78a.86) and gas migration response (25 Pa. Code § 78a.89) must be reported and/or managed per the respective regulatory requirements.

Well control incidents/losses of well control and *well control emergencies* should be reported to DEP within 2 hours of discovery. Additional coordination recommendations for *sensitive offset environments* are covered in subsection A, above. Contact information for well control contractors should also be established to facilitate timely incident response and mitigation.

An operator should consider modifying an existing PBP and developing appropriate training if a *well control emergency* or *well control incident/loss of well control* is narrowly avoided, as determined by the operator.

The Oil and Gas Inspector and Supervisor are the appropriate contacts in the Oil and Gas Program. After normal business hours, the operator should reference Appendix B to determine the appropriate DEP Emergency Response point of contact. Nothing in this guidance should be interpreted to prevent the operator from coordinating with local emergency responders, as needed, or abiding by all other relevant DEP rules, regulations, statutes, and policies.

APPENDIX A

Regulatory Citation(s):

78a.72 and 78.72 Use of safety devices – blow-out prevention equipment.

Initial Function and Pressure Testing (prior to placing in service on the well)

(e) The operator shall conduct a complete test of ram type blow-out preventer and related equipment for both pressure and ram operation before placing it in service on the well. The operator shall test the annular type blow-out preventer in accordance with the manufacturer's published instructions, or the instructions of a professional engineer, prior to the device being placed in service. Blow-out prevention equipment that fails the test may not be used until it is repaired and passes the test.

Subsequent Function and Pressure Testing (while in service on the well)

(f) When the equipment is in service, the operator shall visually inspect blow-out prevention equipment during each tour of drilling operation and during actual drilling operations test the pipe rams for closure daily and the blind rams for closure on each round trip. When more than one round trip is made in a day, one daily closure for blind rams is sufficient. Testing shall be conducted in accordance with American Petroleum Institute publication API Standard 53.

Question:

API Standard 53 establishes BOP testing protocols that differ from those in the Department's regulatory requirements under Chapter 78 (relating to oil and gas wells) and Chapter 78a (relating to unconventional wells). Some operators have expressed concern that more frequent function testing will cause excessive equipment wear. What is the Department's current interpretation of how API Standard 53 and the regulations under 78a/78.72(e) and 78a/78.72(f) interface?

Response:

Sections 78.72 and 78a.72 distinguish between two different BOP testing protocols:

- (1) *Initial Function and Pressure Testing* – those protocols to be used prior to operations (i.e., before placing the BOP in service) as described in subsection (e) of each section; and
- (2) *Subsequent Function and Pressure Testing* – those protocols to be used after operations requiring a BOP have commenced, as described in subsection (f) of each section.

For *Subsequent Function and Pressure Testing*, the Department's testing program for rams specifies a greater number of assessments than API's in terms of testing frequency.

In light of recent updates to API Standard 53 and operational considerations/industry best management practices, the Department will accept both frequency and function testing as compliant, if they align with all recommended practices in API Standard 53. For operators choosing to utilize another method after the BOP is placed in service and not described in this FAQ, the procedure should be documented

DRAFT FOR TAB DISCUSSION PURPOSES ONLY

on forms provided by the Department ([8000-FM-OOGM0017](#)) and submitted for review and approval by the Department prior to implementation.

DRAFT

DRAFT FOR TAB DISCUSSION PURPOSES ONLY

APPENDIX B

DEP Emergency Contact Numbers		
Region	Emergency Phone	Counties Supervised
Southeast	570-826-2511	Bucks, Chester, Delaware, Montgomery, Philadelphia
Northeast	570-826-2511	Carbon, Lackawanna, Lehigh, Luzerne, Monroe, Northampton, Pike, Schuylkill, Wayne, Wyoming
Southcentral	570-327-3636	Adams, Bedford, Berks, Blair, Cumberland, Dauphin, Franklin, Fulton, Huntingdon, Juniata, Lancaster, Lebanon, Mifflin, Perry, York
Northcentral	570-327-3636	Bradford, Cameron, Centre, Clearfield, Clinton, Columbia, Lycoming, Montour, Northumberland, Potter, Snyder, Sullivan, Tioga, Union
Southwest	412-442-4000	Allegheny, Beaver, Cambria, Fayette, Greene, Somerset, Washington, Westmoreland
Northwest	814-332-6945 After Hours: 800-373-3398	Armstrong, Butler, Clarion, Crawford, Elk, Erie, Forest, Indiana, Jefferson, Lawrence, McKean, Mercer, Venango, Warren
RCSOB	800-541-2050	Statewide and Interstate

Please note this table is specific to Oil and Gas District Operations (emergency incidents in DEP's Southeast Region should be reported using the Northeast Regional Office number and emergency incidents in DEP's Southcentral Region should be reported using the Northcentral Regional Office number).

DRAFT FOR TAB DISCUSSION PURPOSES ONLY

APPENDIX C

References

Burns, MG, Buehler, WM (2010). Analysis of High-Collapse Grade P110 Coupling Failures. Materials Science and Technology. October 17-21. Houston, TX.

IWCF Well Control and Barrier Definitions. <https://www.iwcf.org/>. Accessed March 21, 2021.

Kane RD, Greer, JB (1977). Sulfide Stress Cracking of High-Strength Steels in Laboratory and Oilfield Environments. Journal of Petroleum Technology 29 (11): 1483-1488.

Managing Environmental Aspects Associated with Exploration and Production Including Hydraulic Fracturing, First Edition (2015). Accessed via API IBR Reading Room portal at <https://www.api.org/products-and-services/standards/rights-and-usage-policy>.

Uztel Oilfield Manufacturing and Repairs. <https://www.uztel.ro/index.php/en/bop-system-and-manifolds-2>. Accessed March 21, 2021.

Schlumberger Oilfield Glossary. <https://www.glossary.oilfield.slb.com/>. Accessed March 18, 2021.

Well Control Equipment Systems for Drilling Wells, Fifth Edition (2018). API Publishing Services, Washington D.C.: API.