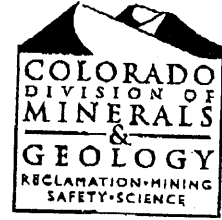


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STATE OF COLORADO

DIVISION OF MINERALS AND GEOLOGY
Department of Natural Resources

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February 9, 2004

*2005
General*

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Berry, PA*

Bill Owens
Governor
Russell George
Executive Director
Ronald W. Cattany
Division Director
Natural Resource Trustee

RE: Coal Program Guidance Document – Methane Drainage and Monitoring Wells

Dear :

Please find enclosed the final version of the Colorado Division of Minerals and Geology, Coal Program guidance document entitled "Installation, Operation and Abandonment of Coal Mine Methane Drainage/Monitoring Wells in Colorado." You may recall that this document was circulated in draft form beginning in 2002.

This document is not intended to override the Colorado Surface Coal Mining Reclamation Act (Act) or Regulations of the Colorado Mined Land Reclamation Board for Coal Mining (Regulations). ~~The document is offered as guidance with the intent to support the land and water resource protection~~ performance standards of the Act and Regulations, during the installation, operation and abandonment of methane drainage and monitoring wells.

Thank you for your previous comments regarding this document. Please feel free to contact me with any questions.

Sincerely,

David A. Berry
Coal Program Supervisor

methane doc ltr.doc

**Colorado Division of Minerals and Geology (DMG)
Coal Program**

**Installation, Operation, and Abandonment
of Coal Mine Methane Drainage/Monitoring Wells in Colorado**

The purpose of this guidance document is to provide a framework for the permitting of methane drainage wells to ensure that appropriate installation, operation, and abandonment procedures are considered during the permitting phase and included in any permitting approval. This document is intended to provide consistency in requirements from site to site and minimize impacts during and after operations.

Methane drainage wells are utilized in underground coal mine operations in Colorado. The methane drainage wells are typically drilled and installed above projected longwall panels for the purpose of pre- and post-mining gas removal. Reducing methane content in the mine significantly contributes to mine safety and productivity.

With the continued advance of longwall technology for extracting coal in Colorado, the need for removal of methane gas in the mine has become common practice. DMG has jurisdiction for permitting and approving these holes as part of the permit. The permitting process is intended, in part, to prevent potential groundwater contamination or gas seepage to the surface.

The life cycle of a methane drainage well can be summarized in four phases;

- Permitting
- Installation and Completion
- Operation
- Abandonment

Permitting – Rule 2.05.3 (1), (2)(b) and (3) and 3.02.2

The need for methane drainage/monitoring wells is often urgent when the operator encounters unexpected gas concentrations and the permitting time frame becomes compressed. It is necessary to ensure that appropriate permitting materials are included and are not overlooked due to time constraints.

Permitting of these holes should typically be done as a technical revision to the permit. The permit document must be revised to include the details on necessary access roads: and installation, completion and abandonment information for each hole. The permitting materials submitted by the operator may vary but at a minimum should include a detailed text discussion addressing road construction and reclamation, the installation, completion, operation, and abandonment of each hole and a reclamation cost estimate. Well completion information should include a proposed completion design diagram. Maps and proposed diagrams must be included with enough detail to allow the conclusion that impacts will be prevented or minimized to the extent possible.

T.R.

Installation and Completion – Rules 3.03.2, 4.03.2, 4.04, 4.05.13(1)(e), and 4.07

Methane drainage wells are often in remote areas. Access to the drill pads should minimize new road construction when possible. Proper installation and completion of the wells ensures that the gas will be vented to the atmosphere during operations and not migrate to other areas that could result in environmental or safety concerns. Similar to a water well or a commercial gas well, the productive zone(s) must be isolated during well installation and completion. Proper completion is also necessary to ensure that abandonment of the well can be successfully accomplished.

Permitting materials regarding installation and completion should include at a minimum:

- A map of access roads, and typical designs for new roads, to each drill pad;
- A map of proposed well locations;
- Sediment control, mud pit, and equipment information;
- Detailed text discussion of the well installation procedure; and
- A proposed well completion diagram including:
 - All casing diameters
 - Total well depths
 - Perforated interval(s)
 - Depth to all proposed packers or cement baskets
 - Type of cement or grout to be used
 - Calculation of annulus volumes to be cemented
- A reclamation cost estimate

Geologic logs must be recorded during drilling to note depths of water or gas inflow encountered during drilling. A high quality completion, that ensures filling of the entire annulus with cement surrounding the solid cased portion of the well will be required. During cementing operations, plugs should be tagged before cementing begins and tagged after each individual pour of cement or grout. Cement should be placed by positive displacement using either the well casing or a tremie pipe from the bottom up. Cement grout should not be poured from the surface. The type of cement or grout mix should be specified, as well as the amounts estimated to be used for each separate cementing operation. It is recommended that sulfate resistant cement be used for sealing the annulus during well completion and subsequent plugging and abandonment procedures. If necessary, centralizers should be used during completion, based on hole conditions recorded during drilling.

The key to a successful abandonment is a high quality completion in which the entire annulus is filled with cement. Responsible and careful operational practices demonstrated by the driller and coalmine operator will result in high quality completions. The operator must ensure that the methane drainage well has an adequate cement seal in the annulus, and has been constructed such that it will allow for permanent sealing of the gas producing zone during the abandonment phase. The methane drainage well completion designs must include an abandonment plan that ensures proper sealing can

be achieved. A representative group of wells should be inspected by DMG during installation if possible. Completion diagrams showing the actual as-built configuration should be submitted to the DMG following installation of each methane drainage well. These well completion diagrams should be incorporated into the permit document for future reference. The completion diagrams will be used in conjunction with the abandonment reports (described below) to assure compliance with permanent sealing requirements.

Operation

Methane drainage wells may passively vent to the surface or they may require pumping to liberate methane from underground. Regardless of how the wells are operated, public health and safety is a primary concern during operation. At a minimum, the site should be properly signed as potentially dangerous, especially on public lands and National Forest. Anti-flare devices should be installed if necessary and fencing may also be necessary in some circumstances. Monitoring during operation may be necessary to ensure that the well is not leaking methane to the soil or surrounding area. Dead vegetation is the usual indicator of a problem.

Abandonment – Rules 2.05.4 and 4.07

Methane drainage well abandonment plans and procedures must comply with Rule 4.07 Sealing Of Drilled Holes And Underground Openings. A reclamation plan and abandonment procedures are standard requirements for all methane drainage wells. Plugging and abandonment information and procedures shall be provided in writing in the reclamation plan of the permit document. Site inspections of the methane drainage well abandonment operations should be conducted periodically by DMG, if possible. Following abandonment, operators will need to submit an abandonment report to the DMG within 60 days. The abandonment report will verify that the methane drainage well has been properly sealed.

Appropriate guidance for gas well abandonment has been developed by the American Petroleum Institute (API). These abandonment procedures are contained in the following document: Environmental Guidance Document: Well Abandonment and Inactive Well Practices for U.S. Exploration and Production Operations [API Bulletin E3 (BUL E3)]. Detailed techniques for well abandonment are presented in the API document. In general, the procedures discussed in this bulletin are applicable to the abandonment of methane drainage wells. Operators may find this document useful for obtaining specific information regarding various abandonment methods. There will be differences in well installation and abandonment techniques due to the nature of methane drainage wells versus gas production wells. The perforated casing intervals of methane drainage wells are typically installed above areas to be mined. Following coal removal, the potential for methane gas migration will increase due to subsidence effects including caving of strata and fracturing of rock above the coal seam, and void spaces/increased porosity created by mining. As described below, well casings may also be damaged due to subsidence effects. Therefore, methane drainage wells may present unusual abandonment situations.

Operators should ensure their plugging programs address the gas migration potential associated with such conditions. Section 2 of the API Bulletin presents detailed information on plugging and abandonment operations including: cementing materials and placement techniques, methodologies for isolating open hole completions and uncased hole, and cased hole abandonment methods. These methodologies are deemed appropriate and applicable guidance for methane drainage well plugging and abandonment.

Methane drainage well completion techniques may vary. Two typical examples of methane drainage well completions are presented in Figures 1 and 2 of this guidance document. Figure 1 provides an example of an open hole completion (i.e., borehole that is uncased and open to the casing string above). Figure 2 shows a cased hole completion with a floating perforated casing below the solid cased portion of the well. These examples are typical of open hole and cased hole completions. Applicable methods for plugging and abandoning open hole and cased hole completion intervals are presented in Sections 2.2 through 2.4 of the API Guidance Document.

At a minimum, all holes must be abandoned in accordance with DMG Rule 4.07.3. If the methane drainage well is completed through an aquifer(s), then sealing must be completed in accordance with DMG Rule 4.07.3 (2) and the entire depth of the blank casing should be sealed using cement (from the bottom to within 10 feet of the surface). If no aquifer is present, the well shall be sealed by replacing a suitable media in the hole and placing a suitable plug 10 feet below the ground surface to support a cement plug to within three feet of the ground surface. The hole is to be marked in the field. Survey coordinates should be included in the abandonment report, if available. Proof of compliance for hole abandonment is required according to Rule 4.07.3(3) of the Coal Regulations.

In situations where a bottom to top cement plug is not specifically required by regulation, the DMG recommends a minimum of fifty feet of cement plug be placed at the lowest point inside the solid casing, above the perforated interval of the well. The cement plug should be a minimum of fifty (50) feet in length and should extend a minimum of fifty (50) feet above the zone to be protected. An inflatable packer, bridge plug, or other mechanical plug approved by the DMG shall be utilized as a foundation for the cement plug. Proof of compliance for the hole abandonment is required according to Rule 4.07.3(3) of the Coal Regulations.

This additional closure recommendation is included to provide protection against post-closure methane migration to water and land resources. Such migration must be prevented. If it is found that damage to water or land resources has occurred due to inadequate methane drainage well installation and/or abandonment, then such damage may be considered a noncompliance situation. Additional work to prevent and mitigate such damage would likely be required.

The DMG recognizes that subsidence effects associated with longwall mining may compromise the integrity of the methane drainage well. Subsidence due to removal of

coal from the longwall section and the subsequent caving of overlying strata may damage the well. The well casing may be collapsed or sheared as longwall panels are retreated beyond the location of the methane drainage well. The DMG recommends that the total depth of the well be measured prior to initiating plugging procedures to determine if the well has been damaged. If the casing is damaged and the packer or plug cannot be set at the proposed depth, then a bridge plug/packer and cement plug should be placed at the lowest point possible in the well, as close to the perforated casing interval as practicable.

EXAMPLE OF TYPICAL METHANE DRAINAGE WELL COMPLETION AND ABANDONMENT

The following discussion is provided as an example of an acceptable well completion and abandonment procedure for permanently sealing a methane drainage well. Well completions may vary, but typically are completed as shown in Figures 1 and 2. Hole diameters range from 9 inches to 15 inches. The total depth of the borehole generally ranges from 25 to 30 feet above the coal seam. The holes are completed with steel casing ranging from 5-1/2" to 9-5/8" in diameter to the projected fracture zone above the longwall mined panels. Generally, the bottom 200 feet of borehole is left open and uncased. The bottom 200± feet of casing is perforated, and the bottom of the perforated casing is left open and is not capped with an end plug. The well is completed with blank casing to the surface. At the top of the perforated casing a cement basket or other seal is placed and cement is pumped into the annulus above the seal, grouting the casing in place. In some instances (as shown in Figure 2), a smaller diameter, perforated casing is set below and overlaps inside the solid cased portion of the well. As the longwall panel retreats past the methane drainage well, the perforated casing is allowed to fall dropping no further than the bottom of the coal seam mined.

Abandonment procedures may also vary due to site conditions or completion specifications. After consideration of internal and external comments received in response to initial drafts of this document, the following procedure is thought to be most effective to control gas from migrating upward through the inside of the casing or through the annulus (between well casing and borehole) to the surface. An example of a methane drainage well after abandonment is shown in Figure 3. In this case, a bridge plug is placed immediately above the perforated casing to create a foundation for cement slurry fill. A tremmie pipe is recommended to ensure a continuous pour of the cement slurry from the top of the bridge plug to the ground surface. In this case, the entire solid cased portion of the well is filled with cement slurry.

Figure 1.
 Gob Ventilation Borehole
 Bowie Resources, LTD,
 July, 1999

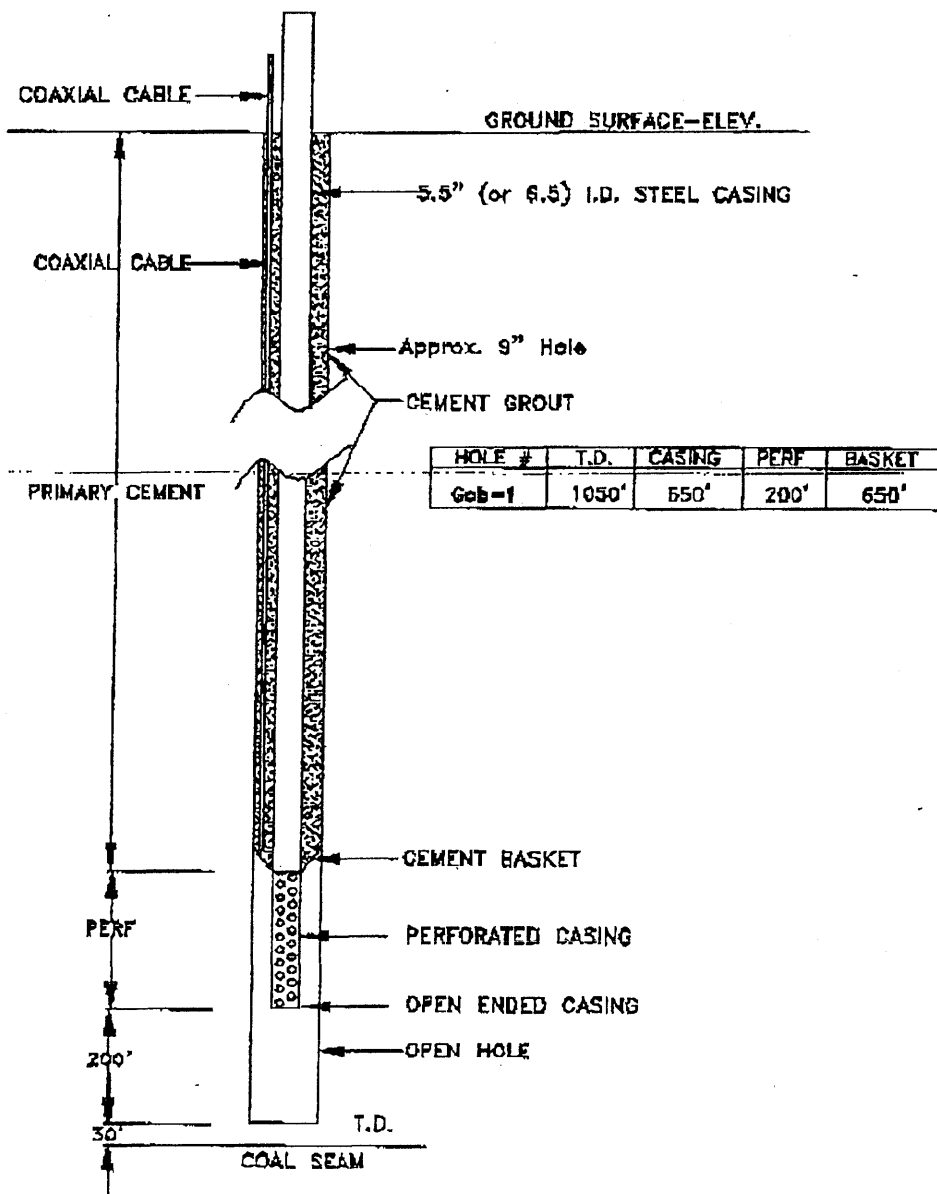


Figure 2.
GVB 15 - 08 As-Built
Mountain Coal Company, LLC.
October, 2001

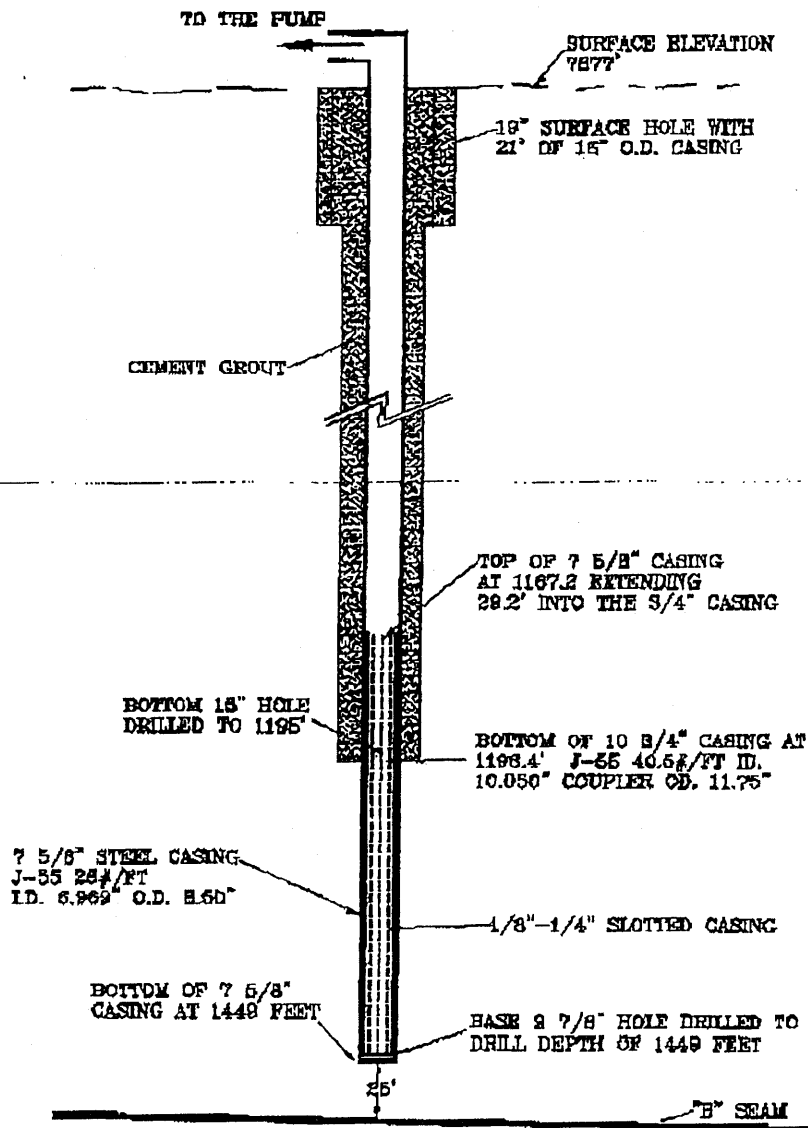
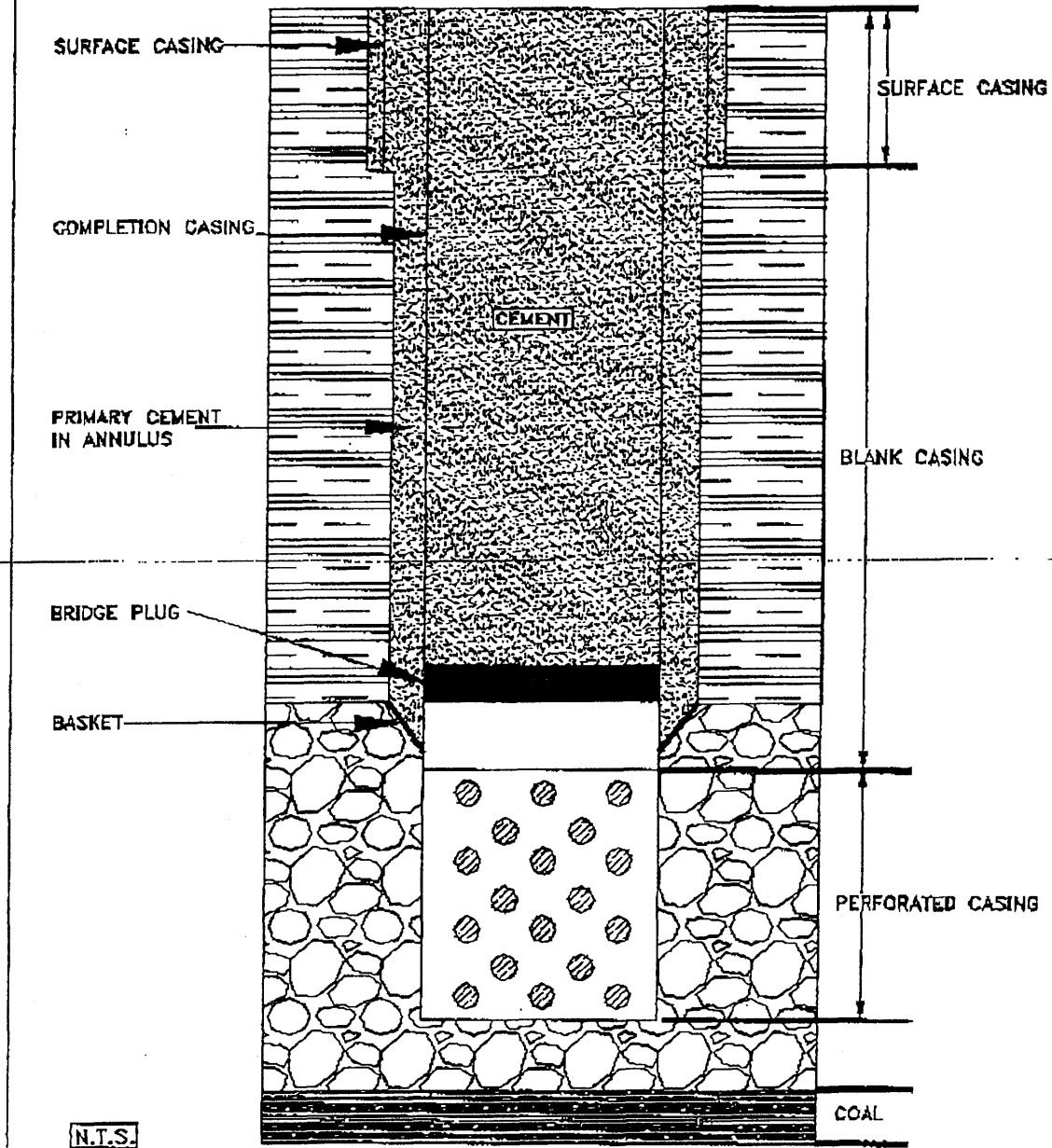


Figure 3.
Methane Drainage Well
After Abandonment



References

Bowie Resources Incorporated, Proposed Sealing Procedure, Bowie No. 2 permit application, June 2001.

Bureau of Land Management, Recommended Sealing Procedure for De-Gas Wells, Rabinowitz 2001.

Environmental Guidance Document: Well Abandonment and Inactive Well Practices for U.S. Exploration and Production Operations; American Petroleum Institute; API Bulletin E3; First Edition; January 31, 1993.

Halliburton web site; <http://www.haliburton.com>.

Mountain Coal Company, LLC. GVB 15-08 As-Built Diagram, West Elk Mine permit application, October 2001.

Oil and Gas Conservation Commission, Rules and Regulations, July 30, 1998.

Regulations of the Colorado Mined Land Reclamation Board for Coal Mining, March 2001.

Water Well Construction Rules, Office of the State Engineer, August 1, 1996.