2006
UPDATE

Coal Bed Methane Best Management Practices

A Handbook

Western Governors' Association

April 2006

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Dear Friends of the Western Governors' Association:

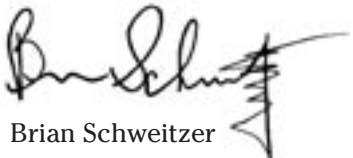
Coal bed methane (CBM) resources play an important role in meeting U.S. domestic energy needs. In 2004, 1.5 trillion cubic feet of CBM was produced in the five Rocky Mountain States of Colorado, Montana, New Mexico, Utah and Wyoming, representing six percent of the total U.S. gas supply. The Rocky Mountain West may contain as much as 63 trillion cubic feet of natural gas from coal seams. Natural gas is used to produce 18 percent of the electricity generated domestically, and is the fastest growing use of natural gas.

While CBM is a critical component of our energy supply, the growth in CBM development in the West poses challenges for the communities in which it occurs, including the construction of new roads, pipelines, compressors and other facilities. Challenges also include management of water resources, waste treatment and disposal and impacts to the social fabric. One means of addressing these challenges is to coordinate and foster sharing of information that will promote the sound, efficient and environmentally appropriate development of CBM. In particular, best management practices can be shared and used to help develop this resource in an environmentally sound manner.

Based on a recommendation developed by a group of stakeholders at a Western Governors' Association Environmental Summit on the West in 2002, the WGA adopted policy to promote the sharing of best practices for CBM. In 2003, WGA convened an advisory committee with a broad range of stakeholders to develop a CBM Best Management Practices Handbook. Funding for that effort was provided by the Environmental Protection Agency, the William and Flora Hewlett Foundation and the Department of the Interior - Bureau of Land Management.

The advisory committee effort noted that the recommendations in the Handbook are voluntary and best management practices do not replace governmental requirements. The committee also stated that the Handbook is intended to be broadly applicable across geographic basins, although the decision to adopt a particular BMP may be site-specific. In addition, committee members believed the Handbook should be updated and amended on a regular basis to reflect the outcomes when recommended practices are employed and when advances in technology and management practices may lead to new BMPs.

We are pleased to provide you with this second iteration of the Handbook, which includes a Web-based appendix featuring descriptions of sites and links to information where BMPs are being used on the ground. We commend the Handbook to our constituents, colleagues and to all those working to ensure that the development of America's energy resources is accomplished in a responsible fashion.



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Coal Bed Methane Best Management Practices

A Handbook

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I. INTRODUCTION AND OVERVIEW

A. Introduction

"The Governors believe that many issues might be alleviated through sharing of information and active implementation of best management practices across the states and the private sector."

The development of this Handbook was initiated by the Western Governors' Association, (WGA) which believes that Coal Bed Methane (CBM) represents a key component of our nation's energy supply and accordingly should continue to be developed. WGA recognizes the importance of CBM and the need by private industry, and state, local and federal officials to develop this critical resource in an environmentally sound manner. The Western Governors, therefore, called for coordination and sharing of information that promotes the sound, efficient and environmentally responsible development of CBM. The Governors believe that many issues might be alleviated through sharing of information and active implementation of best management practices across the states and the private sector[1]. The Governors also called for the use of the Enlibra principles in addressing CBM conflicts. (See Appendix B). WGA's engagement on this issue was based on the presentations and the facilitated discussion at a breakout session during the WGA and the Council on Environmental Quality Environmental Summit on the West II, held in Salt Lake City in April 2002.

With this guidance, the WGA sought funding to engage the CBM industry, all levels of government, and other stakeholders to build a Handbook of Best Management Practices (BMPs). The US Environmental Protection Agency (EPA), the William and Flora Hewlett Foundation, and the US Department of the Interior, Bureau of Land Management (BLM) provided the funding to bring together a diverse group of stakeholders with an interest in CBM to guide the development of the Handbook (the WGA Coal Bed Methane Advisory Committee). The members of the Committee are listed in Appendix C.

[1]Western Governors' Association Policy Resolution, 05-24, "Coal Bed Methane Development" (June 2005). http://www.westgov.org/wga/policy/05/CBM.pdf

The WGA Coal Bed Methane Advisory Committee heard a briefing on the Wyoming CBM Clearinghouse maintained by the University of Wyoming's William D. Ruckelshaus Institute and the School of Environment and Natural Resources. http://www.cbmclearinghouse.info/. The site is a centralized Internet-based clearinghouse for textual, tabular, photographic, and spatially-referenced information pertaining to CBM resource development and related management issues in Wyoming. The ultimate goal of the CBM Clearinghouse is to create and maintain a single, up-to-date, and easy-to-use entry point for accessing data and information on all aspects of CBM-related issues in Wyoming. The WGA CBM Advisory Committee recommended the CBM Clearinghouse at the University of Wyoming as a model that should be considered in the development of a central database for CBM across the region.

The Governors considered this recommendation in Section B4 of their policy resolution cited above where they stated:

"The Western Governors believe in the coordination and sharing of information promoting the sound, efficient and environmentally responsible production of coal bed methane. Toward this end, the Western Governors believe that the states, the federal government and the coal bed methane industry should resolve to create, fund and maintain a central source for the collection of research and data that may aid in the development of improved techniques for the production of coal bed methane, advanced and efficient conflict resolution within the development, and identification of additional issues that merit scientific, policy or legal research. In the WGA handbook, the CBM Advisory Committee states that the CBM Clearinghouse maintained by the University of Wyoming is a model database that should be considered in the development of a central database for CBM across that West. The Governors concur with this recommendation."

B. Purpose and Assumptions

The purpose of this Handbook is to share and encourage the use of best practices that will promote the sound, efficient, and environmentally appropriate development of coal bed methane resources. The document provides site-specific considerations, tools, and practices that, when appropriately applied, encourage excellence in environmentally sound energy resource development in concert with economic realities. The audience for the Handbook is diverse, and includes operators, agencies, surface owners, mineral owners, and other land users.

It is hoped that by applying BMPs, we will reduce conflicts, encourage environmental stewardship, and provide for efficient resource development. Adoption of these practices may require more work early in CBM development; however, the expected benefits are reduced environmental and socio-economic impacts; improved relations between gas well operators and surface owners; less time invested in surface use negotiations and litigation; and increased economic efficiencies. Other benefits and opportunities arising from CBM development such as job creation, tax revenue, royalty payments, and physical improvements for landowners (e.g., installation of cattle guards, fence replacement, on-going road maintenance, etc.) were also noted.

All photos courtesy of U. S. Department of the Interior, Bureau of Land Management

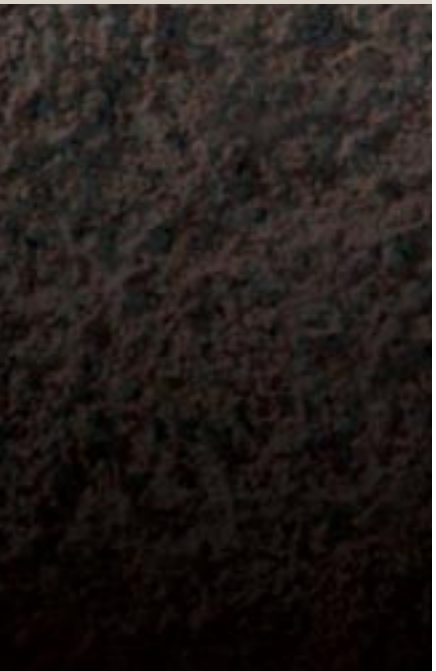
CBM development can have both positive and negative effects on the environment and communities. Development will produce jobs and revenues and contribute to meeting the Nation's energy needs, but should not compromise a healthy environment. Adopting BMPs in CBM development promotes a healthy environment that also produces jobs, revenues, and benefits to society.

Key assumptions in constructing the Handbook are:

- It is not a regulatory document.[2]
- Use of one or more practices is voluntary.
- BMPs do not replace local, state, federal and tribal requirements.
- The Handbook is a "living" document that can be updated and amended to reflect the results of monitoring implementation of BMPs as well as advances in technology that may lead to new BMPs.
- The Handbook is intended to be broadly applicable unless otherwise noted. Differences among geologic basins create different challenges, and some or all of the BMPs documented herein may or may not be suitable for some locations. The decision to adopt a particular BMP may be site specific.

[2]The Handbook is not intended to have legal consequences or to bind any participants or persons affected.

"BMPs are dynamic and intended to promote excellence in how CBM is developed, while still maintaining efficiency, cost effectiveness and competitiveness in producing the CBM resource."



C. Context

Coal bed methane (CBM) (natural gas derived from coal beds) is a valuable energy resource in the Western United States. The natural gas that results from CBM development is an important element of the national goal of a secure supply of energy.[3]

CBM development may entail the construction of new roads, pipelines, compressors, water impoundments, and other facilities and can change landscapes. The development of CBM resources may cover extensive areas and, under certain geologic conditions, requires the extraction of large amounts of water from coal seams before the gas can be collected. Planned and likely CBM development in the West (primarily Colorado, Montana, New Mexico, North Dakota, Utah, and Wyoming) is a matter of local, regional, and national interest.

Widely differing viewpoints on CBM development have polarized some of the communities where the development is occurring. Such difficulties may be exacerbated by split estate ownership, where the mineral resource is owned by one entity and the surface by another. Concerns that have provided impetus for development of the handbook include:

- Management of produced water
- Groundwater quantity and quality
- Surface water quality and quantity
- Visual impacts
- Effects of noise
- Impacts to air quality
- Fish, wildlife and wildlife habitat[3A]
- Changes to soil and vegetation
- Social and economic impacts on communities and states
- Surface owner issues, especially in split estate cases

Handbook topics reflect these issues by providing BMPs in the categories of planning, water, landowner relations, and infrastructure.

D. Best Management Practices (How Used, Definitions, Application, Suitability)

For purposes of this Handbook, a Best Management Practice (BMP) is a proven way of conducting CBM operations, which eliminates or minimizes adverse impacts from CBM development to public health and the environment, landowners, and natural resources; enhances the value of natural and landowner resources; and reduces conflict.

BMPs are dynamic and intended to promote excellence in how CBM is developed, while still maintaining efficiency, cost effectiveness and competitiveness in producing the CBM resource. Adopting BMPs can increase efficiency and/or effectiveness for producers and, at times, has actually lowered costs, which are necessary considerations for operators. In the context of this project, BMPs are not minimum standards (i.e., baseline under statutes or rules) or down-the- hole engineering practices.

[3] Coal Bed Methane Development in the Intermountain West, Natural Resources Law Center, University of Colorado, p.1, July 2002. http://www.colorado.edu/law/centers/nrlc/index.htm

[3A] Fish and wildlife issues are addressed by best management practices throughout this handbook. References to fish, wildlife and habitat issues may be found on pages 5, 6, 8, 10, 11, 15-17, 19, 20.

II. PLANNING

Introduction

Planning is essential to successful CBM development and provides significant environmental and economic benefits. Careful, objective CBM project planning that includes various interests in the planning process is essential to effectively address aspects of a project that could otherwise become challenging issues. Careful and inclusive planning provides opportunity for thorough implementation of development practices that will enhance environmental protection.

A. Development Plans

BMP: Prepare a development plan. A development plan identifies a specific area (e.g., leasehold or watershed) in which development is expected. It provides a comprehensive description of geographic and cultural characteristics of the area, along with the anticipated nature of CBM development. Planning needs may differ by basin and be applied in different ways, depending on such things as subsurface geology, terrain, and land use. As a result, development plans could be complex or simple, depending upon the circumstances, and will need to be customized to fit the individual conditions within a CBM basin or project.

Discussion: The following items could be included in the plan:

- Identification of land ownership
- Identification of existing and expected surface uses (including number and spacing of wells, roads, pipelines, water disposal facilities, treatment facilities, compression facilities, gathering and transmission pipelines, etc.)
- Identification of existing and required infrastructure and utility corridors
- Map of the area with location of existing facilities (i.e., wells) and potential (optimal) locations for future facilities, including production facilities (wellsites, processing units, etc.), roads, flowlines, and utility corridors. The map can also include geographic features such as streams and other water bodies, and special ecosystems.
- Development strategy that addresses environmental and economic objectives
- Identification of opportunities to reduce adverse impacts
- Identification of regulatory requirements
- Water management plan (strategy) - See Section A in Chapter III
- Identification of strategies for interim and final reclamation of disturbed areas and for final abandonment
- Conflict resolution procedures
- Strategy for establishing a baseline and monitoring (surface and subsurface water quality, wildlife and fish, air quality, etc.) and steps to apply monitoring information to existing and future actions
- Steps to address public safety through participation with local emergency preparedness committees

The development plan is based on existing and expected surface use, geologic, engineering, and scientific information about the natural gas reservoir and the environment of the area. Collection of baseline information on such things as surface uses and surface owner preferences, pre-development noise levels, air quality, surface and groundwater quality, and biological resources can assist in identifying critical data or information gaps. Thorough knowledge about existing information and information gaps is necessary for developing an effective monitoring strategy, while thoroughly understanding the commitment of resources that will be necessary to acquire baseline information.

Oil and gas operators, government agencies, elected officials, affected surface and mineral owners, community representatives and other concerned citizens working together to plan for anticipated field development can produce development plans that reflect environmental responsibility, respect for the land, efficient energy resource development and productive relationships among diverse interests, while at the same time, permitting extraction of CBM.

A development plan established during the early stages of anticipated development provides the framework for avoiding or minimizing surface disturbance, protecting other resources, mitigating environmental impacts, and alleviating or addressing concerns of landowners and communities. It serves as a tool for comprehensive, coordinated planning to guide strategic development. It can also assist in meeting the requirements of the Clean Water Act, the Clean Air Act, the Endangered Species Act, and other applicable federal, state, and local laws.

B. Permitting

In order for a project to be approved and go forward, certain agreements and permits, along with valid oil and gas leases, need to be in place. It is imperative that an oil or gas company contact mineral and surface owners and permitting agencies early to minimize timeframe conflicts. Appendix D provides an example of a regulatory checklist (for Wyoming), including regulatory requirements of federal, tribal, state and local jurisdictions. (Appendix D is located with the Handbook at www.westgov.org)

BMP: Master Drilling Plan for Multiple Applications for Permit to Drill (Multiple APD Package): Master Drilling Plans involve multiple wells (two or more) in an identified area, and contain drilling and surface-use procedures common to all wells in the package, and are used in the federal APD review and approval process.

Discussion: The Master Drilling Plan can encompass a planned cluster of wells and facilities in close proximity, sometimes referred to as a "pod," or can be prepared for multiple in-fill wells scattered throughout a field. Each well under a Master Drilling Plan must have a survey plat and an APD that references the Master Drilling Plan. Information contained in the Master Drilling Plan does not have to be repeated within the individual APDs that it covers. Differences in the drilling or surface use programs that may be unique to individual wells are clearly addressed and identified within the Master Drilling Plan and/or individual well APDs.

Multiple APD packages are suitable for areas that have known surface and subsurface characteristics that give an operator the technical certainty to propose multiple wells. Areas suitable for this practice typically have similar reservoir characteristics, subsurface geology and producing zones.

A multiple APD package under a Master Drilling Plan within a specified area achieves more efficient permitting, provides for more effective protection of other resources, and is a valuable tool for future planning. It can result in reduced

paperwork and cost for both the operator and permitting agency, improved development planning, and more comprehensive environmental review, especially with respect to identifying and analyzing cumulative effects.

C. Community and County Services

BMP: Proactive and early engagement with local governmental entities.

Discussion: Proactive and early engagement with local governmental entities is beneficial in gaining an understanding of applicable regulations as well as in establishing positive and important working relationships. State and local government rules and regulations may also have a significant impact on CBM development. Local issues related to air quality, noise abatement, traffic flow, etc. can be better addressed by early coordination with local government.

III. WATER

Introduction

Coal bed methane development can present complex water-related challenges, as well as possible beneficial uses. Extracting CBM generally requires the withdrawal of groundwater to release the pressure within a coal seam, thus allowing the methane gas to begin flowing. Because CBM production generally begins by withdrawing a high volume of water, significant issues have been raised, including the potential waste of valued water resources; concerns about groundwater, specifically on the effects of lowering the water table, potential impacts on residential and agricultural wells, and possible contamination, and; produced water disposal or management, including downstream impacts on both water quantity and quality. When appropriate, landowners are frequently interested in putting the water to beneficial use, and consider it an asset. Adoption of BMPs can help address these and other water related concerns and potentially reduce conflicts with landowners, conservationists, anglers and other land and water users; however, BMPs must be customized to deal with a variety of considerations that vary by basin or project.

Water Best Management Practices

A. Water Management Planning

BMP 1: Prepare a Water Management Plan. Water management plans must be specifically designed for the basin or project in which they are being used, and are typically applicable to surface discharge of CBM-produced water. As part of the plan's preparation:

- **Consult surface owner(s) (as well as affected water-users) early in the planning process and throughout the development of Water Management Plans (WMPs).**
- **Understanding and Application of Laws, Regulations, and Policy.** Develop an understanding of the laws, regulations and policies that would apply to the development of the operation. These will vary by state and locality. For example, when considering underground injection, ensure that the components of the underground injection control program can be met, whether the EPA is administering the program or an individual state has received primacy for the program. Certain design and operating requirements should be researched through the

Resources

An overview document on CBM is ALL Consulting's "Coal Bed Methane Primer," a US DOE Fossil Energy project addressing education and public relations for public meetings, coordination between developers and local stakeholders, and general orientation on this subject. http://www.all-llc.com/CBM/.

Monitoring ground and surface waters helps gauge impact of CBM development on water quantity and quality.

appropriate jurisdictional agency (either the EPA or the primacy state) to ensure a complete application for approval is submitted. (See the sample Regulatory Compliance Checklist in Appendix D at www.westgov.org)

- **Consider Planning on a Watershed Basis.** Watershed Planning in the CBM context is an emerging practice that involves coordinating with other companies, surface owners and permitting agencies within, and potentially downstream of the watershed, and entails baseline monitoring and an assessment of quantity, quality, water rights, and downstream landowners' concerns. The State of Wyoming is in the process of developing a CBM watershed planning program, which may eventually serve as a model for other locales.
- **Mitigate Surface Water Discharge Effects,** i.e., headcuts, road crossing, impoundments, channel stability.

Discussion: Critical to the overall success of a project, is the initial planning before a project begins and refinement of the water management variables in that plan during development of a CBM prospect. To design an effective system for managing produced water, it is necessary to know the following: i) likely quality of produced water; ii) estimated water production rates at various phases of the project; iii) evaluation of the hydrologic relationship between ground- and surface-water; iv) nature and existing use of any proposed receiving waters, including seasonal flow rates flora, fauna and soils associated with surface discharge; v) current or proposed permitting and regulatory restrictions; and vi) the institutional framework governing groundwater within the project area. With the need to maintain flexibility and provide for contingencies, the initial plan may change as data is collected from actual operations.

BMP 2: Produced Water Options. Take the following factors into consideration when evaluating options for managing CBM produced water:

- Landowner preference and concerns
- Quantity and quality of water to be discharged
- Quality of the receiving water standards
- Environmental/ecological effects from surface discharge
- Downstream concerns
- Economic feasibility/cost effectiveness
- Beneficial use possibilities
- Proximity to streams/ponds/reservoirs/wetlands/lakes
- Proximity to clinker/scoria and gravel deposits
- Proximity to springs
- Long-term impacts to the environment
- Protection of groundwater

Discussion: There are a variety of options for managing produced water, including reinjection (either for disposal, or for storage and later retrieval), and surface discharge, which involves release of produced CBM water onto the earth's surface, either to surface water or surface soil. One way to group alternatives for surface discharge is using the following three general categories: i) discharge to surface water, ii) discharge to land surface with possible runoff, and iii) discharge to land surface with possible infiltration into subsurface aquifers and surface water.

Decisions and use of tools for managing produced water will also involve regulatory and technical considerations including geology, and economic and engineering factors as well as surface owner needs. Evaluation of water management options and produced water use alternatives will require planning, data gathering and analysis. Planning should include a detailed understanding of water classifications,

standards, water rights and any other compacts or laws that may exist. Where CBM development is proposed adjacent to or near important fisheries habitat, hydrologic mapping and analysis, and other related research, it is essential to gain a better understanding of ground- and surface-water interactions, and potential impacts of CBM development on water quality and quantity.

BMP 3: Understanding the Capacity of the Receiving Aquifer. When considering underground injection, ensure that the capacity of the receiving aquifer is adequate to handle the anticipated volume of water to be injected.

Discussion: Underground injection is a management option for produced water in some, but not all, places. It can be used for storage and retrieval (of high quality water), or for disposal. Injection is generally viewed as the emplacement of water into a zone or formation that is capable of receiving and storing water. Several important factors can influence the feasibility of injection, including availability of an injection zone, depth of the injection zone, injection pressures, needs for transportation of water, the rate of injection, the quality of water being injected, the quality of water in the receiving formation, and the ultimate storage capacity of the receiving formation(s).

B. Beneficial Use

BMP: Information for landowners. When the landowner is interested in possibly using CBM produced water, provide information about options for beneficial-use and about potential problems and liability.[4]

Discussion: Water extracted during CBM development presents challenges but may also offer opportunities for beneficial use of produced water. (See Appendix E for Beneficial Use Alternatives for CBM Produced Water, www.westgov.org) However, the quality of the water extracted influences how this water can be managed and whether it can be used for beneficial purposes. The quality of water that is produced will vary from basin to basin, within a particular basin, and over the lifetime of a CBM well.[5] There are a variety of technologies existing and evolving that may be applied to improve the quality of the water and consequently the options available for use. (See Appendix F for a discussion of Water Treatment Technologies, www.westgov.org)

Decisions about beneficial-use also need to factor in the reality that the availability of CBM- produced water is not sustained over time. The volume of produced water is typically very high for a short time after production starts and then drops off rapidly. For this reason, long-term reliance on produced water should not be

[4] It is very important that beneficial use of produced water is consistent and meets the requirements of water rights within a given state. In addition, it may be necessary in some cases to obtain a National Pollutant Discharge Elimination System (NPDES) permit. These are important considerations that require the ultimate user of the produced water to research all legal and regulatory aspects thoroughly in order to make informed decisions about beneficially using CBM produced water.

[5] As an example of the differences between basins, as pointed out by the State of Utah, CBM-produced water quality in the Colorado River drainage area of Utah is very poor compared to some other places. Consequently, the only currently approved surface water options are: a) no discharge, or b) a reverse osmosis type of treatment.

encouraged. This also applies to the use of the produced water to enhance wildlife habitat. The Rocky Mountain West is characterized by semi-arid to arid conditions. It is not realistic to think that ecological conditions that are related to areas with significantly more water can be sustained in these arid areas.

C. Water Quality

Land application of produced water can be of benefit to the surface owners in some cases, but also has the potential to produce negative long-term impacts to the soil's physical and chemical properties, if not properly managed. Water quality can also be affected by the construction and maintenance of ponds, impoundments and infiltration systems. These are generally an excavation or diked area that can be used for a variety of water management options. These include treatment; storage; evaporation leakage; disposal of liquids, and storage prior to another water management option, including injection or irrigation. Beneficial uses include fishponds, livestock and wildlife watering ponds and recreational ponds. Ponds can vary from less than one acre to several acres. Non-infiltration impoundments are usually constructed in low permeable soils, to prevent or decrease raw water loss due to subsurface infiltration or percolation.[6] (See Appendix G for a description of impoundment options. Appendix G is located with the Handbook at www.westgov.org)

"Land application of produced water can be of benefit to the surface owners in some cases, but also has the potential to produce negative long-term impacts to the soil's physical and chemical properties, if not properly managed."

BMP 1: Establishing a Baseline. As mentioned elsewhere, it is important to establish a baseline for ground- and surface-water quality in the area where development will occur, relying as much as possible on existing information.

BMP 2: Monitoring Data. Provide assistance to landowners who want monitoring data, either by providing the data, or directing them to the appropriate source, such as a regulatory agency that maintains the information.[7]

BMP 3: Distance from Outcrops. When drilling near outcrops of coal formations, understand the hydrology of the basin to determine a sufficient distance for well placement to avoid contamination of water wells and methane seepage at the outcrop of coal formations.

BMP 4: Fracturing Fluids. Discontinue the use of diesel fuel in hydraulic fracturing fluids injected directly into formations that contain underground sources of drinking water (USDW).

Discussion: Water-based alternatives exist and from an environmental perspective, these water-based products are preferable compared to diesel fuel. The EPA signed an agreement in December 2003 with three major companies that provide approximately 95 percent of the hydraulic fracturing services performed in the United States. The agreement calls for the voluntary removal of diesel fuel from hydraulic fracturing fluids injected directly into those formations that contain USDWs during hydraulic fracturing for CBM production. Included in the agreement are assurances from the companies that fluids used to replace diesel fuel will not endanger USDWs. The Memorandum of Understanding is available at http://www.epa.gov/safewater/uic/pdfs/moa_uic_hyd-fract.pdf

[6] It was noted by some CBM Advisory Committee members that the beneficial use of water is perceived as a positive by many in Wyoming's Powder River Basin.

[7] Individual NPDES permits dictate what type of monitoring will be required.

D. Protection of Wetland/Riparian Areas

BMP 1: Location of Nonlinear Features. To protect the biological and hydrologic features of riparian areas, woody draws, wetlands, and floodplains, locate all well pads, compressors, and other nonlinear facilities to the maximum extent possible outside of these areas.

BMP 2: Crossings by Linear Features. Avoid crossings of wetland/riparian areas by linear features, such as pipelines, roads, and power lines to the extent practicable. Where crossings cannot be avoided, impacts can be minimized through use of the following and other measures that may be consistent with the Corps of Engineers' nationwide permit program.[8]

- Developing site-specific mitigation plans during the permit approval process for all proposed disturbance to wetland/riparian areas
- Constructing crossings perpendicular to wetland/riparian areas
- For power lines, using the minimum number of poles necessary to cross the area
- Scheduling construction in wetland areas to minimize the duration of construction activity within the wetland, and, if possible, to concentrate such activity during dry conditions (that is, during late summer or fall), or when the ground is frozen during the winter
- Not depositing waste material below high-water lines in riparian areas, flood plains, or in natural drainage ways
- Locating the lower edge of soil or other material stockpiles outside the active floodplain
- Locating drilling mud pits outside of riparian areas, wetlands and floodplains, where practical
- Re-shaping disturbed channels to their approximate original configuration or other geomorphological configuration and ensuring they are properly stabilized
- Beginning reclamation of disturbed wetland/riparian areas as soon as possible after project activities are complete
- Conducting stream channel monitoring for erosion, degradation, and riparian health

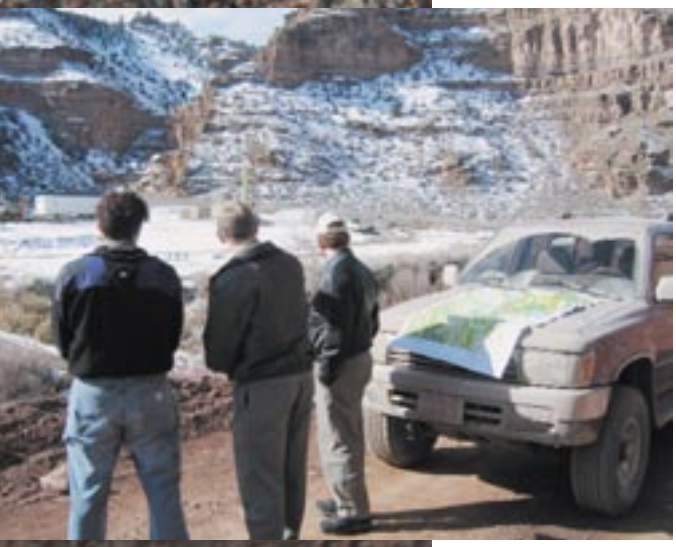
[8]See 33 CFR Parts 330.1-330.6 including Appendix A Part 330-Nationwide permits and conditions.

Resources

Handbook on Coal Bed Methane Produced Water: Management and Beneficial Use Alternatives Prepared by: ALL Consulting, Tulsa, Oklahoma for the Ground Water Protection Research Foundation, U.S. Department of Energy, National Petroleum Technology Office, and Bureau of Land Management. http://www.all-llc.com/CBM/.

IV. LANDOWNER AND OPERATOR RELATIONS

Introduction



Positive relations between landowners and CBM operators are an important aspect of successful development of the resource. As development expands in the Western states, there is increased interaction between the public, the CBM service industry, and local communities. While communities and states receive revenue from CBM development, this interaction can become sensitive in some split estate situations (where the surface and minerals are owned by different entities). Development of a strong relationship between the operator and landowner early in the process allows the operator to tailor operations to complement the landowner's uses. Adoption of BMPs is often helpful in addressing interaction challenges related to a range of landowner issues, including: location of wells, pipelines roads and facilities to accommodate surface uses; reclamation; topsoil preservation; privacy; noise; compensation for surface occupancy; effects and beneficial use of produced water; impacts from infrastructure development; livestock issues; potential loss of groundwater wells; and safety concerns. These practices, combined with open communications and respect for the land and the rights and values of the involved parties, can promote cooperative relationships as well as responsive and responsible CBM development. Best surface-use management practices are good business.

Landowner and Operator Relations Best Management Practices

A. Communication and Notification

It is critically important for operators to develop a relationship early with the surface owner and surface occupant. This relationship should be based on both parties respecting and attempting to accommodate each other's property rights and interests, with open and consistent communication. Both parties should negotiate in good faith.[9]

Onsite visits by the operator for the purposes of planning the development of the oil and gas resources are an important opportunity for coordination and cooperation with surface owners, permitting agencies and other affected parties. The onsite visit provides the opportunity for representatives of the affected entities to discuss and evaluate the proposed activities as well as alternatives for improved operations that consider the needs and rights of everyone. Onsite visits with different representatives can be conducted at different times. For instance, site visits with company representatives and the surface owner can occur when the well sites and access road are being considered and staked. Other site visits can occur after the well sites and access roads have been staked.

[9] "Oil and Gas at Your Door? A Landowner's Guide to Oil and Gas Development" http://www.ogap.org.

BMP 1: The operator and the landowner should each establish a single point of contact.

Issue that was discussed but upon which there was not agreement:

The CBM Advisory Committee discussed whether, how, when, and by whom surface owners might be notified about a CBM lease under their property, but the group did not reach agreement. The following BMP was proposed: "Provide the surface owner with a copy of the mineral lease or other publicly filed documents within 180 days of acquiring the lease either through purchase or assignment".

The perspective of some CBM Advisory Committee members was that surface owners need to know when the mineral estate under their property is leased in order to make informed decisions about management of the surface. They acknowledged that lease information is publicly available, but said it is extremely difficult for individual landowners to find and track the information. At one point in the discussion it was suggested that county governments might be enlisted to assist in notifying surface owners of leasehold ownership changes.

"It is critically important for operators to develop a relationship early with the surface owner and surface occupant."

The perspective of others was that landowners have access to this information as public record and, therefore, do not need additional notification. Furthermore, they expressed a concern that the proposed BMP could infringe on proprietary information that could affect the competitiveness of an operator. They also pointed to the emphasis elsewhere in the Handbook regarding early and frequent communication with landowners, which, in their view, precludes the need for the proposed BMP.

There was a sense in the group that this important issue merits further discussion and that finding a satisfactory resolution would contribute substantially to improving landowner-operator relations.

B. Plans, Agreements, and Bonds

BMP 1: Surface Use Agreements (SUAs), (sometimes also called Surface Owner Agreements, SOAs). Once an operator decides to undertake operations under a valid lease, immediately notify the landowner so there is adequate time to understand the proposed operations. This would include notice to the surface owner-of-record, based upon the last known address which is found in county records, and a minimum set of details about anticipated operations within the notice (e.g., tentative well, road, pipeline and facilities) and a request that the landowner provide input regarding locations which reduce adverse impacts of surface use. Thereafter, the operator and landowner should proceed in good faith to develop a mutually agreeable SUA.[10]

[10] It was suggested by some that a Master Surface Use Agreement might also be employed where the development involves a large ranch or related tracts (i.e. joint ventures or associations) and contains drilling and surface use procedures common to all wells, and where there is agreement on well and facility locations (or a procedure for determining locations), minimum footprints, reclamation criteria, and surface use compensation prior to drilling individual wells. It is believed by some that where numerous wells are contemplated, such Master Surface Use Agreements could significantly speed up well drilling, virtually eliminate well-by-well negotiations, mitigate adverse surface impacts, insure good reclamation practices, and reduce operator/surface owner conflicts.

Discussion: Operators and landowners could benefit by negotiating a mutually agreeable SUA. The SUA should address all relevant concerns, including such items as compensation for use of the surface, damage payments, and development plans that address facility and road locations, timing of operations, construction and reclamation requirements, water management, and access to the property. (See the WGA web site for samples of SUAs. www.westgov.org).

BMP 2: Water Well Mitigation Agreements. During CBM planning, operators should determine who has appropriated water wells within the vicinity of its proposed operations. Operators should determine whether their operations could impair the capability of these water wells and take appropriate actions to mitigate such impacts when CBM development is occurring within the same aquifer. A Water Well Mitigation Agreement should be offered to owners of wells and springs that could potentially be affected by CBM operations. Such an Agreement provides a method to determine operator responsibility for any damage to wells or springs and provides an opportunity to an owner of a well or spring affected by CBM operations to obtain repair, replacement or compensation by the operator. Surface owners and the operator should inventory existing water wells, prior to the commencement of operations, to have baseline data on the quantity and quality of the applicable wells. (See the WGA web site for a sample Water Well Mitigation Agreement. www.westgov.org).

C. Dispute Resolution

BMP 1: Dispute Resolution Services. Alternative Dispute Resolution services (ADR) should be considered to resolve disputes. An ADR process such as mediation that encourages good communication and development of working relationships, and that allows parties to retain control over the ultimate solution would be preferable.

BMP 2: Payment Mechanisms. Unless otherwise mutually agreed, the initial costs should usually be covered 50 percent by the Operator and 50 percent by the surface owner. Costs and attorney's/mediator's fees may be allocated as part of an agreement.

Resources

A Model Agreement Approach to Resolving Conflicts over CBM in the Powder River Basin" (Institute for Environmental Conflict Resolution), (March 2003). http://www.ecr.gov/s_publications.htm

Wyoming Split Estate Initiative – Petroleum Association of Wyoming, Wyoming Stock Growers Association, Wyoming Farm Bureau Federation, and Wyoming Wool Growers Association. http://www.wysei.com

Wyoming Agriculture and Natural Resource Mediation Program. To receive additional information on the program, or to receive a list of available mediators, contact: Mediation Coordinator, Wyoming Dept. of Agriculture, 2219 Carey Ave., Cheyenne, WY 82002, 307-777-7323, or the WY Agriculture Mediation Board, Department of Agricultural Economics, University of Wyoming, P.O. Box 3354, Laramie, WY 82071-3354, 307-766-5133.

V. INFRASTRUCTURE

Introduction

CBM development can impact the environment by affecting soils, land use, wildlife, aesthetics, and surface drainages as construction of roads, utility corridors, compressors, wells, and other facilities occur. When properly managed, CBM development may also enhance the use and value of a landowner's property. BMPs for this infrastructure can complement local regulations, influence how development proceeds, and can determine what will be impacted and the extent of the impacts. The impact on communities, the landscape, habitat, and air can be minimized through careful practices and infrastructure design considerations. These practices and design considerations can minimize surface disturbances, view shed impacts, noise levels, emissions, and erosion. This in turn has a direct bearing on the quality of life of the communities and can affect the success of the development project.

Infrastructure Best Management Practices

Guiding principles for infrastructure best practice operational standards can be summarized as follows:

- Use the means of operation that minimize adverse impacts while still maintaining efficient and cost effective operations.
- The surface owner, as a vested stakeholder, should be consulted early about decisions regarding siting for wells, roads and other facilities.
- In general, there needs to be a heightened awareness of habitat fragmentation in sensitive areas where there are high levels of biodiversity, or sensitive and critical habitats.
- During development, landowners should be kept informed of the ongoing schedule of activities to prevent serious use conflicts, and operators should communicate with each other regarding land use activities that could result in conflict.

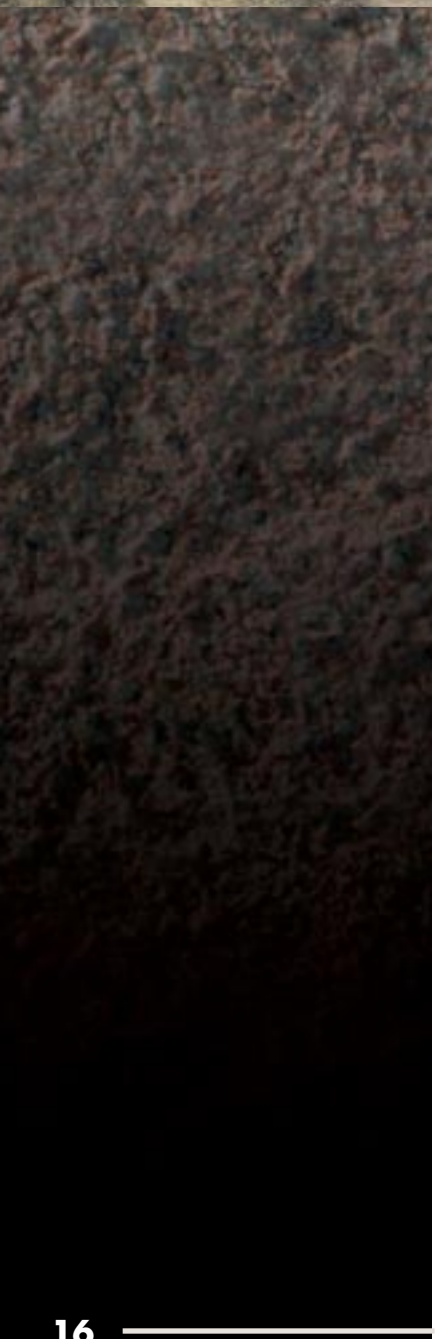
The following BMPs are suggested as means to minimize impact of operations. It should be noted that some of the BMPs in other sections of the document also relate to infrastructure.

A. Roads and Transportation

BMP 1: Minimizing Road Development. Where it is operationally feasible and safe, encourage the use of two-track roads into well locations. Suitable locations for two-track roads typically have the following features: low "average daily traffic" for wells being drilled, wells equipped with remote monitoring/telemetry, low maintenance traffic during production; flat to gently rolling country; stable soils; road use primarily during dry conditions.

BMP 2: Siting. Utilize existing roads to gas facilities to the maximum extent possible. Locate new roads in areas that will optimize year-round, all-weather access, and minimize surface disturbance and environmental impacts. Road location should be selected in consultation with the surface owner, and should consider future development plans.

BMP 3: Inclement Weather and Wet Ground Conditions. If using unimproved two-track roads, limit use during inclement weather and wet ground conditions when severe rutting and other resource impacts might occur.



BMP 4: Road Construction and Reclamation. Plan, maintain and construct all roads in conformance with road standards established by the local jurisdictional agency (i.e., BLM or the County). In select cases such as major access roads to the general development area or in individual circumstances, a higher standard of road is necessary.[11] Practices that can enhance reclamation include:

- Reclaim and revegetate all disturbed surface that will not be used for oil and gas operations in a manner that restores topsoil and minimizes erosion.
- Following well plugging and abandonment, the access road should be left in the condition prescribed by the surface owner. If complete reclamation is required, the access road should be recontoured back to the original contour, topsoil replaced, and revegetated so that the reclaimed areas blend with the surrounding land, and revegetation establishes either the agricultural crop desired by the surface owner or, over time, migrates toward the local native plant community.
- Use only certified and state inspected seed that is free of noxious weeds for reclamation/revegetation.

BMP 5: Bypass Routes. When feasible, heavy equipment and trucks should use bypass routes to avoid municipalities, schools, rural residential or other sensitive areas.

BMP 6: Service Industry Traffic. Enter into discussions with surface owners, local and other government agencies for road maintenance and traffic about potential problems and solutions related to increased CBM service industry traffic to ensure safety and minimize problems such as with dust, compaction, and debris.

B. Pipelines and Power Lines (Gas, Water, and Power)

BMP 1: Corridors. Use existing disturbance corridors whenever possible (ideally following access routes or existing pipeline routes).

BMP 2: Trenches. Locate all lines (i.e. gas and water disposal) in the same trenches (or immediately parallel to), and at the same time, if possible.

BMP 3: Equipment. Use ditch witches or wheel trenchers (versus back hoes) wherever practical for installation of buried lines.

C. Habitat and Species Protection.

The following measures help protect habitat and sensitive species:

BMP 1: Whenever practical, bury utilities, particularly in grouse habitat and in and near areas of sensitive species critical habitat, such as prairie dog towns. Minimize the disturbance footprint by burying utilities along the road to the extent possible, rather than cross-country.[12]

[11] Consider guidelines such as the "Gold Book" (Surface Use Standards for Oil and Gas Exploration and Development, which is available at http://www.blm.gov/nhp/300/wo310/O&G/Ops/GoldBook.pdf), the BLM Road Standards Manual 9113 for designing roads, applicable county or state design criteria, or similar high quality engineering standards.

[12] Early research indicates that utility poles can lead to diminished sage grouse numbers as the poles provide perches for raptors to prey on sage grouse. See, http://www.uppergreen.org/library/docs/Sagegrouse_factsheet.pdf, http://www.uppergreen.org/library/docs/NAmConf_Braun.pdf, http://www.uppergreen.org/library/docs/Sagegrouse_report.pdf.

BMP 2: Aerial power line should be designed and existing power poles should be modified, if possible, to prevent or minimize raptor perching and mortalities.

BMP 3: Reclaim and revegetate all disturbed surfaces as soon as possible after completion of pipelines or well abandonment pursuant to regulations and surface owner preference. Use native plants from local seed sources whenever possible.

BMP 4: Long Term Production Pits. Long-term production pits should be netted and fenced to prevent entry by birds, wildlife, and livestock, in accordance with applicable regulations.

BMP 5: Impacts to Environmentally Sensitive Areas. To the extent possible, minimize traffic and disturbance in and near wildlife habitat, wetlands, winter range, birthing and rutting areas, and other environmentally sensitive areas. Examples of ways to accomplish this objective are to minimize access and to use telemetry in monitoring wells.

D. Wells

BMP 1: Surface Disturbance Minimization. The use of alternative techniques, for example, directional drilling, drilling multiple wells from the same pad, co-mingling, recompletion, using existing well pads, are encouraged to minimize surface impacts, if technically feasible and not economically prohibitive.

BMP 2: Equipment Removal. Remove all equipment not necessary for well operations.

BMP 3: Landowner Involvement in Siting Decisions. Contact the surface owner before staking access routes and well facility sites.[13]

BMP 4: Siting and Construction Considerations. Where feasible, site and construct wells with the following considerations:

- Locate well sites in stable, non-erosive soil areas, with grass or brush cover and on relatively level areas that minimize pad construction. Choose sites that avoid steep slopes, unstable soils, stream bottoms, wetlands and floodplains.
- Where no code exists, locate facilities and roads away from occupied dwellings.
- Locate in visually acceptable areas (avoid dwelling view sheds) and paint facilities colors that blend in with the natural environment.
- Locate where safe access can be maintained year round.
- Avoid sensitive wildlife habitat and migration corridors. Consultation with the State wildlife agency can help determine areas to avoid.

BMP 5: Reclamation. As soon as reasonably possible after drilling is completed, conduct interim reclamation to reduce the drill site to the minimum area required for production operations and to restore the disturbed areas to their pre-disturbance condition, or better, pursuant to landowner preference. Interim reclamation should include the following:

- Recontour disturbed areas to be compatible with existing grades, including for agricultural purposes.
- Depending on landowner preferences, replace topsoil to at least the depth and quality that existed prior to disturbance for final reclamation of the site upon abandonment of the well.

Resources

Avian Power Line Interaction Committee (APLIC). 1996. Suggested Practices for Raptor Protection on Power Lines: The State of the Art in 1996. Edison Electric Institute/Raptor Research Foundation Washington, D.C. http://www.aplic.org/

[13] See also the Landowner and Operator Relations Chapter.

- Revegetate disturbed areas using a seed mixture to match native vegetation.
- Remove all chemicals, equipment, materials, and waste not necessary for sustaining production from the well pad.
- Use only certified and state inspected seed that is free of noxious weeds for reclamation.

BMP 6: Multiple Seam Completions. In areas where multiple seam completions are conducted, development plans should account for increased water production and the necessary disposal/management options and variations in water quality in the coal seams.[14]

E. Central Gas Gathering Treatment, Compression, and Metering Facilities.

BMP 1: Route Identification and Description. Contact the surface owner before staking routes and facility sites.[15] This provides an opportunity for mutual agreement about proposed locations and reclamation. Off-lease gathering and transmission pipelines can often be located in existing utility or transportation corridors.

BMP 2: Co-locating Water and Gas Gathering Lines and Roads. Locate roads and water and gas gathering lines in the same easement along a route agreed to with the surface owner. In general, for smaller tracts of land (160 acres or less) and tracts that may be subdivided later, roads and gathering lines should be located in designated utility easements or along property boundary lines to avoid splitting off unusable tracts.

BMP 3: Rights-of-Way Width and Line Depth. Minimize the width of gathering line rights-of-way. Bury the top of each gathering line below the surface,[16] unless local rock outcrops and terrain prohibit such burial, and the exception is agreed to by the surface owner.

BMP 4: Reclamation. Each gathering line should be double-ditched and topsoil should be restored in each disturbed location to at least the depth and quality that existed prior to such disturbance. Pipeline trenches should be compacted during back-filling. After installation, repair or other surface disturbance, the operator should promptly reclaim the surface, re-contouring to conform to existing grade, revegetating with a seed mixture specified by the surface owner, and filling of any settled areas with comparable quality topsoil. Use only certified and state inspected seed free of noxious weeds for reclamation.

BMP 5: Pipeline Agreements. Pipeline agreements should routinely permit the overlap of pipeline rights-of-way. [17]

Resources

Coal Bed Natural Gas Well Application for Permit to Drill and Plan of Development Preparation Guide. Bureau of Land Management. Buffalo Field Office. May 9, 2003. Contact: BLM Buffalo Field Office, 1425 Fort Street, Buffalo, WY 82834 (307) 684-1100.

[14] It was noted that multiple seam wells should be, and are most often, drilled from the same well site or utilizing multiple completions in the same well. In the Powder River Basin, multiple seam wells are routinely enclosed in the same small winterized box.

[15] See also the Landowner and Operator Relations Chapter.

[16] There were two suggestions regarding depth: One was to bury the top of each gathering line "48 inches" below the surface" and the other was "below plow depth."

[17] There were three alternate suggestions regarding the placement of subsequent pipelines. The suggestions were that they should be placed: a) within 10 feet or less of existing pipelines, b) "as close as possible to" existing pipelines, or c) pursuant to industry standards for installation.

BMP 6: Roads. Use the same standards/criteria as noted above for constructing roads to metering and compressor sites.

F. Pests and Noxious Weeds

BMP 1: Integrated Pest Management. Discuss proposed pest and weed management plans with the surface owner and permitting agency as part of the planning process. Application of and use of herbicides for weed control must follow applicable local and state regulations. Approved permits must be obtained before implementing plans as required.

BMP 2: Mulch. Mulch used for reclamation should be certified weed free.

BMP 3: Education. Review weed educational material during pre-construction on-site meetings with operators, subcontractors and landowners.

BMP 4: Revegetation. Moist soils near wetlands, streams, lakes or springs in the project area should be promptly revegetated if construction activities impact the vegetation in these areas. Revegetation should be designed to avoid the establishment of noxious weeds. As noted with reclamation, use only certified and state inspected seed that is free of noxious weeds in any revegetation operation.

BMP 5: Pests. Waste handling, construction practices and operations should take into consideration pests such as mosquitoes (which can potentially transmit West Nile Virus – of significant concern for sage grouse and other wildlife, as well as humans), rodents (which can potentially transmit hantavirus), flies, and other pests that can cause problems. It was pointed out that at this time (Spring 2004) there is no proven connection between CBM development and these pests.[18]

BMP 6: Vehicles/Heavy Equipment. Vehicles and machinery contaminated with soil can be sources of non-native noxious weed seed, which can seriously degrade native habitats. When moving vehicles and machinery from areas containing populations of noxious weeds, consider washing vehicles prior to entering CBM development areas.

BMP 7: Long-term weed infestation issues. It is important for companies to plan for the condition of the surface lands after holding ponds no longer hold water. It is likely that the ponds will have changed the soils and habitat characteristics of that immediate land and when water is no longer there, non-native weed infestation is very likely. Reclamation plans should include post-pond weed and soil restoration considerations.

G. Visual Impacts

BMP 1: Minimize Footprint and Use Existing Facilities. Minimize the footprint of well locations, access roads and utilities, and use existing well pads where feasible. Avoid creating large cut and fill slopes, minimize clearing, taking into consideration state well-spacing requirements.

BMP 2: Color Selection and Screening. Use vegetative and topographic screening when siting well and facility locations, avoid highwall cuts, and reclaim all portions of the location not needed for production facilities. All well facilities should be painted a color which allows the facilities to blend with the background, typically a vegetated background.

BMP 3: Ridgelines. Avoid locating wells, equipment and facilities on highly visible ridgelines.

[18] The University of Montana is completing a three-year study on the affects of West Nile Virus on Sage-grouse populations.

Following construction, the use of an erosion control mat, improves reclamation success.

Control of noise levels around production facilities is a best practice that is important to wildlife and communities.

H. Noise Abatement

BMP 1: Noise Levels. Where CBM operations generate noise that can impact established receptors (for example residences, churches, schools, established campgrounds or sensitive wildlife) control of noise is good practice.[21] If low frequency noise becomes an issue, it should be addressed in consultation with those being affected.

BMP 2: Distance. Provide the appropriate distance between a CBM facility and an existing noise-sensitive receptor (residences, schools, medical facilities, sensitive wildlife habitat areas and recreational areas).[20]

BMP 3: Features. Consider utilizing obstacles as a noise abatement measure.

Discussion: Noise can be reduced by construction of obstacles in the direct path from the noise source to a receiver. These obstacles can be tightly spaced wood fences (no gaps in the wood panels), engineered noise barriers, concrete fences, earth berms, structures, straw bale "zig-zag" design structures or naturally occurring hills. Care must be taken even with a tightly spaced wood fence. Even a small opening between the individual slats on a fence can allow a pathway for noise to transit through the opening. In fact, the noise can actually be enhanced through a small opening because the noise energy is channeled through the opening. To mitigate this problem, wood fences are generally constructed with two faces with the slats on one face overlapping the adjacent face.

BMP 4: Compressor and Pumpjack Equipment Noise Abatement. The following measures can help abate compressor and pumpjack equipment noise:

- Utilize compression equipment, which reduces or alleviates noise (e.g., properly selected hospital grade mufflers matched to the noise reduction being sought).
- Use design retrofits to reduce or alleviate noise associated with older compression equipment.
- Locate equipment to take advantage of surface topography to aid in noise abatement, etc.
- Install high-grade mufflers on the exhaust of compressor engines, wellsite, and facility engines to reduce the exhaust noise.
- Consider the use of multi-blade fan configuration on the cooling fan.
- Electric power should be utilized when possible (rather than diesel).

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[19] Two versions of additional specific noise reduction guidance were suggested. Version one: In the absence of local ordinances or state laws, a general guideline of 55 dBA for outdoor residential, farms, and outdoor areas where people spend significant amounts of time can be considered as published by the U.S. Environmental Protection Agency entitled "Information On Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety." Version two: Noise should be mitigated to the satisfaction of the receptor. Noise in excess of 50 decibels measured 200 feet from the equipment or at a property line or an established receptor (for example residences, churches, schools, established campgrounds, or sensitive wildlife) is normally unacceptable. For residential areas, the BLM has established a maximum standard of 48.6 dB(A)Leq at any structure. CBM wells, facilities and equipment can often be cost effectively quieted below these maximum standards using "hospital grade" mufflers (which may be buried), sound panels (or hay bales), sound insulated buildings and other methods.

[20] There were two alternative suggestions regarding appropriate distance. Version one: Provide the appropriate distance… to comply with an Ldn of 55 dBa. In otherwise quiet rural areas, even low level sound can be heard for long distances. Version two: Provide the appropriate distance… to minimize noise impacts. Prescribing a specific noise standard may conflict with local ordinances and state laws.

- Use progressive cavity pumps or other quiet-running, artificial lift equipment instead of conventional pumpjacks/rocker arms to reduce noise and visual impacts.

I. Air Quality

BMP 1: Reduce Emissions. Operators should strive to reduce total emissions in CBM operations.

Discussion: EPA has joined with companies across all sectors of the natural gas industry to reduce methane emissions through a voluntary partnership known as the EPA Natural Gas STAR Program. (See http://www.epa.gov/gasstar/index.htm for further information.) For larger internal combustion engine, lean-burn technology is recommended.

BMP 2: Particulates. Emissions of particulate matter from construction and road use can be minimized with various techniques such as the application of water, gravel, or other dust suppressants, with at least 50 percent control efficiency. Companies should contact the counties to ascertain the procedures to be followed on county roads and should post and obey speed limits set by local authorities.

BMP 3: Air Quality Management/Coordination with Local Stakeholders. In some jurisdictions, city, county and regional air-quality oversight entities are now being established in addition to the State and Federal air quality regulatory agencies to deal with possible exceedances of air quality standards. Operators should contact the appropriate regulatory agency to ensure compliance and coordination of air quality requirements. Other BMP examples include: establishment of cooperative boards to ensure air quality performance that meets local, regional, state and national requirements; increased monitoring resources due to the involvement of a wider body of participants; need for effective coordination to avoid conflicting efforts or duplicative performance requirements for CBM operators.

J. Public Safety Around CBM Infrastructure

BMP 1: Operational Awareness and Signs. Unless otherwise required by state or federal requirements, provide operational information and post necessary signs to minimize accidents. Post telephone number for emergencies.

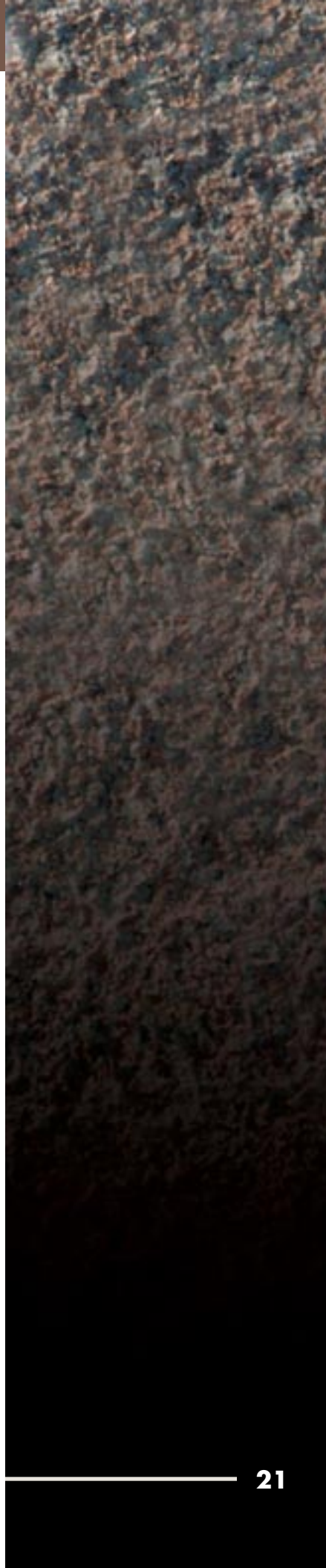
BMP 2: Site Security. In consideration of each landowner's land use, and as necessary in high-risk areas, minimize entrance by unauthorized personnel through effective site security or barriers.

BMP 3: Flare Fire Prevention. In CBM basins where cavitation is used as a completion technique (instead of hydraulic fracturing), flaring can be a safety and fire hazard. In addition to complying with local regulations regarding fire prevention, specific precautions should be taken to prevent fires, including wetting down areas and ensuring adequate berming of flares. Flare pits used in cavitation should not be constructed adjacent to public roadways.

BMP 4: Coal Fires. In the San Juan Basin, dewatering of Fruitland Coals may contribute to coal fires burning at the outcrop. While control of such coal fires has proven to be extremely difficult, during dry periods, areas near underground coal fires should be monitored for grass and forest fires.

BMP 5: Education. Educate schools and communities about the dangers of going near CBM activities.

BMP 6: Emergency Management Plans. Residents should be made aware of emergency procedures and be supplied with emergency phone numbers for fire departments and operators. Each operator should have an emergency management plan in place that is shared with state and local emergency management authorities.



APPENDIX A

Acronyms

ADR – Alternative Dispute Resolution

APD – Application for Permit to Drill

BLM – Bureau of Land Management

BMP – Best Management Practice

CBM – Coal Bed Methane

DOE – Department of Energy

EPA – Environmental Protection Agency

NEPA – National Environmental Policy Act

NPDES – National Pollution Discharge Elimination System

RMP – Resource Management Plan

SOA – Surface Owner Agreement

SOP Agreement – Standard Operating Practices Agreement

SUA - Surface Use Agreement

SN – Sundry Notice

USDW – Underground Source of Drinking Water

USFS - United States Forest Service

USF&WS - United States Fish & Wildlife Service

WGA – Western Governors' Association

WMP – Water Management Plan

APPENDIX B

Enlibra Principles

WGA uses a set of principles to guide its work on complex environmental and natural resource issues. Based on successful problem solving experiences, the Enlibra principles were articulated and endorsed by the Western Governors to serve as a guide to policy development and decision-making in the West. Enlibra is a hybrid word with Latin roots created to mean balance and stewardship. Enlibra is based upon the following eight interdependent principles:

One: National Standards, Neighborhood Solutions - Assign Responsibilities at the Right Level

Two: Collaboration, Not Polarization - Use Collaborative Processes to Break Down Barriers and Find Solutions

Three: Reward Results, Not Programs - Move to a Performance-Based System

Four: Science For Facts, Process for Priorities - Separate Subjective Choices from Objective Data Gathering

Five: Markets Before Mandates - Pursue Economic Incentives Whenever Appropriate

Six: Change a Heart, Change a Nation - Environmental Understanding is Crucial

Seven: Recognition of Benefits and Costs - Make Sure All Decisions Affecting Infrastructure, Development and Environment are Fully Informed

Eight: Solutions Transcend Political Boundaries - Use Appropriate Geographic Boundaries for Environmental Problems.

The WGA resolution, *Principles for Environmental Management in the West*, can be found on the Web at: http://www.westgov.org/wga/policy/05/enlibra.pdf.

APPENDIX C

Western Governors' Association Coal Bed Methane Advisory Committee Members

The CBM Best Practices Handbook represents a working collaboration between a number of individuals from federal, state, tribal and local government. The Western Governors also consulted with and utilized input from a broader group of interested stakeholders and experts. The following individuals are current members of the CBM Advisory Committee and many of them participated in the development of the handbook.

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Dan Arthur
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Bernie Barlow
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Southern Ute Growth Fund

Facilitators:

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Meridian Institute

The following additional Appendices are lengthy and were not included in the printed version of the WGA CBM Best Practices Handbook. They may instead be accessed via the WGA Web site at www.westgov.org

D. Regulatory Compliance Checklist – Wyoming Example

E. Beneficial Use Alternatives for CBM Produced Water

F. Water Treatment Technologies

G. Impoundment Alternatives

H. Emerging Technologies and Practices

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