A REGULATORY PERSPECTIVE ON
COALBED METHANE DEVELOPMENT IN ALBERTA

University of Alberta School of Business
BUEC 560 – Energy Technologies and Institutions

Prepared For:
Dr. J. Doucet

Submitted By:
Jeff Sansom

February 1, 2005
# TABLE OF CONTENTS

1.0 INTRODUCTION................................................................................................................... 1

2.0 STATUS OF CBM ACTIVITY IN ALBERTA................................................................. 2

3.0 REGULATORY STATUS OF COALBED METHANE IN ALBERTA ....................... 2

4.0 PURPOSE OF THE PAPER............................................................................................... 3

5.0 ISSUES IDENTIFIED WITH CBM DEVELOPMENT....................................................... 3

   5.1 EXTENSIVE MINERAL LEASES...................................................................................... 3
   5.2 DENSITY OF WELLS.................................................................................................... 3
   5.3 DEWATERING OF COAL SEAMS.................................................................................. 4
   5.4 VENTING AND FLARING OF CBM GAS..................................................................... 5
   5.5 GAS MIGRATION INTO GROUNDWATER AQUIFERS................................................... 5
   5.6 HYDRAULIC FRACTURING............................................................................................ 6
   5.7 NOISE............................................................................................................................ 6
   5.8 CUMULATIVE IMPACTS............................................................................................... 6

6.0 REVIEW OF CURRENT LEGISLATION GOVERNING CBM DEVELOPMENT.......... 7

   6.1 AGENCIES RESPONSIBLE FOR REGULATING CBM DEVELOPMENT....................... 7
   6.2 EXTENSIVE MINERAL LEASES...................................................................................... 7
   6.3 DENSITY OF WELLS.................................................................................................... 8
   6.4 DEWATERING OF COAL SEAMS.................................................................................. 8
   6.5 VENTING AND FLARING OF CBM GAS..................................................................... 9
   6.6 GAS MIGRATION INTO GROUNDWATER AQUIFERS................................................... 10
   6.7 HYDRAULIC FRACTURING............................................................................................ 10
   6.8 NOISE............................................................................................................................ 11
   6.9 CUMULATIVE IMPACTS............................................................................................... 12

7.0 RECOMMENDATIONS........................................................................................................ 12

   7.1 MINIMIZE THE LAND AREA IMPACTED BY CBM DEVELOPMENT.......................... 12
   7.2 REVIEW OF IMPACTS OF DEWATERING NON-SALINE AQUIFERS............................ 13
   7.3 EVALUATE THE OPTIMUM METHOD TO USE/DISPOSE OF NON-SALINE WATER... 14
   7.4 AVOID OR MINIMIZE VENTING AND FLARING......................................................... 14
   7.5 PREVENT AND RESPOND TO PROBLEMS ASSOCIATED WITH GAS MIGRATION.... 15
   7.6 REQUIRE NON-TOXIC SUBSTANCES FOR HYDRAULIC FRACTURING IN NON-SALINE WATER ZONES 15
   7.7 LIMIT NOISE.................................................................................................................. 16
   7.8 REQUIRE EIAS OF CUMULATIVE EFFECTS OF LARGE SCALE CBM DEVELOPMENTS .... 16
   7.9 EVALUATE ENHANCED RECOVERY OF CBM USING CO₂.................................. 17

8.0 CONCLUSION....................................................................................................................... 17

Figure 1: Natural Gas from Coal in Canada – Areas of Exploration ........................... 1
Figure 2: Coal Zones with CBM Potential in Alberta................................................. 2
Figure 3: Stratigraphic Interval Containing Coal Zones with CBM Potential in Alberta 3
1.0 Introduction

As demand for natural gas continues to increase in North America and the supply of conventional natural gas continues to decline within the continent, firms involved in the upstream oil and gas industry are beginning to examine the possibilities of developing gas reserves from “unconventional” sources. “Unconventional” sources include natural gas from coal seams, tight gas sands, gas shales, and gas hydrates.¹ Due to the abundance of coal reserves in Western Canada, some firms are beginning to focus their attention towards Alberta and British Columbia due to their high potential for the extraction of “natural gas from coal” (NGC). NGC is commonly referred to as “coalbed methane” (CBM). While coal deposits exist in other regions of Canada, the most significant deposits are located within the extensive areas of sedimentary rock, which lie between the Canadian Precambrian Shield in the east and the Rocky Mountains in the west. The coal formations with the greatest potential for CBM development are located within Alberta and in the Peace River coalfield in British Columbia (Figure 1).²

Although CBM volumes can vary from one coal seam to another, greater volumes of CBM are generally found in the higher-ranking coal reserves, such as bituminous coals as opposed to lower subbituminous coals and lignite found at shallower depths (Figure 2). Since Alberta is blessed with abundant reserves of both bituminous and subbituminous coal and has the infrastructure (i.e., pipelines) to transport CBM to markets, it presents an ideal opportunity for firms to examine the feasibility of future CMB development. Current estimates by the Alberta Geological Survey (AGS) indicate that 91 billion tonnes of coal resources at depth are suitable for mining within the province (Figure 3). Furthermore, AGS estimates that an additional 2 trillion tonnes of coal at depth in the Alberta Plains may be suited for CBM exploration. AGS also forecasts that the coal reserves in the Foothills and Rocky Mountains significantly add to the tonnage suited for CBM exploration. In total, 14 trillion cubic metres or 500 trillion cubic feet (tcf) of gas has been estimated to be in place in all the coal in Alberta.³

---

¹ Canadian Society for Unconventional Gas Website: http://www.esgu.ca
² Canadian Society for Unconventional Gas Website: http://www.esgu.ca
³ Alberta Geological Survey Website: http://www.ags.gov.ab.ca
With such large coal reserves, the extraction of CBM has the potential to spur a major new wave of development by the upstream oil and gas industry in Alberta and British Columbia. Since the development of CBM in Canada is relatively new and the potential for CBM development within Alberta is high, various stakeholders including landowners and environmental organizations are expressing their concerns about CBM development. Many of these concerns are based upon experiences with negative environmental impacts associated with CBM developments in the United States (US) and for some stakeholders, the failure of the Alberta Government to undertake public consultation prior to authorizing the commercial development of CBM. Some stakeholders are requesting a moratorium on CBM development within the province until the public has been consulted and regulations and guidelines are in place to deal specifically with issues, principally environmental, associated with CBM developments.

2.0 Status of CBM Activity in Alberta

According to Alberta Energy's (AE) figures, about 50 CBM wells were drilled in Alberta in 2000. By December 2003, the number grew to over 1,000 wells with over 400 wells having some production. As of September 2004, almost 2,500 CBM wells were drilled, including 500 recompleted wells (i.e., a reentered well bore to complete a different zone), of which over 1,000 had some production (Figure 4). Overall, most drilling activity was associated with projects in the exploration, experimentation or pilot stages of development. Currently, fewer than 100 wells produce a small amount of CBM from two commercial projects in Alberta.  

3.0 Regulatory Status of Coalbed Methane in Alberta

To address stakeholders' concerns, AE is currently reviewing the regulations and guidelines that govern CBM development to ensure that they continue to balance economic benefits for Albertans while protecting the land, air and water resources. As part of the review, a cross-section of stakeholders is currently participating in provincial working groups to study issues related to CBM development. A number of community information sessions were held in Spring 2004 to give Albertans information on such developments and collect their suggestions with respect to any issues they may have. The Coalbed

---

4 Alberta Energy Website: [http://www.energy.gov.ab.ca](http://www.energy.gov.ab.ca)
5 Canadian Society for Unconventional Gas Website: [http://www.csgu.ca](http://www.csgu.ca)
Methane/Natural Gas in Coal Multi-Stakeholder Advisory Committee (MAC) expects to release its preliminary findings from consultation activities in early 2005 and submit its final report to the Alberta Government in the summer of 2005.  

4.0 Purpose of the Paper

This paper will examine the major issues identified by stakeholders through the consultation process with respect to CBM developments and provide an overview of the current regulatory scheme that governs such developments. Based on the review and assessment, I will provide recommendations with respect to enhancing current government regulations to address the various issues raised by stakeholders concerned with the potential increase in CBM development throughout the province.

5.0 Issues Identified with CBM Development

5.1 Extensive Mineral Leases

CBM wells are generally less productive as compared to conventional gas wells. Consequently, firms may seek to ensure that they obtain extensive, contiguous mineral leases for CBM development upon which they can drill enough wells to make a project economical. Since it may take as many as 10 to 20 CBM wells to extract the same amount of gas produced by two or three conventional gas wells, such extensive mineral leases could potentially translate into widespread surface disturbance in an area. Moreover, greater disturbance is more likely for CBM developments that have wet wells (i.e., additional wells drilled for disposal of water within the coal must also be drilled). Based on US producers interviewed, a land base of at least one or two townships is generally considered for a feasible CBM project.

5.2 Density of Wells

The standard well spacing in Alberta is one gas well per section (640 acres) and one oil well per quarter section (160 acres). To obtain the maximum recovery of CBM, a firm may need to drill wells at a higher density than required for a conventional gas development. The density required is dependent on the

---

6 Alberta Energy Website: http://www.energy.gov.ab.ca/com
7 Encana Website: http://www.encana.com
9 Oil and Gas Conservation Act. Oil and Gas Conservation Regulations. Alberta Regulation 151/7.
specific geological conditions at the site. A higher density of wells could lead to greater surface disturbance not only from the construction of well pads and access roads, but also from the increased density of pipelines connecting each well. Such extensive surface disturbance could potentially limit land use by farmers and, in wilderness areas, cause the loss or fragmentation of wildlife habitat and make species more vulnerable to predators and hunters. For example, in the Powder River Basin of Wyoming, the maximum well density used was about one well per 40 acres. This drilling density is considerably higher than that used for normal conventional gas wells (i.e., a 16 fold increase from current EUB regulations).\textsuperscript{11}

5.3 Dewatering of Coal Seams

The dewatering of coal seams is often necessary prior to the production of CBM. The quantity and quality of water can vary from one coal formation to another. The quantity of water depends on the cleat (i.e., tiny cracks within the coal) volume and the permeability of the coal seam. Some coal seams investigated to date in Alberta have tight cleats and, thus contained relatively small volumes of water.\textsuperscript{12}

One of the greatest concerns of landowners in the vicinity of CBM operations is that dewatering of aquifers may affect their water supply and force them to drill more water wells or find alternative sources of water. Since each CBM development may require high well densities and this density may extend over considerable tracts of land, the potential effects of dewatering could be felt over a wide area. Besides affecting groundwater users, any decline in the water table in an area could indirectly lead to the drainage of wetlands and reduced flows in streams and rivers resulting in significant long-term impacts to surface water resources.

Another challenge associated with the extraction of CBM is the management/or disposal of the water produced by the dewatering process.\textsuperscript{13} This challenge becomes more critical when the water is saline or brackish (i.e., high levels of total dissolved solids (TDS)). If improperly managed, saline water can react with the soils and damage the surface of the land. With respect to volumes of water, the average well produces over 40 cubic metres/day in the Power River Basin in Wyoming; where as, the average well

produces around four cubic metres/day in the older San Juan field in New Mexico. For perspective, an average well in the Powder River Basin could fill more than four Olympic swimming pools in a year. From this data, it is clear that dewatering activities of CBM developments with several wells per section may result in significant quantities of water being removed from aquifers and significant quantities of water of potentially poor quality requiring proper management/or disposal.

5.4 Venting and Flaring of CBM Gas

During the early stages of the dewatering phase in CBM wells, only a small volume of gas is produced. Firms may choose to vent or flare the gas to defer the cost of the equipment needed to capture and compress the gas until the volumes reach an economic level. Venting and flaring of gas is a great concern to local residents adjacent to CBM developments since the release of gas or its incomplete combustion generates air pollution. Moreover, methane (CH$_4$) released to the atmosphere is also a powerful greenhouse gas, which contributes to global climate change.$^{14}$ Besides emissions, the light and noise from flares may also be disruptive if they are close proximity to residences, livestock, or wildlife.$^{15}$

5.5 Gas Migration into Groundwater Aquifers

Methane sometimes naturally migrates from gas reservoirs into aquifers, but this migration can also occur as a result of incomplete casing on wells or casing failures. The migration of methane into groundwater aquifers has been previously documented from CBM developments in some places in the US. Public concern lies in that the methane that migrates into groundwater can then flow to the surface and be released to the air via residential or agricultural groundwater wells or it may travel within the groundwater aquifer to a location where the water naturally outcrops at the surface or the bottom of a lake or river. Such migration can potentially be a nuisance to groundwater users as it can interrupt the flow and pressure of water, as well as, pose a danger or explosion hazard if it is allowed to concentrate inside an enclosed structure or home.

---


5.6 Hydraulic Fracturing

Hydraulic fracturing is a process that serves to open up the coal seams and help release the CBM from the formation. Fracturing is usually achieved by pumping a fracturing fluid or inert gas (i.e., nitrogen or carbon dioxide ($CO_2$)) into the coal seam at pressures sufficient to crack open the cleats within the coal enabling the gas to more easily flow to the well. Fracturing fluids are primarily water-based, but may contain other substances, including acid and small quantities of hydrocarbons.\textsuperscript{16} In public forums, landowners have expressed their concerns that CBM such fracturing processes could contaminate their water wells.

5.7 Noise

Noise is an issue identified by various landowners concerned with the development of CBM. Typically, the initial drilling of a CBM well and the associated vehicle traffic create some noise. However, once drilling ceases, there will be continual noise from the pump jack, which brings the water to the surface, and the compressor. With the exception of CBM from dry coals, where the gas flows freely, the pressure of the gas when it reaches the surface is quite low compared to conventional gas operations. Consequently, the gas must be compressed before being piped any distance. Due to the need to generally increase gas pressures, and also the generally higher density of CBM wells, CBM developments will generally have more compressor stations than conventional gas wells or an additional stage of compression at existing stations.

Besides noise impacts, compressors also emit pollutants such as nitrogen oxides ($NO_x$) from the gas or diesel fuel that drive them (i.e., unless it is powered by electricity). $NO_x$ is an acidifying emission that contributes to the formation of ground level ozone and to the secondary formation of fine particulate matter.

5.8 Cumulative Impacts

Finally, landowners and environmental groups are very concerned on the cumulative impacts of large-scale developments. In particular, stakeholders are very concerned with CBM developments, which require the coal seams to be dewatered to extract the gas. Dewatering is a major concern for shallow CBM wells, since it may impact non-saline aquifers on a regional basis. Furthermore, these groups are also concerned over the substantial impact on the land surface from the construction of new well pads, interconnecting

pipelines and supporting infrastructure. Environmental groups are extremely concerned with CBM development in regions where previous oil and gas activity has not occurred, as potential impacts will be more dramatic. If development occurs in natural areas, such groups are fearful that the fragmentation of the land by roads and pipelines will impact wildlife, while the disturbance of the ground surface could destroy native vegetation and result in the introduction of non-native species.

6.0 Review of Current Legislation Governing CBM Development

6.1 Agencies Responsible for Regulating CBM Development

Currently, the Alberta Energy and Utilities Board (EUB) regulates CBM extraction within the province in the same manner as conventional gas activities. Notwithstanding, the EUB recognizes that CBM developments may differ somewhat from that of conventional gas developments. At this time, the proponent is required to apply for a well licence in the same manner as a conventional well. In addition, the proponent is required to obtain an approval and/or licence from Alberta Environment (AENV) for the dewatering and disposal of water from wells that produce non-saline water. If a proponent has to apply to AENV for an approval or licence for dewatering non-saline water, they are required to provide information on the baseline hydrological and hydrogeological conditions. AENV then uses this information to determine potential impacts and decide on the appropriate requirements for water management, which is done on a case-by-case basis.

6.2 Extensive Mineral Leases

The current regulations do not directly address the issue of surface land disturbance associated with the extensive leases and the density of wells required for CBM projects. Currently, the EUB approval process affords directly affected landowners an opportunity to comment on requests for well densities that exceed the routine EUB requirements (i.e., one gas well per section). However, stakeholders feel the current process is insufficient to direct proponents to reduce surface land disturbance. Stakeholders believe that

---

18 Sections 38 and 51 of the Water Act.
20 Personal Communication with Rick Nutbrown, Water Administration Engineer, Alberta Environment, Northern Region.
the higher densities inherent with CBM developments have resulted in exemptions by the EUB being the norm for past CBM applications. Several stakeholders, particularly environmental groups, advocate that CBM developments with large surface disturbances be required to undergo an Environmental Impact Assessment (EIA) to address their cumulative impacts over a more regional perspective.

6.3 Density of Wells

Currently, the EUB spacing requirements apply to specific geological formations or zones, and not to the number of wells allowed on the surface. Stakeholders argue that the intention of the EUB spacing requirements is to regulate the exploration and orderly development of the underground gas resources, and not designed to limit the surface impacts. For instance, multiple wells targeting different zones can be paced adjacent to each other. Likewise, a firm may purchase the rights to several zones or formations, but different firms may own the right to different formations. In this case, each firm could potentially construct its wells on separate pads.

Since CBM wells are regulated in the same manner as conventional gas wells, a firm must request special approval from the EUB if it proposes to exceed the standard density. Consequently, the EUB has discretion to determine exactly what spacing will be allowed for each formation and indirectly could address issues of surface impacts. Such a special request involves the EUB currently requiring the proponent to undertake discussions of proposed spacing with stakeholders who are directly affected by the development and reporting any concerns to them.

6.4 Dewatering of Coal Seams

According to AENV's current guidelines, a proponent is required to obtain a licence and/or approval for the removal of non-saline water from a coal seam from AENV. This approval process involves public notification and input. Within the application, AENV requires a proponent to assess the environmental risks before issuing an approval for dewatering non-saline aquifers or disposal of such water to the

---

21 Oil and Gas Conservation Act. Oil and Gas Conservation Regulations. Alberta Regulation 151/7.
environment. On the other hand, if dewatering involves saline water a licence and/or approval from AENV is not required. Such withdrawal and disposal falls under the jurisdiction of the EUB. Under these circumstances, the EUB requires a proponent to report all produced water volumes. Such water must be injected into deep saline aquifers, usually below the zone of extraction. Saline water from current CBM wells in operation is managed this way. In general, stakeholders view Alberta's current guidelines for handling water with different levels of salinity as more stringent than in some parts of the US. Notwithstanding such stringent requirements, stakeholders have expressed concern that the current process makes it difficult for AENV to estimate long-term cumulative impacts to water resources by reviewing applications on a well-by-well basis. Stakeholders have noted that AENV does not have sufficient data on aquifers and river basins to determine the cumulative impacts of extracting water from coal seams for CBM developments.\(^{24}\) Again, stakeholders contend strongly that EIAs are needed for large CBM development to understand cumulative impacts to both surface water and groundwater resources. Stakeholders allude to the fact extensive cumulative impact studies have been required prior to approval for large-scale CBM developments on federal land in the US.\(^{25}\)

6.5 Venting and Flaring of CBM Gas

The EUB regulates the venting and flaring of gas from all types of oil and gas operations and CBM is currently regulated in the same manner as conventional gas wells. The current guideline on flaring does not refer specifically to CBM development.\(^{26}\) The EUB permits the venting of sweet gas, which includes CBM, during well testing and maintenance, but sets criteria for the volume of gas that can be vented and the duration of venting. Venting is permitted only if the volumes of gas are insufficient to burn. Firms are required to report venting operations to the EUB. Well test or maintenance venting is not allowed within 500 metres of a residence, unless the resident gives consent and it is approved by the EUB.\(^{27}\) Flaring is

\(^{24}\) Hui, E. Director, Alberta Environment Drinking Water Branch. 2003. Presentation on “Understanding the Business of Coalbed Methane”.


permitted until gas volumes are sufficient to make piping economic, which in the case of CBM could take several months. The EUB also requires a firm to consider alternatives to flaring to reduce emissions. Other options include incineration or a catalytic converter, which converts small and variable gas streams to CO₂. Currently, the EUB is revising Guide 60 that regulates venting and flaring. The new guideline recognizes that the extraction of CBM is different from that of conventional gas as CBM venting is exempt from the duration and volume limits set for venting during well testing or maintenance. At this time, it is unclear what volumes of CBM will be vented or how the total volumes will compare with the venting of conventional gas wells. The Clean Air Strategic Alliance (CASA) has a province wide plan to reduce flaring and venting from oil wells (i.e., solution gas), but there are currently no targets to reduce venting and flaring of CBM.

6.6 Gas Migration into Groundwater Aquifers

Since CBM reservoirs in Alberta are tight, there have been very few documented cases where natural methane leakage has occurred. Notwithstanding, where CBM developments reduce the pressures, there is a potential for gas from coal seams to enter groundwater aquifers through the annuli of old wells or wells with leaky casing. This potential problem should be detected by casing vent flow tests that are required by the EUB. Recognizing the public’s concern, industry has identified the need to encourage baseline analysis of methane gas seepage.

6.7 Hydraulic Fracturing

From a regulatory perspective, there is no outright restriction to what substances can be added to water to assist in hydraulic fracturing. For example, hydrocarbons such as diesel fuel that contain various toxic substances, may be used in fracturing fluids; however, water based polymer gels are available and

---

30 Gunter, W. 2003. Climate change solutions may be found in coalbed methane recovery. Climate Change Central Newsletter 5.
preferable from an environmental perspective.\textsuperscript{32} As a result of landowner complaints that hydraulic fracturing had contaminated their water wells, the US Environmental Protection Agency (EPA) investigated this issue. The EPA determined that since groundwater flows toward the well where the pressure is the lowest, it is unlikely that the fracturing fluids would migrate beyond the well zone. Although the study did not fine definitive evidence that drinking water wells were contaminated by CBM hydraulic fracturing, the EPA did advise that water based alternatives exist and from an environmental perspective were preferable. In Alberta, oil based fluids are uncommon for fracturing CBM, but if they are used, a firm must notify the EUB.

Besides fracturing additives selection, a secondary issue with hydraulic fracturing very important to regulators relates to the volume of water needed when non-saline water is used. This is particularly relevant if supplies of fresh water in the area are limited. To address this, the EUB also has established a protocol for consulting AENV when drilling plans could affect non-saline water production. As previously indicated, the diversion of non-saline water for fracturing in the White Zone of the province requires a licence under the \textit{Water Act}. Where non-saline water is used, it is important that regulators ensure that as much water as possible is recycled. Currently, both the EUB and AENV are reviewing this issue to determine whether more definitive rules are needed with respect to freshwater use for hydraulic fracturing for CBM developments in shallow zones.

\textbf{6.8 Noise}

The EUB currently has strict limits on noise from all energy installations.\textsuperscript{33} In addition, to the noise from compressors, emissions of NO\textsubscript{x} from gas or diesel driven compressors are of a concern to regulators. Consequently, the EUB and AENV also recognize the need to limit NO\textsubscript{x} emissions and regulate such emissions by a Code of Practice for compressors and pumping stations.\textsuperscript{34}

\begin{flushleft}
\textsuperscript{32} US Environmental Protection Agency. 2002. \textit{Study of Potential Impacts of Hydraulic Fracturing of Coalbed Methane Wells on Underground Sources of Drinking Water.}
\textsuperscript{34} Alberta Environment. Undated. \textit{Code of Practice for Compressor and Pumping Stations and Sweet Gas Processing Plants.}
\end{flushleft}
6.9 Cumulative Impacts

Currently, there is no regulatory requirement for EIAs to be conducted for CBM developments within the province. Consequently, there is no regulatory process that directly addresses the issue of cumulative impacts associated with CBM developments in combination with other industrial developments in a specific area or region.

7.0 Recommendations

At this time, CBM projects developed within Alberta are currently being regulated under existing legislation that applies to conventional gas developments. Due to calls from industry and various stakeholders to alter current standards, AE initiated a review to determine whether the existing regulatory structure for CBM developments is appropriate.\textsuperscript{35,36} Preliminary findings from these consultation activities are expected to be released in early 2005 with the final report being submitted to the Alberta Government in the summer of 2005.\textsuperscript{37} To date, the preliminary report has not been released, so in lieu of the MAC committee’s recommendations, I am providing my personal views with respect to changes to the current regulatory structure governing CBM developments.

7.1 Minimize the Land Area Impacted by CBM Development

Because of the potential high density of CBM well pads and associated roads and pipelines, I believe every effort should be made by a firm to minimize their impact to the land. The current EUB process gives landowners an opportunity to comment on requests for well densities that exceed the routine on gas well per section, but in my opinion this process in itself is insufficient. Any request to the EUB for more than the standard of one well per section should be carefully scrutinized. For that reason, I believe the proponent should be required to provide an evaluation of the technical and economic feasibility for multiple wells from one well pad. I feel this is reasonable since it is technically possible to use directional drilling technologies to access large underground areas from a single well, thus reducing the amount of surface land disturbance.

\textsuperscript{35} Alberta Energy. 2002. \textit{Alberta Examines the Potential for Coalbed Methane Development.}

\textsuperscript{36} Alberta Energy. 2003. \textit{Coalbed Methane/Natural Gas from Coal.}

\textsuperscript{37} \texttt{http://www.energy.gov.ab.ca/com/Gas/NGC-CBM/default.htm}
To support this assertion, horizontal drilling from the base of the well bore, which is one type of directional drilling, has been used to access CBM in several areas in the US.\textsuperscript{38}

I strongly believe that if the regulatory process encourages companies to minimize their footprint on the land, through utilization of multiple well pads, there will also be other indirect benefits. First, concentrating operations on fewer sites will avoid the proliferation of compressors and reduce the overall area impacted by noise. Second, it may also help reduce venting and flaring. Finally, use of directional drilling techniques will reduce the area required to provide the Right-of-Way (RoW) for pipelines associated with such developments. This reduction may make it possible to concentrate wells along development corridors or adjacent to pipelines and powerlines, thus reducing the amount of land fragmentation caused by CBM developments.

7.2 Review of Impacts of Dewatering Non-Saline Aquifers

Although the coal seams in Alberta have far lower permeability than the coal seams found in the US suggesting that the volume of produced water will be lower for CBM developments within Alberta, I believe that the regulatory policy needs to be revisited to ensure that it is in alignment with the provincial water strategy.\textsuperscript{39} While current regulations make ever effort to ensure that non-saline water aquifers used for water wells are not impacted, I believe there must be concrete provisions to protect landowners and residents if their wells are affected by dewatering activities associated with CBM development. Proponents should be required to pay for water well tests before, during and after all dewatering operations. These tests should encompass at least a one-kilometre radius from each CBM well or one kilometre from the further extent of underground drilling when directional drilling has been used. If a water well is impacted, the testing zone should then be expanded. Firms should be required to compensate landowners for any losses, and be required to maintain the status of the water supply established during baseline evaluations.

\textsuperscript{38} Molvar, E. 2003. *Drilling Smarter: Using Directional Drilling to Reduce Oil and Gas Impacts in the Intermountain West.*

7.3 Evaluate the Optimum Method To Use/Dispose of Non-Saline Water

Water removed during the initial dewatering of coal seams can be dealt with in different ways. First, the EUB requires saline water from CBM wells to be handled in the same manner as conventional gas wells, through deep well disposal. My feelings are that the current regulation is satisfactory and should remain unchanged. Second, when water produced from dewatering is non-saline, proponents must ensure that the water meets AENV existing requirements for water quality before discharging it onto the surface or to a surface waterbody. While some firms have indicated during consultation that they may look for a relaxation of current requirements for handling water, I strongly believe it is essential to uphold existing standards for both saline and non-saline water. Furthermore, I believe AENV should provide an opportunity for public input in the use and disposal of different grades of non-saline water produced by dewatering activities associated with CBM developments. Such usage could range from watering cattle to irrigation. I also believe AENV should require continual testing of water quality from dewatering activities since the salinity of the produced water may increase overtime. An increase in salinity may require a change to initial disposal methods. Finally, firms wishing to dispose of saline or marginal non-saline water from CBM wells should be required to investigate potential synergies with other firms involved in the conventional oil and gas industry. This is especially relevant where large quantities of non-saline water are being used for well drilling and enhanced recovery of oil. Where possible, water produced from CBM should be utilized instead of non-saline water to enhance the recovery of either oil or gas wells. I believe AENV should issue some guidelines to industry describing the level of effort required to investigate potential synergies; moreover, AENV should verify in its approval process that the firm has fully investigated all reasonable potential uses of the water.

7.4 Avoid or Minimize Venting and Flaring

I believe that every effort should be made to avoid or minimize the venting of methane. This reduction would protect air quality and minimize greenhouse gas emissions, since methane is far more potent than CO₂ as a greenhouse gas. With rapidly increasing number of CBM wells, venting even a small volume of

---

methane at each well will increase methane emissions and make it more difficult for Canada to reach greenhouse gas reduction targets. While there is recognition of the fact that some venting may occur during the initial stages of dewatering, before there is sufficient gas to flare, I believe there should be stringent requirements to minimize and, if possible, avoid any venting of CBM. I believe that with proper design, the venting and flaring can be eliminated. To avoid venting of methane during the early stage of dewatering, the gas can be collected and burned intermittently by installing a flare stack with pilot light. Furthermore, incinerators, which destroy the gas more thoroughly than flares can be used instead. New technologies are also being developed such as catalytic converters to convert methane to CO$_2$ at a reduced cost. I believe that CASA should take a lead in any plans to alter requirements for CBM venting and flaring. This multi-stakeholder team has already set targets for the reduction of solution gas flaring. I believe a similar process would be a workable way to set realistic targets for minimizing the emissions from venting and flaring of CBM.

7.5 Prevent and Respond to Problems Associated with Gas Migration

With respect to gas migration, I believe a proponent should be required to assess the risk of gas migration prior to start up of a CBM development as part of its application to the EUB. A geological assessment of the strata should indicate if gas migration is a possibility. In addition, a firm should be required to indicate what measures will be taken to monitor or mitigate gas migration during operations as part of its EUB application for approval.

7.6 Require Non-Toxic Substances for Hydraulic Fracturing in Non-Saline Water Zones

Although a study by the EPA concluded “the threat to public health from hydraulic fracturing to be low, it may be feasible and prudent for industry to remove any threat whatsoever from injection of fluids”. The study also pointed out that the use of diesel fuel in fracturing fluids was the main cause of stakeholders concern and that “water based alternatives exist and from an environmental perspective, these water based products are preferable”. Knowing that alternatives exist to diesel and using the precautionary principle in

\[41\text{ US Environmental Protection Agency. 2002. Study of Potential Impacts of Hydraulic Fracturing of Coalbed Methane Wells on Underground Sources of Drinking Water.} \]
environmental planning, I would recommend that industry be required to use only non-toxic alternatives as additives during hydraulic fracturing activities.

7.7 Limit Noise

I strongly feel that the EUB must continue to stringently regulate the level of noise generated by all industrial activities. Although more pumps and compressors may be required for CBM operations, current technologies coupled with improved operational design can reduce noise to acceptable levels. I believe there should be no relaxation of current standards. For example, compressors may not be needed at every wellhead and should be located as far as possible from residences. Installing state-of-the-art compressors with a lower basic noise level can also reduce noise levels.\textsuperscript{42} In addition, where noise levels from an existing compressor is creating a disturbance, a baffle around it can be constructed to reduce the sound. Once again, if good planning is used (i.e., multiple wells are placed on a single), the noise from pumps and compressors can be concentrated into fewer areas. Moreover, if more wells are located on a single well pad, the proponent may have an easier task to locate pumps and compressors away from residences. It may then also be possible to use a central compressor to suck gas along the line instead of pushing it with a normal compressor.

7.8 Require EIAs of Cumulative Effects of Large Scale CBM Developments

In my opinion, the cumulative impacts associated with CBM developments are a special concern that is not addressed thoroughly in the current regulatory structure. Given the higher density of wells and potential for large-scale development in a given area, I believe that an EIA should be required for large CBM developments. In comparison, EIAs are mandatory for steam assisted gravity drainage (SAGD) oilsands projects and the land base affected by large scale CBM developments may potentially as great or greater than that impacted by SAGD developments.\textsuperscript{43} Currently, CBM wells are regulated as if it were a

\textsuperscript{42} Personal Communication with PC Compression Inc. of Nisku

\textsuperscript{43} Environmental Protection and Enhancement Act. Environmental Assessment (Mandatory and Exempted Activities Regulation). Alberta Regulation 111/93.
conventional gas well and exempt from environmental assessment process.\textsuperscript{44} I believe large-scale CBM developments should be on the mandatory list with a land based trigger that is comparable to the land disturbance required for a comparable mandatory SAGD project that is triggered based on an output volume (i.e., produces 2000 cubic metres of crude bitumen or its derivatives per day).\textsuperscript{45}

7.9 \textbf{Evaluate Enhanced Recovery of CBM Using CO$_2$}\textsuperscript{17}

Given the tremendous potential for CBM development in Alberta, I envision a great opportunity for injecting CO$_2$ into coal seams to enhance the recovery of CBM and to reduce emissions of greenhouse gas within the province. I strongly believe that industry and government should collaborate on the research (i.e., funding and studies) to demonstrate the benefits and risks associated with belowground storage of CO$_2$ not only as it applies to CBM development, but to all oil and gas production activities within the province.

8.0 \textbf{Conclusion}\textsuperscript{17}

I truly believe that CBM and oilsands development are the future of the oil and gas industry in Alberta. Given that CBM is a big part of the future of energy development within Alberta, I find it only prudent that the Alberta Government in consultation with various stakeholders are currently reviewing the existing regulations and guidelines associated with CBM projects. In general, I believe the current regulatory framework for conventional gas industry applies to CBM development; however, as discussed above, I strongly believe that some changes need to be made to the current system (Section 7.1-7.9). I am looking forward to reading the advice from the MAC committee in the near future and see how it compares to my suggestions.

\textsuperscript{44} \textit{Environmental Protection and Enhancement Act. Environmental Assessment (Mandatory and Exempted Activities Regulation). Alberta Regulation 111/93.}\textsuperscript{45} \textit{Environmental Protection and Enhancement Act. Environmental Assessment (Mandatory and Exempted Activities Regulation). Alberta Regulation 111/93.}
Figure 2: Coal Zones with CBM Potential in Alberta
Figure 3: Stratigraphic Interval Containing Coal Zones with CBM Potential in Alberta