



Kallisto Energy Corp.

Application for a Well Licence
Crossfield East Field

February 24, 2012

ENERGY RESOURCES CONSERVATION BOARD

Decision 2012 ABERCB 005: Kallisto Energy Corp., Application for a Well Licence, Crossfield East Field

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ENERGY RESOURCES CONSERVATION BOARD

Calgary Alberta

**KALLISTO ENERGY CORP.
APPLICATION FOR A WELL LICENCE
CROSSFIELD EAST FIELD**

**2012 ABERCB 005
Application No. 1697898**

DECISION

Having carefully considered all the evidence, the Energy Resources Conservation Board (ERCB/Board) hereby approves Application No. 1697898, subject to the conditions set out in Appendix 1.

INTRODUCTION

Application

[1] Kallisto Energy Corp. (Kallisto) applied, pursuant to Section 2.020 of the *Oil and Gas Conservation Regulations*, for a licence to drill a vertical well from a surface location in Legal Subdivision (LSD) 11, Section 26, Township 27, Range 1, West of the 5th Meridian (the 11-26 well). The purpose of the well would be to obtain crude oil production from the Basal Quartz (BQ) Formation. The maximum hydrogen sulphide (H₂S) concentration would be 17.4 moles per kilomole (1.74 per cent), with a cumulative drilling H₂S release rate of 0.0271 cubic metres per second (m³/s). The radius of the corresponding emergency planning zone would be 110 metres (m). The proposed well would be located about 3.3 kilometres (km) north of Airdrie.

INTERVENTIONS

[2] CrossAlta Gas Storage & Services Ltd., BP Canada Energy, BP Canada Energy Company, and TransCanada Pipelines Limited (collectively referred to as “CrossAlta”) own and operate a gas storage scheme using the depleted Crossfield East Elkton A and D pools (Elkton storage reservoir), as approved by the ERCB in Approval No. 7607. CrossAlta is concerned with the possibility of communication between its stored gas and the wellbore of the proposed 11-26 well.

[3] The Freehold owners of the minerals in the northwest quarter of Section 26, where the well is proposed, supported the application.

HEARING

[4] The Board held a public hearing in Calgary, Alberta, which commenced on January 10, 2012, and concluded on January 28, 2012, before Board Members George Eynon, P.Geol. (Presiding Member), and Rob McManus, M.E.Des., and Acting Board Member Andy Warren, P.Eng. Those who appeared at the hearing are listed in Appendix 2.

ISSUES

[5] The Board considers the issues respecting the application to be

- the risk of communication with the Elkton storage reservoir,
- the rights of the parties and the public interest, and
- the mitigation of risks.

[6] In reaching the determinations contained in this decision, the Board considered all relevant materials constituting the record of this proceeding, including the evidence and argument provided by each party. Accordingly, references in this decision to specific parts of the record are intended to assist the reader in understanding the Board's reasoning relating to a particular matter and should not be taken as an indication that the Board did not consider all relevant portions of the record with respect to that matter.

THE RISK OF COMMUNICATION WITH THE ELKTON STORAGE RESERVOIR

Evidence

[7] CrossAlta and Kallisto agree that the Basal Quartz "A" (BQA) pool and the Elkton storage reservoir are in effective communication, as indicated by the well at LSD 7-25-27-1W5M (the 7-25 well); however, they disagree over whether this communication is natural or induced by a hydraulic fracturing operation at the 7-25 well in 2001.

[8] In 2007, CrossAlta acquired 3-D seismic in the area and mapped the Elkton D pool as extending under Section 25. It realized that the 7-25 well had been producing storage gas since 2001. CrossAlta noted that the well logs did not indicate any Elkton Formation was present, and that, prior to interpreting the seismic data, it believed the edge of the gas storage was about 1000 m from the 7-25 well.

[9] CrossAlta contended that it was a 5-tonne hydraulic fracture stimulation in the BQA pool reservoir at the 7-25 well in 2001 that caused a breach of the Elkton storage reservoir. CrossAlta argued that an increase in the gas production rate at the 7-25 well and a close correlation with pressures in the storage pool at LSD 10-36-27-1W5M (the 10-36 well) show that communication was occurring after the stimulation took place.

[10] CrossAlta submitted that the production and inflow performance relationship analyses indicated that some form of external pressure support was necessary to justify the production rates observed at the 7-25 well and that it could only have come from the storage reservoir. Furthermore, the composition of gas at the 7-25 well exhibited a continuous reduction in CO₂ concentration and a continuous increase in methane concentration that CrossAlta contended indicated increased production of storage gas from the 7-25 well. CrossAlta also argued that the material balance calculation suggested that the 7-25 well has produced more gas than its recoverable gas in place after fracture stimulation.

[11] Kallisto, on the other hand, argued that the BQA pool sands in the 7-25 well were in communication with the Elkton storage reservoir prior to the fracture stimulation. Kallisto noted the BQA pool discovery pressure of 20 900 kilopascals (kPa) from the drillstem test (DST) in the well at LSD 10-1-28-1W5M (the 10-1 well) on November 1964. Subsequent pressures from the DST in November 1968 (19 400 kPa) and the static gradient test in September 1970 (18 500 kPa) indicated that pressure had steadily dropped by about 2350 kPa from 1964 to 1970. Kallisto argued that this pressure depletion occurred while there was no production from the BQA pool, indicating that the Elkton storage reservoir was in communication with the BQA pool before production commenced from the pool at the 7-25 well.

[12] Kallisto submitted that the pressure in the 7-25 well had declined by 5768 kPa by July 1980; however, by January 19, 2001, prior to the hydraulic fracture stimulation in the 7-25 well, the well exhibited an extrapolated pressure of 9157 kPa. Kallisto submitted that the increase in pressure at the 7-25 well while the BQ zone was abandoned—and not on production—is explained by gas storage operations commencing in the Elkton storage reservoir in 1994. Further, Kallisto submitted that the pre-frac pressure was essentially the same as the post-frac pressure of 9214 kPa that was recorded on February 22, 2001. Kallisto argued that because the pressures before and after the fracture stimulation were essentially the same, communication between the BQA and the Elkton storage reservoir was not induced by the fracture stimulation, but had existed before it.

[13] Kallisto submitted that the DST on the 10-1 well was a valid BQA test, basing its conclusion on the interpretation of the core from the section over which the DST was run. Kallisto described the core as being sandstone and silty shale, intermixed with carbonate clasts, and exhibiting sedimentary structures indicative of deposition by debris flows. It also described what appeared to be an Elkton carbonate/dolomite boulder within the sandstone and silty shale section. Based on this, Kallisto concluded that the carbonate clasts were Elkton colluvium that was derived from the adjacent Elkton high and deposited in a muddy, clastic, dolomitized matrix, and that the DST on the 10-1 well was, therefore, a valid BQA pool test and not an Elkton test as suggested by CrossAlta.

[14] CrossAlta argued that the DST interval was not BQA, but rather karsted Elkton and that the 20 900 kPa value from November 1964 represented the Elkton D pressure and should not be used in the BQA pool pressure analysis. However, CrossAlta admitted that it had not examined the core itself, but was interpreting photographs of the core taken and presented in evidence by Kallisto.

[15] CrossAlta submitted that the depth interval tested by the DST in the 7-25 well covered more than just the BQA pool reservoir interval and, therefore, should not be used for BQA pool pressure analysis. However, Kallisto asserted that the DST interval included only BQ sediments, a portion of which was the productive zone.

[16] CrossAlta also argued that Kallisto's extrapolated pre-frac pressure of 9157 kPa at the 7-25 well was invalid because the shut-in time of 90 minutes was too short to establish radial flow and there were insufficient data for a valid Horner plot extrapolation.

[17] CrossAlta calculated a pre-frac pressure of 7880 kPa and a post-frac, pre-production pressure of 9214 kPa. Based on the difference between these pressures, it concluded that the

fracture stimulation was the direct cause of communication between the BQA pool and the Elkton storage reservoir.

[18] CrossAlta accepted the static gradient pressure at the 7-25 well on September 1970 as a valid pressure and the initial pressure for the BQA of about 18 500 kPa. It stated that the pressure in the Elkton storage reservoir at the time was in the range of 13 000 to 16 000 kPa. It argued that this difference in pressure is further evidence that the BQA pool and the Elkton storage reservoir were not in communication prior to the fracture stimulation in the 7-25 well.

[19] Kallisto, relying on a study by Zaitlin et al. (2002), interpreted the Crossfield area as a setting of relatively high accommodation space at the time of BQ deposition, with thick, blocky sands and fine-grained sands from mainly meandering streams. Kallisto used this study to support its seismic interpretation of a north-south trending BQ channel cutting into the Shunda Formation immediately west of the well at LSD 9-26-27-1W5M (the 9-26 well). Kallisto used a seismic model based on a thick, porous BQ sand at LSD 15-2-26-8W4M to match the seismic amplitudes.

[20] CrossAlta submitted that regional BQ was deposited in all low areas of the pre-Cretaceous unconformity surface, completely filling the topography and over-topping the Mississippian highs. CrossAlta argued, therefore, that communication would occur between the proposed 11-26 well and the storage reservoir through sand-on-sand contact within the regional BQ and the BQA sands. Relying on a study by Arnott et al. (2002), CrossAlta argued that the BQ is a fluvial estuarine complex in a low accommodation setting where continual reworking of early sediments resulted in thin sheet-like deposits that are in lateral sand-on-sand contact with each other.

[21] CrossAlta further submitted that there is an isolated BQ channel in Section 26. It contended that the regional BQ is “ubiquitous” and that the 11-26 well would encounter the same sheet-like sandstones found in the 9-26 well and in the wells located at LSD 2/10-34-27-1W5M (the 2/10-34 well) and 2/4-22-27-1W5M (the 2/4-22 well).¹ CrossAlta argued that these wells indicated a laterally extensive regional BQ that is in sand-on-sand contact with the BQA pool sandstone.

[22] Kallisto explained that definition and characterization of cross-communication between sheet-like sandstones in the study by Arnott et al. (2002) does not apply since his paper was focused on a different area about 250 km upstream of the Crossfield area during BQ deposition. It further noted that characterization of the Crossfield area as exhibiting “low to intermediate” accommodation space in the study by Leckie et al. (2004) was based on a larger regional assessment. Kallisto concluded that the interpretation of the Crossfield area by Zaitlin et al. was more applicable and noted that none of the 11 sheet sands identified by Zaitlin et al. further south are found in the Crossfield area.

[23] In cross-examination, CrossAlta acknowledged the following: (1) the Arnott et al. study area is about 250 km away from the Crossfield area, (2) the 11-26 well would not have been in a low accommodation setting during the time of BQ deposition, and (3) thin sheet-like sands are not associated with an intermediate to high accommodation setting.

¹ 2/ refers to the second well with a bottomhole location in the same LSD.

[24] Nevertheless, CrossAlta contended that the presence of high porosity streaks would enable fluid flow within and between wells, and that this would occur from the proposed 11-26 well, through the 9-26 well, and to the 7-25 well. CrossAlta contended that the BQ in these wells was predominantly composed of porous sandstones and that the wells did not encounter thick mudstones as suggested by Kallisto. However, under cross-examination, it accepted that the BQ sands in the 9-26 well had an average porosity of only about 8 per cent after shale correction.

[25] To illustrate its sand-on-sand connectivity argument, CrossAlta presented two seismic models with 8 m of porous BQ sand: one with communication over the crest and the other with communication around the shoulder of the Elkton high. The shoulder model, which represented a number of potential pathways, indicated the potential for communication between the 11-26 well and the BQA pool at the 7-25 well via a route south of the Elkton high in Section 25.

[26] While Kallisto agreed that a BQ sand-on-sand communication pathway to the BQA pool along a profile south of the Elkton high could exist in theory, it argued that the presence of tight nonreservoir interchannel and overbank deposits at the 9-26 well and the wells located at LSD 9-35-27-1W5M (the 9-35 well) and LSD 11-23-27-1W5M (the 11-23 well) demonstrated that the BQ channel sands are isolated from the BQA pool.

[27] CrossAlta agreed that the 2/4-22 and 2/10-34 wells have low permeability and are not in effective communication with the BQA pool at the location of the 7-25 well. CrossAlta distinguished between effective communication and geologic communication, considering effective communication as that which occurs over the economic life of the reservoir. CrossAlta explained that simply because communication was not evident in the pressure signature of the wells initially, it does not mean that the wells were not in effective communication—only that the communication takes time to become effective and noticeable in the pressure data. CrossAlta acknowledged that the 2/10-34 well, which was drilled into the BQ, had an original discovery pressure of above 20 000 kPa.

[28] CrossAlta also raised concerns that dissolution channels and natural fractures within the Mississippian at the pre-Cretaceous unconformity surface might facilitate communication between the proposed 11-26 well and the Elkton storage reservoir. CrossAlta contended that the logs for the 9-26, 10-1, and 10-36 wells indicated karsting below the BQ, and argued that hydraulic fractures could propagate out of zone through natural fractures and dissolution channels to create secondary connectivity with the gas storage reservoir.

[29] Kallisto stated that the interpretation by CrossAlta of karsting at and near the top of the Mississippian Elkton/Shunda Formations in the 9-26, 9-35, and 10-1 wells is possible, but concluded that the rocks are not reservoir quality. Kallisto stated that karsted rocks can be tight and often form seals. Kallisto also noted that there are natural fractures within the sand-bounded carbonate unit identified in the core of the 10-1 well but not within the sands themselves. Kallisto noted that there is no evidence of natural fractures on the seismic and that most of the karsting of the Shunda unit that might have developed was likely to have been removed by scouring the BQ channel at the location of the proposed 11-26 well.

[30] Kallisto stated that the BQ sand that is the target at the 11-26 well is a north-south trending channel deposit, comparable to one that occurs about 11 km to the east where the BQ "M," "N," and "O" pools are located. The channel deposits are the product of a larger, braided to meandering fluvial system with occasional and relatively thick, overbank sandstone deposits and

interchannel mudstones. Kallisto contended that these channel deposits represent a later, younger stage of sedimentation and that these channels cut down into and through older deposits such as the BQA pool sands.

[31] Kallisto stated that it expected a 36.5 m thick, fining-upward sequence at the proposed location of the 11-26 well with a “dirty” (i.e., shaly) gamma-ray log signature and porosity lower than that of the lacustrine beach deposits in the 7-25 well, which have up to 6 m of sand with a blocky, “clean” gamma-ray log signature and high porosity. Kallisto argued that the sands of the BQA pool at the location of the 7-25 well are part of an earlier lacustrine shoreline deposit.

[32] Given its interpretation of a north-south linear channel feature from the seismic and its deep scour model and that the 2/10-34 well tested both gas and light brown oil from two intervals down to -1281 m subsea, Kallisto asserted that the 11-26 well would encounter oil in the BQ.

[33] CrossAlta disputed the concept of a separate “deep scour” BQ channel, presenting seismic comparisons that showed the depth of erosion to be much less than what Kallisto suggested. CrossAlta noted Kallisto’s predicted depth of erosion of the Shunda Formation at -1277 m subsea, but from seismic modelling calculated that this estimate was too deep by about 14 to 16 m. CrossAlta estimated the top of the Mississippian rocks to be only about 5 m deeper than the 9-26 well. CrossAlta argued, therefore, that the 11-26 well would produce gas and not oil, as applied for by Kallisto because the proposed well is 6 m structurally updip of the 10-34 and 2/10-34 wells that encountered gas at -1283 m subsea, which is the base of the BQ sand.

[34] In response, Kallisto asserted that CrossAlta’s calculations failed to account for regional dip, which is estimated to be 6–8 m between the location of the 2/10-34 and 11-26 wells.

[35] CrossAlta expressed considerable concern with the potential for hydraulic fracturing at the 11-26 well to create communication with the storage unit. CrossAlta stated that the edge of the gas storage reservoir was 1000 m from the 7-25 well and that a mere 5-tonne hydraulic fracture stimulation at that well had created communication. However, CrossAlta submitted seismic maps indicating that more than 15 m of the Elkton Formation extended over most of Section 25.

[36] Kallisto noted that the 7-25 well is, therefore, only about 100 m from the storage reservoir. Kallisto submitted that the proposed 11-26 well would be more than 900 m from the eastern edge of Section 26 and about 1200 m from the Elkton D reservoir. Kallisto stated that if it needs to stimulate the BQ, it would do so with a hydraulic fracture stimulation in the range of 20–40 tonnes. It noted that a fracture stimulation of this size is commonly used in this type of reservoir at these depths and in this area. While CrossAlta noted that there is significant uncertainty regarding how far a fracture might propagate from the wellbore, both parties suggested that it was unlikely that such a stimulation would cause a fracture to extend more than 200 m in this case.

[37] Kallisto stated that the 11-26 well is also targeting oil in the Upper Mannville Glauconitic Formation. It stated that hydraulic fracture stimulation of the zone would not affect the Elkton storage reservoir since the Glauconitic seismic anomaly is only about 400 m wide and is 110 m above and 1000 m west of the Elkton storage unit and the BQA pool. Kallisto noted that the Glauconitic Formation is expected to be oil bearing and may not need to be hydraulically fractured.

Analysis and Findings

[38] The panel agrees with Kallisto and CrossAlta that the BQA is in communication with the Elkton storage unit reservoir; however, the evidence presented by the parties is not conclusive on when or how communication was established. There are pressure data that indicate the BQA pool may have been in communication with the Elkton storage reservoir prior to any production from the BQA pool at the 7-25 well.

[39] The panel notes the parties' different interpretations of the early pressure data presented for the BQA pool. CrossAlta's evidence that the DST pressure of the 10-1 well in 1964 and the DST pressure of the 7-25 well in 1970 are not valid BQA pool pressures was not convincing. The panel, therefore, finds Kallisto's conclusion that the initial pressure depletion of about 1200 to 2350 kPa between 1964 and 1970, prior to production, is evidence of natural communication and is the most reasonable interpretation of the available pressure data.

[40] The panel notes the evidence of close vertical proximity (a few metres only) of the BQA pool reservoir to the Elkton storage reservoir, as indicated by the reworked Elkton sediments in the BQA core from the 10-1 well. The panel further notes the close horizontal proximity (about 100 m) of the 7-25 wellbore to the Elkton storage reservoir, as indicated by the seismic interpretation of the Elkton surface in Section 25 by both parties.

[41] The panel, therefore, is not persuaded that the relatively small 5-tonne hydraulic fracture stimulation performed at the 7-25 well in 2001 is the only reasonable explanation for the communication. The panel finds that it is possible, and indeed likely, that it merely enhanced a pre-existing communication between the BQA in the well and the Elkton storage reservoir.

[42] The panel notes that CrossAlta's argument for communication between the proposed well at 11-26 and the BQA pool in the 7-25 well and, therefore, to the Elkton storage unit, is almost entirely based on what it described as sand-on-sand communication within the BQ being a ubiquitous phenomenon in the area. However, the panel notes that the evidence from the three wells closest to the 11-26 well on the east side of the Elkton storage unit—the 10-34, 9-26, and 2/4-22 wells—indicates that there are few sands in the BQ, which both Kallisto and CrossAlta agreed were of relatively low porosity and permeability. The presence of relatively tight, stratigraphically equivalent rocks around the 11-26 well does not support an argument for sand-on-sand communication within the BQ Formation.

[43] The panel further notes that the initial DST at the 10-34 well exhibited a pressure of about 21 000 kPa, which is consistent with a virgin reservoir pressure for BQ rocks at this depth in the area, and well above the 12 000–17 000 kPa of the Elkton storage unit.

[44] Both parties' arguments with respect to the nature of the sediments in the regional BQ were based on references to the studies done by Zaitlin et al., Leckie et al., and Arnott et al. The panel notes that CrossAlta applied Arnott et al.'s description of sedimentation in a low accommodation space setting to an area that all three primary authors—including Arnott—acknowledged to be intermediate accommodation space.

[45] Given the foregoing, the panel finds it unlikely that sand-on-sand communication within the BQ Formation exists over large distances, whether by a direct route over the crest or a more circuitous route around the shoulder of the Elkton high. The panel is not convinced that the

evidence of BQ deposition suggests with any certainty that the mere drilling of a well at the location of the 11-26 well would result in natural communication with the BQA pool and, therefore, communication with the Elkton storage reservoir. In fact, the panel concludes that drilling the 11-26 well may serve to assist in resolving the uncertainty of the parties' regional geological models without imposing any additional harm to the Elkton storage unit or its owners.

[46] The different interpretation of the two seismic data sets with respect to the existence of a separate channel might appear to be a problem. However, the expert witnesses for the parties both noted that given the different processing histories and vintages of the data sets, the interpretations and conclusions drawn by each of them were valid and merely the different opinions of competent professionals. The panel agrees that different seismic interpretations are reasonable based on different assumptions and expert opinion and, although neither interpretation is conclusive, some evidentiary weight can be assigned where commonalities exist.

[47] With respect to the validity of the separate channel model proposed by Kallisto, the panel notes the existence of similar channel systems, also identified by the three authors cited above, with productive BQ pools farther to the east. The panel notes that both interpretations of the seismic data sets indicated a significant amplitude anomaly at the base of the BQ Formation, which is the same as the top of the Mississippian unconformity, even though the witnesses mapped and interpreted the anomaly somewhat differently. The panel is persuaded that the concept of a separate BQ channel development to the east of the Elkton high, as proposed by Kallisto, is entirely reasonable.

[48] The panel notes the different spatial relationships (or geometry) of the BQ at the 7-25 well and the proposed 11-26 well with respect to the Elkton storage reservoir. The 7-25 wellbore is in close lateral proximity (100 m) to the Elkton storage reservoir, and the lateral extension of the BQA pool reservoir in the well is in extremely close vertical proximity (11 m) to the underlying Elkton storage reservoir. In contrast, the location of the 11-26 well is underlain by the Shunda Formation (not the Elkton) and is about 1200 m lateral to the closest part of the Elkton storage reservoir.

[49] The panel finds that the different geometry at these two locations is important with respect to assessing the risk of hydraulic fracture stimulation at the proposed 11-26 well inducing communication with the Elkton storage reservoir. Based on the foregoing analysis of the geometry, the panel finds it unlikely that a well at LSD 11-26-27-1W5M, even if hydraulically fractured, would create communication with the Elkton storage reservoir.

[50] There are several possible outcomes for the 11-26 well, all of which need to be considered in assessing the risk to the Elkton storage reservoir. In the event of a dry hole² at the location of the 11-26 well, the well would likely be abandoned and there would be no possible harm to the Elkton storage unit. In the event of an oil well at the location of the 11-26 well in either the BQ or the Glauconitic horizons, it is entirely possible that Kallisto might want to fracture the zone(s). Assuming that there is no immediate evidence of pressure communication with the Elkton storage unit, it is likely that Kallisto will propose a 20-40 tonne hydraulic fracture stimulation, which is the industry norm for a vertical BQ well in the area. The panel notes that Kallisto is on record as having committed to not exceeding this fracture size. The panel further notes that both

² Dry hole: No potentially productive horizon worth completing.

Kallisto and CrossAlta agreed, under cross-examination, that it is unlikely that a fracture of this size would extend more than a few hundred metres laterally from the wellbore.

[51] The panel notes that to communicate directly into the Elkton storage reservoir a fracture from the location of the 11-26 well would have to extend at least 1000 m laterally. To fracture into the BQA pool and indirectly into the Elkton storage reservoir would also require a lateral fracture of this length or greater, given that the BQA pool lies on the eastern flank of the Elkton storage reservoir high.

[52] The panel notes that if the 11-26 well is a gas well, Kallisto must have a full drilling spacing unit (DSU) to put the well on production, which it appears it currently might not have. However, the panel does not see a reason to prohibit Kallisto from fracturing the well prior to resolving the DSU problem. Indeed, the results of a fracture stimulation may be relevant to a pooling application and should be known prior any such application being filed.

[53] If the 11-26 well is a gas well with a pressure indicating communication with the Elkton storage unit reservoir, the panel accepts that the well would likely be in natural communication with the storage reservoir, making a fracture both inadvisable and unnecessary. In this case, the Board would order that the well be shut-in without any fracture stimulation in the offending zone. The panel further notes that, without any production from the well, there would be no additional harm of communication or conversion of Elkton storage unit gas.

RIGHTS OF THE PARTIES AND THE PUBLIC INTEREST

Evidence

[54] CrossAlta submitted that it owns and operates the Crossfield gas storage unit using the depleted Crossfield East Elkton A and D pools. The facility operates pursuant to Approval No. 7607 and has done so since 1994. CrossAlta stated that the natural gas in the storage reservoir is the personal property of the customers of CrossAlta and that Kallisto has no right to produce storage gas. CrossAlta noted that it has operated the storage reservoir long before any rights were acquired by Kallisto on adjacent lands.

[55] CrossAlta has the legal right and a responsibility on behalf of its customers and shareholders to prevent interference with and conversion of its property. CrossAlta stated that its experts convinced it that drilling the 11-26 well proposed by Kallisto presents an unacceptable risk to the storage reservoir regardless of whether or not the target formation is hydraulically fractured. CrossAlta noted that it could take years to detect and prove that communication with the storage reservoir might exist and that by then, the damage done would be irreversible.

[56] CrossAlta submitted that communication with an adjacent reservoir, such as the BQ, whether deliberate or inadvertent, effectively expands the storage reservoir, making reservoir management more complicated. It would require additional monitoring and regulatory action and degrade the storage reservoir as the BQ is not of the same reservoir quality as the Elkton. Such communication could result in legal action if storage gas is unlawfully produced. CrossAlta also argued that it may suffer financially if its clients lose confidence in its ability to inject and withdraw gas when required to meet its customers' needs.

[57] CrossAlta submitted that Kallisto does not have the right to apply for or hold a licence for a gas well because it does not have the rights to a complete DSU, which is a section of land for a gas well.

[58] CrossAlta stated that it had secured storage rights in Section 25, given that the BQA is in communication with the storage reservoir in that section. CrossAlta also stated that it had the storage rights and a partial interest in petroleum and natural gas (P&NG) rights in the southern half of Section 26.

[59] Kallisto acknowledged that it does not have the right to remove or convert storage gas and has no intention of doing so. Kallisto stated that their intention is to drill an oil well, not a gas well. It pointed out that CrossAlta does not own either the mineral or the storage rights in the quarter section beneath the proposed 11-26 well, as those rights are owned by the Freehold owners and are leased to Kallisto. Kallisto also noted that there was a dispute with CrossAlta regarding ownership of the minerals in the southern half of Section 26, but that a compulsory pooling application would ensure compliance with the ERCB requirement of a complete DSU if the well was to be produced as a gas well.

[60] The Freehold owners advised of the following: (1) they own the mineral rights under the northwest quarter of Section 26, (2) Kallisto has acquired a surface lease, and (3) they are in favour of drilling the 11-26 well. They stated that they have owned the rights to this quarter since 1955, long before CrossAlta established its storage scheme. Regarding the potential communication with the storage reservoir, the Freehold owners stated that Kallisto's well should be drilled as they have the right to access their minerals or know whether their lands are being used by CrossAlta to store gas or were drained by the previous operator in the area who depleted the pools now being used for the storage reservoir. Lastly, the Freehold owners stated that CrossAlta does not have storage rights on their quarter and noted that CrossAlta would like Section 26 to be connected to the storage reservoir as CrossAlta has obtained storage rights to the southern half of Section 26.

[61] CrossAlta submitted that it was difficult to create a buffer around the storage reservoir because the Crown requires that it be shown that the land is part of the storage operation in order for it to be included in the gas storage unit and held without production from those lands. CrossAlta also advised that Freehold lands cannot be held without production.

[62] CrossAlta noted that it monitors all well licence applications within a two-section zone around the storage reservoir, but is concerned with drilling and completion activities within one mile of the reservoir from the top of the Mannville Formation to top of the Banff Formation. CrossAlta has only objected to two wells in their buffer zone, the 9-26 re-entry by Sirius Energy Inc., and the 11-26 well proposed by Kallisto.

[63] CrossAlta admitted that it had not acquired seismic data over the entire storage reservoir, but that it was prudent for it to acquire seismic and that it planned to do so.

[64] Kallisto argued that CrossAlta is asking the Board to create a buffer zone around the storage facility at no cost to CrossAlta to guarantee protection against any production activity that CrossAlta thinks might affect its storage reservoir. This proposed buffer zone, or "no development" zone, would be a large area using lands and resources that CrossAlta does not own

or control. CrossAlta is asking the ERCB to do what the Crown says it will not do—create a buffer zone.

[65] CrossAlta stated it is not advocating the sterilization of mineral resources. However, it also stated that approving a questionable oil well that is pursuing a small resource based on an uncertain seismic interpretation is not in the public interest due to the risk of significant impact on the storage reservoir and the loss of confidence in storage schemes in Alberta that would result.

[66] CrossAlta submitted that gas storage has recognized public benefits: (1) market balancing, (2) security of supply regardless of demand, (3) price stability and protection against extreme price shocks, (4) production efficiency, and (5) prevention of the shut in of wells and facilities due to price instability. Furthermore, gas storage provides liquidity in the market, which aids in the efficient and orderly development of resources. CrossAlta referred to jurisdictions in the United States that recognize gas storage as a public benefit.

[67] CrossAlta stated that its storage scheme represents about 15 per cent of the total storage capacity in Alberta. This storage is fully used each year, generally with injection occurring in the summer and withdrawal in the winter.

[68] Kallisto argued that CrossAlta is asking the ERCB to sterilize other parties' legitimate mineral resources to protect its own commercial interests. Kallisto argued that allowing the 11-26 well to be drilled would promote orderly and efficient development of resources and permit the owners to obtain their share of production, which protects property rights.

Analysis and Findings

[69] The panel acknowledges that Kallisto has the right to apply for and drill the 11-26 well to evaluate the mineral lease it obtained from the Freehold owners with respect to the northwest quarter of Section 26. It is also apparent that Kallisto has obtained a valid surface lease that it secured from the same Freehold owners. Although Kallisto acknowledged that it does not have the right to produce storage gas, the panel notes that a well licence does not give Kallisto the right to breach the storage reservoir or produce storage gas. Furthermore, Kallisto acknowledges that if the well turns out to be a gas well, it cannot be produced without first securing a complete DSU for gas (i.e., a complete section). Should this be necessary, and Kallisto cannot secure the DSU by voluntary agreement, it has the option of applying for compulsory pooling. Other owners of minerals in the DSU would then have the right to intervene in any proceeding on the application.

[70] The panel acknowledges the Freehold owners' right to evaluate and produce the minerals underlying the lands in northwest quarter of Section 26. Similarly, the panel acknowledges that CrossAlta has the right to store royalty-paid gas in and withdraw it from the Elkton storage reservoir as per its approval. The panel further notes that CrossAlta has a responsibility to operate its storage reservoir and, in doing so, assess and understand the full extent of the storage unit reservoir (i.e., justify the boundary). The panel notes that CrossAlta has exercised its right to intervene and object in the licensing of oil and gas wells that it believes may have the potential to directly and adversely impact its storage reservoir.

[71] The panel notes the Freehold owners' argument that sterilizing their legitimate rights in lands that extend within 1-2 sections around the entire boundary of CrossAlta's storage unit interferes with individual rights. Similarly, the panel notes Kallisto's public interest argument that sterilizing legitimate rights in that manner is counter to the orderly and efficient development of the oil and gas resources in Alberta. In making that argument, Kallisto noted that the provincial mandate of the ERCB is for efficient, effective, and orderly development of the resources, including the conservation of those resources and the prevention of waste.

[72] On the other hand, CrossAlta argued that natural gas storage facilities perform a public service by: (1) facilitating year-round production of natural gas (i.e., store gas in low-demand summer months), (2) providing peak-demand capability during high demand periods (e.g., high consumer demand in winter) (3) providing gas market stability and futures market liquidity and efficiency, and (4) facilitating lower price volatility to the end-user or consumer (i.e., industrial, commercial, or residential).

[73] The panel notes that the ERCB must address and balance the public interest in the areas of public health and safety, the protection of the environment, resource conservation, and economics while facilitating the efficient, effective, and orderly development of Alberta's resources. The panel accepts that the ability to store natural gas performs an important function in the orderly development of natural gas. However, the panel is of the opinion that most, if not all, CrossAlta's arguments relate primarily to adverse impacts on its commercial interests and its customers, rather than to the broader public interests of Albertans.

[74] The panel recognizes the benefits that gas storage brings to the province, the public, and industry, including CrossAlta. The panel notes that these benefits must be weighed against potential resource sterilization and interference of other legitimate property rights including the mineral rights of Freehold owners in this case. The panel is of the view that the risk to the integrity of the storage reservoir must be balanced against the right to explore for and develop hydrocarbon resources in proximity to the storage reservoir and, where the risk can be appropriately and responsibly managed, such development is in the public interest and should occur.

ASSESSMENT AND MITIGATION OF RISKS

Evidence

[75] Regarding its operations for the proposed well, Kallisto stated that it intended to obtain the stabilized initial pressure and a bottomhole fluid sample for a pressure, volume, and temperature (PVT) analysis. If it hydraulically fractured the well, Kallisto committed to obtaining pre- and post-frac stabilized pressures. Kallisto also committed to conduct a monthly fluid sampling and analysis if and when it produces from the 11-26 well.

[76] Kallisto further stated that it would be open to working with CrossAlta if it wanted to conduct further tests such as coring, noting that it would expect CrossAlta to pay for any additional testing or monitoring that it requested.

[77] CrossAlta stated that if the well is approved, drilled, and is a gas well, it should be shut-in and not allowed to produce. Further, CrossAlta stated that hydraulic fracture stimulation should

not be permitted in the 11-26 well regardless of the fluid it might be producing. CrossAlta requested that if the 11-26 well is an oil well, no production should occur for at least one complete injection/withdrawal cycle of the gas storage reservoir, which would be about six months. It also requested permanent downhole monitoring to assess potential communication with the reservoir scheme during cycling. CrossAlta also suggested that a quality bottomhole fluid sample be obtained and that the ERCB require a monthly gas sampling and analysis when producing.

Analysis and Findings

[78] The panel finds that the risk of communication between the proposed 11-26 well and the Elkton storage reservoir is low, given the distance and the geology of the area. While it is unreasonable to conclude that there is no risk, the panel finds that the risk is not of sufficient magnitude to warrant denying the approval of drilling the 11-26 well. The panel acknowledges that a number of scenarios are possible with the drilling of the well and the gathering of well data. Therefore, the panel is inclined to condition the well licence to further assess and reduce the risk during completion of the well.

[79] The panel does not accept CrossAlta's request that it would be necessary to automatically shut in the well if it is a gas well. The panel finds that it is entirely possible that the well will encounter a gas pool not in communication with the storage scheme, and notes that production could not commence in any event until a gas well DSU was obtained or a compulsory pooling order issued.

[80] The panel finds that it is reasonable for Kallisto to obtain and immediately submit stabilized initial pressure data to the ERCB and to CrossAlta, subject to confidentiality considerations, to confirm that the BQ and/or Glauconitic zones are not within the pressure regime of the Elkton gas storage reservoir. This information sharing is intended to establish whether or not the BQ and/or the Glauconitic zones are encountered at virgin or depleted reservoir pressures for the area.

[81] As the panel noted in paragraph 53, if the 11-26 is a gas well with a pressure indicating existing communication with the Elkton storage unit reservoir, the Board would order that the well be shut-in without any fracture stimulation in the offending zone. The panel finds that there would be no additional harm done to the Elkton storage reservoir, given that no gas production would occur in this case.

[82] In the event that the well demonstrates a virgin reservoir pressure, the panel does not accept CrossAlta's request that Kallisto not be permitted to fracture the well. A frac of the size proposed by Kallisto is not considered a risk significant enough to induce communication over the distance that a fracture would have to propagate from the 11-26 well. The panel finds it reasonable to limit the size of a fracture stimulation in the well to 40 tonnes or less. The panel notes that both parties suggested that it was unlikely for such a fracture in this case to extend more than 200 m. The panel also finds it reasonable for Kallisto to obtain and immediately submit stabilized pre- and post-frac pressure data to the ERCB and CrossAlta. Furthermore, the results of a hydraulic fracture stimulation should be available if a compulsory pooling application is necessary.

CONCLUSION

For the reasons set out above, the Board hereby approves Application No. 1697898, subject to the conditions set out in Appendix 2.

Dated in Calgary, Alberta, on February 24, 2012.

ENERGY RESOURCES CONSERVATION BOARD

G. Eynon, P.Geol.
Presiding Member

R. C. McManus, M.E.Des.
Board Member

W. A. Warren, P.Eng.
Acting Board Member

APPENDIX 1 SUMMARY OF CONDITIONS

Conditions generally are requirements in addition to or otherwise expanding upon existing regulations and guidelines. An applicant must comply with conditions or it is in breach of its approval and subject to enforcement action by the ERCB. Enforcement of an approval includes enforcement of the conditions attached to that licence. Sanctions imposed for the breach of such conditions may include the suspension of the approval, resulting in the shut-in of a facility. The conditions imposed on the licence are summarized below.

CONDITIONS

- The licensee must obtain and immediately submit stabilized initial pressure data to the ERCB and CrossAlta.
- The licensee must not use fracture stimulation on the well that exceeds 40 tonnes unless consent has been given by the Board.
- The licensee must obtain and submit stabilized pre- and post-frac pressure data to the ERCB and CrossAlta.

APPENDIX 2 HEARING PARTICIPANTS

Principals and Representatives (Abbreviations used in report)

Witnesses

Kallisto Energy Corp.

G. Fitch

E. Dixon

R. Lore

R. Clark

C. Hartzler

J. Byers

P. Pedersen

J. Chipperfield

R. Bachman

A. E. Wren

CrossAlta Gas Storage & Services Ltd.

F. Foran, Q.C.

C. Thompson

D. Prince

K. Tate

K. Olsen

L. Herd

B. Hughes

L. Mattar

D. White

P. Collins

Freehold mineral owners

K. Verbeurgt

G. Jensen

F. Jensen

Energy Resources Conservation Board staff

D. Burns, Board Counsel

K. Stilwell

R. Reid

A. Jones

M. Wuraola

R. MacDonald

B. Lee

N. Rutherford (Rutherford Consulting
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