

ALBERTA ENERGY AND UTILITIES BOARD

Calgary Alberta**APPLICATION FOR WELL LICENCES
WELL LICENCE NOS. 0202155 TO 0202162
PURCHASE OIL & GAS INC.
MORGAN FIELD****Examiner Report 98-4
Application No. 970483**

1 INTRODUCTION**1.1 Application and Intervention**

On 26 May 1997, Purchase Oil & Gas Inc. (Purchase), applied to the Alberta Energy and Utilities Board (Board), pursuant to section 2.020 of the Oil and Gas Conservation Regulations for licences to drill eight wells from one pad location at Legal Subdivision 16, Section 1, Township 52, Range 4, West of the 4th Meridian (the 16-1 pad site). The purpose of the wells is to produce heavy oil from the Sparky and Lloydminster sands. Seven of the eight wells would have bottom hole locations underlying the northeast quarter of section 1-52-4W4 (section 1) and one well would have a bottom hole location underlying the northwest quarter of section 6-52-3W4 (section 6).

On 4 June 1997, the Board issued Well Licence Nos. 0202155 to 0202162 to Purchase on the understanding that there were no outstanding issues relating to the Board's jurisdiction.

On 9 June 1997, the Board received a submission from the landowners, Tom and Doreen Brown, requesting that the well licences be suspended. The Browns are the surface landowners and residents on the northeast quarter of section 1. In the intervention, concerns were raised about environmental, agricultural, safety, and personal lifestyle effects the wells would have on the Browns, their son Murray, his wife Tina, and their two children who live on the northwest quarter of section 6.

Although Purchase maintained that the only unresolved issue was compensation, the Board was satisfied that the Brown's concerns were issues within its jurisdiction and that a hearing under section 43 of the Energy Resources Conservation Act was appropriate.

The attached map illustrates the location of the proposed wells, the Brown's residences and farmyard, as well as alternative surface locations, other surface improvements, and topographical features discussed at the hearing.

1.2 Hearing

The application was considered at a public hearing on 16, 17, 18 and 19 December 1997 in Lloydminster, Alberta before examiners appointed by the Board. The examiner panel consisted of R. N. Houlihan, P.Eng., Ph.D., C. D. Hill, and F. G. Sorenson.

At the opening of the hearing, prior to Purchase's formal presentation of its application, the examiners and hearing participants viewed the Brown's farmyard, the proposed 16-1 pad site, one operating pad site at Legal Subdivision 15, Section 1, Township 52, Range 4, West of the 4th Meridian (the 15-1 pad site), and one approved but undrilled pad site at Legal Subdivision 9, Section 1, Township 52, Range 4, West of the 4th Meridian (the 9-1 pad site). All of these are located on the Brown's land.

The following table lists the participants at the hearing:

THOSE WHO APPEARED AT THE HEARING

Principals and Representatives (Abbreviations Used in Report)

Witnesses

Purchase Oil & Gas Inc. (Purchase)
A. Chapman

G. Faulkner,
K. Powell, P.Eng.

Tom and Doreen Brown (the Browns)
J. Bodnar

T. Brown
D. Brown
M. Brown
T. Brown
C. Brown

County of Vermilion River No. 24
P. Green, Reeve

P. Green, Reeve
C. Walker

Alberta Energy and Utilities Board staff
D. Larder, Board Counsel
M. Vandenbeld, C.E.T.
G. McLean

1.3 Preliminary Matters

At the commencement of the hearing, the Browns motioned for an adjournment of the hearing until such time as Alberta Environment Protection (AEP) could be present. The Browns argued that AEP was not notified of the hearing and that without its presence at the hearing, proper

consideration of environmental issues could not occur. The Browns did not request, formally or otherwise, the attendance of AEP prior to the hearing.

The examiners denied the Brown's request and indicated AEP presence at such proceedings is voluntary. The examiners were satisfied that AEP was aware of the proposed site and that it was given Notice of Hearing. Also, the Board exercises jurisdiction over environmental matters pursuant to its enabling legislation and would consider environmental issues raised at the hearing.

At the commencement of, and throughout the course of the hearing, the intervener invited the examiners to deny the application "for want of proper form and substance in terms of regulatory compliance, technical support, economic analysis, and geological analysis". The examiners denied the request on the basis that the hearing was necessary in order to provide a forum for the applicant and intervener to present evidence that was not available prior to the hearing.

2 ISSUES

The examiners consider the issues respecting the application to be:

- C the need for the wells,
- C the subsurface location of the wells, and
- C the surface location and impact of the wells and access road.

Each issue is addressed in the following sections.

3 NEED FOR THE WELLS

3.1 Views of the Applicant

Purchase submitted that it acquired the freehold interest in the petroleum and natural gas (P & NG) rights under section 1 from Norcen Energy Resources Limited in 1993. Purchase holds a 37.5 per cent interest in the P & NG rights, Virgin Oil and Gas (Virgin), holds a 12.5 per cent interest in the P & NG rights, and PanCanadian Petroleums Limited (PanCanadian) holds the remaining 50 per cent interest in the P & NG rights in sections 1. PanCanadian previously owned a 100 per cent interest in the P & NG rights in section 6 and assigned a 50 per cent interest to Purchase. Purchase is the operator of sections 1 and 6 on behalf of itself and PanCanadian. Purchase noted that Virgin is a corporate affiliate of Purchase.

Purchase stated that the targeted zones include the Colony, Sparky, Lloydminster and Dina sands. Purchase believes the proposed wells would comply with spacing order Misc. 95016 and would improve overall oil recovery from the targeted sands because the wells would be drilled into portions of the reservoirs that are not currently being drained by existing wells.

3.2 Views of the Interveners

The Browns did not question the need for the wells. They stated that they would not be opposed to the drilling of the wells if the surface location was relocated near the southern edge of the northeast quarter of section 1, directly west of the 9-1 pad site (the Brown's preferred site).

3.3 Views of the Examiners

The examiners are satisfied that there is a need to produce the reserves from the area and that Purchase has the right to explore for, and produce the reserves. In addition, the examiners are satisfied that additional wells are needed to adequately drain the oil underlying the northeast quarter of section 1 and northwest quarter of section 6.

In reviewing spacing order Misc. 95016, the examiners note that it has been replaced by spacing order SU 2795. The examiners further note that SU 2795 applies only to the Sparky and Lloydminster sands for section 1. Purchase could develop the Colony and Dina sands on normal spacing but would be required to apply for reduced spacing in order to exploit those reserves on the same basis as the Sparky and Lloydminster sands.

4 THE SUBSURFACE LOCATION OF THE WELLS

4.1 Views of the Applicant

Purchase stated that it had studied geophysical information provided by a 3-D seismic survey, together with geological data from six directional wells drilled from the 15-1 pad site. Purchase described how each of the prospective sands increases in structure toward the northeast corner of section 1 and the northwest corner of section 6 and that there is approximately 125 metres of vertical depth between the top and bottom sands. Reservoir thickness ranges from 4 to 12 metres depending on the sand and remains constant in the Colony, Sparky, and Dina sands and increases in thickness toward the northeast corner of section 1 and the northwest corner of section 6 in the Lloydminster sand.

Purchase described how the northeast corner of section 1 and the northwest corner of section 6 are the optimum bottom hole locations based on three factors: increase in structural elevation of each sand to the northeast reduces potential for bottom water; increased pay thickness; and improved reservoir quality. Purchase explained that the proposed bottom hole locations have the greatest potential to economically recover oil given the proposed surface locations.

Purchase stated that the preferred method to drill the wells would be vertically because it is more cost effective; however, it is also very surface intensive as each well requires a separate site. To reach the proposed bottom hole locations would require eight separate sites which would be

situated in the Vermilion River valley in and around the Brown's farmyard and cultivated fields. As a result, vertical wells were ruled out.

Horizontal wells, although considered, were ruled out because each well would allow access to only one of the prospective sands. In addition, they would be significantly more costly to drill, and would require more frequent servicing than a directional well. Purchase estimates that each horizontal well would cost approximately \$470,000 as compared to \$130,000 for each of the proposed directional wells. Purchase stated that it had drilled a horizontal well from the 15-1 pad site but added that it was not able to obtain production rates that would justify the additional drilling costs.

Purchase determined that drilling eight directional wells from the proposed 16-1 pad site would be the most effective way to drill the wells as it would allow for access to all the targeted sands. Purchase noted that drilling the subject wells directionally would result in a maximum horizontal displacement of approximately 250 metres. The limitation of the horizontal displacement was described as being a function of both the drilling and production operations. Purchase described how increasing the degree of bend in the well makes it more difficult to drill, complete, and operate downhole equipment. Due to the limited horizontal displacement of directional wells, Purchase explained how it sacrificed preferred bottom hole locations in the northeast corner of section 1 and the northwest corner of section 6, given the proposed surface location.

In response to questioning, Purchase conceded that it does intend to drill the #8 well with a horizontal displacement of 335 metres. Purchase explained that increasing the maximum horizontal displacement is necessary in order to produce the optimum portion of the reservoirs and retain its mineral rights in section 6. Purchase explained that it would attempt to extend its maximum horizontal displacement by directionally drilling the surface hole. It conceded that this was operationally difficult but would be necessary to gain the extra distance.

4.2 Views of the Interveners

The Browns did not dispute the geological and reservoir evidence provided by Purchase regarding its choice of subsurface targets for the proposed wells. The Browns stated that they would not be opposed to the subsurface target locations provided the wells were drilled from alternate surface locations such as the Brown's preferred site.

4.3 Views of the Examiners

The examiners have considered the information submitted by Purchase and, given the restrictions related to the surface location, do not take issue with the selection of the bottom-hole targets or the applicant's geological interpretation.

The examiners note that Purchase has drilled several directional wells in the area and that based on its experience is reluctant to attempt horizontal displacements exceeding 250 metres. In addition, Purchase drilled a horizontal well from the 15-1 pad site and again, based on its

experience, is reluctant to use horizontal technology to access its minerals in section 1 and section 6.

At the hearing, there was considerable discussion of alternate drilling methods, specifically slant hole and horizontal drilling. Although the examiners appreciate that these methods result in an increase in cost and technical risk, horizontal wells in particular are becoming common place in Alberta. The examiners are aware of several producing horizontal wells drilled into the targeted sands in the vicinity of the applied-for wells. The examiners are therefore not convinced that horizontal wells should be ruled out as a viable method of accessing reserves while at the same time mitigating potential surface impacts.

5 SURFACE LOCATION OF WELLS AND ACCESS ROAD

5.1 Views of the Applicant

Purchase described how the choice of one multi-well pad site versus eight separate vertical well sites would reduce surface impacts and disturbances to the Browns by conserving arable farm land, minimizing the number of access roads, and limiting the amount of movement of field staff and tank trucks.

Purchase submitted that the 16-1 pad site was selected having regard for the subsurface targets of the wells and reducing surface impacts and disturbance to the Browns. Purchase chose the location in order to keep as far away from the Brown's residence as possible while staying close to the northeast corner of section 1 in order to attain the best bottom hole locations possible. An alternative surface location for the 16-1 pad site was reviewed by Purchase and the Browns as shown on the attached map. The alternate site to the east of the applied-for site was felt to be too close to the Brown's residence and in addition, would be difficult to construct without interfering with drainage courses that run off the Brown's cultivated field. Another alternate surface location between two drainage courses was discussed, but again, was thought to be too difficult to construct and would probably interfere with the drainage courses. Purchase described how it felt the applied-for location was the best location as it sits on top of a small hill along the northern edge of cultivated field and does not interfere with the natural drainage courses. Purchase measured the nearest building in the Brown's farmyard to be some 288 metres away.

Purchase explained that to protect potable water, it intends to drill the wells following practices that are commonly required in this area. It would drill a surface hole to 99 metres with fresh water and run steel casing to the bottom of the hole and cement that casing back to the surface. From the bottom of the surface hole, the main production hole would be drilled to approximately 350 metres using fresh water, at which point it would convert to a specialized mud in order to drill to the total depth of the well. Steel casing would then be run to the total depth of the well and cemented back to surface. Purchase indicated that by following these procedures the Brown's water wells would not be contaminated. During questioning, Purchase also agreed to have the Brown's water wells tested prior to drilling operations.

Purchase advised that it intends to apply to the Board to flowline production from the 15-1 pad site through the 16-1 pad site and down to the 9-1 pad site provided sufficient volumes of oil can be produced from the proposed wells. Purchase described how flowlining would minimize the amount of on-site tank requirements and reduce the movement of tank trucks.

Purchase explained that by placing the proposed pad site on the edge of the valley break, it would minimize disturbances to the Brown's cultivated field and problems associated with the movement of farm machinery around the pad site. Purchase indicated that although the pad site was on the edge of the valley break, the wells themselves would be 56 metres from the edge of the embankment. Purchase explained that no trees or vegetation would be removed or disturbed in the construction or operation of the lease and that the berms surrounding the lease would be re-seeded to prevent soil erosion. Purchase has agreed not to place or operate any heavy equipment directly on the edge of the valley break. In response to questioning, Purchase felt the valley break was stable enough to withstand the construction of the pad site and operation of the wells; however, it conceded that it had not conducted any tests but would endeavour to do so prior to commencing operations.

Purchase stated it would maintain the pad site with crushed gravel and install underground power. The pad site would be levelled out and adequately bermed to contain any fluid spills. Until flowlining occurred, Purchase proposed to place two 750 barrel tanks on the southwest portion of the 16-1 pad site to minimize visual impacts from the Brown's residence. Purchase described how drilling fluids would be contained in a tank on site during the drilling phase and would be transferred to a vacuum truck and spread onto nearby lands subject to the agreement of one of the nearby landowners. Saltwater produced with the oil would be disposed of in an existing disposal well located in Legal Subdivision 13, Section 1, Township 52, Range 4, West of the 4th Meridian (the 13-1 disposal well). The water would be trucked to the disposal well until such time as flowline systems were applied for and put in place. Sand produced with the oil would be trucked off site to an approved storage cell for future disposal.

Purchase proposed to install downhole electric driven pumps and electric driven hydraulic drives on the well heads in order to keep noise to a minimum. Purchase explained hydraulically driven wellheads would be much quieter than the existing belt driven wellheads at the 15-1 pad site. In addition, Purchase stated that it owned the service rig which would be used at the pad site and it had an advanced muffler system which would greatly reduce noise emissions. Purchase stated that owning its own service rig would allow it to control operating hours and agreed to operate it only during daylight hours.

Purchase described that it would not expect to encounter any harmful amounts of H₂S gas while drilling or producing the proposed wells. Purchase described how any produced gas would be vented from the top of the storage tank and that it had never had a problem with H₂S emissions in nearby operations and had never received a complaint with respect to emissions in the area. Purchase believed the proposed wells would have a maximum H₂S release rate of less than 0.01 cubic metres per second. As the Brown's residence is greater than 200 metres from the proposed wells, Purchase felt no H₂S submission to the Board was required. In response to questioning,

Purchase conceded that it had not tested nearby wells for concentrations of H₂S but would endeavour to test existing wells and the proposed wells when drilled.

Purchase submitted the access road was selected with the intention of preserving arable farmland by staying to the east and north edges of the cultivated field. The attached map indicates the proposed access road flows from the access off the county roadway through the 9-1 pad site and up to the 16-1 pad site along the west edge of the Blackfoot coulee and atop the valley break on the north side of the cultivated field. Purchase would use crushed gravel on the access road. During the course of the hearing, Purchase agreed that the access road chosen may not have been the best choice considering the various drainage patterns off the cultivated field. Purchase advised that it would be prepared to consider an alternative access road to alleviate any drainage problems and accommodate the wishes of the Browns. An alternative that was discussed but not explored in detail was an east/west road from the 15-1 pad site.

Regarding the use of the County of Vermilion River No. 24 (the County) road, Purchase submitted that it had committed to address issues regarding trucking safety, working with the Browns to approach the County about upgrading the municipal roadway, restricting the activity of service rigs, and scheduling tank truck visits around school bus schedules.

5.2 Views of the Interveners

The Browns stated that the proposed 16-1 pad site, if drilled, would have an adverse effect on their quality of life and expressed concerns regarding safety, health, environmental impacts, noise, agricultural impacts, water well impacts, wildlife impacts, and visual impacts. While the Browns acknowledge that Purchase looked at two alternative surface locations for the 16-1 pad site, they confirmed with Purchase that neither would be acceptable and indicated a preference for an alternative surface location away from the edge of the valley break, perhaps at the Brown's preferred site.

The Browns described their farmstead and how the Blackfoot coulee runs north through the valley break of the Vermilion River and how the County road runs through the Blackfoot coulee, giving access to their farmyard. In addition to the site visit, the Browns presented several photographs of the farmstead in order to explain the location of various buildings, building improvements, and various topographical features in relation to the proposed 16-1 pad site. The Browns noted that the proposed pad site is situated on the edge of the valley break approximately 450 feet (137 metres) away from the end of their garden which runs part way up the hill of the valley break on the south side of their residence. The Browns also noted that the oil tanks on the southwest portion of the proposed pad site would be visible from the farmyard.

The Browns explained that their water wells supply the best drinking water available anywhere in the area. One well located in Tom and Doreen's farmyard, produces eight gallons per minute and another well, located in their son's yard, produces three gallons per minute. The Browns testified that the family farmyard was relocated from the south of section 1 to its present location in 1947 in order to be close to the water supply as it was difficult to find sufficient water in the

previous location. The Browns also explained how many of their neighbours have difficulty finding adequate water supplies. The Browns gave no direct evidence as to the source of the water but believe it comes from a quicksand formation which has been encountered in various places throughout the Brown's farmyard when digging building foundations and water wells and also in the Blackfoot coulee. The Browns expressed their concerns over the effect the wellbores may have on the quality and quantity of their water supplies.

The Browns described the various trees and bushes on the valley break behind their residence and how the vegetation consolidates soils on the hill and prevents it from slumping and washing away. The Browns provided photographs showing that portions of the valley break are prone to slumping and washouts during rainy seasons. As the valley break is directly behind their residence, the Browns are particularly concerned with anything that could affect the stability of the hill. The Browns stated that the destruction of trees and vegetation on the hill that could be caused from the construction of the proposed pad site or the drilling and operation of the wells would be of particular concern. The Browns explained that if an oil spill or some other unforeseen mishap were to destroy the trees and vegetation on the hill, the Brown's residence would be susceptible to mud slides and washouts during rainy periods. The Browns raised concerns about what effect the weight and vibration of drilling and operation equipment may have on the valley break. The Browns indicated that without proper geotechnical engineering analysis, there is uncertainty regarding the possible effects the drilling and operation of the proposed wells may have on the valley break.

The Browns raised safety and health concerns with regard to H₂S gas emissions from the proposed wells and said that Purchase had not contacted them directly to inform them about the possible presence of H₂S, the concentration of the gas, or the possible harmful effects of the gas. They were concerned about the cumulative effects of H₂S gas from eight wells. The Browns noted that the H₂S would have a general tendency to drift down the valley break into their farmyard. The Browns noted that unpleasant odours from the 15-1 pad site have been noticed in their farmyard. The Browns also raised concerns over the harmful effects the H₂S gas may have on their livestock.

The Browns objected to the applied-for access road. They noted the access road would interfere with natural drainage courses from the cultivated field which could affect the slopes of the valley break and the Blackfoot coulee by creating erosion caused by unnatural water drainage. The Browns stated that the general placement of both the pad site and the access road would make it more difficult for them to manoeuvre farm machinery around the cultivated field. The Browns also stated that the preferred access to existing and proposed pad locations would be from the west off an existing private access road.

The Browns commented on the noise generated from existing wells at the 15-1 pad site and the 13-1 disposal well and noted they could hear these noises from their farmyard. The Browns stated they were not interested in adding any additional noise to their normally quiet farmstead.

The Browns also commented on the nature of the Vermilion River Valley and Blackfoot coulee and its abundance of different species of wildlife. The Browns said that if oil was spilled on or around the proposed pad site or access roads, it could be washed down to the valley floor by rain and enter the Vermilion River.

Regarding the use of the County road and approach at the 9-1 pad site, the Browns expressed concern with increased service rig and truck traffic and its effect on safety, with particular concern for school busing of Murray and Tina's two children. The Browns believe that the County road would fall into disrepair from the increased usage. They also stated that any oil spills on the road would wash down the Blackfoot coulee into their farmyard.

Representatives from the County expressed its policy about oil companies having to request and be approved to use an existing approach or construct a new approach to access a County road. The County explained that it is impacted by the heavier traffic causing damage to the roads, increasing dust and raising safety concerns. The County stated that it has limited funds available for upkeep of county roads and expressed wishes for Purchase to use an existing approach and private access road currently being used to service the 15-1 pad site rather than the County road and proposed approach directly east of the 9-1 pad site.

5.3 Views of the Examiners

The examiners heard considerable discussion related to the potential impacts of the proposed 16-1 pad site and access road on the Browns and the environment. The examiners believe that Purchase has committed to prudent measures to mitigate many of the concerns, such as noise, protection of groundwater aquifers, school bus safety, and containment of fluids on lease. However, the examiners note that there was a lack of evidence provided by the applicant with respect to the intervener's concerns about the stability of the slope immediately adjacent to the proposed pad site. Evidence was presented by the Browns which indicates the stability of the valley slope is uncertain. The potential for substantial erosion and sloughing was demonstrated through evidence presented at the hearing. Although the examiners believe the probability of a slope failure occurring as a result of drilling or production operations at the proposed pad site is low, the location of the Brown's farmyard and residence at the base of the slope demands the issue be adequately addressed. Purchase did not provide any geotechnical analysis or studies to substantiate its views that its operations would not pose a threat to the stability of the valley slope.

The examiners believe that there is a preferable alternative to the applied-for lease road. Accessing the proposed 16-1 pad site from the existing 15-1 pad site would avoid crossing drainages off the field and thereby reduce the potential for erosion and runoff of materials through the Brown's farmyard. It would also place the road further from the farmyard, away from the Blackfoot Coulee and the edge of the Vermilion River valley break, and avoid the use of the County road. With respect to the latter, the examiners acknowledge the county's concern regarding the use of county roads for oilfield activity. Through cross-examination both Purchase and the Browns agreed that accessing the proposed 16-1 pad site from the existing 15-1 pad site would be preferable. The examiners believe that more effective communication between the parties prior to the hearing would have resulted in a better choice for the proposed lease road.

With respect to H₂S, the examiners note that Purchase has made no attempt to accurately determine the expected concentrations, if any, or communicate with the Browns any measures it would take to minimize any potential risk. The examiners believe that it is incumbent upon the proponent of a development to anticipate and assess the impacts of its operations on others, seek input from those affected, and address the issues appropriately. The examiners acknowledge that Purchase has agreed to test nearby wells for H₂S, but believe it could have made a more substantive effort, prior to the hearing, to identify and address any concerns regarding H₂S.

6 RECOMMENDATIONS

The examiners recommend that Purchase's Well Licence Nos. 0202155 to 0202162 be cancelled for reasons of insufficient evidence addressing stability questions and the existence of a preferred alternative to the applied-for lease road.

7 OTHER MATTERS

It was evident throughout the course of the hearing that the intervener had not, or was unable to, solicit technical expertise to assist with the preparation of the intervention. The examiners note that under section 31 of the Energy Resources Conservation Act and its Local Interveners Costs Regulation, that where the applicant has addressed a particular issue, the intervener can obtain the services of technical experts and request reimbursement for such costs where they are reasonable and directly and necessarily related to the preparation and presentation of the intervention.

DATED at Calgary, Alberta, on 23 March 1998.

<Original signed by>

R. N. Houlihan, P.Eng., Ph.D.

<Original signed by>

C. D. Hill

<Original signed by>

F. G. Sorenson