

ALBERTA ENERGY AND UTILITIES BOARD

Calgary Alberta

**STARTECH ENERGY INC.
APPLICATION TO DRILL A NONCRITICAL LEVEL-1
SOUR GAS WELL
TURNER VALLEY FIELD**

**Decision Report 99-26
Application No. 1027549**

1 INTRODUCTION

1.1 Application and Interventions

Startech Energy Inc. (Startech) applied to the Alberta Energy and Utilities Board (the Board/EUB), pursuant to Section 2.020 of the Oil and Gas Conservation Regulations, for a licence to drill a level-1 noncritical sour gas well from a surface location of Legal Subdivision 13, Section 32, Township 21, Range 3, West of the 5th Meridian (the 13-32 surface location). The purpose of the well would be to produce sour gas from the Turner Valley Formation from a bottomhole location of Legal Subdivision 7, Section 5, Township 22, Range 3, West of the 5th Meridian (the 7-5 bottomhole location).

The Board received several objections to the application from area residents living near the proposed well. Many of the residents formed an interveners group known as Whiskey Hills Owners Alliance (WHOA).

1.2 Prehearing Discussions

The Board originally scheduled a hearing to consider the application and interventions to commence on 19 January 1999. Following a request by WHOA, the hearing was rescheduled to 23 February 1999. Shortly before the 23 February 1999 hearing date, both Startech and WHOA, through their counsels, requested that the hearing be adjourned again pending further discussions between the two parties aimed at resolving the issues and concerns identified by WHOA. These discussions failed to resolve the outstanding objections and the Board rescheduled the hearing to commence on 13 April 1999.

1.3 Hearing

Prior to the hearing, the Board viewed the proposed and alternative well sites and the surrounding area. The application and interventions were considered by the Board at a public hearing in Priddis, Alberta, on 13, 14, 15, and 16 April 1999, before Board Members J. D. Dilay, P.Eng., T. McGee, and Acting Board Member D. Waisman. At the conclusion of the hearing, the Board directed that written final arguments be submitted by 31 May 1999. Those who appeared at the hearing are listed in the following table.

THOSE WHO APPEARED AT THE HEARING

Principals and Representatives (Abbreviations Used in Report)

Witnesses

Startech Energy Inc. (Startech)

L. Cusano
D. Wood

M. Mason, P.Eng.
K. Johnston, P.Geol.
K. Olsen
T. Gibson,
of Gecko Management Consultants
R. Clissold, P.Geol.
of Hydrological Consultants
D. M. Leahey, Ph.D.
of Jacques Whitford Environment Limited

Whiskey Hill Owners Alliance (WHOA)

R. C. Secord

C. Soules
W. Dudley
J. Kerluke
S. Kerluke
P. Steen
L. Knott
J. Seaborn
J. Hoyle
C. Hoyle
T. Lambert, Ph.D.

R. Greenwood

R. Greenwood

N. Worthington

N. Worthington

H. Jacobsen

H. Jacobsen

D. Nelson

D. Nelson

M. Heffring

M. Heffring

Alberta Energy and Utilities Board staff

D. Larder, Board Counsel
G. McLean, C.E.T.
A. Wiechert, P.Geol.
M. Zelensky, P.Eng.
A. Girgis, P.Eng.
B. Austin, P.Geol.
M. Craig
S. Etifier

Citizens Oil & Gas Council submitted a letter but did not participate in the hearing. Mr. F. Franklin filed a submission at the hearing but did not participate further.

The location of the proposed well, adjacent residents, emergency planning zone (EPZ), emergency awareness zone (EAZ), and general development area are shown on Figures 1, 2, and 3 (attached).

1.4 Request for Conceptual Development Plan

Having regard for the fact that Startech, Stampede Oils Inc., and Berkley Petroleum Corp. had each applied to the EUB for well licences in the Priddis and Millarville area and that each contemplated additional wells and facilities if the initial wells were successful, the Board asked these companies to submit a joint conceptual development plan. By letter dated 4 June 1999, the Board extended the deadlines for submission of final arguments to seven days from the day of receipt of the conceptual development plan and directed that interested parties would have a further seven days to file any replies.

2 ISSUES

The Board considers the issues to be

- C need for the well,
- C proposed well and access road locations,
- C impacts of the proposed well and access road,
- C safety of the well, including potential hydrogen sulphide (H₂S) release rates, drilling, completion and production considerations, public safety risk assessment, and emergency response planning and preparedness,
- C public notification and consultation, and
- C other matters.

3 NEED FOR THE WELL

3.1 Views of the Applicant

Startech submitted that it would earn the petroleum and natural gas (P&NG) rights under Section 5, Township 22, Range 3, West of the 5th Meridian (Section 5) from PanCanadian Petroleum Limited (PanCanadian) by drilling the proposed well to the targeted Turner Valley Formation. Startech would hold a 60 per cent interest in the P&NG rights and Cypress Energy Inc. (Cypress) would hold a 40 per cent interest. Startech would be the operator of Section 5 on behalf of itself and Cypress. Startech indicated that it would pay a \$400 000 penalty to PanCanadian if the well were not drilled.

Startech explained that the proposed well was needed to test Startech's geological, geophysical, and reservoir interpretations that predict a Turner Valley structural high with the potential to contain significant new gas reserves. Startech described the proposed well as a development well to be drilled in the same structure as an existing shut-in gas well located at 7-32-21-3W5 (the

7-32 well). On the basis of seismic data, Startech interpreted that the Turner Valley Formation climbs structurally approximately 40 metres (m) from the 7-32 well to the proposed well, with no further elevation gain to the north of the 7-5 bottomhole location. Startech chose the 7-5 bottomhole location because it appears to be a structural high in close proximity to the known gas accumulation found in the 7-32 well. Startech estimated that the proposed 7-5 location would have the potential to encounter up to two thrust sheets in a thrust sheet anticline with up to 22.5 m of net gas pay if two gas-filled sheets were encountered.

3.2 Views of the Interveners

WHOA did not challenge Startech's need to exploit its P&NG rights underlying Section 5. However, it argued that it had not clearly established the need for the well to be drilled at the 13-32 surface location. WHOA submitted that the Board must consider whether the project is in the public interest, having regard to the social, economic, and environmental effects of the project. WHOA argued that the burden of proof falls on Startech to demonstrate that the proposed well is in the public interest.

3.3 Views of the Board

The Board notes that while WHOA and others argued against the proposed well on the basis of public health, safety, and environmental impact concerns, there was no dispute about Startech's right to exploit its P&NG rights under Section 5. The Board accepts Startech's right to exploit its P&NG rights under Section 5 and accepts that, provided the development can be carried out in an acceptable fashion, there is a need for the well. The Board considers whether the development can be carried out in an acceptable fashion in the following sections.

4 PROPOSED WELL AND ACCESS ROAD LOCATIONS

4.1 Views of the Applicant

Startech submitted that it initially considered drilling a vertical well with a tophole and bottomhole location of 14-5-22-3W5 but ultimately decided against it based on ongoing geological, geophysical, and reservoir reviews. Startech concluded that the proposed 7-5 bottomhole location had the greatest potential for success.

Startech explained that it assessed alternative surface locations that would allow it to achieve its preferred 7-5 bottomhole location, while taking into consideration technical and safety matters, concerns of the community, and wishes of the landowners of the potential surface leases. Startech considered two possible surface locations to access the preferred 7-5 bottomhole location: one at the proposed 13-32 surface location and another at 4-5-22-3W5 (the 4-5 surface location). Startech explained that it selected the contemplated surface locations to the southwest of the 7-5 bottomhole location to take advantage of the natural wellbore drift that results from the orientation of the bedding above the Turner Valley Formation. As a result of a southwestern dip to the bedding, the wellbore would tend to drift to the northeast, perpendicular to the southwest bedding planes. Startech concluded that, due to drilling and safety issues, it was more desirable to drill the 7-5 bottomhole location from one of the two possible surface locations

using the natural drift imposed by the bedding planes. Startech rejected directionally drilling or slant drilling the well from a surface location more distant than either of the contemplated 4-5 or 13-32 surface locations due to safety concerns. Startech explained that directionally drilling against the natural inclination of the rock creates a greater potential for hole instability problems and increases the time that the hole is open. Startech conceded that it would be possible to directionally drill a well from a more remote location but stated that it chose the proposed surface location in order to mitigate the safety concerns and take advantage of the natural inclination of the bedding.

Startech explained that it undertook surface lease negotiations with two different landowners for both potential surface leases until agreement for a surface lease at the proposed 13-32 location was reached, at which time negotiations for the 4-5 location ceased. Startech submitted that on the basis of concerns raised by the community about visual impacts, it considered the 13-32 location more desirable than the 4-5 location. The 13-32 location would be surrounded by trees, whereas the 4-5 location would be on an open hillside. Startech believed that the trees would reduce visual and noise impacts. Startech said that drilling from 13-32 would result in none of the residents being within the calculated 710 m EPZ. Startech submitted that a site-specific construction plan for the proposed well site was designed to prevent, minimize, or mitigate any possible soil erosion or fluids running off the site. Startech said that Alberta Environment (AENV; formerly Alberta Environment Protection) reviewed and approved the report and the site.

Startech submitted that it was difficult to conceive of a location less intrusive to the area and more accommodating to all of the factors and considerations. It rejected WHOA's argument to have the surface location moved to the previously contemplated 4-5 surface location. It noted that while the applied-for surface location is closer to some residents than the 4-5 surface location, it is farther away from others. It also noted that because the landowner of the alternative 4-5 surface location did not want the well on his property, the only way to obtain a surface lease for this location would be to apply to the Alberta Surface Rights Board (SRB) for right of entry to the site. It argued that any use of the Surface Rights Act to obtain access to the surface should be used only as a last resort, as it would strip away certain fundamental private property rights. It stated that "any suggestion that Startech chose its applied for surface location without regard to the wishes of landowners is utterly without foundation." Startech stated that WHOA's submissions in this regard focused on its own wishes without having regard for the rights of the landowner.

Startech submitted that the proposed well site would first be accessed by a temporary access road using an existing trail across the northeast quarter of Section 31, Township 21, Range 3, West of the 5th Meridian (Section 31) and an existing approach off Plummers Road. It explained that once the well was drilled and proven to be successful, Startech would construct one of two potential permanent access roads. One option would be to run the access road east from the well site along the north boundary of Section 32, Township 21, Range 3, West of the 5th Meridian (Section 32) to the east boundary of the northwest quarter of Section 32 and then south along the east side of the northwest quarter of Section 32 to Plummers Road. The second option would be to run the access road from the well site north into the southeast quarter of Section 6, Township 22, Range 3, West of the 5th Meridian (Section 6) and then north along the west

boundary of the road allowance between the southeast quarter of Section 6 and the southwest quarter of Section 5 to Coal Mine Road. Startech submitted that the landowner of the proposed 13-32 well site would not permit construction of a permanent access road until testing demonstrated that a successful well had been drilled, based on his opinion that there is no ready access through his property other than the proposed temporary access road.

Startech stated that the temporary access road would use an existing trail that would require minimal changes, if any, to the existing landscape. In accordance with the landowner's request, Startech would strip the topsoil and put the soil in salvage piles on the east side of the north/south-running access road and on the south side of the east/west-running access road to create a barrier against water runoff from higher elevations. Startech stated that the landowner recognized this as more environmentally benign and gave his approval to use the trail. Startech argued that the temporary access road could be reclaimed easily and returned to its former condition after drilling and testing because road construction activities would be minimal.

Startech maintained that it did not make sense to construct one of the possible permanent access roads prior to drilling the well. It explained that the road allowances for the permanent access roads have not been entirely cleared of trees and brush and that these road allowances are restricted by the Municipal District of Foothills' requirement to construct all road allowances to "high grade road" standards. Startech indicated that landowners of the adjacent properties wanted to keep these road allowances undeveloped to control unauthorized access to their property. Startech believed that if the well were drilled and found to be uneconomic to produce, the environmental impacts and reclamation activities caused by the construction of a permanent access road would prove to be both unnecessary and extensive.

4.2 Views of the Interveners

WHOA did not dispute the geological and reservoir evidence provided by Startech regarding the choice of the proposed 7-5 bottomhole location.

WHOA was concerned with the proposed surface location for several reasons. First, it would be situated near to 52 occupied residences within the proposed EAZ, which extends more than 2 kilometres (km) from the proposed well. WHOA argued that a portion of a resident's property and a portion of Plummers Road would fall within the proposed 710 m EPZ and that an EPZ should not cross any major road. It maintained that the well should be moved to a less-populated area. WHOA argued that by moving the well from the 4-5 site to the 13-32 site, more residents were closer to the well.

WHOA stated that prior to a 22 June 1998 town hall meeting held with Startech, area residents believed that the well would be drilled from the 4-5 surface location. When WHOA learned that a surface lease agreement was reached for the 13-32 site, it believed that Startech had ignored a commitment it had made to the community to drill the well at the 4-5 surface location.

WHOA stressed that the proposed location could result in the channelling of an emission plume from the well through the valley in which the residents live. It referred to the behaviour of smoke from the burning of trees and bush by the landowner of the proposed lease site in 1998 as an example of this channelling effect through the valley.

WHOA expressed environmental concerns regarding the grade of the proposed lease site and said that runoff from it could impact lower-lying areas. It also raised concerns over the need to cut down trees and clear brush to prepare the lease site. WHOA suggested that the well be moved to a location that would have fewer environmental impacts.

When asked by the Board if there was a better site, WHOA responded that it would rather not have any well drilled near its community. It suggested that the previously proposed 4-5 location might be a better location because it would be farther away from the community, would have less elevation change across the site, and would require no tree removal. WHOA acknowledged that the landowner of the 4-5 location did not want a well on his land but noted that a surface lease could be obtained from the SRB in order to use this location. Although WHOA did not have any other specific alternative location in mind, it argued that Startech had never discussed possible alternative locations with the community. Startech informed them that the location was selected by the landowner and was not a negotiable issue. It believed that Startech chose the 13-32 location for ease and convenience based on the fact that once a lease was signed, it rendered ongoing negotiations for a surface lease at the 4-5 location unnecessary. WHOA requested that Startech be required to drill the well at the 4-5 surface location if the well licence were approved.

WHOA argued that it did not make sense to construct a temporary access road first and then a permanent access road later, as this would impact both the community and the environment more than once. It argued that the approach from Plummers Road and the temporary access road would be in one of the worst possible locations at one of the busiest portions of Plummers Road and very close to several residents, which could cause dangers and noise levels. It also argued that the temporary access road would run close to a dugout pond used by domestic and wild animals and expressed concern over the topsoil salvage piles interrupting normal drainage patterns. WHOA argued that the 4-5 well site would have easier access, resulting in less environmental impact. It submitted that if an access road to the proposed well site must be constructed, it should only be constructed once. It thought that it might be best if the road approached the well site from the east. WHOA requested that if the well licence were approved, the access road to the well site be approved by WHOA.

4.3 Views of the Board

The Board notes that Startech identified the proposed 7-5 bottomhole location using geological, geophysical, and reservoir interpretations to identify the optimum location, providing the greatest chance for success of its well, and that no technical evidence was presented to dispute the interpretations or selection of the 7-5 bottomhole location. The Board also notes the concerns raised by the interveners about the siting of the well and access road and Startech's attempts to

choose locations that would minimize personal safety risks and impacts. It also notes that the 13-32 surface owner was satisfied with the location of the proposed well and temporary access road.

While the Board acknowledges that the interveners considered other surface and access road locations to be more appropriate, the Board would not deny an application unless it would result in unacceptable impacts or clearly superior locations were identified. Alternative locations were not identified, and the Board is satisfied that the proposed locations meet requirements for siting such wells and access roads.

Although the Board agrees that it is desirable to avoid impacts on the community and environment, it understands that if the proposed well were drilled, it could prove to be dry or uneconomic to produce. If this occurred, there would be no need to build a permanent access road. The Board is satisfied that the proposed temporary access road currently presents the least harmful alteration of the landscape, given the existing trail and the anticipated road work required.

The Board notes that Startech chose the proposed temporary access road based on negotiations with the surface owner and that evidence suggests the community had little input into the choice of access road(s). If the well is approved and proves to be successful, the Board expects Startech to consult with the community and address reasonable concerns in choosing a permanent access road. The Board believes that the public should have sufficient information to participate meaningfully and have their concerns heard, properly addressed, and, if possible, resolved. Also, the Board would expect Startech to take special safety precautions when moving heavy equipment on and off the lease, such as controlling traffic using a flag person.

Finally, the Board notes that the subject application was submitted to the Board on 13 July 1998 with a surface location of 13-32 and that Startech's choice to move the well from the 4-5 location to the 13-32 location occurred prior to the submission of the application. The Board acknowledges that in final arguments WHOA compared Startech's site change to one outlined in *EUB Decision Report 96-14*.¹ The Board notes that *Decision Report 96-14* concerns a surface location that was changed after the application was filed with the Board. In that case, the company did not make any amendments to the application or do any public consultations regarding the changes prior to or during the hearing. The Board believes that there are important distinctions between the two cases. Although the Board accepts that Startech's decision to change the location negatively affected its relationship with WHOA, it does not constitute a failure in the well-licensing process. The Board acknowledges that lease negotiations and changes to well-site locations are normal events in the industry and accepts Startech's decision to relocate the well because of a landowner's refusal to consider a lease.

It is the Board's view that it is desirable for the public to have an opportunity to provide its views about site selection to the company so that they may be properly and genuinely considered by the applicant as part of the formal application being submitted to the Board. However, if applicants and local residents do not come to a consensus on this issue, the company is entitled to choose a site for the purpose of completing and submitting its proposal. The ultimate decision

¹ *EUB Decision Report 96-14: Application for a Well Licence, Chedderville Field, Canadian 88 Energy Corp.*

on the suitability of the proposed site will, in those circumstances, be made by the Board. It does not believe that a site should be selected by one group of people at the expense of another. In the present circumstances, the Board does not consider the 4-5 site to be clearly superior to the 13-32 site. The Board believes that the 13-32 site is acceptable.

5 IMPACTS OF THE PROPOSED WELL AND ACCESS ROAD

5.1 Views of the Applicant

Startech maintained that there is no potential for its proposed drilling operations to impact area water wells, as its hydrogeological investigation indicated that a regional aquifer is not present across the area. Startech indicated that it had developed a program to test area residents' water wells, a commitment it had made at a 5 October 1998 meeting with residents. Startech maintained that WHOA had committed to provide Startech with a list of area residents who wished to participate in the program but had not yet received the list.

Startech acknowledged that area residents were concerned about environmental and visual impacts the proposed well and access road would have on the area. It stated that natural drainage patterns of the surrounding area combined with erosion control methods would minimize erosion of the well site and access road and committed to the use of straw bales along the temporary access road. It believed that the use of the straw bales would prevent any water runoff or erosion from the temporary access road entering the dugout pond, which would be located directly west of the temporary access road. It stated that it would haul all waste off site and nothing would be buried on the well site. It noted that AENV has given its approval to the environmental study and the proposed lease site.

Startech did not dispute that the burning of trees and brush on the northwest quarter of Section 32 had created significant amounts of smoke in 1998. Startech stated, however, that it had not requested the landowner of the quarter section to clear or burn any trees or brush. It committed that it would not burn any trees or brush from the clearing of the proposed well site and stated that the brush would be used as material to stabilize the slopes of the lease. Startech would haul any surplus brush away from the site.

Startech stated that it has made several commitments to the community regarding traffic concerns and road use. It would restrict heavy loads to minimize potential conflicts with school bus schedules, peak work commuting times, and normal sleeping hours. It would prepare a temporary staging area, so that well-site traffic would not park on Plummers Road and impede normal, safe traffic flow. It would not use the staging area for equipment storage. Startech would keep all contractors well informed of the need to respect community rights and the environment and the need to drive responsibly. Rig crews would reside off site and would travel together to reduce traffic. It would prohibit the use of engine retarder brakes on grid roads as a means of noise reduction. Startech also committed to promptly repair any damage made to county roads related to its traffic and to communicate with the Municipal District of Foothills respecting its specific requirements for road maintenance. It would also use dust control measures.

Startech proposed that drilling operations would be conducted 24 hours a day and acknowledged residents' concerns about the noise levels during nighttime hours. It stated that 24-hour drilling would be necessary, as it would minimize the time the borehole would be open and therefore would make the drilling operation much safer. Startech committed to use a diesel-electric drilling rig with an upgraded muffler system to ensure noise levels are kept as low as possible and stated that additional sound-control measures would be assessed on an ongoing basis during drilling.

Startech acknowledged the residents' concern regarding property values but noted that no evidence was brought forward to substantiate claims that the proposed well would reduce property values in the area.

Startech recognized that WHOA had concerns about potential vandalism to equipment and harassment of residents by the industry but noted that no such threats have ever been linked to Startech. It stated unequivocally that it has not and would not engage in such activity.

Startech submitted that it was incorporated in 1983 and has been involved with the operation of over 300 wells, approximately 70 per cent of which have some sour gas component. It stated that it is insured for liability, well control, and property damage to \$10 million coverage per single event by a recognized insurer.

If the proposed well were found to be dry and the well were abandoned, reclamation activities would take place as soon as possible, weather permitting. Startech stated that it is committed to various stakeholders, including the public, to conduct its operations in a sound and environmentally responsible manner and to minimize all liabilities associated with the reclamation of all abandoned facility sites it operates.

Startech submitted to the Board, and all interested parties, a joint conceptual area development plan in conjunction with Berkley on 10 June 1999. The plan was requested in response to area residents' concerns about the various impacts the proposed well and any future applications for wells, pipelines, and production facilities would have on the area. Startech noted that any future developments would require separate applications to be submitted to the Board.

Startech submitted that the conceptual development plans were complete to the extent possible in light of available information. It pointed out that the plan includes a clear statement of Startech's commitments, as well as the Imperial Oil Resources Community Awareness Program Guide, which it suggested be used as a framework for the industry and the community's future relationship in this area in the context of the Quirk Creek Gas Processing Community Committee. It stated that Stampede submitted a separate plan because there are two conceptually different types of developments being pursued by the companies. Startech and Berkley based their development plan on gas exploration, while Stampede based its development plan on oil exploration. Startech argued that the development plans not only met the Board's requirements but would be flexible enough to accommodate new information as it becomes available.

5.2 Views of the Interveners

WHOA and Mr. Greenwood suggested that the Millarville and Priddis environment could potentially become too hazardous to live in and expressed concerns regarding the environmental impact the petroleum industry is having on the province of Alberta as a whole. WHOA explained that many of the residents moved to the country to avoid the noise, traffic, and pollution of the city and never expected to be within view of a flare stack or exposed to the toxic compounds released from it. WHOA described how individuals have seen various animals with diseases and abnormalities that they attributed directly to the petroleum industry. Mr. Greenwood demanded a moratorium on all applications for wells in the area until there is a comprehensive plan that guarantees the health of the province.

WHOA raised environmental concerns, including the logging of trees and the general effect the development could have on wild animals. It was concerned that Startech's environmental report indicated that it would burn some smaller trees and brush that would be removed for lease construction and explained how the burning of trees and brush on the northwest quarter of Section 32 in 1998 had created significant amounts of smoke in the valley. It questioned Startech's commitment to ensure that the well site and access road would be maintained properly, including any waste removal, and future reclamation activities Startech or future owners of the well may undertake.

WHOA raised concern about the potential impact the proposed well could have on water wells and submitted that Startech had not discussed or explained the water well testing program to residents. WHOA also expressed concern regarding potential impacts on the dugout pond, which would be just west of the temporary access road. WHOA explained that many wild and domestic animals use the dugout pond for drinking water and was concerned that runoff and erosion from the temporary access road could contaminate the water. WHOA suggested that special measures beyond those already committed to by Startech should be taken to ensure that no runoff or erosion from the temporary access road enters the pond.

WHOA identified several concerns regarding the increased traffic the well would create and the effects this traffic might have on the county roads and the community. WHOA explained that Plummers Road is not meant for heavy or excessive traffic and expressed concern over excessive wear and tear to the road. It believed that Plummers Road would not be wide enough for the heavy equipment that would be moved in and out of the well site. WHOA expressed concerns about potential traffic congestion and safety on the road during school bus hours and peak work commuting times. It also expressed concern that Startech would use the road during normal sleeping hours. It stated that the approach off of Plummers Road to the proposed temporary access road is on one of the busiest portions of Plummers Road and that it believed this would cause undue dangers and noise levels.

WHOA claimed that the proposed well would adversely affect the property values within the community. It stated that the owner of the previously contemplated 4-5 surface location told WHOA that his property values would go down by \$1000 per acre if the proposed well were on his property.

WHOA expressed concerns about increased noise levels associated with the drilling and operation of the well. It was concerned that the drilling operations would be conducted around the clock and that noise levels of the drilling operations and associated traffic may be excessive. It also stated concerns about the noise levels that would be generated by flaring during testing and maintenance operations and gave verbal accounts of noise levels from other flares in the area.

WHOA indicated concern about the possibility of vandalism to wells and associated equipment and suggested that the landowner of Section 5 could attract vandalism due to his high profile in the petroleum industry. WHOA also claimed that it understands that other industry operators have made threats and committed acts of harassment against residents involved in disagreements with those companies.

WHOA questioned Startech's ability to conduct its operations in a sound and environmentally responsible manner and expressed concern regarding any reclamation activities that would take place when the well was abandoned.

Mr. Jacobsen submitted that the oil and gas industry has had a positive impact on the local and provincial economies over his lifetime of living in the area and that it has been his experience that the negative impacts, such as sour gas flaring, have been greatly reduced over the years.

Ms. Nelson indicated that she had no health concerns associated with the proposed well or any other wells in the area and suggested that many of the ailments described by people in the area could be attributed to food preservatives.

In final argument, WHOA said that it did not believe that an adequate conceptual development plan was provided to the interveners. It concluded that Stampede did not submit a joint development plan in conjunction with Startech and Berkley because the three companies could not work together cooperatively. It believed that the conceptual material supplied by Stampede did not fit in with that supplied by Startech and Berkley.

5.3 Views of the Board

The Board acknowledges the area residents' concerns about the various impacts the proposed well and any future wells, pipelines, and production facilities may have on the area. The Board believes that Startech has addressed all of the potential impacts the proposed well could have on the community. The Board concludes that Startech's proposed well would meet or exceed all standards, regulations, and guidelines for noncritical level-1 sour gas wells and believes that although there will be some impacts, which are inevitable for this type of development, the impacts would be no greater than typical industrial impacts accepted by society.

The Board does not believe that the proposed well poses a risk to area water wells. However, the Board expects Startech to work with area residents to ensure the proposed water well testing program meets their needs. Startech must also take any precautionary measures necessary to prevent erosion and runoff from entering the dugout pond and test the water prior to road preparation.

The Board recognizes the difficulties in providing details regarding future development in the area because of the uncertainties related to whether a reservoir exists and, if it does, the nature and extent of it. It accepts that only a conceptual development plan is possible at this time. Should the well be drilled and found to be economic to produce, the Board expects future development to take into account all of the latest information available and the information to be shared with other operators to achieve a carefully planned and coordinated development in order to minimize impacts to local area residents.

The Board sees no reason to place a moratorium on all applications for wells in the area given the exploratory nature of the drilling and the Board's view that all applicants must satisfy all regulatory requirements to ensure that public safety risks and impacts will be minimized.

6 SAFETY

6.1 Potential H₂S Release Rates

6.1.1 Views of the Applicant

Startech submitted that for the proposed 7-5 well the maximum expected H₂S concentration was 5.38 per cent and the maximum sandface H₂S release rate was 0.167 cubic metres per second (m³/s), with a corresponding EPZ of 710 m. It anticipated that the 7-5 bottomhole location would have a production potential of 113 x 10³ cubic metres per day (m³/d) and that the absolute open flow (AOF) potential of the well would be 268 x 10³ m³/d. Startech used the 7-32 well as an analog well for the anticipated reservoir and flow characteristics of the proposed 7-5 well. It stated that the 7-32 well had a maximum H₂S concentration of 5.38 per cent and an AOF of 134 x 10³ m³/d.

Startech indicated that only the upper, or first, sheet of the Turner Valley in the 7-32 well was gas bearing and that approximately 7 m of net pay in the first sheet contributed to AOF flow rate. At the proposed 7-5 well location, Startech anticipated approximately 22.5 m of net pay if both the first and second sheets of the Turner Valley were present and gas bearing.

Startech relied on a methodology it called "surrogate Kh" (where K is permeability and h is net pay thickness) to adjust the AOF potential of the 7-32 well to reflect the anticipated pay at the proposed well. This methodology used the 5-22-21-3W5 well (the 5-22 well) as a core analog well for the purpose of estimating the permeability of the reservoir at the 7-32 well, which had not been cored. The 5-22 well core data were used to develop a core porosity/permeability relationship to estimate the permeability of the reservoir at the 7-32 well using its porosity log data. The 7-32 well porosity log data and the estimated K were used to develop a surrogate Kh. This surrogate Kh was normalized to the Kh information derived from the AOF test on the 7-32 well. On the basis of these calculations, Startech concluded that a well at the 7-5 location would potentially have an AOF rate 1.88 times the AOF from the 7-32 well. It stated that, as a safety margin, it increased the anticipated AOF from the proposed 7-5 well to twice the AOF rate of the 7-32 well.

Startech stated that it made certain assumptions to use this method:

- C The porosity and permeability characteristics in the 5-22 and 7-32 wells are similar.
- C The cored interval in the 5-22 well is the same zone as the tested interval in the 7-32 well.
- C The core porosity to log porosity relationship in the 5-22 well is similar to the relationship that would be found in the 7-32 well if it were cored.
- C The porous intervals in the 7-32 well could be directly correlated to the proposed 7-5 well.

Startech agreed that the surrogate Kh method implied a unique permeability for each porosity value encountered and acknowledged that a range of permeabilities is possible for any given porosity value. Startech believed that this method provided its best estimate of a given permeability for a given porosity.

Startech noted that the 5-22 well only had gamma ray and neutron logs, so it was unable to calibrate the core porosity to a density log and then subsequently calibrate the porosity log from the 7-32 well to the core porosity from the 5-22 well. While Startech assumed the core porosity to porosity log relationship in the 7-32 well was the same as that in the 5-22 well, it did not know for certain what that relationship was. Startech stated that the use of one core to establish a core porosity/permeability relationship was sufficient to provide a reasonable relationship, but noted that the use of additional core would establish a more comprehensive relationship and increase confidence in the permeabilities derived for the 7-32 well. Startech stated that, while it assumed that the porous intervals in the 7-32 well could be directly correlated to the proposed 7-5 well location, it could not state for certain that they did. Startech believed that there was equal potential for increased or decreased net pay or permeability at the proposed location relative to that indicated by the 7-32 well.

Startech acknowledged that there were other methods of calculating an H₂S release rate, such as a pay ratio method, but believed that, given its interpretation of the porosity and permeability, a surrogate Kh methodology was appropriate. Startech agreed that using the pay ratio method did provide a factor of three times the AOF rate of the 7-32 well, while the surrogate Kh method provided a factor of roughly two times the AOF rate of the 7-32 well. It argued that the pay ratio method did not take into account the quality of the reservoir. Startech acknowledged that the pay ratio method did provide a more conservative result when applied to the emergency planning zone outcomes.

6.1.2 Views of the Interveners

WHOA expressed concerns with regard to public safety, including that

- C the well level could be higher than level 1;
- C the H₂S release rate was revised from 0.150 m³/s and the EPZ revised from 670 m in Startech's pre-application submission;
- C if the release rate were different, the EPZ would be different;
- C 5.4 per cent H₂S concentration was not a low level concentration; and
- C the well could potentially be classified as critical.

WHOA stated that it had lost trust in Startech and identified a need for Startech to re-establish trust and confidence in its abilities and its commitment to a safe and healthy operation in its

community. In final argument, WHOA stated that the Board should rely on the most technically sound data and that, if the well were approved, Startech should be required to file an ERP based on the maximum H₂S release rate that would be reasonably expected.

6.1.3 Views of the Board

The Board notes WHOA's concern with regard to the maximum H₂S release rate and its corresponding impact on EPZ calculations. The Board acknowledges that Startech, in its representations to the community, attempted to provide the maximum H₂S release rate that would be reasonably expected and the corresponding EPZ calculation. Startech used the slightly larger sandface AOF rate rather than the surface deliverability, as directed by *Interim Directive 97-6 (ID 97-6)*² resulting in a slightly higher H₂S release rate. Startech also rounded up its anticipated 7-5 well AOF to twice that of the 7-32 well. From the evidence presented, the Board notes that the proposed well would encounter two thrust sheets, with potential Turner Valley gas pay in both sheets.

Startech's surrogate Kh methodology attempted to account for the anticipated increase in net pay in the proposed 7-5 well as compared to its AOF analog well, the 7-32 well. Startech concluded that the 7-32 well was a reasonable reservoir and flow analog for its proposed 7-5 well and that, therefore, it is reasonable to conclude that porosity and permeability in the wells may be similar. Startech's surrogate Kh methodology relies on the use of core data to establish a relationship between core-derived permeability and porosity. It then proceeds in a comparative fashion to estimate permeability in an uncored well. In this case, only the 5-22 well had core data available.

The Board agrees with Startech that the availability of additional core data would increase the confidence in this relationship. However, the Board does not believe that one data source is sufficient to establish a correlative relationship between core porosity and permeability and log porosity in a reservoir. In this case, the reasonableness of this relationship is further tested by Startech's inability to calibrate the core porosity/permeability relationship to porosity logs in common to both wells, as the 5-22 well only has a neutron porosity log.

The pay ratio method also relies on the assumption that the reservoir characteristics in a proposed well will be similar to the chosen analog well. However, this assumption then allows the ratio of anticipated pay to analog pay to account for thickness changes in reservoirs. Startech stated that the pay ratio method did not account for changes in the quality of the reservoir. The Board notes that Startech acknowledged that its method could not establish with certainty that the proposed 7-5 well will encounter parameters similar to those inferred for the 7-32 well from the 5-22 well core data. The Board agrees with Startech that there is potential for increased or decreased net pay or permeability relative to the 7-32 well. The Board expects that, given the assumptions made, the uncertainties in reservoir parameters, and the impact these variations have in producing a range of maximum H₂S release rates, it is reasonable for an operator to use the maximum of the calculated range. In this case, the Board believes that the methodology yielding a more conservative H₂S release rate should be applied. The Board calculated an H₂S release rate of 0.254 m³/s using the following:

² *Interim Directive 97-6: Sour Well Licencing and Drilling Requirements*

- C the pay ratio method to correct for the anticipated increase in net pay;
- C the anticipated net pay value of 22.5 m;
- C the 7 m net pay value in the 7-32 well;
- C a 5 per cent friction loss factor to correct the 7-32 well sandface deliverability of 133 820 m³/d to surface deliverability; and
- C a 5.38 per cent H₂S concentration.

The Board believes that 0.254 m³/s is the maximum potential H₂S release rate that could be reasonably expected at the 7-5 location. This well would not be classified as a critical sour gas well according to *ID 97-6* because it does not meet any of the criteria.

6.2 Drilling, Completion, and Production Considerations

6.2.1 Views of the Applicant

Startech submitted that its application is unremarkable in every way and that all drilling, completion, and production programs established at the proposed well would meet or exceed all applicable standards, regulations, and guidelines.

Startech indicated that it would notify all area residents, area operators, and government agencies before drilling operations commenced, prior to entering the sour zone, and before completion operations began.

Startech stated that it would equip the drilling rig with class-4 blowout prevention (BOP) equipment. It would use two well-site supervisors to ensure 24-hour supervision during drilling operations. Startech submitted that it would use a water-based drilling fluid and a continuous pH monitoring system on the drilling rig to monitor the drilling fluid for any indication of soluble sulphides caused by the presence of H₂S. It estimated that the well would be drilled in 60 days to a total depth of approximately 3500 m. Startech committed to set surface casing to a depth of 400 m, or possibly lower if a lost circulation condition developed. It would drill an intermediate hole to the top of the Rundle zone and set and cement intermediate casing. Startech would then drill the well through the sour gas zone to the final total depth, where a production liner would be cemented into place. Startech committed to use a downhole float in the drill string to maintain a positive resistance to flow up the drill pipe.

It would store barite on the well site to weight up the mud system if required to balance any abnormal pressures encountered. Startech would conduct daily H₂S and BOP drills with well-site personnel until all personnel responded satisfactorily; thereafter, it would conduct drills bi-weekly. It would supply breathing apparatus for all on-site personnel and conduct safety and evacuation drills. Startech would also conduct daily walk-around rig inspections, as well as more comprehensive weekly rig inspections.

If H₂S concentrations encountered by Startech were higher than the amount estimated in its application, Startech would immediately stop drilling operations, shut in the well, and notify the EUB and WHOA. Startech submitted that additional actions might include increasing the size of

the EPZ, increasing other safety precautions, or enhancing the emergency response plan (ERP), as conditions warranted.

Startech indicated that all freshwater aquifers penetrated by the proposed well would be protected by surface casing and that it would drill the surface hole with an additive-free freshwater system. Its review of historical drilling information suggested that lost circulation during drilling of the surface hole was unlikely, but it stated that it would control any instances of lost circulation with inert material.

Startech would hold a meeting with all safety company and testing personnel before perforating the well, to ensure everyone knew their role. Once the well was perforated, Startech would perform a stimulation treatment on the well and flow test it as part of the well testing phase.

Startech stated that a production test is required from the proposed well to assess its production potential and noted that it would be required to obtain a permit from the EUB in order to undertake any flaring. The results of the test would enable the proper design of well-site equipment and pipelines. Startech acknowledged that any future proposed pipelines would be subject to public consultation and subsequent applications to the Board. Startech stated that it had considered the possibility of performing an in-line test to a nearby gas plant, but there is no gas pipeline close to the proposed well that could accept the gas produced during testing. Startech stated that it would use portable testing equipment that would meet or exceed EUB regulations. The equipment would include a separator to separate any oil or water that may be produced during the test and a storage tank for those liquids.

Startech accepted that area residents were concerned about the potential health effects caused by emissions from flaring of the proposed well during testing. Startech said that the proposed well would not add significant amounts of flare emissions to the atmosphere in the long term, but it committed to use incineration technology for the testing phase of the well, provided that field trials of the incineration equipment continue to be successful. Startech indicated that the incinerator must be able to handle an anticipated flow from the well of approximately $113 \times 10^3 \text{ m}^3/\text{d}$ and that emissions from the incinerator must meet ground-level sulphur dioxide (SO_2) concentration guidelines. Dispersion modelling showed that ground-level SO_2 concentration during flaring would be much less than the air quality guidelines. It did not anticipate that incineration would be a problem, because there is less heat loss from an incinerator than from a flare, thus contributing to more plume rise and lower ground-level SO_2 concentrations. Startech indicated that the makers of the incineration equipment believe that gas from the proposed well can be incinerated successfully. Startech also stated that the test would take place over a four- to seven-day period and would produce no more than a maximum allowable volume of $600 \times 10^3 \text{ m}^3$.

Once it completed the well test, it would shut in the well and set a downhole plug and subsurface safety valve in the tubing. It noted that a subsurface safety valve is not required by the regulations for a level-1 sour well. It would then chain and lock the wellhead and notify all area residents, area operators, and government agencies. Startech would fence the site and post the appropriate signs.

Startech submitted that following the original production test, it would need to flare the well once every year or two for approximately 30 minutes in order to do maintenance on the well.

6.2.2 Views of the Interveners

WHOA stated that Startech should not only meet the various standards, regulations, and guidelines, but also should use or be required to use the highest technical standards possible for both equipment and procedures to ensure the highest standards of public safety.

WHOA questioned how Startech would choose the drilling contractor and speculated that it would be chosen based on the lowest quoted price rather than experience or expertise. It requested Startech to advise it what drilling contractor would be used in order to facilitate WHOA's research of the drilling company's track record.

WHOA expressed concern over naturally occurring geophysical features found in the area, such as small earth tremors and underground caverns, and questioned how these features might affect the safety of the drilling and operations of the proposed well.

WHOA expressed health concerns with regard to flare emissions from the proposed well and any future wells in the area. WHOA argued that flare emissions include unknown chemicals of unknown toxicity and that the chronic health effects and the susceptibility of sensitive individuals need to be addressed. WHOA expressed concern that toxic compounds from flaring would be released into the atmosphere and that these compounds may also leach into the ground and water table, affecting plant, animal, and human health.

WHOA questioned the possibility of Startech performing an in-line production test to a nearby gas plant. It stated that if an in-line test is not possible and a production test is necessary, the use of incineration technology should be a mandatory requirement and no flaring should be permitted for the testing or annual maintenance of the well.

Mr. Worthington expressed concerns regarding how flare emissions could affect the health of both humans and animals in the area. He suggested that during the testing phase of the well, a new type of electric generator be used on the well to produce electric power from the burned gases rather than using flaring or incineration. He had no information regarding the complexities or costs that would be associated with implementing the technology for a four- to seven-day test.

WHOA expressed concern regarding the safety of transporting acid used in the completion and stimulation phase of the well operations on county roads.

6.2.3 Views of the Board

The Board requires that the drilling, completion, production, and maintenance of all wells drilled in Alberta be done in accordance with the Oil and Gas Conservation Act and Regulations and all EUB standards and guidelines. In this case, the Board concludes that Startech's proposed well would meet or exceed all requirements. In particular, the Board notes that Startech has

committed to the use of a downhole float and a subsurface safety valve, as required for critical sour gas wells.

The Board recognizes that the interveners are concerned about health risks due to the “unknown” emissions during testing and ongoing operations. The Board understands that the use of incineration technology for the testing phase of the well depends upon the success of field trials of the incineration equipment. The Board expects Startech to keep the Board informed of test trial results. The Board will decide if incineration technology has a reasonable chance of success for the testing of this well; if not, flaring may be necessary to test the well to determine if it is economic to produce and to size pipeline and other equipment. In any event, testing would be limited to seven days and would require written approval from the Board of the method, stack height, and equipment to be used to handle the gas. The Board expects Startech to advise the public prior to testing as to whether incineration or flaring would be used. The Board accepts that routine maintenance may necessitate some flaring to depressurize the well or its connecting pipeline on occasion. The Board does not believe that in-line testing of the proposed well would be feasible due to the proximity to existing pipelines. The proposed use of incineration would promote complete combustion and reduce the emission of the “unknown” products of incomplete combustion. The Board notes that any emissions would meet Alberta’s ambient air quality guideline and therefore believes that the health risks associated with operation of the proposed well would be acceptable.

The Board acknowledges WHOA’s request to be advised of the drilling contractor chosen by Startech. The Board expects that this advice would be given to WHOA when the information is available. If the well were approved, it would be subject to detailed EUB drilling rig inspections. The EUB inspections would ensure that the drilling contractor would meet or exceed all standards, regulations, and guidelines.

6.3 Public Safety Risk Assessment

6.3.1 Views of the Applicant

Startech’s objectives for its risk analysis were to assess the risk to the public associated with an uncontrolled release from the well and to assist in designing the ERP. Dr. Leahey, Startech’s risk expert, predicted annual risks of lethality or serious irreversible injury would decrease rapidly with increasing distance from the well. He predicted that, beyond 10 m from the well, risks would be less than 1 chance in a million in all directions and less than 10 chances in a trillion beyond 50 m from the well. Dr. Leahey assessed risks at the closest residence, some 800 m from the well, as being negligible. He said that an annual risk of 100 chances in a million was acceptable to the Advisory Committee to the ERCB, Reviewing Public Safety and Sour Gas,³ and therefore the risks associated with this well were acceptable.

³ The ERCB (now the EUB) had formed a multistakeholder committee to examine the adequacy of the Board’s setbacks and other public safety standards relating to accidental releases of sour gas. The committee submitted its report and recommendations to the Board in February 1994.

Dr. Leahey said that the total predicted risk is the sum of the risks during drilling, production, and servicing and that the highest annual risks of lethality or serious irreversible injury were predicted to occur during the production phase, followed by servicing and drilling. He believed that it was necessary to annualize the drilling blowout probability and servicing blowout frequency to allow comparison to everyday risks and to risk acceptability guidelines expressed on an annual basis. Dr. Leahey's risk estimates included an annualization factor to account for the duration of the activity that could lead to a release. In the case of drilling in the sour zone he applied a factor of 10/365 to represent 10 days of drilling in the sour zone. In the case of servicing, he applied a factor of 7/365 to represent seven days of servicing. To allow for the chance that immediate ignition did not occur following an uncontrolled sour gas release during drilling or servicing, Dr. Leahey applied the probability of nonignition. For uncontrolled releases during production, the probability of a failure to control the release allows for the chance that the subsurface safety valve fails to work as planned.

Startech did not dispute the known health effects associated with exposure to H₂S but stressed that it did not anticipate any person being exposed to unacceptable levels of H₂S as a result of the drilling, servicing, or production of the proposed well. Startech did not consider assuming a 30-minute exposure time to H₂S in the risk analysis to significantly affect the risk estimates.

6.3.2 Views of the Interveners

WHOA expressed concern for the health and safety of its members, their families, and domestic and wild animals should an accidental release of sour gas occur. WHOA argued that any risk of exposure to H₂S was too much risk.

WHOA's risk expert, Dr. Lambert, believed that the risk estimate provided by Startech was a factor of about 1000 too low for drilling. He said that this was because Dr. Leahey misapplied the factor for the probability of nonignition, inappropriately used an annualization factor, and did not apply a depth correction factor. Dr. Lambert pointed out that the ignition criteria in Startech's ERP did not suggest immediate ignition and that there would be an actual decision-making process taking place. Therefore, immediate ignition could not be assumed in the risk analysis. He also believed that an exposure time of 60 minutes should be used for rural areas based on the assumptions used in the risk analysis for the Advisory Committee to the ERCB, Reviewing Public Safety and Sour Gas. WHOA requested that Startech be required to perform site-specific plume dispersion modelling of an accidental release and that the risk assessment be resubmitted as a condition to drilling the well, if it is approved.

However, notwithstanding his concerns with the risk assessment, Dr. Lambert considered the risks of lethality or serious irreversible injury to be acceptable for this well, based on his experience with level-1 wells within northeast Calgary.

6.3.3 Views of the Board

The Board believes that an annualization factor is necessary to convert the drilling blowout probability to an annual frequency. However, the Board notes that the applicant's annualization factors are not dimensionally correct, as they do not result in the proper units for annual

individual risk. The Board believes that the appropriate annualization factor to apply to the drilling blowout probability is one well drilled per year. The applicant's risk estimates during drilling are therefore a factor of 36 (~365/10) low. Blowouts during servicing are already expressed on an annual frequency basis, so the annualization done by the applicant is not required. The applicant's risk estimates during servicing are therefore a factor of 52 (~365/7) low. As a result, the Board believes that the greatest risks are due to servicing and then during the production and drilling phases.

The Board believes that the application of the probability of nonignition in the risk estimates is acceptable, as Startech has committed to immediately ignite a level-3 emergency uncontrolled sour gas release. The Board notes that the ERP outlines actions to be taken to control the well during a level-2 emergency to prevent a level-3 emergency from occurring. The Board has requirements for ignition based on mobile air monitoring for H₂S and believes these are adequate to protect the public during a level-3 emergency. Nonetheless, the Board notes that Startech has committed to immediate ignition of a level-3 emergency release to prevent exposure to H₂S.

The Board believes that the use of the depth correction factor proposed by the interveners is reasonable, as previous EUB interpretations of blowout data showed that deeper wells have a higher blowout probability. However, this potential increase in risk is offset because the proposed well is a developmental, rather than an exploratory, well. The EUB has shown that developmental wells have a lower probability of blowout than exploratory wells. This is because the additional information available from other wells in the area results in a better prognosis, a safer drilling program, and more effective response in the event of a kick or blow during drilling.

With respect to Startech's assumed exposure time of 30 minutes, the 60-minute exposure time proposed by the interveners would result in a 41 per cent increase in toxic load. This would result in a probability of lethality or serious irreversible health effects several times higher than that presented by Startech. However, the Board considers the assumed 30-minute exposure to be reasonable for this location, since the EPZ would be evacuated at a level-2 emergency during drilling or servicing. Therefore, the Board believes that it is highly unlikely that any member of the public would be exposed for 30 minutes if a level-3 emergency were to occur. It is thus highly unlikely that any member of the public within the EAZ would be exposed to H₂S for 60 minutes if a release were to occur during drilling or servicing and it is overly conservative to assume that in these situations. However, for releases during production, a 60-minute exposure is reasonable to assume for this location.

Having regard for the above, the Board believes that, although the applicant's risk estimates are low for the proposed level-1 well at the setback of 100 m, the risks to a permanent resident are still negligible. The annual risk of lethality or serious irreversible injuries to the nearby residents is even less.

With respect to WHOA's requests, the Board will not require Startech to perform site-specific plume dispersion modelling of an accidental release as a condition of the well being approved. The Board believes that Startech's dispersion modeling is adequate to determine an appropriate

EPZ. If a release were to occur, mobile air quality monitoring will provide information to the emergency responders to protect the public beyond the proposed EPZ from exposure. In addition, if the well is approved, the Board will not require Startech to submit a revised risk assessment, as it would provide little additional value to the ERP and would not result in improved public safety.

Public safety is a judgement of the acceptability of risk. An activity is considered to be safe if its risks are judged to be acceptable. The Board has not used a numerical risk guideline. It judges each application considering public safety risk, technical measures to control risk, economic benefits of the facility, costs to further reduce the risk, and factors such as perceptions of risk acceptability from public, industry, and governmental perspectives. The Board has not adopted, nor had the Advisory Committee to the ERCB, Reviewing Public Safety and Sour Gas proposed, an acceptable risk criterion of 100 chances in a million per year of lethality or serious irreversible injury, or any other value.

The Board recognizes that there is a difference between how the public perceives voluntary risks, such as those associated with recreational activities, and involuntary risks, such as the subject sour gas well. The Board is also aware that risks associated with common or familiar hazards, such as driving, are perceived as safe, while dreaded hazards, such as sour gas or “unknown” emissions during flaring, are judged unacceptable by the public, even at much lower levels of risk. For example, the Board notes that WHOA said that any amount of risk resulting from the proposed well would be too much risk. Experience in Alberta has shown that the risk control measures required by regulation result in safe drilling, servicing, and production operations for sour gas wells.

6.4 Emergency Response Planning and Preparedness

6.4.1 Views of the Applicant

Startech stated that it had developed an ERP with the objective of enhancing safety procedures and ensuring public safety in the event of an emergency, even though there were no residences within the calculated 710 m EPZ and, therefore, no ERP would be required by the EUB. Startech stated that it decided to develop an ERP for operations at the well to address concerns of the community. It further stated that the EAZ of 2+ km was equivalent to an EPZ for a well with a potential release rate of at least five times that expected from the proposed 7-5 well.

Startech agreed that certain area residents may be more susceptible to potential health effects as a result of exposure to sour gas. Startech stated that, if the well is approved, it planned to revisit all residents within the EAZ in response to their concerns. It would update the personal information, including identifying individuals who would be considered sensitive or require evacuation assistance, and would explain the safety precautions the company had planned and how the ERP would work. Startech stated that residents within the EAZ would be treated as if they were in the EPZ.

Startech stated that because there would be no actual risk to the public outside of the EPZ and within the EAZ, no public protection measures would be needed. It further stated that because

the public within the EAZ would be worried about risk, it agreed to notify residents at a level-1 (minor) emergency so they could voluntarily evacuate if they so chose. Startech stated that it would need to check the whereabouts of people within the EPZ periodically during drilling so that people could be quickly located and evacuated in the event of an emergency. Within the EAZ people would be able to voluntarily evacuate, and Startech would support paying reasonable expenses related to an evacuation. Startech agreed to provide evacuation assistance to those residents within the EAZ who indicated they required assistance, even though evacuation would be voluntary. Startech agreed to revise its ERP to reflect this.

Startech stated that if the EUB were to determine that a larger H₂S release rate should be assumed for drilling the well, the EPZ would also be greater. It agreed that significant enhancements to the ERP would be required if the EPZ encompassed residences. These enhancements would include

- C locations of roadblocks to isolate the appropriate area,
- C mandatory evacuation, possibly at level-1 emergency, and
- C specific evacuation, shelter, and ignition criteria.

Startech agreed to include specific evacuation criteria in the ERP for outside of the EPZ related to measured concentrations of H₂S and SO₂ if the well is ignited. It did not believe that sheltering criteria would be necessary, since sheltering is more applicable to short-duration releases, such as from pipeline failures, and also because it calculated that there would be no residences within the EPZ.

Startech stated that it would immediately ignite a partially controlled or uncontrolled flow of sour gas to remove any risk to the public. It agreed to revise its ignition criteria to reflect this commitment. It also agreed to have a remotely activated automatic ignition system at the well site, with a shotgun and flare shells as a backup ignition system. Startech would revise the ERP to reflect this as well.

Although Startech demonstrated that ground-level SO₂ concentrations resulting from ignition would not reach evacuation levels based on its H₂S release rate estimates, it agreed to incorporate specific SO₂ criteria in the ERP. Upon request by the Board, an undertaking demonstrated that the predicted concentrations would increase by only 10-30 per cent if the release rate were doubled, but still would not reach evacuation levels.

Startech stated that it would utilize mobile air-monitoring units with very precise equipment to measure H₂S and SO₂ concentrations in the event of an emergency. The equipment would be called out to the site at the earliest sign of a well control problem. It further stated that there would be stationary monitoring equipment on the well site that would detect levels before the mobile unit arrived.

Startech stated that it would have appropriate emergency communications equipment in place during sour drilling and servicing operations at the well and that it would test all equipment to ensure its reliability in the area. Startech did not believe that it would be necessary to isolate the EAZ with roadblocks in the event of an emergency. However, it did state that roadblocks might be established at appropriate locations during an emergency based on monitored levels of H₂S.

Startech stated that it would hold a detailed ERP review meeting with its personnel and contractors prior to drilling into the sour formations to ensure that all involved understood their responsibilities. It would not propose to carry out a test of the response, but the review meeting would ensure that the crew had proper training.

Startech agreed that since Plummers Road is a school bus route, it would contact school authorities and include pertinent information in the ERP.

6.4.2 Views of the Interveners

The interveners expressed many concerns regarding Startech's proposed ERP. Ms. Dudley believed that her home might be within the 710 m EPZ, but even if it is not, she considers her property as part of her home, which is within the EPZ. She stated that if the H₂S release rate and subsequently the EPZ were larger, her home would certainly be within the EPZ. Other interveners shared her view that their property was part of their home.

The interveners were concerned that the 710 m EPZ included part of Plummers Road, which is a main road in the area and would be the evacuation route in the event of an emergency. They also expressed concern that Plummers Road is a school bus route and buses could break down in the zone, placing school children at risk. They stated that the EPZ is used for many activities, such as viewing wildlife and riding bikes and horses.

The interveners stated that the placement of additional roadblocks on Plummers Road to isolate the area in an emergency would not alleviate their concerns that Plummers Road is within the EPZ. It was their understanding that the personnel required to block the roads would need to travel to the area from Calgary. In their view, the company's response time would be too long and the emergency level could have increased by then. They stated that Startech had indicated the possibility of using personnel from the Quirk Creek plant but that they had not been able to get a response when they called the plant. Therefore, they did not believe that was an option.

The uncertainty about the H₂S release rate and subsequent EPZ has left the interveners more concerned and with more questions.

The interveners also expressed concern that the EUB would allow a number of wells to be drilled with overlapping EPZs, which would increase the risk to residents who were in more than one EPZ at a time.

Ms. Dudley stated that Dr. Leahey predicted H₂S concentrations of 20 ppm, the mandatory evacuation level, out to 408 m from the well site – more than halfway to her home. She further stated that she believed H₂S is heavier than air and therefore would settle into the valley where she lived. She expressed concern that 10 ppm could extend 825 m from the well, according to Dr. Leahey, and her home is within this area. She was concerned that Startech had not provided her or WHOA with a final ERP outlining procedures for transporting her mother, who does not drive, or others. She argued that if Startech believed there was no difference between the EPZ and the EAZ, then there were many residences within the EPZ.

Dr. Lambert, on behalf of WHOA, included H₂S/SO₂ toxicology tables in his submission because he believed that accurate tables were necessary to communicate risk to the community and emergency response providers. The tables showed mandatory and voluntary evacuation criteria. He stated that he had been developing the tables primarily to understand emergency response and possible health effects at different concentrations. He believed that companies should determine the distance to the 20-ppm and 1-ppm H₂S isopleths for emergency purposes and suggested that the community should be informed at a level-1 emergency. He stated that he believed Startech's ignition criteria do not suggest immediate ignition and that there would be an actual decision process taking place prior to ignition. Therefore, he argued that Startech should not assume immediate ignition in its risk assessment. In his opinion, immediate ignition implied that the rig crew would not attempt to control any kick or loss of circulation but would clear the lease and ignite the well, possibly creating a greater risk to the community. Therefore, he believed the ERP was flawed. Dr. Lambert agreed that there were actions outlined in the draft ERP to attempt well control at all three levels of emergency.

The interveners stated that with 52 residences and some 200 people in the EAZ, public safety was a major concern. They believed that it was not acceptable to live with the threat of being evacuated from their homes and also expressed concern about the significant length of time it might take for a mobile monitoring unit to arrive in the area if it were called out from Red Deer or Calgary after an emergency had occurred.

The interveners quoted from the dispersion modelling report submitted by Startech that "a peak concentration of 20 ppm could extend 1.1 km, the maximum distance at which mobile monitoring would require immediate evacuation." They stated that most of the WHOA members resided within the 1.1 km distance and would therefore need to be evacuated. WHOA stated that no health survey of the area had been done and therefore Startech was not aware of persons with health problems.

In its submission, WHOA asked that Startech confirm details of its ERP, including evacuation procedures, contractors to be used, and locations of where people and animals would be evacuated.

WHOA expressed concern that sabotage of the well, if it were to be drilled, could take place, creating the risk of a large-scale toxic release, particularly because the chairman of a prominent energy company is the adjacent landowner. The community questioned what security measures Startech would have in place to avoid such instances.

WHOA stated that Startech had indicated to the residents all along that it would have mobile monitoring in the area during drilling and servicing, in addition to stationary monitoring on site, but at the hearing it stated that it would not use a mobile unit until an emergency occurred. The residents' understanding was that an air-monitoring unit would be on site during drilling, not just during flaring, and WHOA expressed concern that a unit may need to come from Red Deer once an incident occurred.

WHOA stated that the community had asked Startech for air-monitoring devices to be placed at the bottom of the valley and possibly other locations so that residents could check the air quality at any time to ensure it was safe. They requested that if such technology exists, it be provided.

The interveners questioned Startech's financial capability to deal with a disaster if it were to occur.

WHOA expressed concern that cell phone reliability in the area is inconsistent and therefore would not be adequate for emergency communications.

WHOA submitted that mistrust of Startech could affect the interveners' willingness to cooperate and abide by the proposed ERP, therefore reducing the effectiveness of the ERP and placing the lives of community members at risk.

6.4.3 Views of the Board

The Board notes that Startech has developed a draft ERP using a calculated 710 m EPZ, which would generally meet EUB requirements for the type of well applied for under normal circumstances. The Board further notes that, using data provided by Startech, the maximum H₂S release rate could be as high as 0.254 m³/s and that the corresponding EPZ would be 904 m. This distance incorporates several residences within or bordering the EPZ.

Although the Board would not normally require a company to develop a site-specific ERP for a noncritical sour gas well where there are no residences within or bordering the EPZ, the Board expects industry to respond to public concern by adjusting the size and configuration of the EPZ and establishing reasonable site-specific emergency response procedures.

The Board also notes that, while Startech has defined a 2+ km EAZ in its ERP, no emergency response procedures for the protection of the public within the EAZ are included in the draft plan other than notification of the public in the event of an emergency. Startech stated that it has committed to treating the EAZ in much the same manner as an EPZ. Given this commitment, the Board believes that Startech should have defined mandatory public protection measures in the event of an emergency, such as mandatory evacuation and isolation of the zone, to protect the public within the 2+ km EAZ.

The Board expects Startech to consult with the community and address reasonable concerns in the development of an ERP prior to submitting one to the EUB for review and approval. As a minimum, it expects Startech to define an EPZ of at least 904 m, including residences that border the EPZ or egress towards the proposed well. The Board expects that if an EPZ includes a person's property with a residence on it, the occupants must be given the opportunity to be included in the ERP if they wish to be. Any residents within the EAZ of the proposed well who want to be included in the EPZ should be incorporated.

The Board expects Startech to address the specific needs of the community in its ERP, including, but not limited to, notification, evacuation, and ignition criteria; description of ignition equipment; roadblock procedures; details regarding school bus schedules and

procedures for rerouting or delivering children to alternative locations; mobile air-monitoring equipment; and dispatch locations.

With respect to Mrs. Knott's concern about her residence being located within more than one EPZ, it is not uncommon for sour wells with overlapping EPZs to be drilled in an area at the same time. The Board requires operators of such wells to coordinate and communicate emergency response procedures to the community.

The Board notes WHOA's objection to the EPZ crossing major roads. It points out that this is a common practice for industrial facilities throughout the world and that many secondary and primary highways in Alberta are within an EPZ. In the event of an emergency, roadblocks would be established on all roads traversing the EPZ, as outlined in the operator's ERP, to control and monitor access and egress.

The Board expects Startech to address how its ERP will be coordinated with municipal and provincial plans for assistance and protection of the public beyond the EPZ. It also expects Startech to ensure that personnel have been adequately trained to respond to an emergency and that emergency response equipment, including communications equipment, has been tested prior to drilling into the sour formations.

The Board notes the interveners' concerns regarding immediate ignition. The Board is confident that immediate ignition of an uncontrolled release is possible if the crew responsible is adequately trained. The Board expects that Startech will test its ignition equipment and procedures prior to drilling into the sour formations. Igniting a sour gas release would convert the H₂S in the gas to SO₂, which would be more widely dispersed due to thermal rise, resulting in reduced public risk.

The interveners believed that Startech had committed to having a mobile monitoring unit on site while drilling in the sour formations. The Board would not accept Startech utilizing a mobile air-monitoring unit from as far away as Red Deer at a level-1 emergency, and it notes Startech's commitment in its conceptual development plan to have a unit on site while drilling the sour zones.

Regarding the interveners' concerns about the possibility of sabotage at the well site, the Board does not believe that there would be any greater risk of sabotage at this location than at any other similar location. The Board is confident that in the unlikely event of an emergency at the well site, regardless of cause, Startech's safety measures and emergency response procedures would be sufficient to protect the public safety.

In Startech's rebuttal submission, there is some uncertainty regarding the difference between the EPZ and the setback. The Board wants to be sure that industry and the public both understand that EPZs and setbacks are very different concepts. The EPZ is based on potential H₂S concentrations during a reasonable worst-case release event, whereas the risk-based setback affects land use and is usually less than the EPZ. Based on the highest potential H₂S rate of 0.254 m³/d, as determined by the Board, the proposed well would be classified as a noncritical level-1 sour gas well, as defined in *ID 97-6*. At level 1, the well would require a minimum

separation distance (setback) of 100 m from any individual dwelling, unrestricted country development, urban centre, or public facility. The Board notes that the proposed well would meet all of the above setback requirements.

7 PUBLIC NOTIFICATION AND CONSULTATION

7.1 Views of the Applicant

Startech submitted that its public consultation efforts have been extensive, including several mail-outs of information packages, letters to area residents addressing concerns, several private meetings, and a town hall meeting. Startech prepared comprehensive residential information packages after interviewing about 50 residents and gathering materials prior to the preparation of its action plan to address resident concerns. In addition, Startech attempted to educate and address concerns of the area residents by funding a general consultant and four technical experts of WHOA's choice. Recognizing that oil and gas development is new to many of the residents, it attempted to explain its plans, the risks involved, and the application process and listen to and consider the concerns of the residents. Startech believed that all concerns expressed by the interveners have been addressed in the sense of its having provided information or having taken the concerns into account and adjusting its approach to the proposed well. Startech indicated that it had done everything it could to effectively work with the residents and believed that its public consultation process greatly exceeded that typically undertaken for similar facilities. Startech also contended that the human element involved in any public consultation process guarantees that no such process can ever be perfect.

Startech believed that the surface location was the focus of considerable discussion and probably the cause of much of the opposition and subsequent consultations over the proposed well. Startech argued that WHOA's claim that there was no consultation in relation to the surface location is completely unsupported by evidence. Startech chose the site after considerable consultations, taking into account several concerns and desires of both the landowners and neighbouring residents. Startech concluded that no other location was shown to be less intrusive to the area or able to accommodate the various factors examined through consultations.

Startech argued that much of WHOA's testimony was based on misinformation and anecdotal evidence, citing examples such as WHOA's attempt to visit other Startech well sites and use this as evidence. Startech stated that it had offered to conduct site visits to similar facilities with the interveners but received no reply to the offer. Startech provided evidence that WHOA's attempted visit to other Startech well sites in the Little Bow Area failed to identify the proper location, erroneously attributed odors coming from another operator's facility to Startech, and erroneously attributed, or at least left the impression, that Startech had caused death or injury to livestock.

Startech contended that WHOA's claim that Startech informed it that there were 60 sour gas wells within a 5-mile radius of the proposed well was a misinterpretation of information. Startech explained that the map provided to WHOA, and entered as an exhibit to the proceedings, contained a legend that clearly showed the status of all the wells within the 5-mile

radius, including that the majority of the wells were abandoned. Startech claimed it simply indicated that there were 60 wells drilled within that area.

Startech argued that seldom have so many well-intentioned efforts by an applicant been so misinterpreted. Startech concluded that, fundamentally, the area residents' concerns ultimately resolved themselves into a fervent desire not to have development in this area. It stated that "At every turn, where some piece of information might be interpreted in more than one way (whether reasonable or not), WHOA has chosen to interpret this information in a negative fashion."

7.2 Views of the Interveners

WHOA contended that Startech conducted an ineffective public information program, rather than a public consultation program. WHOA explained how the community became increasingly uneasy with the proposed well following several incidents of being misinformed or uninformed by Startech.

WHOA submitted that the residents first became aware of Startech's intention to drill a well in January 1998 after surveyors working in the area were questioned about their presence. It argued that no public consultation was attempted by Startech prior to the work carried out by the surveyors and stated that Startech began its public consultations only after WHOA had meetings with the EUB.

WHOA explained that prior to the 22 June 1998 town hall meeting held by Startech, the community believed that the well would be drilled from the 4-5 surface location. At the meeting, Startech informed the community that negotiations for the 4-5 location had been discontinued after a surface lease agreement was reached for the 13-32 site. WHOA argued that Startech essentially ignored a commitment it had made to the community to drill the well at the 4-5 surface location. WHOA indicated that Startech's approach to the site selection and communication of the change to the community was a significant event that resulted in a loss of trust in Startech.

WHOA expressed anger and concern that Startech provided misinformation regarding the type of overall oilfield development that existed in the general area during its public consultations. WHOA testified that Startech indicated that some 60 sour gas wells existed within a 5-mile radius of the proposed well. After reviewing a map supplied by Startech, WHOA concluded that there was only one sour gas well within the area and the other wells were all classified as oil wells. WHOA stated that the misinformation added to the feeling of mistrust toward Startech in the community.

WHOA argued that attempts on several different occasions to obtain additional information to understand technical details and the nature of the risks involved with the well proved to be frustrating, painstaking, and time consuming. WHOA also expressed frustration that it was not provided with information and assistance from the EUB to the extent that it believed was appropriate.

Ms. Nelson expressed her opinion that many of the area residents were unaware of the local oil industry when they moved to the area. She believed that the residents needed to be better educated about the oil industry and believed the residents' fear of the industry was largely due to misunderstandings about it.

WHOA expressed concern over the apparent lack of information supplied in Startech's joint conceptual development plan. WHOA claimed Startech failed to coordinate its plan with Stampede and Berkley and that the plan was confusing.

7.3 Views of the Board

The Board notes that Startech provided information packages containing information about the well characteristics, proposed location(s), and the ERP. It also accepts that Startech submitted a joint development plan to the Board and interveners as an undertaking to the hearing. The Board notes that Startech attempted a comprehensive consultation program, including door-to-door consultations, private meetings, and a town hall meeting with the community. Also, Startech attempted to educate the community by providing funding to the community for the hiring of a general consultant and four industry experts of their choice.

The Board notes the concerns of the interveners who, in most cases, believe that much of the information Startech provided was either incomplete or misleading and that attempts to obtain additional information about the exact nature of the application and the risks involved were frustrating, painstaking, and time consuming. The Board also notes that the interveners believed that they could not believe their own experts' advice.

The Board believes that Startech's attempts to consult with the public, although well intentioned, failed to promote a sense of security or trust in Startech. In the Board's view, much of Startech's efforts to consult and educate the residents through presentations to WHOA was either misinterpreted or interpreted negatively. As a result, most of the interveners did not believe Startech would be a responsible operator, able to ensure that public safety measures could be met.

The Board believes that the public should have sufficient information to participate meaningfully in the decision-making process by voicing their concerns and having them heard, properly addressed and, if possible, resolved. The evidence presented suggests that Startech, in large part, met those expectations. However, it may not have been fully prepared to deal with the magnitude of WHOA's concerns or informational needs. The Board believes that there were occasions when the information presented to WHOA may have been considered untimely and inconsistent, but it also believes that the extent of the informational requests and the human element involved reduced the chances of a public consultation process devoid of criticism.

The Board notes that Startech has undertaken to advise residents of significant events, such as the commencement of drilling operations prior to spud, prior to entering the sour zone, and prior to beginning completion operations. In general, the Board expects Startech to keep the residents

informed on the progress of drilling on a regular basis. In that respect, the Board notes that Startech might utilize WHOA's communication network, among other means, to provide regular updates.

8 OTHER MATTERS

In its written final argument, WHOA listed a number of conditions, restrictions, and stipulations relating to several different issues that it requested be attached to any well licence if the Board were to approve Startech's application.

The Board believes that Startech has agreed to incorporate some of these conditions, particularly those that would enhance public safety. The additional conditions listed but not addressed in this decision report will not be required in this case. In particular, conditions for which WHOA requested that it have final approval are not appropriate, as the Board would be abdicating its responsibility in this area if it acceded to this request.

9 DECISION

Having carefully considered all of the evidence, the Board determines that approval of Application No. 1027549 is in the public interest, as it meets all of the Board's regulatory requirements. The Board is satisfied that Startech has committed to take appropriate measures to ensure that public safety risks and impacts will be minimized. Additionally, the Board determines that the public safety risks and impacts associated with the proposed well are representative of normal industrial risks and impacts accepted by society.

Given the above, the Board is prepared to issue the well licence after Startech has committed to, undertaken, and submitted the following for Board review and approval:

1. Startech will adopt a maximum potential H₂S release rate of 0.254 m³/s and a corresponding EPZ of at least 904 m. Any property owner within the EAZ who wishes to be included in the EPZ will be incorporated into the ERP.
2. Startech will satisfy the Board that it has consulted with the community and developed a significantly enhanced ERP that will address the specific needs of the public. The enhancements will include, but will not be limited to the following:
 - C The ERP will include specific notification, evacuation, sheltering, and ignition criteria, for both within and beyond the EPZ.
 - C The ERP will include a description of ignition equipment.
 - C The ERP will outline roadblock procedures.
 - C The ERP will provide details regarding school bus schedules and procedures for ensuring the safety of the children in the event of an emergency.

- C The ERP will identify sensitive individuals within the EPZ and EAZ. In a level-1 emergency, sensitive individuals will be notified and provided the option of evacuation. The ERP will also include procedures for evacuation of all residents within the EPZ and EAZ who are considered sensitive if the well is ignited to protect them from exposure to any level of SO₂.
- C The ERP will detail procedures for coordination with municipal and provincial plans for assistance and protection of the public beyond the EPZ.

The following conditions will apply once a well licence has been issued:

- C Startech will ensure that all individuals involved in implementing the ERP are familiar with the program and capable of implementing it as required.
 - C Startech will test all key components of its ERP, including communication equipment, evacuation procedures, and ignition procedures, and demonstrate that the systems are in order for immediate implementation prior to drilling into the sour zone.
 - C Startech will notify all individuals in the EPZ and EAZ prior to drilling into the sour zone.
 - C Startech will provide a mobile air-monitoring unit stationed at the well site during drilling in the sour zone.
 - C Startech will ignite an uncontrolled release of sour gas in the event of a level-3 emergency.
3. Startech will take special safety precautions when moving heavy equipment on and off the lease, such as controlling traffic and using a flag person.
 4. Startech will notify EUB field surveillance personnel 24 hours in advance of the pre-spud and pre-sour zone penetration safety meetings.
 5. Startech will report test results on the use of incineration technology for the testing phase of sour gas wells to the Board. The Board will decide if the proposed incinerator can handle the anticipated flow of the well and will meet all relevant standards. If there are significant concerns about the application of incineration technology to this well, flaring would be allowed but limited to seven days. Startech will advise the public of the Board's decision on whether flaring or incineration will be used one week before testing begins. Startech will provide a mobile air-monitoring unit stationed downwind of the well site during testing.
 6. Startech will develop a program to test area residents' water wells and the pond (located directly west of the temporary access road) prior to drilling.

7. If the subject well proves to be successful, Startech will consult with the community and address reasonable concerns in the choice of a permanent access road.

Issued at Calgary, Alberta, on 25 October 1999.

ALBERTA ENERGY AND UTILITIES BOARD

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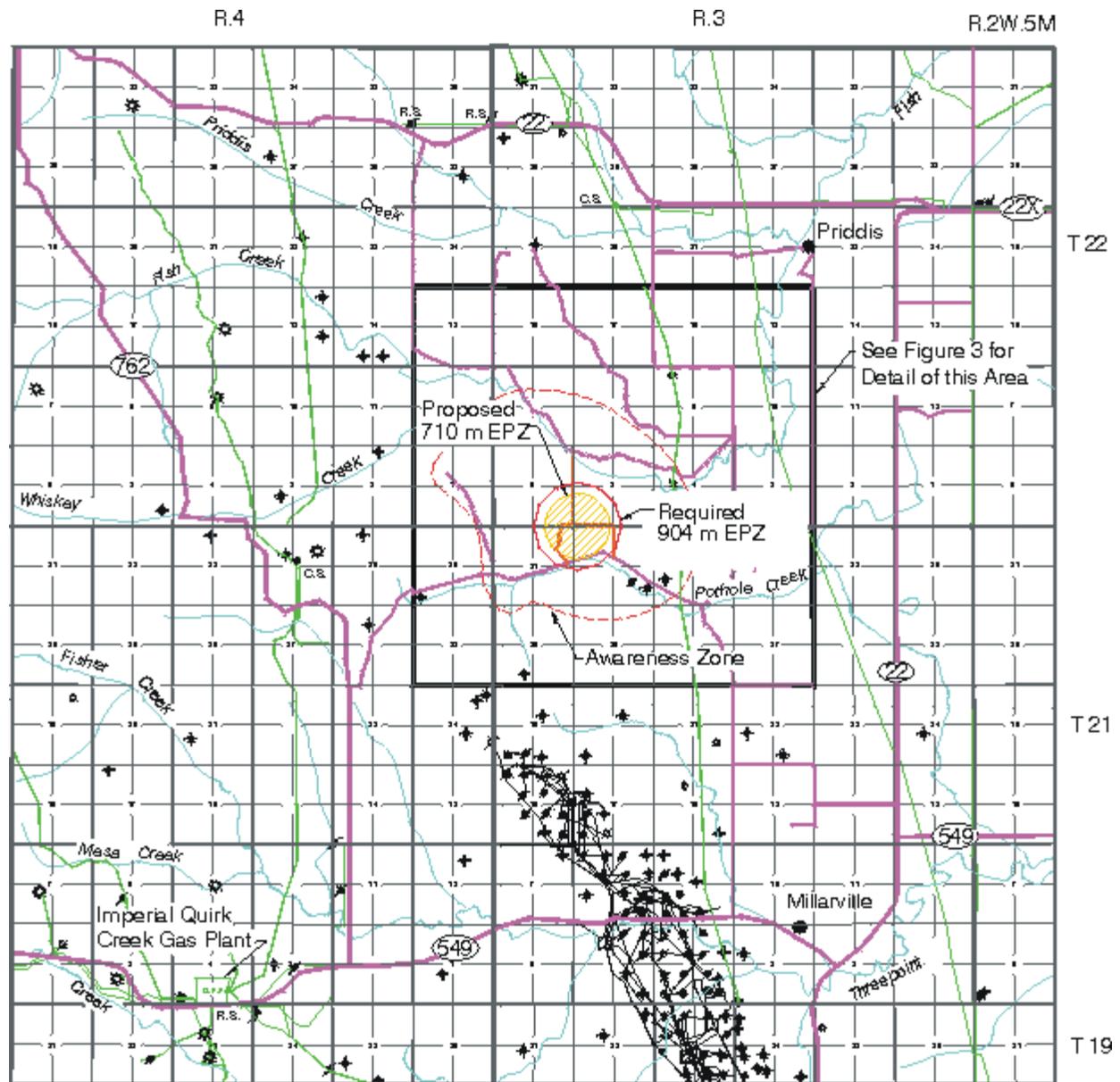
J. D. Dilay, P.Eng.
Presiding Member

[Original signed by]

T. McGee
Board Member

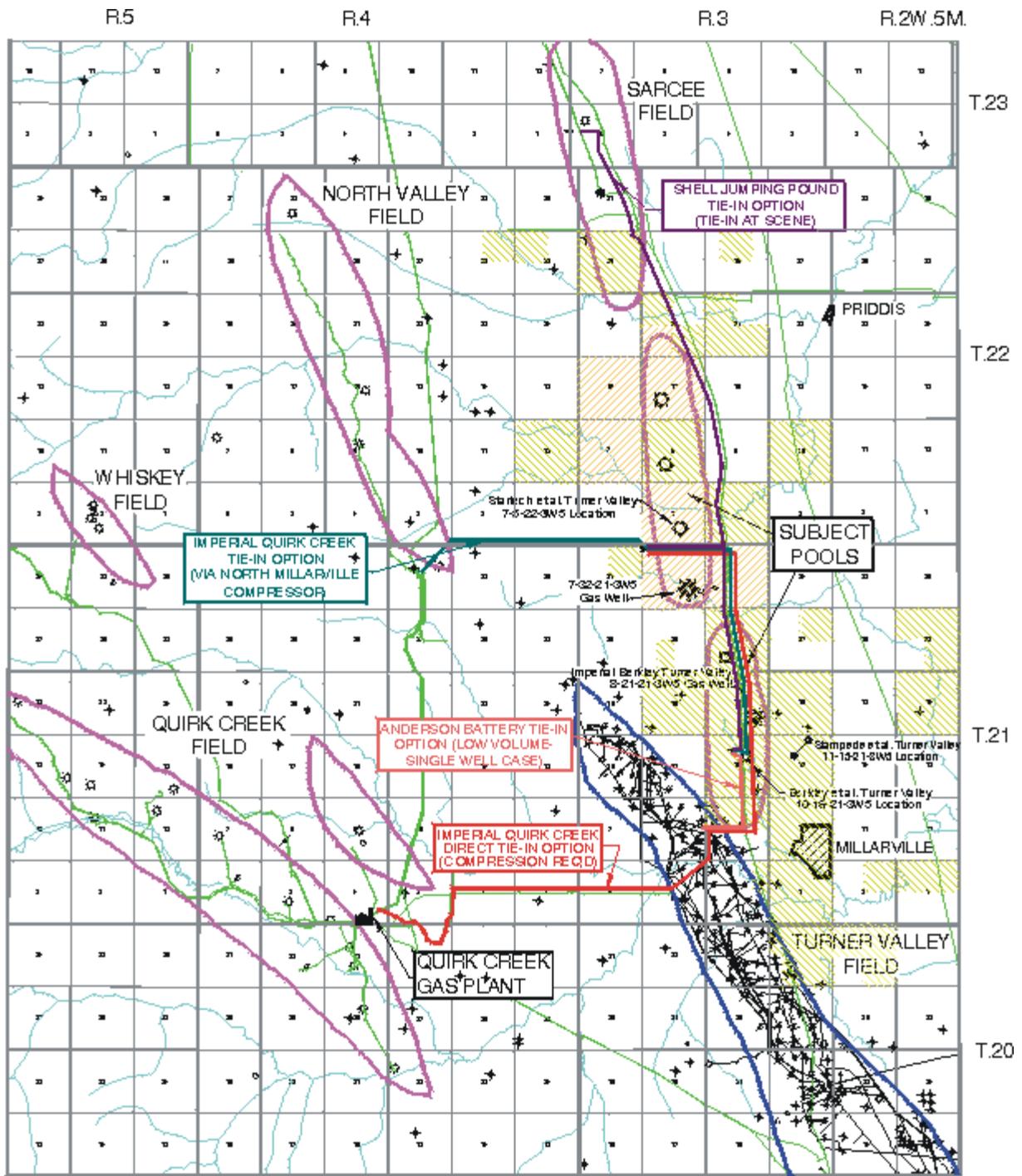
[Original signed by]

D. Waisman
Acting Board Member



- Legend
- | | |
|------------------|----------------|
| Improved Roads | Abandoned Well |
| Unimproved Roads | Standing Well |
| Pipelines | Injection Well |
| Gas Well | Suspended Gas |
| Oil Well | |

Figure 1. Startech Cypress Whiskey Creek 7-5-22-3W5
(Surface Location 13-32-21-3W5)



Legend

- Existing Key Gas Well Locations
- Relevant Startech et al. Lands
- Relevant Berkley/Imperial/Stampede et al. Lands
- Approximate Potential Development Well Locations
- Natural Gas Pools
- Crude Oil Pools
- Existing Pipelines

Figure 2. Startech Conceptual Development Plan

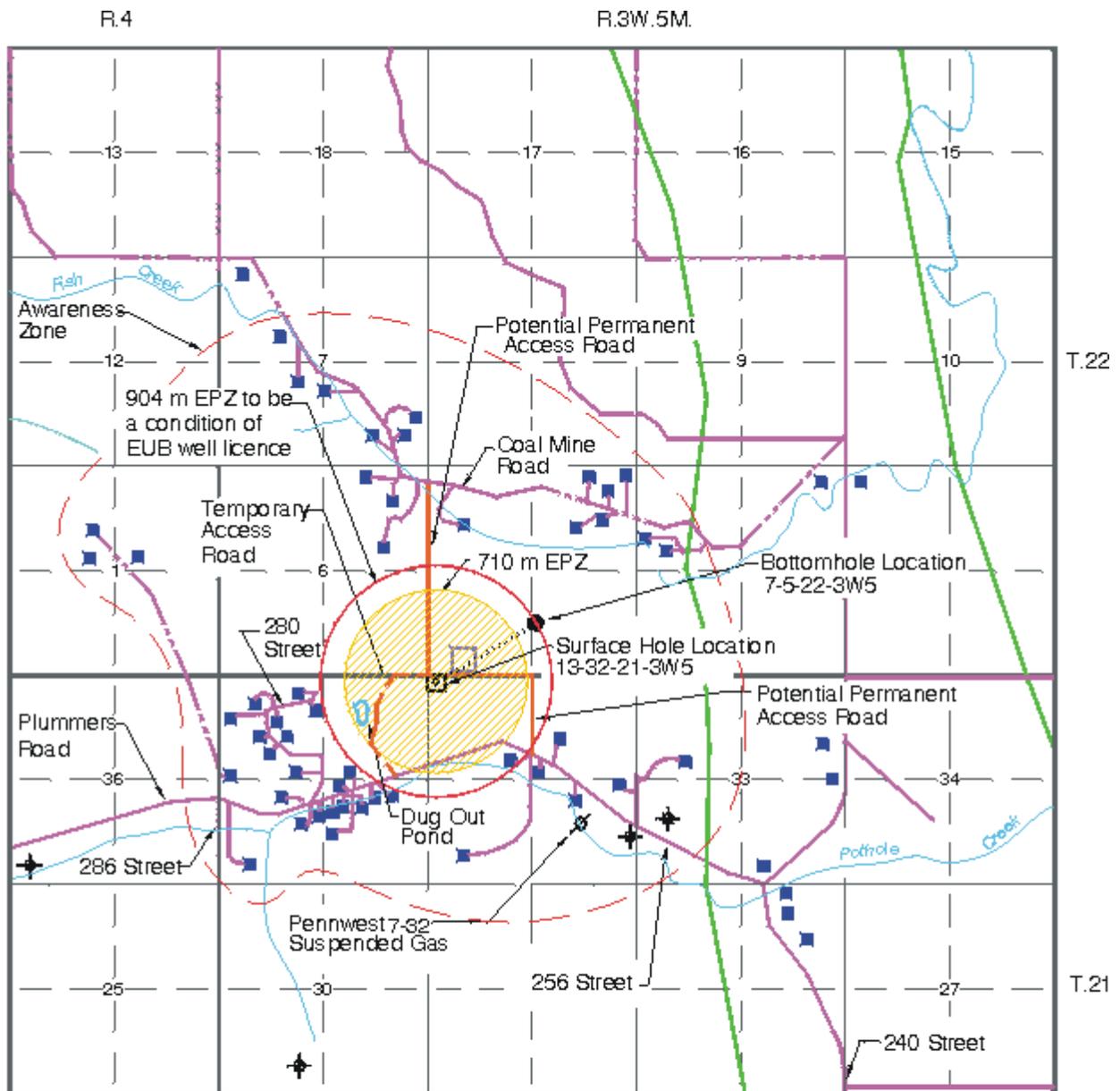


Figure 3. Startech Cypress Whiskey Creek 7-5-22-3W5
(Surface Location 13-32-21-3W5)