ALBERTA ENERGY AND UTILITIES BOARD
Calgary Alberta

SHELL CANADA LIMITED
APPLICATION FOR A WELL LICENCE
SHELL PCP FERRIER 7-7-38-6W5 **Decision 2001-9**
FERRIER FIELD **Application No. 1042932**

1 DECISION

The hearing considered whether the development of the proposed sour gas well would be in the public interest and included an examination of the unique topographic and demographic conditions in the vicinity of the proposed well in conjunction with the potential release rate from the well under reasonable worst-case conditions.

Having carefully considered all of the evidence, the Alberta Energy and Utilities Board (EUB/Board) is of the view that the emergency response plan proposed by Shell Canada Limited (Shell) has not adequately addressed these unique conditions. Since public safety cannot be acceptably assured, the Board does not believe the drilling of the well, as currently proposed, to be in the public interest. Therefore, the Board denies Application No. 1042932 without prejudice to any future application.

2 APPLICATION, HEARING, AND ISSUES

Shell applied to the EUB, pursuant to Section 2.020 of the Oil and Gas Conservation Regulations, for a well licence to drill a level-4 critical sour gas well[1] to be located at Legal Subdivision 7 of Section 7, Township 38, Range 6, West of the 5th Meridian (7-7 well). The well would be drilled for the purpose of evaluating and obtaining gas production from the Ostracod, Ellerslie, and Swan Hills zones.

According to Shell, the maximum hydrogen sulphide (H_2S) concentration in the raw gas would be 35.6 per cent. Shell estimated that the cumulative drilling H_2S release rate would be 17.4 cubic metres per second (m^3/s) by comparing gas compositions from similar wells in the southern and central part of the Caroline Field. It believed that the reservoir would not be underlain by the regional aquifer, indicating that H_2S concentrations would be similar to wells in the south and central part of the Caroline Field.

The Board held a prehearing meeting in Rocky Mountain House, Alberta, on January 31, 2000, to consider the timing and location of the hearing, among other things. The Board issued a

[1] *Interim Directive (ID) 97-6: Sour Well Licensing and Drilling Requirements* sets out some of the relevant regulatory restrictions for such wells. A critical sour gas well is a designation that reflects the proposed well's proximity to an urban centre and its maximum potential hydrogen sulphide (H_2S) release rate during the drilling and completion stages. Any well having a maximum potential H_2S release rate of 2 cubic metres per second (m^3/s) or greater is defined as a critical sour gas well regardless of its proximity to an urban centre, as is the case of the subject proposed well.

Memorandum of Decision based on the prehearing meeting on March 8, 2000 (copy attached). In that memorandum, the Board specified that the hearing would commence on June 5, 2000. Subsequently, the Board received and approved a request for adjournment from Shell and the Clearwater Coalition (the Coalition) so that they could participate in a mediation process.

The Board subsequently considered the application and interventions at a hearing at the Dovercourt Community Hall near Rocky Mountain House, Alberta, commencing on November 7, 2000, before Board Members B. F. Bietz, P.Biol. (Presiding Member), J. D. Dilay, P.Eng., and T. M. McGee.

The proposed location of the well, the proposed reduced emergency planning zone (EPZ), and the corresponding emergency awareness zone (EAZ) are shown in Figure 1. The reduced EPZ is shown in Figure 2. 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
Shell Canada Limited (Shell)	
S. H. T. Denstedt	I. Kilgour, P.Eng.
B. Gilmour	G. Gerlach, P.Eng.
	K. Johnson, P.Eng.
	G. C. Granville, P.Eng.
	W. van de Pypekamp, P.Geol.
	K. Anderson, P.Eng.
	J. H. Brown
	D. B. Davies, Ph.D., of Cantox Environmental Inc.
	K. E. Preston, Ph.D., of Jacques Whitford Environment Limited
	D. M. Leahey, Ph.D., of Jacques Whitford Environment Limited
	E. D. Burgess, M.D., of the University of Alberta Hospital
	B. Milne, Ph.D., of ATECH Application Technology Limited
The Clearwater Coalition (the Coalition)	
R. C. Secord	L. Berry
	B. Bertagnolli
	M. Bertagnolli
	B. Bosworth
	E. Bosworth
	L. Courtright

THOSE WHO APPEARED AT THE HEARING (continued)

Principals and Representatives (Abbreviations Used in Report)	Witnesses
	M. Day B. Foster B. Hopkins C. Manuel F. Manuel A. McAllister J. Morton M. Scott C. Shipley E. Tait C. Titford M. Zalasky R. Zalasky E. Nyland, Ph.D., of ENY Consultants Inc. W. A. Springer, P. Eng., of RWDI West Inc. I. P. Dowsett, R.E.T., of RWDI West Inc. C. W. Erwin, of ERII International Inc. D. G. Howery, of Applications Management Consulting Ltd.
S. Dahlgren[2]	S. Dahlgren
Tougas, Hardill, and Brown (the Clearwater Community)	
G. S. Fitch	M. C. Tougas B. Tougas K. Hardill B. Brown M. C. Moncur, P.Eng.
David Thompson Health Region (DTHR)	
R. Zimmer, M.D.	R. Zimmer, M.D.
T. Lambert, Ph.D.	T. Lambert, Ph.D.

THOSE WHO APPEARED AT THE HEARING (continued)

Principals and Representatives (Abbreviations Used in Report)	Witnesses
J. van Tol	J. van Tol
E. Diedrich, V. Vavrek, and J. Vavrek	E. Diedrich V. Vavrek J. Vavrek
Alberta Energy and Utilities Board staff W. Kennedy, Board Counsel P. R. Forbes, C.E.T. K. Eastlick, P.Eng. S. Etifier N. Cherry, M.D. H. Nychkalo L. Wilson-Temple B. Austin, P.Geol. R. Kennedy J. I. Fujikawa	

[2] Mr. Dahlgren was a member of the Clearwater Coalition but also spoke on his own behalf.

On the basis of the evidence adduced at the public hearing, the Board considers the issues respecting the application to be

- need for the well,
- location of the well,
- risk and hazard assessment,
- emergency preparedness,
- land-use impacts,
- public consultation, and
- other matters.

3 NEED FOR THE WELL

3.1 Views of the Applicant

Shell indicated that it and its partners needed to drill the proposed well in order to earn an economic interest in any potential oil and gas from the mineral owner, PanCanadian Petroleum Ltd. Shell stated that the proposed well would be drilled to test several geological features revealed by seismic data to establish whether there were economically recoverable hydrocarbons at this location as well as in adjacent lands with Crown-held mineral rights. The exploratory well would enable Shell to evaluate and obtain sour gas production from the Swan Hills Formation,

as well as to establish the gas producing potential of the Ostracod and Ellerslie zones. Shell noted that while it did not currently have any specific plans for the development and processing of any gas that it may discover with the proposed well, long-term planning needs made it prudent to continue to develop regional gas reserves.

3.2 Views of the Interveners

The interveners acknowledged that the general economic benefits of oil and gas development were an element of the public interest that needed to be considered in deciding whether a project should proceed. With regard to the benefits to Albertans from energy developments, the interveners noted that it appeared that the current level of income generated from oil and gas royalties in the province would soon eliminate the provincial debt and could even eliminate the need for provincial income tax. They did not believe, however, that the loss of royalties from any single well in general, and from this well in particular, would have a significant effect on the overall public benefits from oil and gas development.

The interveners also did not believe that the loss of any potential profits from this one well would be likely to have a significant effect on Shell's financial status or that any economic benefits to Shell would be sufficiently large so as to offset the risk to the safety, health, and livelihood of area landowners. As a result, the interveners concluded that there was no need for the well.

3.3 Views of the Board

The Board accepts that to fully determine the extent of potential production from a previously unexplored formation in a region, the drilling of a well and the testing of any associated production are necessary to confirm the full economic potential of the suspected reservoir. While such exploratory wells have an inherently lower chance of being successful, they have been and continue to be needed in order to identify the new reserves needed to replace existing gas reserves as they are produced. The Board also accepts that Shell has entered into the necessary agreements with the mineral owners such that, should the well be successful, Shell would be able to produce the gas and generate the associated revenue to the company and royalties to the mineral owners.

The Board accepts the position of the interveners that the success or failure of this particular development is not likely critical to either the economics of the province or of Shell. However, while the economic impact of any one well may be quite small on a provincial basis or to a company as large as Shell, the Board has in the past concluded that the aggregate public economic benefits from energy development at the provincial level can outweigh negative effects at the local level, provided they are properly managed and mitigated.

To reach such a conclusion for any individual well, the Board must ultimately be convinced that it can be developed in a manner that does not have unacceptable impacts on local residents. The Board notes that the circumstances surrounding any individual well will differ and unique features of a particular region may result in adverse effects that would be considered to be

acceptable in other cases. In determining whether an approval is in the public interest, the Board is required, therefore, to balance the issues associated with this particular well in its determination of this application.

4 LOCATION OF THE WELL

4.1 Views of the Applicant

Shell stated that it had examined existing two-dimensional seismic data and later acquired three-dimensional seismic data over the area in its effort to find new sources of gas. This work, along with Shell's geological model, led to further seismic modelling, which showed the proposed 7-7 well location as ideal to provide important information on the Swan Hills anomaly. Shell believed that the 7-7 well location appeared to be structurally "updip" and so more likely to provide good information on the presence of gas at this location and whether the gas was in large enough quantities to develop it economically.

Shell indicated that it proposed to drill a vertical well from the 7-7 surface location approximately 500 m north of the Clearwater River and 900 m east of Highway 22. Shell stated that its selection criteria were based on a combination of technical, economic, safety, and environmental considerations. It indicated that the proposed surface location was also best for penetrating and testing the up-hole Ellerslie and Ostracod zones, because it allowed the drilling of a vertical well.

Shell noted that although it had conducted preliminary investigations into directionally drilling the well from alternative surface locations, there did not appear to be another location that would better satisfy public concerns, particularly regarding health and safety impacts. Since the proposed surface location would allow Shell to test all three downhole zones, provide optimum drilling conditions, and minimize drilling time (which would help to offset some public concerns), Shell stated that it had concluded that there were no significant benefits associated with directional drilling from another surface location.

4.2 Views of the Interveners

The interveners indicated that Shell had not, in their view, appropriately investigated alternative locations for the well before beginning its initial application process. They noted that when Shell first approached the general community, it had already completed negotiations for the proposed well site with the landowner. However, some of the interveners also questioned whether there would be any acceptable location for this type of well in the area, and many believed that there were no acceptable alternative surface locations. None of the interveners proposed an alternative location.

4.3 Views of the Board

The Board notes Shell's belief that the proposed surface location is the optimum location for it to test all three potentially productive geological zones. The Board also notes that although Shell indicated that it looked at alternative surface locations, Shell provided limited detail on those

sites. Shell also did not provide any discussion on alternative locations with respect to the geological features revealed by its seismic data. However, the Board also notes that the interveners did not suggest surface alternatives that may be more suitable and a number indicated that simply relocating the well would not adequately address their concerns.

Since neither Shell nor any other party proposed alternative locations, the Board has limited its consideration to the proposed surface location in its assessment of the acceptability of this well.

5 RISK AND HAZARD ASSESSMENT

5.1 Views of the Applicant

Shell stated that it modelled the potential dispersion patterns of both an unignited and ignited uncontrolled flow of sour gas from the well. In the former case, the compound of primary concern was H_2S, while in the latter it was sulphur dioxide (SO_2). Shell noted that it had used all available relevant meteorological information in its evaluations, including data from its monitoring at the Caroline Field.

Shell stated that in assessing the potential risks associated with the unignited flow, it had assumed that the resulting plume would be neutrally buoyant (i.e., neither heavier nor lighter than air) and therefore had used the computer model GASCON2 for its dispersion calculations. Shell noted that it had also assumed that all of the well discharge would be present in the plume, even though it predicted that a hydrocarbon liquid phase would result during expansion of the gas from formation pressure to atmospheric pressure. Shell predicted that the liquids would be evaporated by the time gravity began to affect plume behaviour as a result of massive air entrainment during the jet discharge phase of the release. On that basis, Shell stated that its selection of GASCON2 for a neutrally buoyant plume was appropriate.

Shell indicated that the use of SLAB, a dense gas dispersion model for a heavier-than-air gas mixture, was not appropriate for this case. Shell argued that SLAB was not designed for sour well blowout calculations and, with respect to air entrainment, it underestimated the effects of high-velocity jet discharge releases. As a result, the SLAB model would result in an overly conservative assessment. Shell noted that SLAB used Pasquill-Gifford plume spread parameters, which are more conservative than the plume dispersion coefficients it had used, and that its plume dispersion coefficients were based on observed turbulence values from the Shell Caroline Gas Plant. Shell believed that the Pasquill-Gifford parameters would result in a 200 to 300 per cent overestimation of H_2S concentrations. Shell stated that as a consequence of underestimating the air entrainment and dispersion coefficients, an evaluation of an unignited release from the well using SLAB would result in an extreme exaggeration of downwind H_2S concentrations.

Shell stated that it had estimated the probability of an uncontrolled, unignited sour gas release occurring during drilling as 2.94×10^{-6} (approximately three chances in one million) per well. This probability was the product of the average blowout rate (4.83×10^{-4} per well), a critical well factor (0.25) that took into account the additional safety features required to be incorporated into a critical sour gas well, a well depth factor (2.31), and a nonignition factor (0.0105). Shell noted

that it had assumed immediate ignition in its initial risk assessment, as it believed that the initial gas release would not be at the maximum discharge rate during the early stages of loss of well control and that it would take some time for maximum rates to occur.

With regard to the impacts of an ignited uncontrolled release, Shell stated that it used both the ISC3 (Industrial Source Complex) and the RTDM (Rough Terrain Dispersion) models developed by the United States Environmental Protection Agency to assess the resulting SO_2 concentrations. It stated that both models conservatively overpredict ground-level SO_2 concentrations for irregular terrain.

For its hazard assessment, Shell noted that it had evaluated the hazard associated with both the predicted H_2S and SO_2 concentrations that may be associated with an uncontrolled sour gas release. Furthermore, it had modelled releases that could potentially result during the drilling, servicing, or operational phases of the well.

Shell stated that its worst-case predictions for potential downwind H_2S concentrations during an accidental release were associated with an unignited, uncontrolled release during drilling with no tubing or drill pipe in the well. Shell stated that, assuming a gas release rate of 49.3 m^3/s at 35.6 per cent H_2S, this worst-case scenario resulted in a predicted three-minute average H_2S concentration of 100 parts per million (ppm) to a maximum distance of 3.3 km for a vertical jet release and in a 1 per cent probability of lethality at 1.9 km for a horizontal downwind jet release. It noted that both of these distances were within the proposed reduced 4 km EPZ (see Section 6).

Using the GASCON2 model, Shell estimated time-averaged H_2S concentrations and predicted the toxic load (i.e., the integration of concentration and exposure time). Shell also determined the population susceptibility to predicted H_2S concentrations using the triple-shifted Rijnmond probit parameters as an estimate of lethality for a sensitive individual. Shell noted that the 1994 report of the Advisory Committee to the ERCB Reviewing Public Safety and Sour Gas stated that these parameters were believed to be sufficiently conservative and that they also accounted for serious, irreversible health effects, but to an unknown degree.

Shell noted that since it was also possible that some gas could be released at less than the maximum rate before an ignition attempt was made, it had assessed the potential duration of an ignition delay, based on the results of its drilling rig exercises. Shell indicated that the most probable delay would be two minutes or less; however, it noted that there was a small possibility that the delay could be up to six minutes. On the basis of a six-minute ignition delay, Shell estimated fatality risks at the nearest residence, about 500 m west-northwest of the well, to be 3.4 and 1.3 chances in one million for 100 per cent and 25 per cent of the maximum drilling discharge rate respectively. It noted that the Major Industrial Accidents Council of Canada (MIACC) viewed such risks as acceptable for low-density residential land use. Shell believed that it had conservatively determined the public safety risks associated with its proposed well and that they were within MIACC guidelines. It said that any risks would be further reduced by the implementation of an early evacuation policy, the proposed ignition procedures, and the presence of redundant well control equipment. Shell stated that the evidence demonstrated that the public safety risks associated with the proposed well were acceptable and the well should be approved.

With regard to SO_2 concentrations, the predicted maximum 15-minute, 3-hour, and 24-hour average ground-level SO_2 concentrations were 1.63, 0.98, and 0.21 ppm respectively based on an ignited, uncontrolled release during drilling. Shell noted that these predicted values did not exceed the 15-minute, 3-hour, and 24-hour suggested evacuation guidelines of 5, 3, and 0.3 ppm respectively.

In assessing the hazards associated with routine flaring, Shell noted that it had made a number of recent improvements in its ability to minimize the flaring associated with well cleanup and testing, so that flaring would be in the order of 48 hours.

With regard to the risk of earthquakes affecting the proposed well, Shell did not comment on the evidence provided by interveners regarding the likelihood of an earthquake. However, Shell presented evidence indicating that its engineering practices could withstand an earthquake of the magnitude predicted by the Coalition's expert. Further, Shell noted that the Coalition's expert did not dispute this evidence.

5.2 Views of the Interveners

The Coalition indicated that in their view a number of dispersion models, including GASCON2 and SLAB, could have a valid role in decision making. The key issue was the selection of the appropriate tool for the gas being dispersed. In this case, the interveners did not agree with Shell's use of GASCON2 to evaluate a worst-case release from the well. They believed that GASCON2 could not handle effects such as gravity slumping, reduced air entrainment associated with a denser-than-air plume, and the thermodynamics of evaporating liquids. They stated that they believed that the SLAB model was the more appropriate model in this case because it could handle the effects of a dense gas.

The Coalition estimated that between 15 and 25 per cent of the mass released from the well would be in the form of hydrocarbon liquids, depending on whether there were obstructions in the path of the release. They further said that evaporating liquids would remove energy from the plume and would tend to reduce plume temperature, with the potential for the plume to have larger hazardous extents. They believed that dense gas effects could be important between 40 m to as far as 600 m from the well under cold, low-wind winter evening or morning conditions.

The Coalition believed that a reasonable worst-case release scenario should be used in order to calculate publicly acceptable hazard zones. They submitted that probability information should not be applied for making decisions on hazard zones. They stated that a reasonable worst case would be the maximum well release rate over a 30-minute period, with little regard for mitigative measures, since they may or may not be successful.

The Coalition noted that the current approaches for defining an EPZ included the estimated distance to the 100 ppm, 30-minute average H_2S concentration and the distance where the probability of fatality falls below 1 per cent. They believed that Shell's probability-of-fatality criteria would be appropriate only in areas with no permanent dwellings. On this basis, the Coalition believed that the hazard zone (i.e., the reduced EPZ) of 4 km proposed by Shell was inappropriate. The Coalition stated that they had calculated the distance to a 100 ppm H_2S concentration as 7.6 km for a 30-minute release.

The David Thompson Health Region (DTHR) noted that Shell had not provided an evaluation of a gas release based on dense gas dispersion modelling. It said that Shell's risk assessment was also based on an unrealistic assumption of immediate ignition of a well release and that the criteria proposed by Shell for ignition of the well (see Section 6) would be very difficult to interpret and would introduce a significant amount of time in making a decision to ignite. It said that, as a consequence, Shell had underestimated risks associated with the well. It noted that ERCB Report 90B, Volume 1, *Risk Approach, An Approach for Estimating Risk to Public Safety from Uncontrolled Sour Gas Releases, October 1990*, suggested a time to ignition of 60 minutes and that the 1994 Advisory Committee had suggested 30 minutes. The DTHR recommended that the ignition criteria for the well should be based on igniting a release within one minute of gas to surface. It also recommended that Shell have its revised risk assessments peer reviewed.

The DTHR noted that while Shell had assessed the potential health risks associated with an H_2S release, it had not done a health risk assessment for the effect of SO_2 emissions from an ignited uncontrolled well release. It recommended that such a risk assessment be completed and that it include solutions to manage identified risks prior to drilling the well. The DTHR also recommended that further work was required to ensure that the potential effects of an H_2S release on sensitive members of the population were better understood. It stated that nonlethal effects from the proposed well test flaring on sensitive, average, and resistant area individuals should be assessed following World Health Organization guidelines.

Many of the interveners expressed concerns over what they perceived as an apparent lack of a clear and consistent approach to risk analysis. They noted that errors in and subsequent significant revisions to Shell's initial risk assessment, coupled with disagreement on methodologies among experts, confused and undermined the confidence of the public in the safety of the well. They also believed that modelling should be field-checked and that defined criteria for well release ignition times should be established.

The Coalition noted that, as there had been cases in which operators had had difficulties igniting wells, it believed that the ignition delays incorporated into the risk assessment should be longer than those proposed by Shell. It stated that an assumption of a 30-minute release time, as opposed to the 6-minute time proposed by Shell, would be a reasonable and consistent basis for conducting screening-level risk assessments. They were concerned with the validity of Shell's risk assessment, as immediate ignition criteria were not written into Shell's emergency response plan (ERP).

Other interveners noted that Shell had stated that it was unable to identify any examples where the immediate ignition of a sour gas well had been achieved. They believed that Shell's assessment was not sufficiently conservative in the absence of evidence that a well could be immediately ignited.

The Coalition stated that if the Board had not been provided sufficient information to assess the acceptability of the risk imposed by the well, the Board could not approve the well. The interveners noted that they had not provided an alternative risk assessment in their submission but rather only a critique of Shell's assessment. They said that they had done this so that the Board could not simply choose a value between the applicant's and theirs. They noted that the potential for dense gas plume behaviour and the related larger hazard area relative to Shell's

assessments created significant uncertainty in Shell's assessment. Their view was that Shell's risk assessment results were not conservative and did not appropriately reflect the hazards and risks related to the proposed well. As a result, the Coalition maintained that the Board could not satisfactorily determine the public risks related to the well based solely on Shell's evidence.

Many of the interveners stated that they also did not accept that Shell would require only 48 hours of flaring to test the well. In their experience, upset conditions routinely occurred and flaring could proceed on and off for more than two or three weeks. They believed that Shell should eliminate flaring by some other means in order to further reduce or eliminate hazards related to the well.

An expert for the Coalition indicated that earthquakes had been historically recorded in the Rocky Mountain House area. He believed that should a worst-case earthquake occur, significant questions remained regarding the ultimate effects of this on the risk of an uncontrolled release, but he did not elaborate on what these questions were.

5.3 Views of the Board

In assessing the evidence on public safety hazards and risks, the Board believes that it must consider three key aspects in reaching its conclusions.

First, in order for the hazards and risks for a proposed development to be estimated, appropriate tools, in this case computer programs for modelling plume dispersion, need to be selected. These tools need to be applied with plausible, yet appropriately conservative or protective, assumptions with respect to methodology and input data.

Second, it is necessary to be able to understand and assess the implications of the public safety hazards resulting from a failure or series of failures that could potentially occur. The assessment of hazards relies on understanding the consequences of a failure but does not incorporate the probability that the failure would occur.

Finally, acceptable risk assessment requires the appropriate combination of the hazards associated with a development and the probability that the events or series of events will occur. While the potential for events that result in identified hazards may not be eliminated, it is possible to reduce the probability of such events through mitigation. The Board has used these three key aspects to organize its evaluation of the public safety hazard and risk evidence.

Modelling

The Board notes that air dispersion computer models differ in terms of their capability to account for the range of possible release scenarios, including the presence of dense gases, the thermodynamics of liquid aerosols, jet air entrainment, and the effects of elevated surrounding terrain. It recognizes that available dispersion models may be more or less conservative in the extent to which they may overpredict ambient air concentrations for H_2S, SO_2, and other contaminants of concern.

The Board believes that it would not be reasonable to predetermine the "right" model to be used in all regulatory applications. Rather, it is first necessary to understand potential release conditions and possible plume characteristics associated with a particular case and then select the most appropriate model or models to evaluate the situation. The Board does believe that input assumptions and calculation tools should be appropriately, but not unreasonably, conservative and that the assumptions and model determinations should be based on plausible worst-case release scenarios and potential plume dispersion conditions. The Board believes that where ambiguity exists on the appropriateness of any one computational tool, such as the case for the 7-7 well, the more effective approach would be to evaluate the release using the various alternative methods in question. In this particular case, the Board would have found it useful to have a comparison of the results of such a modelling exercise, including a discussion of the implications of the input assumptions and of the relative extent to which each of the alternatives may over- or underpredict possible actual concentrations.

The evidence of both Shell and the interveners indicated that a significant fraction of the well effluent at the source would likely exist as hydrocarbon liquid. The Board agrees with the applicant's claim that it is possible that high energy levels at the wellhead may result in the plume acting in a neutrally buoyant fashion. The Board's view, however, is that the potential for the formation of hydrocarbon liquid aerosols in the plume also warrants assessment of dense gas plume behaviour and evaluation of related hazards and risks, in addition to assessing the effects of a neutrally buoyant plume. The Board believes that the implications of both dense gas and neutrally buoyant plume calculations could have been used to describe a range of potential outcomes of an unignited sour gas release. As a minimum, in situations where source conditions suggest that there may be a reasonable potential for the formation of a dense gas plume and where the proponent prefers to use only one modelling methodology, the Board expects that the more conservative of available approaches (i.e., more protective of public safety) will be used in determining the potential gas behaviour.

Notwithstanding the above, the Board does agree with all of the participants that additional clarification of acceptable protocols for air dispersion modelling, as well as hazard and risk assessment for sour gas releases, would be beneficial for both applicants and interveners alike. The Board also agrees that a forum other than a project-specific public hearing would be more conducive to productive debate among experts. The objectives of such a forum should include arriving at a set of protocols and computational tools that could be consistently used in sour gas development planning and in preparing regulatory applications. The Board intends to pursue this issue further, possibly as part of the ongoing Public Safety and Sour Gas Review.

Hazard

The Board believes that the appropriate determination of hazard involves evaluation of the consequences of a potential and plausible event. Shell's hazard assessment indicated the maximum distance to the three-minute average 100 ppm isopleth as 3.3 km and the maximum distance to a 1 per cent probability of lethality of 1.9 km. Evidence supplied by the Coalition for a 30-minute release indicated a maximum distance of 7.6 km to the 100 ppm H_2S isopleth and 5.5 km to a 1 per cent probability of lethality. While the Board notes the discrepancy in the

hazard areas estimated by Shell and the interveners, both evaluations indicate that a significant hazard potential would exist for an area occupied by permanent residences and where the public is often outdoors, pursuing farming and various recreational activities.

Given the significance of the predicted hazard, the Board must be satisfied that Shell's proposed emergency response measures are feasible and sufficient to address the protection of the public, whether they are in their homes, working their farmland, or pursuing outdoor recreation. This issue is addressed in Section 6.

Risk

The Board has not adopted specific criteria or guidelines that set out what levels of risk imposed by petroleum industry activities should be considered acceptable. The Board believes that the MIACC guidelines are a useful reference to proposed land uses that might be appropriate for a given level of existing risk. It is the Board's view, however, that in this case it must also consider whether the proposed activity is acceptable relative to surrounding public land uses already in place.

The Board believes that sour gas wells can be drilled and operated with very small failure probabilities. The Board also accepts that in calculating the probability of failure, it is appropriate to use historical well blowout frequencies with probability adjustments for

- a critical well factor that accounts for additional planning and equipment required for critical sour wells,
- a depth correction factor that increases the probability of loss of well control with increased well depth,
- the potential release configuration, and
- the probability of nonignition.

The Board notes that Shell has attempted to quantify the above factors in its estimation of risk and believes that Shell's assumptions were reasonable. The Board further notes that there are other factors that may also mitigate the hazards associated with a sour gas well release, although they are perhaps slightly overstated, since these considerations are to some extent already accounted for in the critical well correction factor. While these factors have not been quantified by Shell's assessment protocol, the Board believes that they will further reduce the risks associated with the drilling of sour gas wells. For example, the Board agrees with Shell that it is probable that any well control problems that could ultimately lead to a release during drilling would normally be quite apparent for some time, usually a matter of several hours, before any release occurs. This would allow for a heightened state of readiness, including precautionary evacuations (see Section 6) and preparation for short-notice ignition of a release. The Board is satisfied that a release scenario that assumes immediate full open flow would also be very conservative.

The Board believes that reasonable risk estimates should include both the sum of risks associated with a shorter duration release of unburned gas prior to the first ignition attempt and risks associated with a longer duration release with the nonignition factor applied. The Board notes in particular Shell's evidence that the estimated risk at the nearest residences is substantially affected by the assumptions made regarding the time required to make an initial

ignition attempt. This evidence suggests that estimated risks appear to be more sensitive to ignition delays in the order of only a few minutes over the range of 25 to 100 per cent of full well release flow rates than they are to well discharge rates.

The Board would generally view risk assessments based on initial ignition attempt delays of 30 minutes or more as being very conservative (i.e., highly protective). In this case, the Board believes that Shell's assessment of time to ignition to be between 2 to 6 minutes may be reasonable. The Board also accepts Shell's view that it is highly unlikely that the well would flow at its maximum release rate prior to ignition.

Although there remains some question as to which of the various scenarios best describes the relative risk to public safety associated with an unignited, uncontrolled flow from the 7-7 well, the Board believes that all of the predictions suggest that the public could be placed at significant risk in the absence of an effective ERP. This issue is addressed further in Section 6.

The Board accepts Shell's assessment that the risks associated with an uncontrolled well release would not represent unacceptable public safety risks once ignition has been achieved. However, the Board notes from Shell's evidence that the predicted highest ground-level SO_2 concentrations resulting from an ignited, uncontrolled well release occur outside the proposed 8 km EAZ southwest of the well. While the maximum SO_2 levels are predicted to be less than evacuation guidelines, the values are significantly greater than Alberta Ambient Air Quality Guidelines. Consequently, the Board believes that emergency response planning should include provision for areas that could be impacted by peak SO_2 concentrations, even if such levels occur only for a short duration.

The Board notes that Shell has proposed only a limited test period for the well if successful and does not believe that Shell's flaring proposal for the 7-7 well represents any significant risk to public safety.

The Board recognizes that there have been documented cases of earthquakes in the Rocky Mountain House area. However, the Board notes that Shell provided evidence that its engineering practices could withstand even the most severe earthquake that could be reasonably predicted. Additionally, the Board notes that the interveners did not provide evidence to the contrary. Therefore, having regard for the evidence presented, the Board is satisfied that the risk posed by earthquakes in the area is extremely small and does not preclude the safe drilling of sour gas wells if proper precautions are taken.

6 EMERGENCY PREPAREDNESS

6.1 Views of the Applicant

Emergency Response Plan

Shell stated that it had designed a comprehensive draft ERP to protect the public in the unlikely event of an emergency. On the basis of its estimated drilling H_2S release rate at 17.4 m^3/s, Shell calculated an EPZ of 19.2 km. Shell proposed a reduced 4 km EPZ and a corresponding 8 km

EAZ. Shell stated that although it had not applied for final approval of its reduced EPZ, it was committed to doing so, with supporting documentation, once it had finalized its ERP.

Shell indicated that the reduced 4 km EPZ would allow for effective planning and management of public safety in the event of a well control problem. Shell argued that its 4 km EPZ was also supported by its plume dispersion modelling, which indicated that the 100 ppm isopleth was within the 4 km. In support of the reduced EPZ, Shell noted that the 19.2 km calculated EPZ contained numerous secondary highways, urban centres, and public facilities. The relatively dense population and extensive road systems outside of the 4 km EPZ made the area complex to manage and difficult to isolate for an effective evacuation prior to well ignition.

Shell stated that it had made extensive efforts to address the special needs of specific members of the community in its ERP by way of early notification and evacuation prior to any release of H_2S. Shell stated that although it had communicated information about the ERP to the public, it would endeavour to explain the plan to the public in greater detail prior to drilling. It stressed that the ERP was in draft form so that, should this application be successful, it could be updated, revised, and improved prior to the actual drilling of the well.

Shell stated that it had used the existing Shell Caroline Gas Plant ERP as a model for the 7-7 well ERP. Shell believed that this had helped in the development of a much more comprehensive site-specific plan for the 7-7 well. Additionally, Shell noted that the Caroline Gas Plant control room, which was integrated into the 7-7 well ERP, was staffed 24 hours a day, seven days per week, and that Shell Caroline personnel conducted frequent safety meetings and emergency procedures training. This included mock field exercises and drills. Shell stated that it was confident that it could protect the public within the proposed 4 km EPZ and that its risk assessment had confirmed this. Shell stated that it was committed, through the use of effective ignition and evacuation criteria, to ensuring protection of the public by minimizing the potential for people to be exposed to hazardous levels of H_2S or SO_2.

Shell stated that its personnel would provide the lead role in managing the response for public safety within the 4 km EPZ. Within the EAZ beyond the 4 km EPZ, Shell indicated that, as part of the Clearwater County (the County) disaster services protocol, it would transfer the lead role for public safety to the County's Disaster Services and provide support to that response organization. Shell stated that it had full confidence in the County's ability to respond to the EAZ, as demonstrated by the County's participation in many of the Caroline Gas Plant exercises.

Shell defined three levels of emergencies in its ERP and the associated key actions to be taken.

Level-1 Emergency

- The H_2S formation(s) are open to the wellbore, and an abnormal drilling, completion, servicing, or testing problem has occurred with the potential to lead to a well control problem. There is no immediate danger to the public, as there is no release of H_2S gas and the situation can be controlled by on-site personnel.

- Key actions to be taken by Shell to ensure protection of the public include notifying sensitive residents within the 4 km EPZ that they may wish to evacuate voluntarily, alerting mobile air

monitoring units stationed in the EPZ, carrying out a survey of the EPZ to locate residents and transients, and notifying company, contract, and government personnel required to implement the plan.

Level-2 Emergency

- A controlled, low-volume flow of H_2S gas is occurring at surface, posing a limited hazard to the public.

- Key actions to be taken by Shell to ensure protection of the public include mandatory evacuation of the people within the 4 km EPZ, surveying of the EPZ to locate residents and transients, repositioning mobile monitoring units if required (downwind at the nearest unevacuated area), establishing roadblocks and river blocks, assembling ignition equipment, notifying schools, school division, and bus lines that they may need to reroute children to the evacuation centre, and mobilizing all company, contract, and government personnel required to implement the plan.

Level-3 Emergency

- An uncontrolled release of H_2S gas is occurring from the well that cannot be controlled immediately by on-site personnel, and the situation may pose an immediate hazard to the public.

- Key actions to be taken by Shell to ensure public protection include reviewing the status of the public activity within the 4 km EPZ, notifying local radio stations so that they prepare to issue a public warning message, igniting the uncontrolled H_2S flow if the ignition criteria are met, and evacuating other areas and readjusting roadblocks outward if required based on monitoring results.

Shell noted that under extreme blizzard weather conditions, when visibility restricted travel, Shell would suspend any activity at the well within the critical sour zone until adequate visibility returned. Additionally, Shell stated that it was absolutely confident that there would be an adequate time frame (hours, even days) before loss of well control occurred to invoke the necessary level-1 or level-2 emergency response to protect the public.

Shell acknowledged in its ERP that there was a possibility that certain individuals within the 4 km EPZ may be proportionately more susceptible to potential health effects following exposure to sour gas. Shell stated that although it was confident that these residents would not be affected by the proposed well, it was prepared to relocate them to outside of the EPZ while conducting operations in the critical sour zone. Shell stated that it was also prepared to cover all reasonable expenses incurred during relocation.

Shell noted that the monitoring of ambient air quality at a sour gas well would normally begin at the testing phase. However, Shell committed to three months of baseline monitoring for the 7-7 well prior to drilling and should the well prove to be successful, another five months of air monitoring prior to any field development. Shell noted that this would allow for the gathering of baseline information and also ensure that monitoring would already be in place in the unlikely

event that emissions occurred from the drilling operation. In addition, Shell stated that it would provide an independent air-monitoring unit to be stationed at or near the dwellings of sensitive individuals during operations in the critical sour zone to better address resident concerns. Shell stated that it was not at liberty to discuss any further details of its monitoring, as this information fell under the confidentiality provisions of the mediation process it had entered into with local residents.

Ignition

In the event of an H_2S release, Shell stated that it would ignite the well during any of the following situations:

- the well was experiencing an uncontrolled flow of H_2S gas at surface and public safety was at risk because evacuation of the public within the 4 km EPZ could not be accomplished;
- air monitoring data indicated H_2S levels in excess of 20 ppm for a three-minute average in unevacuated areas;
- air monitoring data indicated H_2S levels in excess of 1 ppm at the nearest urban centre or where evacuation was not feasible; or
- air monitoring was not taking place due to weather conditions.

Shell committed to have the following ignition equipment available to ignite any release of H_2S:

- an automatic ignition system, and
- shotgun-type flare guns complete with 25 millimetre flare shells.

Shell stated that it would endeavour to regain control of the well without ignition in the event that the public had been evacuated from the EPZ prior to an uncontrolled release. Should the 4 km EPZ not be evacuated, however, Shell would follow its ignition criteria. Shell was confident that should the EPZ not be evacuated and its ignition criteria were met, ignition procedures would be immediately initiated with the use of the automatic ignition system. Shell stated that ignition procedures would be initiated regardless of the circumstances in any event where public safety was at risk.

Shell believed that the ignition criteria outlined in its ERP followed the standard ignition criteria set out by EUB policy. Shell was confident that the procedures and criteria outlined in its ERP were sufficient to ensure that ignition could take place within six minutes of a maximum flow of gas from the well. It confirmed that its on-site representative would have full authority to ignite the well in the absence of contact or guidance from the Shell's Calgary office. Shell noted that there were a number of internal training programs, including a three-day emergency response training course, that the on-site representative must complete prior to the drilling operation.

Evacuation

Shell stated that it would coordinate evacuation within the EPZ, while the evacuation of the public outside of the predefined EPZ boundaries, if required, would be handled in partnership with the various public safety services in accordance with the government's ERP. Shell stated that it had participated in a meeting with the Regional Health Authority, the County, Alberta Environment, and EUB staff to review its proposed ERP and discuss coordinated plans and actions in the event of an emergency. The criteria that Shell would use to initiate evacuation following ignition were SO_2 levels that reached 5 ppm (15-minute average), 1 ppm (3-hour average), or 0.3 ppm (24-hour average). Shell noted that it would not normally notify residents within the additional 4 km EAZ in the event of an incident. Shell would expand its area of notification and/or evacuation only in the event that a risk of impact existed beyond the 4 km EPZ.

Shell proposed a computerized telephone callout system as its primary means of notifying the public within the EPZ in the event of an emergency. Shell stated that it had advised residents of the notification system during its public consultation program and at its open house. Shell noted that no concerns had been raised with respect to the proposed system at the open house.

Shell reported that the evacuation section of its ERP contained the following evacuation criteria within the 4 km EPZ based on monitoring results at each level of emergency:

Level-1 Emergency

- There would be voluntary evacuation of predefined special-needs persons.

Level-2 Emergency

- If H_2S concentrations below 10 ppm were monitored over a one-hour average in unevacuated areas, sensitive individuals should consider leaving the area if health symptoms persisted or became more severe, and all other individuals should consider leaving the area if health symptoms developed.

Level-3 Emergency

- If H_2S concentrations exceeded 10 ppm for eight hours or more, local conditions would be assessed and all persons may be advised to evacuate.

- If H_2S concentrations of 20 ppm or greater were averaged over three minutes or SO_2 concentrations of 3 ppm or greater were averaged over 1 hour, evacuation of all persons would take place.

Shell stated that it had included the EUB evacuation criteria set out in *Informational Letter (IL) 89-15: Evacuation and Ignition for Sour Wells* in its ERP in order to satisfy EUB requirements. It pointed out, however, that its proposed evacuation criteria for the 7-7 well

site-specific ERP would supersede these requirements and be much more stringent. Shell stated that it believed that the published EUB criteria were minimums and that it intended to evacuate the public much sooner than the legislated requirements.

Shell noted that if its application were approved, a tabletop exercise and a deployment training exercise would be conducted to familiarize its response personnel with the region and their related roles and responsibilities. Shell indicated that it had had experience in conducting and participating in such exercises, some of which had included members of the public in the Caroline and Morley areas. Although Shell believed that there would be some interest from key members of the public to participate in an exercise, it was reluctant to discuss details, as this fell under the confidentiality terms associated with the mediation process.

Although Shell had not yet confirmed with the RCMP that two cruisers would be available for response during an evacuation, it stated that it had been assured through discussions with the County that this was possible. Shell noted that in the short term the RCMP would implement the road closures on highways, but for the long term the highway contractor would manage detours. Should the local health facilities be amenable to an information training session, Shell stated that it would have its occupational health personnel visit the facilities to discuss the general safety and health impacts of H_2S and SO_2.

6.2 Views of the Interveners

Many of the interveners expressed concerns regarding Shell's proposed ERP. These included the adequacy of a 4 km EPZ, the ability of Shell to identify and then respond in a timely manner to an emergency, and the response capabilities of the County.

The Coalition took the position that for the ERP to be effective, the expectations of the public must become the focus of emergency planning and operations. They strongly believed that both Shell and the County had failed to meet the expectations of the public in the area. They believed in particular that the ERP did not address several issues, including

- evacuation during extreme weather conditions, which were common in the area,
- the large number of transient and recreational users in the area,
- the significant number of residents on dead-end roads,
- the evacuation of children home alone and unwilling to speak to strangers,
- notification to those property owners with no phones on site,
- the risk of vandalism, and
- pet and livestock protection and/or evacuation during an emergency.

The Coalition also questioned Shell's ability, given a one-hour response time from the Caroline Gas Plant, to respond to an emergency in a timely manner.

Many of the interveners stated that they also believed that the potentially affected public must be provided the opportunity to have input into the ERP and that Shell did not adequately fulfill this responsibility. Several members of the intervener groups stated that, as a result, they were not convinced that Shell could adequately address the needs specific to their families in the event of an emergency. They contended that, although it was true that some members of the community had refused to meet with Shell representatives to provide personal information, Shell, in general,

had failed to meet its responsibility to identify which residents were actually within the 4 km EPZ. They also said that the resident information contained in the ERP was inaccurate and incomplete.

With respect to the County's role in the ERP, the Coalition noted that the local government must also be able to meet the increased public demands that would occur during an emergency. They believed that neither Shell nor the County had clearly demonstrated that the challenges faced during a disaster would be mitigated by Shell's emergency response procedures. In evaluating the capabilities of the County's disaster plan relative to the public's expectations, the Coalition found that the following areas were inadequately addressed:

- alerting the public in advance of a disaster,
- addressing the magnitude of an emergency quickly and accurately,
- keeping the public properly informed of the situation,
- evacuating the impact zone safely,
- relocating residents to a safe place,
- providing for a rapid restoration of services,
- giving assistance in the form of recovery services,
- mitigating the impact of future emergencies,
- protecting life and property adequately,
- having secure mutual aid agreements with the RCMP, and
- ensuring that reliable communications exist between Shell and the County.

The Coalition further believed that in the event of an emergency there could be a tremendous amount of responsibility placed on the local government to respond. It noted that the County's draft ERP currently failed to contain a specific reference to operators of upstream petroleum facilities in the area. It indicated that it was also concerned about the use of a circular boundary line to denote an EPZ. It suggested that Shell should consider the use of geopolitical boundaries, such as Highway 11 to the north and the secondary road system to the south, which would be readily identifiable. However, it also noted that Shell would possibly also experience some new resource allocation problems by expanding the zone in such a manner.

The interveners submitted that Shell's proposed reduced 4 km EPZ was inadequate and that the reduction from the calculated 19.2 km was unwarranted. They believed that the Board should not approve the Shell application if Shell could not effectively manage the larger EPZ.

The Tougases stated that they also had concerns arising from Shell's plans for future development and production in the area. They believed that Shell would not be capable of timely notification to residents or response in the event of servicing, production, or pipeline incidents. They noted that in these cases, unlike the drilling scenario, there would be immediate connection between the source of the sour gas and the surface, resulting in no delay between the initiation of the event and the release of sour gas to the environment. They further observed that Shell had not provided for these types of scenarios in its ERP.

The Coalition said that Shell's proposal to recommend indoor sheltering as a temporary means of public protection failed to recognize that a significant number of the dwellings in the area were trailers or cabins, which were far from airtight. It also did not believe that Shell had adequately considered the more than 200 people, on a monthly average basis, that they believed

visited the area for recreational purposes during the spring, summer, and fall months. It noted that these recreational users were not capable of sheltering, nor would they be readily able to evacuate from the river valley in the event of an emergency. It believed it would not be possible to effectively evacuate the recreational users on the river due to the steep banks, dense bush on both sides, and lack of access roads. It noted that there was a measured 30-minute walk from the river to the nearest gravel road.

The Tougases noted that many of the area residents, including some of the most sensitive individuals, lived on dead-end roads and must egress toward the well in order to evacuate the area. Evacuation during the winter could be further exacerbated by adverse weather conditions. In their experience, it could take up to four or five days to have the roads cleared by the County during the winter months. They noted that although Shell had committed to keeping the road clear, this offer was made only for the drilling, completion, and testing of the well. Shell, they observed, had not discussed long-term public protection.

The Coalition noted that there was no possibility of a helicopter landing at or near the river as a means of public evacuation. It questioned the safety of using a helicopter within the vicinity of an uncontrolled sour gas release. It also had concerns that a helicopter would not be deployed during adverse weather conditions, and given the limited number of seats, it believed that a helicopter could not possibly accommodate the public in that particular area.

Some interveners noted that significant additional work was required to adequately complete Shell's ERP. This would include a complete update of the draft ERP, a tabletop exercise that would include affected stakeholders, the development of detailed specific emergency response actions beyond the 4 km EPZ, and ignition criteria modified to reflect immediate ignition. Furthermore, some of the interveners believed that a full deployment exercise, including the public, should be initiated and conducted without notice by an unbiased outside organization to test the effectiveness of the ERP.

Mrs. Van Tol and Mr. Diedrich raised the possibility of landowners setting livestock free during an emergency, leading to a significant impact on residents' ability to evacuate and on Shell's ability to carry out its ERP.

Ms. Hardill noted that while she had elected not to discuss public safety procedures with Shell, she believed that the company should have been fully aware of her conditions based on correspondence with Shell. She also believed that, despite this awareness, Shell had not attempted to address those issues in its ERP. Given the serious nature of some of these health conditions, Ms. Hardill believed that it could take an extensive amount of time for her to evacuate. The stress of evacuation could also potentially cause negative impacts due to her condition. She noted that the hearing itself had created significant levels of stress, including requiring the hospitalization of one particularly high-risk individual in the community.

Mr. Tougas acknowledged that Shell had offered to relocate him and his family at its expense during the drilling of the well through the sour zones and during any subsequent testing and servicing of the well due to the severity of his medical condition. He stated that the issue was not compensation, however, but rather the significant and potentially ongoing intrusion into the quality of his life and the potential increased threat to his health and safety. He noted that he and

his family could potentially be relocated again as more wells were drilled and tested. In his view, this would be not only a major disruption in their lives, but also would represent a real risk to his already compromised health.

The interveners stated that while they appreciated Shell's offer to provide additional assistance to sensitive individuals, they questioned where the responsibility of determining who was or was not "sensitive" should lie. They questioned Shell's right to determine which members of the public would be deemed sensitive and which ones would not; all the residents in the community should, in their view, be deemed sensitive individuals. Some interveners stated that they believed that everyone should be offered a compensation package due to the stress imposed by Shell on the community. Additionally, some interveners noted that Shell's current offer of relocation and subsequent compensation in the event of an emergency was unacceptable, since those requiring relocation would not be in a position financially to be able to incur the initial costs.

Several interveners believed that this proposed development threatened their quality of life sufficiently that they would be forced to move away from the area if the Board approved the application.

6.3 Views of the Board

The Board believes that there are four key issues that it must address in determining the adequacy of Shell's emergency preparedness. These are

- the acceptability of the proposed reduction of the calculated EPZ,
- the ability of the local government to carry out its proposed role in the ERP,
- the ability of the ERP to address unique individual needs, and
- the impact of ignition times on the ERP assumptions.

The Board, in reaching its conclusions on all four issues, has been particularly cognizant of the interveners' evidence regarding the unique features of the area. An effective ERP for this area must address all unique features, including those not normally faced by a proponent. In this case, the presence of the Clearwater River creates a significant barrier to effective evacuation in the case of an emergency. This would be true in the spring, summer, and fall, when large numbers of recreational users are likely to be present within the steep river valley, and in the winter, when road access may be problematic.

The Board notes that communication with the public in the area may also be difficult under emergency conditions, since many residents are transitory and/or do not have telephones. Furthermore, there appear to be a number of individuals who could be particularly sensitive to not only the effects of an uncontrolled well release, but also the stress that such an event may introduce. While Shell has clearly tried to address this particular issue by offering to remove these individuals from the area during drilling and testing, the Board does believe that this solution is not without its own potentially significant impacts on the health of these individuals.

The Board notes that Shell's drilling H_2S release rate of 17.4 m^3/s results in a corresponding calculated EPZ of 19.2 km. However, Shell proposed a reduced EPZ of 4 km for the purpose of effective manageability. The Board, in considering such an amendment, requires that an application for use of a reduced zone be submitted for review and approval at the onset of a

project and prior to public consultation taking place. Further, the Board normally expects an application for use of a reduced EPZ to contain detailed supporting documentation of the reasons that the proponent believes that the calculated zone would be unmanageable and details of all enhanced public protection measures and other safety features proposed to ensure protection of the public in the event of an emergency. The criteria the Board reviews in order to determine whether a reduced EPZ is appropriate include a review of local terrain, population density, the proposed evacuation and sheltering criteria for H_2S and SO_2 within and beyond the 4 km EPZ, ignition criteria, and the proposed air quality monitoring strategy. The Board notes that Shell did not apply for use of a reduced EPZ in advance. Rather, Shell chose to make the proposed reduction part of its application to be considered at the public hearing.

In this particular case, the Board is not convinced from the evidence at the hearing that the use of a reduced EPZ has been adequately justified by Shell. While Shell has proposed some safety enhancements, there remain significant questions, based on the information provided by Shell and the interveners, as to whether these would be sufficient to address the unique area issues. For example, Shell proposes to begin evacuation of the reduced EPZ at a level-2 emergency rather than at the earliest indication of well control problems (level 1), when there would be no risk of exposure to H_2S. Shell's proposed ignition criteria are dependent on factors such as status of evacuation and monitoring results, rather than agreement to immediate ignition of an uncontrolled release of H_2S regardless of other factors. Shell has indicated that it would transfer the responsibility for protection of the public beyond the 4 km reduced EPZ to the County but has failed to provide specific details of procedures or agreements that would be in place to ensure protection of the public from exposure to H_2S or SO_2.

The Board agrees with the residents that there is a very high degree of uncertainty that a helicopter could be used effectively to carry out evacuations during an uncontrolled release in some of the area, particularly considering the potential number of people that may be affected. The Board has significant reservations about approving any measure that cannot reasonably be expected to be effective under most foreseeable conditions. Similar concerns exist, for example, about the value of sheltering in an area where many people will be out of doors and the value of up- and downstream barricades on a recreational river. Therefore, the Board does not consider Shell's draft ERP to be a comprehensive site-specific plan. If the Board were to approve the drilling of the 7-7 well, either significant amounts of additional information would be required to support the proposed 4 km EPZ or, alternatively, Shell would need to be able to demonstrate that a larger EPZ could be managed effectively.

With regard to the role of other agencies in the ERP, the Board realizes that industry must depend on assurances from local government and be satisfied that the local authority is able to carry out its responsibilities as proposed in an operator's ERP. The Board, however, ultimately holds industry responsible for ensuring that an adequate ERP is developed and that roles and responsibilities of all emergency responders are addressed. To do so, the Board requires industry to consult directly with other necessary support services during the initial stages of developing an ERP in order to confirm the availability of the resources the company will need to make its ERP effective, as well as the acceptance of that responsibility by those other agencies. Shell, however, was unable to provide evidence sufficient to convince the Board that adequate support services would be available should an incident occur at the proposed location. While it was clear that discussions had taken place between Shell, the County, and other agencies, the Board was

not able to confirm from the information provided in Shell's application that the potentially significant responsibilities of the local government set out in Shell's proposed ERP had been agreed to and could be met. This, in the Board view, also brings into question the efficacy of Shell's ERP.

With regard to the ability of Shell to respond to individual needs, the Board notes that several members of the public would not meet with Shell's representatives to discuss the proposed project. Despite the lack of cooperation, the Board believes that Shell was able to become reasonably aware of many of the specific local concerns. These included the potential for extreme weather conditions to restrict travel, the need for some families to egress initially towards the well, and the fact that hypersensitive people reside in proximity to the well. The Board expects industry to recognize special needs and concerns pertaining to all residents within an EPZ and develop acceptable procedures to address those special needs in its ERP prior to submitting an application to the EUB. The Board also expects industry to respond to public concerns by adjusting the size and configuration of an EPZ and, if necessary, establishing reasonable site-specific procedures in consultation with the public. The Board believes that while Shell has identified a number of approaches to address these individual concerns, substantive issues remain related to emergency response planning that Shell has been unable to address. The Board does not consider this to be a failure by Shell, per se, but believes this is partly a function of the unique conditions in the region.

For example, the Board notes that Shell has proposed to evacuate Mr. and Mrs. Tougas and other hypersensitive individuals from their homes for the duration of the drilling program in the critical gas zone. The Board believes that this approach commonly used by industry has often been successful in addressing resident concerns. In this particular case, however, Mr. Tougas, who may become a candidate for a kidney transplant only if he maintains his general health level for several years, is potentially placed at high risk simply by the stress of the evacuation itself. While resolution of this issue may eventually be possible, there was no evidence before the Board as to how it might be accomplished.

With regard to ignition criteria, as noted earlier, the Board believes that there are sufficient data to conclude that the probability of an uncontrolled release at a critical sour gas well is very remote. However, although the risk of the event is small, the potential consequences of such an event are substantial and, if not properly managed, entirely unacceptable. Therefore, ignition criteria are of the utmost importance in relation to all other protective actions that would be taken to mitigate impacts that could result from an uncontrolled flow of H_2S gas. The Board considers that immediate ignition is a key element in protecting the public should such an event occur. The Board defines immediate ignition as ignition occurring once the well has experienced an uncontrolled flow, the well effluent has reached the surface, and all personnel working at the site are cleared to a safe distance. For critical sour gas wells with reduced EPZs, the Board requires immediate ignition whether or not evacuation of the reduced EPZ has been accomplished.

The Board believes that Shell did not demonstrate a clear understanding of the Board's definition of immediate ignition in setting out its ignition criteria for the 7-7 well. Although the Board is reasonably satisfied that the proposed ignition equipment would be adequate to ensure immediate ignition, as defined above, the Board is concerned about Shell's reluctance to commit

to meeting this expectation of the EUB. The Board understands Shell's ignition criteria to be directly linked to the successful evacuation of the public and the results of air monitoring data. Shell has proposed that it would further delay ignition in order to continue to attempt to control the well if it believed that evacuation of the area had been accomplished. Given Shell's proposed reduced EPZ, the historically significant transient/recreational usage, and the public sensitivities within this area, the Board finds that Shell's proposed ignition criteria would be unacceptable for this project.

The Board is quite concerned with the notion raised by some of the interveners that landowners may choose to set their livestock free during an emergency, thereby greatly reducing the effectiveness of Shell's proposed ERP. The Board agrees that such actions could render any ERP ineffective and that it would be almost impossible for any company to deal with such an eventuality. However, while the Board can appreciate the need for livestock owners to protect their livelihood, the Board cannot accept that landowners would place this objective above the safety of their families and that of their neighbours.

7 LAND-USE IMPACTS

7.1 Views of the Applicant

Shell stated that it had examined the issue of land values in the Caroline area as it related to oil and gas installations, sour gas wells, and sour gas plants. It stated that land values had not been an issue with local landowner groups in the area within a 10-year period since the Caroline Gas Plant proceedings. Shell also provided some anecdotal evidence that it believed demonstrated that the land values had not been impacted by the development in the Caroline area, where there are level-4 critical sour gas wells.

Shell stated that it believed that the evidence presented by the interveners on the impacts of a range of industrial developments and industrial accidents on land values was generally irrelevant and of little value to the Board. Shell noted that there was no evidence provided by the interveners specific to the effects of sour gas wells and stated that the only potentially germane evidence before the Board related to a tax assessment in the Municipal District of Brazeau for a gas plant. Shell believed that this particular evidence was also of little value, since the landowners were motivated to convince the County that land values had been reduced in order to reduce their tax assessment.

Concerning the land-use effects of increased traffic, Shell stated that there would be approximately 60 truck movements to and from the well site during mobilization and demobilization of the drilling equipment. There would also be some additional traffic during the time the well was being drilled. Shell stated that it had agreed to try to organize crew changes to avoid high-traffic times in order to address these effects. Shell stated that it would also ensure that there were no rig moves during school bus hours, that flagmen were posted during rig moves, and that training was provided to its drivers and contractors to make sure they respected the rules of the road. Shell advised that it would also post signs to lower traffic speed if necessary.

Shell acknowledged the efforts of Mrs. van Tol to collect and present information regarding traffic patterns and volumes from Highway 22 to the well site and the real or perceived hazards that may be encountered as a result. Shell stated that it had not looked at this issue in any detail. It indicated that it believed any traffic safety issues were manageable and that it would work with the County to ensure that Highway 22 was safe during the time of drilling.

Addressing groundwater protection, Shell noted that the interveners had thoroughly reviewed its reports and recommendations with regard to the protection of groundwater. Shell indicated that it believed the interveners generally agreed with Shell's proposed approach.

7.2 Views of the Interveners

Many of the interveners agreed that oil and gas development had increased the standard of living for all Albertans. However, they also believed that Albertans would also agree that maintaining their own current standard of living should not be accomplished by endangering the lives of others, driving people from their homes, reducing individuals' livelihood, or destroying the natural environment.

The interveners also acknowledged that there was already significant oil and gas development in the general region. They observed, however, that most of these were sweet oil or gas developments. They noted that even these developments had had significant negative impacts on their lifestyles and the enjoyment of their property. They indicated that while they were prepared to, and in fact had previously, lived with and accepted these impacts, they were not prepared to accept a level-4 critical sour gas well in proximity to their homes. Many of the interveners noted that while Shell may have extensive experience with sour gas development, notwithstanding all of the planning and best intentions of the company, accidents had occurred and would continue to occur.

A number of potential specific impacts from Shell's proposed well on land use were identified by the interveners. They indicated that cases existed where value-based tax assessments were reduced as a result of oil and gas activity. They stated that many of the area landowners would be selling their property and moving if this project were approved. They did not believe that landowners would realize full market value (i.e., the value they would have received if the project did not proceed) for their property should the project be approved.

The interveners strongly disagreed with Shell's views regarding the potential effects of this development on area land values. Many of the interveners living near the Clearwater River and, therefore, among the closest residents to the well, noted that they had purchased their properties because of the natural beauty and pristine nature of the region. They stated that in reaching their decisions to buy, they were aware that there was oil and gas development in the region but that it was still sufficiently removed that it was not a significant issue. Furthermore, none of the wells in the region was a level-4 critical sour gas well.

The interveners believed that both public concern and public awareness regarding sour gas and the associated perceived risks were growing. It seemed only reasonable that this awareness would influence the choices made by people looking to purchase property. Even if the only result was to reduce the number of people willing to purchase their property, this, they believed, would

have a negative effect on land values. The interveners also noted that, given their personal perceptions of the risks associated with this development, they would be forced to sell their property if the well were approved. Because they could no longer control when they brought the property onto the marketplace, this would also have an effect on their ability to achieve full market value for their land.

Mrs. van Tol was particularly concerned with road safety issues in general and with the use of the "angle" road to access the well site and the road's access point from Highway 22 in particular. Mrs. van Tol critiqued Shell's proposal to use Highway 22 as the main north-south travel route for its operations. She observed that if traffic bound for the well site were travelling north on Highway 22, it would have to turn more than 90 degrees to the right at the T-intersection. Furthermore, since the road descended into the Clearwater River valley at this point, there were significant line-of-sight problems for northbound traffic approaching the angle road intersection with Highway 22. Shell traffic turning from southbound Highway 22 to the angle road would necessarily be turning across the oncoming lanes of the highway and would hold up traffic behind it.

Mrs. van Tol believed that the current volume of traffic on Highway 22 was sufficiently high to create a hazardous situation for local residents and motorists on the highway if Shell were to access the well from this direction. She also expressed concern that exiting from the angle road onto Highway 22 presented its own visibility challenges due to the steep sides of the road cut. These, it was argued, necessitated easing a vehicle partially into the intersection to obtain a clear view of traffic. Mrs. van Tol believed that even though Shell appeared to agree that there was a problem with the intersection, at no time prior to or during the hearing did it come up with an adequate solution to the issue or allay the concerns of the residents regarding the probability of road accidents at this intersection.

Several interveners were also concerned about the large volume of traffic on the angle road that would occur during equipment moves and drilling operations. They noted that children, horseback riders, local landowners with farm machinery, and school buses used the road frequently and that wildlife, such as deer, were commonly found on the road. The interveners believed that Shell's application did not adequately address the impacts of traffic during rig moves, ERP exercises, or a full-blown emergency situation. They referenced previous problems with the impacts of increased traffic and associated road damage from other oil and gas operations in the region and indicated that they had no reason to believe that similar problems would not occur when Shell carried out its operations.

7.3 Views of the Board

With regard to the potential impacts on land use and associated land values from oil and gas development and particularly from sour gas development, the Board accepts that this issue is of growing public concern. Unfortunately, while the public concern is real and appears to be increasing, there is very little relevant evidence available for the Board to use in determining the magnitude of these impacts. In this case, the first issue appears to be how the public might perceive the potential risk associated with sour gas development when considering whether to purchase property in the region around the proposed well. The second and even more complex issue is how these perceptions would ultimately affect the market value of these same properties.

The Board does not believe that the examples provided by the interveners' experts are particularly germane to the issues being considered. Those examples generally appeared to reflect the impacts of significant and likely long-term real contamination arising from various forms of environmental releases. Since in this case no such release has occurred and therefore the concern is potential future impacts, these examples would seem to have at best only marginal application to the issues being considered here. The Board also notes that the evidence provided regarding tax assessments in the Municipal District of Brazeau was relative to a gas plant. The Board does not equate the visual and aesthetic impacts of a gas plant to those associated with gas wells and pipelines. The Board also agrees with Shell's position that in that particular case the landowner was likely motivated to have the value of the property minimized, since this would result in reduced taxes.

The Board does accept that through its Caroline development, Shell has likely gained some experience with regard to the historic response by the public to large sour gas development in the region. Furthermore, the Board does not doubt that the value of recreational property in the general area has likely increased significantly since the development of that plant and the surrounding gas fields. Unfortunately, this does not assist the Board in determining what that value might have been in the absence of sour gas development. Certainly, the anecdotal evidence provided by Shell is of little assistance. The evidence provided by Shell with regard to the various more quantitative studies previously carried out to try to quantify this issue also now appear to be potentially dated in light of the apparently changing public attitudes to sour gas noted above. However, these earlier studies are at least indicative of the number of variables that need to be considered when trying to assess the impacts of sour gas development on land values, and they confirm just how complex this issue is.

The Board does accept that in this instance the potential for a nearby sour gas development has clearly had an impact on the landowners' perceived value of their property. It also appears likely that at least some of the landowners will choose to put their property on the market if the well does go ahead. The Board notes that in reaching this decision to sell, area residents have clearly distinguished between the effects of the other oil and gas activity in their area and the development of a level-4 sour gas well.

The Board is also prepared to accept that sour gas operations may adversely affect some individuals' perceptions of the value of neighbouring lands. The Board is of the opinion that, at least for some of these individuals, those negative perceptions will be greatest during the drilling and completion operations, when the site activity level is high, while for others, the negative effects on the use and enjoyment of their property will continue even after these operations are completed. However, the Board is not prepared to conclude, based solely on the evidence available, that this would result in direct tangible effects on property values. The Board does expect that if landowners believe that they are in effect being forced to sell their property quickly and that if, furthermore, several properties do go onto the market at the same time, there is a reasonable expectation that this may have a negative effect on the value received for the property. The Board is not able, however, to determine what the relative size of this impact might be or if it would be significant.

The Board notes that it is charged with determining whether an energy development is in the public interest and that the public interest includes the environmental, social, and economic effects of the project. While there are relatively simple tools for assessing the net economic benefits of a project, similar methods for assessing the economic costs to nearby landowners are not as readily available. The Board believes that if the growing public concerns regarding the long-term impacts of oil and gas development on property values are to be adequately addressed in the future, a process needs to be developed that allows both applicants and landowners to approach this issue from a common point of view. The Board has asked staff to examine how this issue might be addressed and to report back to the Board on possible options.

Concerning the issue of the impacts from vehicle traffic during rig and equipment moves, the Board notes that these concerns arise wherever oil and gas development occurs in proximity to other land uses. The Board also notes that the concern is not related exclusively to oil and gas operations, but also to other activities that include a traffic component. The Board believes that in the vast majority of cases, these concerns can be and are adequately addressed through close cooperation among the energy industry, the local government, and the community.

With regard to the 7-7 well, the Board accepts that if access from Highway 22 were improperly managed, it could represent a significant risk to public safety. However, the Board does not believe that the proposed well site presents any unique conditions in terms of access relative to other developments in the province and so will rely on the judgement of the local authorities to determine if Shell can safely gain access to the site from this location. The Board notes that there are other potential access points to the well site that could serve as alternatives. The Board realizes that each of these also represents other issues for local residents but believes that effective solutions can be advanced through an appropriate dialogue among the proponent, responsible municipal authorities, and area residents.

The Board notes that little evidence was presented at the hearing regarding groundwater protection and the risk of contamination. Additionally, the Board notes that there does appear to be agreement by all the parties with the approach by Shell to address this issue. The Board is satisfied that the measures proposed in Shell's application adequately address groundwater issues.

8 PUBLIC CONSULTATION

8.1 Views of the Applicant

Shell stated that it began its public notification process in late 1998. In planning its program, it first assessed the potential sensitivity of the public in the area by comparing it to other areas where similar sour gas wells had been proposed. This assessment identified that this was an area with significant existing oil and gas activity. As a result, Shell determined that it would be adequate to initially advise the local residents of its proposal to drill the 7-7 well through a mail-out of its public information package.

Shell stated that it became aware shortly after its initial mail-out that there was strong opposition by the local community to the proposed well. Shell acknowledged that it had misread the

comfort level of the community with sour gas development and regretted the approach that it had initially taken to public consultation. Shell stated that it may also have offended people by the timing of its information package, which was sent out in late 1998, with drilling proposed to begin in January 1999, and by having already negotiated for and agreed upon a surface location for the well with a local landowner. Shell stated that once the company realized there was a problem, it immediately initiated further consultation with the community in December 1998, advising that the project would be delayed pending a more thorough public consultation process.

Shell stated that in an effort to address the community's concerns, an open house was held in February 1999. Shell observed that this generated a significant number of additional questions from the community to which it attempted to respond. As a result of the extensive community feedback, Shell then appointed a full-time public consultation coordinator to determine how it could better resolve the community's issues and concerns. Many meetings were held, one-on-one visits were conducted, and a number of question-and-answer packages were provided to the community regarding drilling, casing, cementing, groundwater, safety practices, and a variety of other issues. In addition, a project manager was appointed to focus more attention on the proposed project.

Shell stated that it understood that local residents had expressed concerns about the timeliness of Shell's written responses. However, Shell believed that it had made every effort to cooperate with requests for written information and stated that it had simply been overwhelmed by these requests. Shell observed that it had responded to hundreds of different questions and that many individuals had chosen not to respond to or participate in its earlier processes.

Shell stated that it had resubmitted its application to the EUB on June 23, 1999, based in part on the input that it had received from the public. It described its efforts to resolve community issues within the revised application. Shell stated that it received requests for additional information from the EUB in September 1999. In its October 1999 response to those questions, Shell observed that it believed the application to now be complete.

Shell noted that it subsequently mailed another information package to the community in November 1999, offering to host a second open house. This package contained fact sheets about its drilling safety and emergency response practices. Shell stated that it decided that an open house was not warranted, since only three residents responded to the November 1999 information package.

Shell noted that it agreed in February 2000 to enter into a mediation process with the Coalition and other interested parties using a third-party facilitator. Shell observed that it was agreed that the discussions during these meetings were confidential. Meetings took place approximately every two weeks and continued through the spring of 2000. Prior to the initial hearing date of June 5, 2000, Shell noted that the community requested a delay of the hearing. Shell stated that it had also supported the further adjournment to provide more time to resolve issues and address the community's needs. Mediation continued until mid-July 2000.

During this time, Shell noted that the members of the community directly involved in the mediation process placed an advertisement in the local newspapers to make the community aware that the discussions were occurring. Following a summer break, negotiations resumed in

early September 2000 and were suspended at the end of September 2000 in order to provide all parties with an opportunity to prepare for the hearing. In conclusion, Shell considered the mediation process to have been beneficial for sharing information, discussing areas of concern, and improving dialogue.

8.2 Views of the Interveners

The interveners in general were strongly critical of Shell's public consultation efforts. They noted that the process got off to a particularly bad start. The interveners observed that Shell had greatly underestimated their potential concern regarding the development of a critical sour well in the region. They stated that the fact that Shell had already negotiated a surface lease with one of their neighbours not only left them with a feeling that there was little or no flexibility in Shell's approach, but also served to almost immediately divide the community. They noted that the short time frame between the initial consultation with the public (late November 1998) and the proposed drilling date (January 1999) and the fact that the process was also expected to occur over the holiday season left them with the feeling that Shell was not serious about meaningful consultation.

The interveners also criticized Shell's response to their early efforts to obtain additional information about the well, suggesting that answers to their questions had been neglected or tardy. The interveners believed that Shell should have provided more information earlier and, in particular, more information regarding the risk associated with the proposed project. The interveners indicated that the effort required to understand the details of this application and the technical basis for and the exact nature of the risks involved had been a frustrating and time-consuming process. They noted that in response to questions, Shell had often provided relatively generic answers that did not adequately respond to the specific concerns raised by individuals with unique circumstances.

The interveners believed that Shell's failures in carrying out an effective public consultation program had led to an erosion in the public's confidence in Shell and the great unease they had regarding Shell's application. The interveners believed that the application failed to meet the EUB's requirements to provide accurate and complete information to the community, to individuals with specific concerns, and finally to the EUB itself. They noted that despite the intense levels of discussion, Shell's application appeared to have changed very little as a result. In this case, the interveners believed that Shell did not meet the EUB's minimum requirements for consultation, resulting in a lack of trust, and furthermore that Shell had been unable to make up for its initial mistakes.

Despite their criticisms of Shell's consultation program, a number of the interveners also acknowledged that, given the nature of this well, it was possible that no matter how effective the consultation program, their opposition to the proposal would have remained.

8.3 Views of the Board

It is clear that in designing its initial public consultation program, Shell significantly underestimated the concerns of the area residents. It is equally clear that Shell made a number of additional errors in the early stages of its consultation program. Shell acknowledged that these

included assuming that the presence of regional oil and gas development meant that public concerns about new development would be reduced. Other errors included concluding negotiations for the well site prior to initiating community discussions, initially relying on a mail-out of information packages as the primary communication tool, and providing a narrow time period, over the holiday season, for the public to read and respond to that information package. In the Board's view, the result was a serious erosion in public trust in Shell from the outset. The Board accepts the interveners' views that these initial errors very likely made future effective consultation almost impossible, despite Shell's subsequent efforts.

The Board accepts that Shell made significant efforts to re-establish a dialogue with the community once it realized the magnitude of its error. In order to more fully answer the community's questions regarding risk, etc., the company began to assemble additional technical information and, as this was prepared, to forward it to the community. The company, unfortunately, does not appear to have been able to meet the demands for information from the community in what the community perceived as a timely manner. And it would appear that because Shell's relations with the community were already strained, the community became increasingly alarmed at what it perceived to be large time gaps between communications from Shell. Although the Board recognizes that the large number of community questions in part led to the lengthy response time, the Board believes that Shell may again have underestimated the depth of community concern and may have failed to ensure that sufficient communication was ongoing with the community.

The Board also notes, however, that at least some members of the community also chose not to engage in Shell's initial consultation attempts. While this is certainly their right, the public must understand that the EUB only requires proponents to make every reasonable attempt to carry out public consultation. It would be very unlikely that the Board would find that an applicant had failed to meet the EUB's expectations for consultation should the public choose not to participate.

The Board believes that appropriate notification and public consultation must be conducted well in advance of the submission of an application to the EUB. It must be thorough enough to allow all parties who are or may be affected to be sufficiently aware of not only the proposed project but also the EUB process. The Board believes that the public must have sufficient information to participate meaningfully in the decision-making process, to be able to voice their concerns, and to have their concerns heard, properly addressed, and if possible, resolved. The proponent's information must be extensive, consistent, factual, and disclosed in a timely way. If the proposal is unique in any way or part of a larger project, the proponent should be prepared to discuss the entire project and explain how its components complement other energy development plans in the area.

The Board believes that Shell eventually met this level of public notification and consultation through the subsequent consultation and mediation process. Unfortunately, Shell failed to meet these standards in its earlier process, which in turn likely led to the significant widespread opposition to this application. Furthermore, given the uniqueness of this area, the Board believes that additional efforts were required by Shell in order to ensure that communications with the public were maintained and to assist the public with their individual issues.

9 OTHER MATTERS

The Board identified two areas of particular concern on which it wishes to comment.

Use of Experts

In preparing for and presenting evidence at an EUB public hearing, the Board encourages the use of experts to assist in mounting an effective and focused intervention. These individuals are usually a recognized authority on one or a number of issues and provide a wealth of services to assist their clients and ultimately the Board in its deliberations. While these services include researching and generating reports and critiquing an applicant's position, the Board also expects specialists to meet with their clients to provide them with their experience and advice so that the public can gain understanding and clarification on complex issues.

The Board was very concerned to learn during the course of the hearing that the experts contracted by the Coalition's counsel had not consulted with the Coalition members themselves. As a result, the members were not well informed about the issues and facts presented on their behalf by these experts. It appeared to the Board that the members believed that contact with these specialists was ill advised because speaking with them could potentially taint the evidence of their experts.

The Board's experience is quite the opposite. Professionals and scientists who come before the Board generally put forward a position rooted in research and fact, not popular opinion. The Board has found that the educational component the professionals can embark upon with their clients prior to the hearing is also a key component of the expertise they offer. Obviously, that cannot occur when those parties are not engaged in sharing information or discussion.

The Board notes that Shell also expressed concern that the majority of the area landowners had never met with the expert witnesses hired to represent their interest. It indicated that it also believed that these experts could have offered additional advice to the public and the fact that these experts were not available to the public to assist in the evaluation made for very little benefit to the Board's process. The Board agrees with this view and believes that the important dialogue that failed to occur between the experts and their clients contributed to a much lengthier hearing process on certain issues than should have been necessary and a less meaningful examination of the issues by both the public and the Board.

Mediation

The Board recognizes the efforts of those parties that participated in a formal mediation process. The Board believes that the willingness of Shell and members of the Coalition to engage in dialogue prior to the hearing provided a venue for information sharing and an opportunity to begin to redevelop a relationship. However, the Board is concerned that during certain areas of testimony, individuals on both the Shell and the Coalition witness panels declined to respond to questions they perceived to be covered by their confidentiality agreement. In some instances, this made it difficult for the Board to gather important and relevant data needed to appraise the project and the public's reaction to it.

The Board also notes that the confidentiality provisions also appeared to have hindered the ability of the parties to communicate the results of their discussions back out to the community as a whole. As a result, it is very unclear as to what degree the mediation process was designed to address general community concerns and, more important, how the community at large was expected to learn the results of the various discussions.

It is very important that participants engaging in any form of dispute resolution process have regard for the information that eventually will need to be communicated to other interested parties, particularly to the Board during its hearing process. While the Board wishes to encourage industry and the public to participate in meaningful and open dialogue to discuss and resolve issues, the Board must be able to explore issues within its jurisdiction in consideration of any application at a public hearing or otherwise. The Board issued *Informational Letter (IL) 2001-1: Appropriate Dispute Resolution Program and Guidelines for Energy Industry Disputes* on January 8, 2001. This IL provides helpful information for parties considering or participating in dispute resolution processes. On the issue of confidentiality, *IL 2001-1* states:

> It is important that the parties discuss and agree to matters of confidentiality and without prejudice discussions. However, the parties must recognize that any agreement must conform to regulatory and statutory requirements and that therefore certain technical, scientific or other information or components of an agreement may have to be disclosed to the EUB or other regulatory authorities.

10 CONCLUSIONS

In determining whether a proposed energy development is in the public interest, the Board is charged with balancing the economic benefits of the proposed project, which generally accrue to the province as a whole, and the potentially adverse environmental, social, safety, and economic impacts of the project, many of which occur at a local or regional level. The Board believes that most Albertans believe that, in general, the economic benefits of oil and gas development have, at least to date, outweighed the potentially negative effects associated with energy projects, provided that they are reasonable and properly managed. The Board notes the testimony of the interveners to this hearing that they also recognized the general benefits of oil and gas development to the citizens in the province. They also noted that they currently lived on a daily basis with the impacts of oil and gas activity and were by and large not opposed to such development. In this particular case, however, their view was that the risks associated with drilling and operating the 7-7 well clearly outweighed any incremental economic benefit either to them or to the public as a whole.

The Board believes that Shell clearly established that it had the agreements in place to be able to drill the 7-7 well. The Board further believes that for future gas development to occur in the province, such exploratory wells will continue to be needed. The Board is also prepared to accept that the proposed surface location provides Shell with the optimal opportunity to test for the presence of hydrocarbons in the three formations of interest. The Board notes that no

interveners proposed an alternative surface location for the well that would, from the community's perspective, be more acceptable than Shell's applied-for location. The Board also believes that the surface location is acceptable from an environmental perspective.

With regard to the physical impacts on the community of drilling this well, the Board notes that in general these would occur primarily in the form of increased traffic, noise, odours, dust, and light during the drilling period. While the Board believes that the disturbance to the community associated with drilling operations would not be trivial, the Board is convinced that drilling operations could be carried out in a manner that would not have an unacceptable impact on nearby residents. In coming to this conclusion, the Board notes that the well location is set back at some distance from the river valley break and from the majority of the area residences, most of which are also separated from the well by some form of tree cover, which would help to reduce the impacts of any noise, lights, or similar disturbance.

The Board does not accept that access to the site from Highway 22 would be so problematic that the associated issues could not be overcome with proper planning and arrangements among the local authorities, the company, and the community. Similarly, the Board does not believe that access to the site would be significantly more difficult than the case for hundreds of other developments in the province. The Board believes that Shell, in close coordination with the County, should also be able to ensure that traffic safety is maintained for both its own operators and for the various forms of community traffic that would share the angle road over the period of drilling activity.

The Board is also convinced that, should the well prove to be successful, completion and testing operations could also be carried out in a safe and acceptable manner. The Board, in reaching this conclusion, notes that although there would be a short-term aesthetic impact during well servicing, there would be little from the wellhead. In addition, the Board notes that Shell committed to significantly limit flaring during well cleanup and testing. There also appears to be no reason to expect that there would be any risk to regional groundwater. Nor does the Board believe that there would be an inordinate risk to the well from earthquakes.

It is evident to the Board that the public has a strong view that the development of the 7-7 well would result in significant negative impacts to the value of their property. Unfortunately, none of the parties to the hearing was able to provide the Board with sufficient evidence to confirm whether this effect would occur or, if it did, whether the impacts to property values would be significant. The Board believes that this is an issue of growing concern to many Albertans and believes that a process needs to be established to better allow local economic effects of industrial development to be assessed by both the public and project proponents. The Board was unable, however, to conclude that any negative effects would be so great so as to preclude the drilling of the 7-7 well.

With regard to the protection of public safety, the Board notes that sour gas drilling and production have been carried out safely in Alberta for several decades. The EUB has established strict requirements, particularly for critical sour gas wells, that are designed to, first, further reduce the risk that the loss of well control will occur and, second, if uncontrolled flow does

occur, ensure that this situation can be safely managed. The Board finds that Shell's proposed drilling program meets the EUB's requirements for critical sour wells and was designed to address foreseeable factors that could lead to the uncontrolled release of sour gas.

Unfortunately, it is equally clear that Shell was unable to convince the public of this. Shell's public consultation program in the community, by its own admission, had a very inauspicious start, and despite significant efforts since, Shell was unable to repair the resulting damage. While the public in general appeared to believe that following the initial communication problems, the Shell on-site representatives had been sincere and conscientious in their actions, they clearly had very little trust in Shell's corporate ability to ensure their safety. This lack of trust also appeared to have an impact on Shell's ability to design an effective ERP. Many members of the community apparently chose to have little or no direct communication with Shell, and so the ERP remained incomplete. While Shell clearly cannot be held responsible for the decisions of these individuals, its early failures in consultation almost undoubtedly exacerbated these issues.

The Board, in considering public safety, must also address whether or not public safety can continue to be assured should a reasonable worst-case scenario arise. The Board notes that, notwithstanding its substantive safety requirements for sour gas well operations, there is also no question that the drilling of sour wells is not risk free. Clearly, regardless of the equipment and procedures put in place, loss of well control has occurred in the past and may occur again in the future. It is also clear that despite these additional safety features, the potential impacts associated with the accidental release of sour gas was the key issue behind the community's opposition to the proposed well. The Board believes that in determining whether the 7-7 well is in the public interest, it must address whether it can be suitably confident that public safety could continue to be assured if an uncontrolled release were to occur.

The Board views that the first step in such a process is the creation of a reasonable worst-case release scenario. This scenario, in turn, becomes the foundation for the development of the ERP. The Board notes that while there was some disagreement between the parties as to the parameters that should be used in establishing the reasonable worst-case scenario, Shell's predicted 49.3 m^3/s gas release rate for the 7-7 well under open-hole conditions with a concentration of 35.6 per cent H_2S was not questioned. The Board is comfortable that this prediction, which was based on available offset data, is sufficiently conservative and is reasonable. The Board also believes that the conservatism built into the range of assumptions used by Shell should help to ensure, for planning purposes at least, that Shell's calculated EPZ of 19.2 km is reasonable.

A number of questions were raised regarding Shell's insistence that in the case of an uncontrolled flow from the well, only a neutrally buoyant gas plume would occur, with all liquid hydrocarbon entrained within the plume. The Board finds Shell's approach on this questionable, since while the results ultimately may prove to be correct, it did make it difficult for the parties to the hearing to evaluate the relative merits of other modelling approaches. As noted earlier, when considering public safety issues, the Board expects applicants to ensure that both they and the public are able to address all of the potential scenarios that may occur. Certainly Shell's approach in this instance did not serve to increase public confidence.

The Board notes that while the calculated EPZ is 19.2 km, Shell indicated that it intended to use a reduced EPZ of 4 km. Shell stated that this was necessary in order to ensure that the ERP was manageable. In the Board's view, in order for its application to be acceptable, Shell must be able to demonstrate that it can effectively implement its ERP. Furthermore, in order to justify such a substantive reduction from the calculated EPZ, Shell must be able to clearly demonstrate that there are other mitigative features that it intends to introduce to offset the potential risks to the public beyond the reduced EPZ.

In considering Shell's proposal to reduce its EPZ, the Board notes the unique area topography and demographics that Shell was forced to address in creating its proposed ERP. Expansion of the EPZ beyond the 4 km radius would require the ERP to address significant additional roads, homes, etc. The Board is comfortable in concluding that a significantly expanded ERP in this region would be difficult, although certainly not impossible, to manage. Even within the proposed 4 km EPZ, the presence of the Clearwater River, with its sharp valley breaks, has a strong impact on the ability of Shell to effectively evacuate residents and transients from the region. This is compounded by other local area features, including the large number of transient users, particularly during the summer months, the nearby presence of high-traffic roads, and the presence of a number of hypersensitive residents in proximity to the well. The residents noted that many of their homes back onto the Clearwater River and are accessed by narrow and winding laneways, often blocked by snow in the winter, and that for some, initial egress from their homes would be toward the 7-7 well if a blowout were to occur.

The Board notes that Shell proposed to use early evacuation as a means of helping to ensure public safety in the event of any indication of well control problems. However, Shell's proposal to rely on early voluntary evacuation to protect public safety was not accepted as feasible by many of the residents in the region. This was due in large part to the wide range of uses being made of the area (e.g., farming, country residences, summer homes, day-use recreation) and the associated concerns they would have with abandoning their homes and livestock for any period of time. They also pointed out that the process of evacuation was not without its own significant risks as well, particularly in the winter months, and that other commonly used forms of protection, such as sheltering, would be of little value to many of the users of the area.

In addition to early evacuation, Shell also offered to evacuate any residents potentially at greater than normal risk (i.e., hypersensitive individuals) for the duration of its drilling program within the critical sour zone. Shell also offered to evacuate these same individuals during subsequent well testing and flaring, irrespective of actual emission levels at the well. However, this approach was also found to be unacceptable by at least some of those individuals. They argued that their health was already so badly compromised that they firmly believed that the stress of the evacuation process in itself could be sufficient to put them at risk. They believed that this risk was even further exacerbated by the general stress that would result from living near a sour gas well with a large release rate. They argued that the impacts to their quality of life were so substantial as to be unacceptable even if the proposed evacuation program did successfully remove them from risk from exposure to sour gas. As a result, should the well be approved, they expected that they would be forced to move permanently from the area.

The Board is not prepared to accept Shell's view that it can rely on early evacuation to ensure public safety in the region. Given the nature of the area and the lifestyles of its inhabitants, the

Board is not certain that Shell would be able, despite its best efforts, to identify and evacuate all residents and transients within the area that it could safely forego ignition if well control were lost. Therefore, the Board concludes that Shell's proposal in its ERP not to invoke immediate ignition (as defined by the Board) is unacceptable.

The Board also does not believe that the offer by Shell to evacuate hypersensitive individuals from the region while drilling through the critical zone would adequately address their unique concerns. While this approach has been and will likely continue to be effective in the future, it does not appear to be appropriate in this particular case.

The Board also notes that successful implementation of any acceptable ERP for the 7-7 well would require a substantive amount of resources from the other government agencies in the region. Based on the evidence provided at the hearing, the Board was unable to assess the ability of the local government to participate effectively in the implementation of the ERP, particularly if the larger EPZ were ultimately found to be appropriate. However, on the basis of its experience with other jurisdictions, the Board does believe it is reasonable to assume that the provision of this level of resources by local government would not be accomplished easily.

Finally, the Board was unable to conclude from the evidence at the hearing that the Shell ERP would adequately protect public safety under a reasonable worst-case scenario (i.e., full open flow without immediate ignition). The Board believes that for an ERP to be acceptable, it must be assured that public safety can be protected, irrespective of the probability of reasonable worst-case conditions actually occurring.

It is worth noting that the Board does believe that the likelihood of the worst-case scenario is extremely low. As noted earlier, the probability of any loss of well control during the drilling of a critical well in Alberta is very small. Furthermore, Shell's assumptions that a significant period of time is likely to occur between the detection of well control problems and loss of well control and that a further period would occur before full surface flow are reasonable. Both increase the probability that immediate ignition would occur long before the public is placed at risk, as does Shell's commitment to install redundant ignition equipment.

In terms of protecting public safety, however, while all of these features would greatly reduce the probability of an event occurring, the Board must also address the results if, despite the taking of all reasonable precautions, the event does occur. For the Board to find that a well is in the public interest, it must be able to conclude that even in that case, public safety can be adequately protected. The Board does not believe that this means that the risk to public must or even can be reduced to zero. However, the Board must be convinced that the risk is acceptable.

Given the evidence before the Board in this particular case, the Board is unable to reach such a conclusion. The Board believes that the unique combination of the potential size and H_2S release rate of the proposed well, the limited and difficult egress from many of the area residences, in some cases towards the well, the relatively large and diverse population with a high probability to be out of doors, and the potential presence of hypersensitive individuals proximal to the well all lead to the conclusion that in the event of the reasonable worst-case scenario, the ERP as currently proposed by Shell cannot assure public safety. In coming to this conclusion, the Board considered whether or not it could take the approach used in other cases, that is, to note that it

would be prepared to approve the requested well licence if certain additional conditions were met. However, given the evidence before it, the Board decided that this approach would not be appropriate.

Issued at Calgary, Alberta, on March 20, 2001.

ALBERTA ENERGY AND UTILITIES BOARD

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Board Member

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Board Member

Attachment

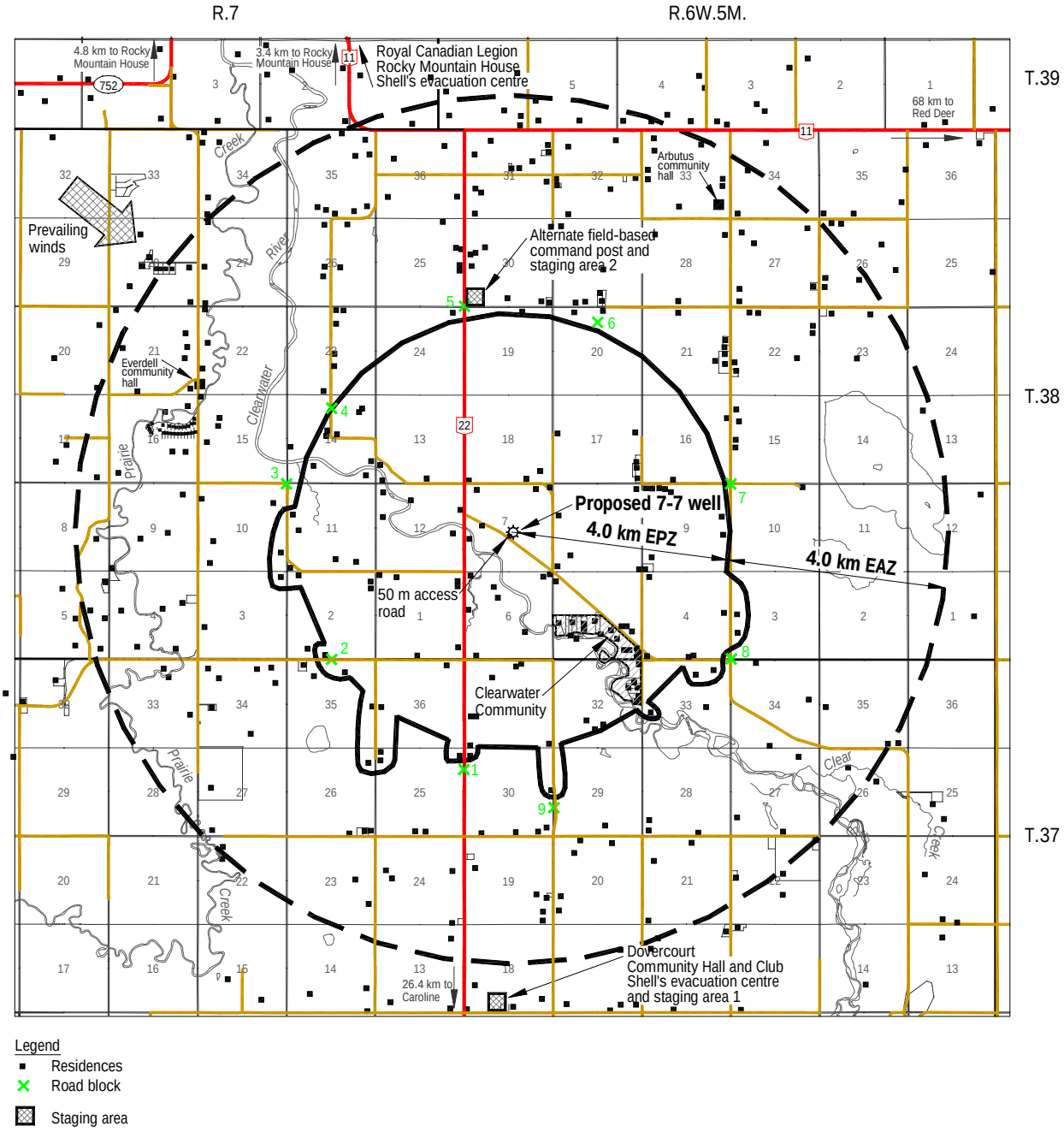

Figure 1 Reduced Emergency Planning and Corresponding Awareness Zones
Application No. 1042932
Shell Canada Limited

Decision 2001-9

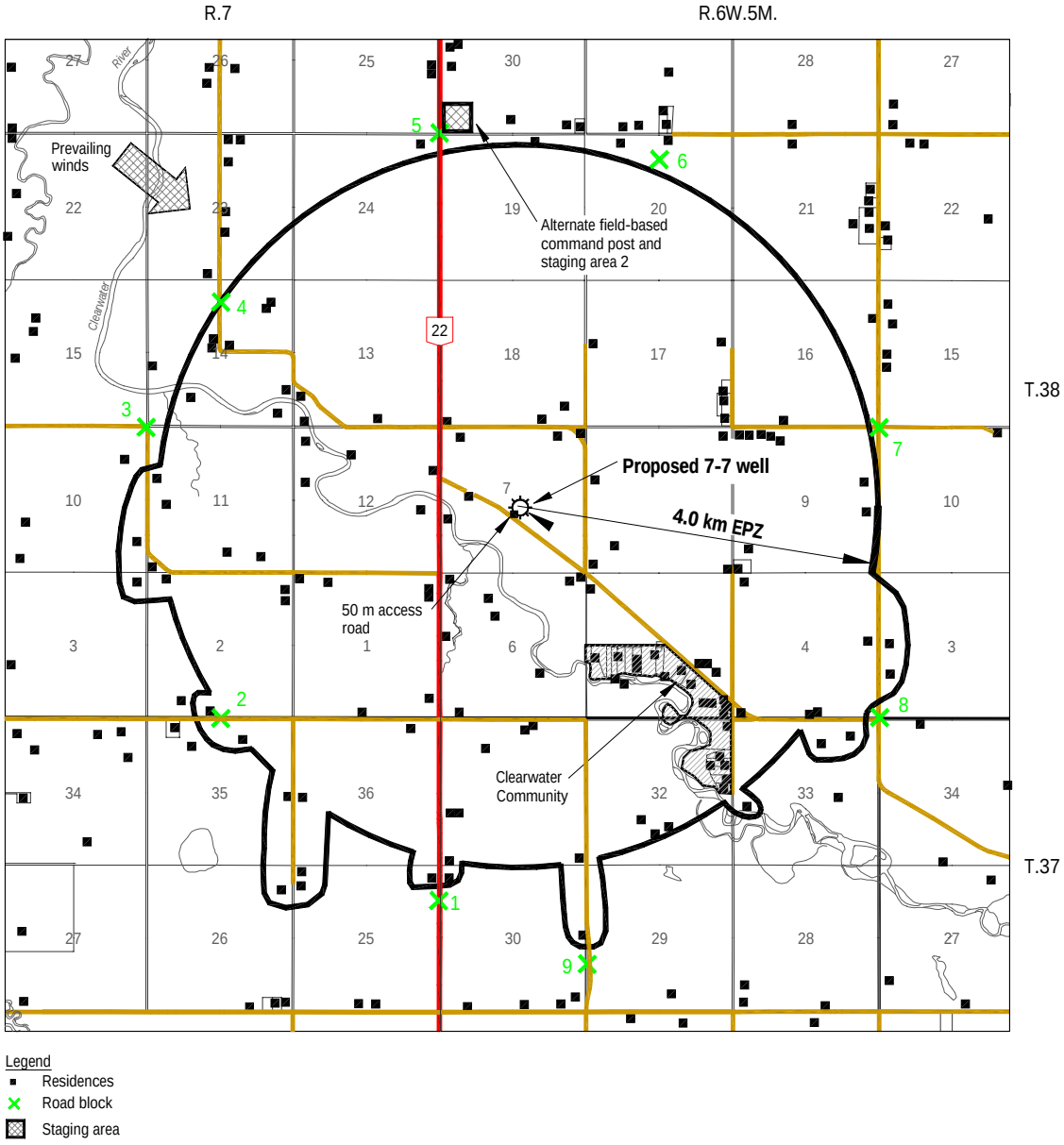

Figure 2 Reduced Emergency Planning Zone
Application No. 1042932
Shell Canada Limited

Decision 2001-9