

ALBERTA ENERGY AND UTILITIES BOARD

Calgary Alberta

ENCAL ENERGY LIMITED APPLICATION TO RE-LICENSE PIPELINE TO TRANSPORT SOUR GAS IN THE RIMBEY AREA

**Decision 96-1 Part 2
Applications No. 951161**

*Decision D 96-1 was issued on 31 May 1996, after a public hearing held in February 1996. In its decision, the Board identified a need for additional information (see Section 9). The Board reopened the hearing in November 1996 to consider the additional information. **The original text from Decision D 96-1 is in sections identified as "Part 1". The text resulting from the reopening of the hearing is contained in sections identified as "Part 2" and is in italics.***

1.1 Application and Hearing

Part 1... ISSUED 31 MAY 1996

Encal Energy Limited (Encal) applied to the Alberta Energy and Utilities Board (Board), pursuant to Part 4 of the Pipeline Act, for approval to change the substance authorized to be carried, from sweet natural gas to sour natural gas, for 37 kilometres of existing 168.3-millimetre outside diameter pipeline. The pipeline (referred to by Encal as the Crystal pipeline) would transport sour natural gas containing up to 18 moles of hydrogen sulphide (H₂S) per kilomole of natural gas (1.8 per cent H₂S) from an existing compressor station located in Legal Subdivision 1, Section 4, Township 47, Range 3, West of the 5th Meridian to the existing Gulf Homeglen Rimbey gas plant located in LSD 4-5-44-1 W5M (see attached figure). The pipeline would have potential maximum H₂S release of 285 cubic metres (m³) and would be a Level I facility according to Interim Directive ID 81-3, "Minimum Distance Requirements Separating New Sour Gas Facilities from Residential and Other Developments."

The application was opposed by P. and N. Hanneman, who own the W1/2 33-45-2 W5M and T. Wheale who owns the NW1/4 22-46-3 W5M.

The application and interventions were considered by Board Members J. P. Prince, Ph.D., J. D. Dilay, P.Eng., and Acting Board Member H.O. Lillo, P.Eng. at a public hearing on 7 and 8 February 1996 in Edmonton, Alberta.

Part 2

Encal notified all those who have residences within the emergency response planning zone of the Encal pipeline and filed additional information in response to the need identified by the Board.

The application was opposed by P. and N. Hanneman, T. Wheale, and by a number of landowners and residents who did not participate in Part I of the hearing. At the request of the interveners, the hearing was rescheduled and the notice was reissued on 20 September 1996 and again on 4 October 1996.

The Board reopened the hearing held in February 1996 to consider representations dealing with additional information filed by Encal. The Board adopted the evidence presented in part I of the hearing and did not require the re-introduction of that evidence. New information and interventions were considered by the Board panel at a public hearing on 26 - 29 November 1996 in Westeros, Alberta.

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

Encal Energy Limited (Encal)

*D. C. Linder*¹
*L. A. Cusano*²
*G. M Vlavianos*²

T. Barrows, P.Eng.
 B. Ball, Ph.D., P.Eng of Ball Associates Engineering Ltd.
*R. K. Dear*² of EMPLAN Emergency Planners Ltd.
*C Duncan, P.Eng.*² of C & M Engineering Ltd.
 B. Forster, P.Eng.¹
*R. Phipps, P.Eng.*² of Concise Design Engineering Services
 B. Vermeulen
 D. Webster, P.Eng. of Corrpro Canada Inc.
*T Wollen, C.E.T*²
 M. Zelensky, P.Eng. of Bovar Environmental

P. and N. Hanneman
 M. Bronaugh

P. Hanneman
*W. H. Bear, P.Eng.*² of Anderson Associates Consulting Engineers Inc.
 M. Bronaugh¹
 L. G. Hepler, Ph.D.¹
*J A. Plambeck, Ph.D.*²
 B. Schmierer, C.E.T. of Brian Schmierer NDT Consulting Ltd.

THOSE WHO APPEARED AT THE HEARING

Principals and Representatives (Abbreviations Used in Report)

Witnesses

T. Wheale

*A. and L. Dyck*²

*J. and S. Granger*²

*W. Hughes*²

*R. and C. Ollenberger*²

*J. and W. Reid*²

*W. and A. Ring*²

*S. Schiefen*²

*D. Whitecotton*²

*Protection of the Holy Virgin Mary Russian Orthodox
Convent*²

*B. O'Ferrall*²

*S. Munro*²

*G. and E. Mosier*²

*T. and P. Stevenson*²

*M. Bunting and L. Ings*³

*M. Woods*³

Alberta Energy and Utilities Board staff

*R. D. Heggie*²

A. L. Larson, P.Eng.¹

T. J. Pesta, P.Eng.

I. P. Dowsett

T. Wheale

*H. Becker*² for *S. Schiefen*

*J. Granger*²

*W. Hughes*²

*C. Ollenberger*²

*J. Reid*²

*D. Whitecotton*²

*G. Mosier*²

*P. Stevenson*²

1 Part 1, only

2 Part 2, only

3 Filed submissions but did not participate in the hearing

2 ISSUES

The Board considers the issues to be:

- application of the Pipeline Act and Regulations,
- the need for relicensing the pipeline,
- suitability of the pipeline for sour gas service,
- safety of the pipeline, and
- risk considerations and public consultation.

3 APPLICATION OF THE PIPELINE ACT AND REGULATIONS

3.1 Views of the Interveners

Part 1 ... ISSUED 31 MAY 1996

Mr. Bronaugh, on behalf of the Hannemans, argued that it would be impossible for the Board to approve Encal's application without breaching its own regulations. Mr. Bronaugh stated that the regulations clearly require the Canadian Standards Association (CSA) standard CSA Z662-94, Oil and Gas Pipeline Systems (Z662-94), as the minimum standard for construction and operation of pipelines. He further stated that, because the CSA standard applies to upgrading of existing installations, it applies to the change of pipeline operation from sweet to sour service. Mr. Bronaugh stated that the CSA requirements should be applied to new and existing pipelines alike. He said that this application does not fit within any of the areas for which CSA allows engineering critical assessment.

Part 2

Mr. Schmierer and Mr. Bear stressed that the normal requirements for sour service are more stringent than for sweet service. Mr. Schmierer noted that the existing Encal pipeline does not meet the requirements for sweet natural gas service. Furthermore, Mr. Granger, Mr. Reid, Ms. Becker, Mr. Whitecotton, and Mrs. Ollenberger suggested that a pipeline must meet the standards to be safe for transporting sour gas. Mr. O'Ferrall argued that many sections of Z662-94 that deal with requirements for sour service also apply to pipelines which are being converted.

Board staff introduced a letter from CSA to Mr. Bronaugh. In the letter CSA responded to his request for confirmation that requirements in Z662-94 apply to any sour-service pipeline that is intended to transport gas containing H₂S, which has previously carried other substances such as sweet gas, regardless of whether the pipeline is new or an older one. Mr. Bronaugh also requested CSA to confirm that the definition within Z662-94 for "upgrading" includes conversion from sweet to sour service. In its response, the CSA stated that Z662-94 does not specifically address the requirements for a change from sweet to sour service. In addition the

CSA noted that the change from sweet to sour service is one of the issues being studied by CSA committees, and that change of service is not considered as "upgrading" under the definitions in Z662-94. Mr. O'Ferrall, on behalf of his clients, argued that the Board should give little weight to the letter since the letter's author was not available to be cross examined.

Mr. O'Ferrall stressed that Z662-94 should not be relaxed for conversions to sour service. He argued that Z662-94 deals with requirements for all sour service pipelines, including those being converted, and that the Board has no flexibility in applying those requirements. However, he acknowledged that, in the absence of any guidance with respect to converting sweet pipelines to sour service in Z662-94, the Board would have a wider discretion in determining the appropriate requirements.

Mr. O'Ferrall addressed certain aspects of incorporating standards by reference. The issue raised by Mr. O'Ferrall might be paraphrased as follows:

The Board is empowered to make regulations under the Pipeline Act. When such authority is conferred on a body by the legislature, that body cannot permit another to exercise its discretion. It cannot "subdelegate ". In Section 6 of the Pipeline Regulation, the Board adopts CSA standards as minimum requirements for construction and operation of pipelines. This might be construed as subdelegation and may be contrary to the enabling legislation.

3.2 Views of Encal

Part 1... ISSUED 31 MAY 1996

Encal believed that the Board could relicense the pipeline for sour service without any breach of the Board's regulations. It stated that the Board adopts the CSA standard through its regulations. It also said that the CSA standard allows for consideration of situations which are noted after construction that do not conform to the standard. In such cases, an engineering critical assessment, as provided for in the standard, must be used to determine the significance of the deviation from the standard. Encal stressed that the opening paragraphs of the standard give direction to use good engineering judgement when evaluating the system. Encal concluded that the standard is not a recipe to be followed in its entirety. It lays out minimum requirements only and does not preclude good engineering judgement. It argued that the standard does not deal with a change in service for a gas pipeline. Therefore, it is necessary to consider the intent of various paragraphs and the recognition in the standard of various techniques such as the engineering critical assessment. All of the codes that Encal is aware of have, in the preamble, or in the opening paragraphs, discussions about engineering judgement and reviews. It is not uncommon for a user of the standard to have to interpret the significance and relevance of specific sections. Encal said that change of service is a new area requiring that a judgement is made about the intent of the code, guided by the overriding concern for safety. Encal believed the Board clearly has jurisdiction to grant the relief sought.

Part 2

Dr. Ball stated that the proposal by Encal exceeds CSA standards in almost all attributes. He was satisfied that the CSA letter of interpretation was clear in confirming that the Z662-94 is silent on conversions of gas pipelines to sour service. Encal argued that the Board can define requirements for pipeline situations which are not specifically addressed in the CSA standard.

Mr. Cusano argued that standards have not been incorporated by reference. The operative language contained in Section 6 of the Pipeline Regulation does not clearly state that the CSA standards are being incorporated by reference. It is axiomatic then, that there could be no subdelegation.

3.3 Views of the Board

Part 1... ISSUED 31 MAY 1996

The Board requires the design, construction, testing, operation, maintenance, and repair of pipelines to be in accordance with the latest published edition of the appropriate CSA standard. The preface of the standard Z662-94 states that "requirements for abnormal or unusual conditions are not specifically provided for." Therefore, the standard does not address all possible situations that could arise in the lifetime of the pipeline. It also states that "although the intended primary application of this standard is stated in its Scope, it is important to note that it remains the responsibility of the users of the standard to judge its suitability for their particular purpose." The Board is satisfied that, as one of the users of the CSA standard, it can consider a specific situation and assess the suitability of the standard for that particular purpose. Clause 1.4 of the scope states that the standard is intended to establish essential requirements and minimum standards for the design, installation, and operation of oil and gas industry pipeline systems. However, it stresses that the standard is not a design handbook and the exercise of competent engineering judgement is a necessary requirement to be employed concurrently with its use. Therefore, the Board can also accept arguments based on competent engineering judgement in determining how to apply the standard. The Board believes that the standard, as adopted by the Board in the Pipeline Regulation, has sufficient flexibility to allow the Board to deal with unique situations without necessarily contradicting its regulations. The Board utilizes such flexibility carefully with due regard for safe and efficient practices in the transportation of energy resources. The Board is satisfied that within Z662-94, it can accept measures proposed by an applicant or it can prescribe other appropriate measures to be taken in converting this pipeline from sweet to sour service.

Section 23(2) of the Pipeline Act states that, on application to change the licensed substance, the Board may amend the licence subject to any terms and conditions it prescribes. That allows the Board to determine and prescribe the appropriate measures, investigations, or actions to be taken by the licensee of the pipeline before the new product can be transported. Such terms and conditions can take the form of developing appropriate requirements or accepting a program proposed by the applicant.

Therefore, the Board believes that it has the authority to decide the appropriate requirements for the change in the transported substance.

Part 2

Although Mr. O'Ferrall stopped short of directly challenging the regulation in question, the Board believes it would be helpful to comment on incorporating standards by reference.

Mr. O'Ferrall raised a number of points in argument. However, the Board believes there are a few essential elements of the issue. The following summarizes what could be an extensive legal argument, but is intended here to simply outline the basis on which the Board reached a contrary conclusion.

- First, the Board does not accept there is a jurisdictional bar to subdelegation in the Board's legislation. Even if a statute does not expressly permit subdelegation, that authority may be implied. However, that argument is not pursued since the Board has concluded that subdelegation has not occurred in this instance.*
- When a document is incorporated by reference, but the effect of the incorporation is within the control of the Board, that does not constitute subdelegation - control of how the power will be exercised is critical.*
- The CSA standards are incorporated in the Board's regulations as "minimum requirements." The Board views these requirements as guidelines rather than regulations in and of themselves. The Board uses the standards because the CSA is a technical body charged with and experienced in establishing of industrial standards. Standards are developed through a consensual approach with representatives of the pipeline industry, the National Energy Board, and provincial agencies, including the Board. This gives the Board confidence that the standards will accomplish what the legislature intended - safe practices related to pipelines. By incorporating these standards through reference, the Board avoids repeating in its own regulations standards that were developed by the CSA with the assistance of the Board.*
- There could be an argument that because Section 6(1) of the Pipeline Regulation refers to "the latest published edition of the standard .. and includes any published addendum ", that it is not fixed - such that the Board retains control over the effect - but is ambulatory - literally meaning capable of being changed or revoked so that the element of control by the Board is lost. If that were true, it could imply that the Board would be unable to make informed decisions about whether the incorporated material will be appropriate for the legislative purpose. This uncertainty could be viewed as abdication of the Board's authority. However, in the view of the Board, the incorporation of CSA standards in no way implies abdication of the Board's authority over standards for pipeline design, construction, operation, and maintenance. On the contrary, the Board's practice is to specifically review and adopt changes to CSA standards. In the present case, the Board had reviewed and adopted Z662-94, and issued Interim Directive ID 95-02, dated 18 April 1995, advising the pipeline industry and others of that adoption.*

- *The Board maintains ultimate control over what conditions will apply to pipeline permits issued in Alberta. The CSA has no role in determining whether pipeline permits will be issued or remain in force. Minimum standards are adopted from the CSA, but the right to deny approval, or set conditions associated with approvals, remains with the Board.*

Mr. O'Ferrall also touched on an associated question: namely, what steps need to be taken to ensure incorporated material (such as the CSA standards) are known. These steps are sometimes referred to as "manner and form requirements ". In Alberta, the Regulations Act excludes documents incorporated by reference from the definition of "regulation". Therefore, such documents need not conform to manner and form requirements.

In summary, the Board does not consider that the incorporation by reference is, in this case, a subdelegation of authority. The issue is resolved by the control the Board continues to exercise over the effect of the CSA standards. In addition, the Board is confident that sufficient certainty exists with respect to what the CSA standard will contain so as to overcome any concerns respecting the ambulatory reference.

The Board is satisfied that Z662-94 deals with sour service pipelines, re-use of materials, and pressure upgrading of gas pipeline systems. The reuse-of-materials section (Clause 5.7) notes that the re-qualification of existing pipeline systems, for different service without removal from their existing locations, is subject to the design and testing requirements of Z662-94. Indeed, the standard addresses the re-qualification of existing oil pipeline systems and the change of service from gas to liquid or from liquid to gas. However, the standard does not specifically address the change to sour service. This was confirmed by the response from CSA to a request from Mr. Bronaugh. The Board continues to believe that, where the CSA does not deal specifically with a particular situation, the Board has not only the right, but also the obligation to consider available information and determine an appropriate approach. Therefore, the Board reaffirms its conclusion that it has the authority to decide the appropriate requirements for the change in the substance to be transported.

4 NEED FOR RELICENSING THE PIPELINE

4.1 Views of Encal

Part 1... ISSUED 31 MAY 1996

Encal stated that the sweet gas reserves supporting this pipeline are depleting. Exploratory drilling in the area has produced significant volumes of non-associated and solution gas containing concentrations of hydrogen sulphide up to 1.8 per cent; these reserves are within a 5 kilometre corridor of the Crystal pipeline. It estimated that the remaining life of the sweet gas reserves is approximately 3 years. Encal noted that only 10 per cent of the pipeline capacity is presently being utilized.

Encal stated that it had considered alternative pipeline systems licensed to transport sour gas either to the Gulf Homeglan Rimbey or Minnehik-Buck Lake gas plants, but they were too far from the new reserves. Encal also stated that it had considered a new pipeline paralleling the existing pipeline which it estimated would cost \$3 million. Encal believed that a new pipeline would not be economic, although it had not completed a detailed evaluation. Encal stated that it believed that each of the alternatives would involve additional expense, landowner disturbance, and possible abandonment of an asset which it believed is entirely suitable for sour gas transmission. Encal believed the relicensing of the Crystal pipeline is the most practical alternative.

Encal stated that denial of the application would result in solution gas being flared rather than being conserved. It said that it would not continue its exploration in the area until there was additional development by other companies that would offer it another alternative to transport its sour product. Encal stated that it believed that the conversion represents orderly, economic, and efficient development that is in the public interest.

Part 2

Encal presented additional information on the economics of various pipeline alternatives it considered. Encal indicated that the re-licensing of the existing pipeline for sour gas service was the only alternative that met the company's economic investment criteria. The other alternatives, while they demonstrated "positive economics", would not produce a sufficient return to warrant investment by Encal's criteria.

4.2 Views of the Interveners

Part 1... ISSUED 31 MAY 1996

The Hanneman's and Mr. Wheale did not question the need to transport sour natural gas out of the area. Mr. Hanneman stated that he was opposed to having the pipeline converted to sour gas and to the construction of a new pipeline. Mr. Wheale opposed the conversion of this pipeline, but would be agreeable to the construction of a new pipeline.

Part 2

The interveners did not question additional information on the economics of various pipeline alternatives.

4.3 Views of the Board**Part 1... ISSUED 31 MAY 1996**

The Board is satisfied that a pipeline system capable of transporting sour gas will be needed in the area if the sour gas reserves are to be produced. The conservation of sour solution gas is also in the public interest. The Board believes that the use of an existing pipeline system, providing it is technically suitable and safe, is preferable to the construction of a new pipeline since it minimizes costs as well as social and environmental impacts. However, the Board believes that, before applying for a specific pipeline project, operators should consider all reasonable alternatives and clearly demonstrate why the preferred option was selected. In this case, Encal has not convinced the Board that it fully examined all reasonable alternatives nor did it provide sufficient evidence to indicate why alternative routes were rejected.

Part 2

Having regard for additional evidence provided by Encal, the Board is satisfied that all reasonable alternatives for the transportation of sour gas have been examined, and that the applied-for change in service is superior to other options from the point of view of economics.

5 SUITABILITY OF THE PIPELINE FOR SOUR GAS SERVICE**5.1 Views of Encal****Part 1...ISSUED 31 MAY 1996**

Encal stated that it believed the pipeline is suitable for sour gas service. Encal noted that it had obtained a complete set of pipe mill certificates which indicate the pipe meets sour service requirements. Encal also stated that it completed a visual inspection of all above-ground facilities including pipe, valves, flanges, and fittings. The surface facilities were examined for identification markings and the representative welds were tested to ensure the hardness requirements were met. Encal concluded that the existing surface facilities are suitable for sour service even though it could not be certain that the valves, flanges, and fittings met the CSA sour service requirements. Encal was not planning to radiograph the surface welds, but during the hearing it acknowledged that a radiograph of these welds would provide reassurance that they were satisfactory.

Encal stated that it conducted a program of material testing to ensure the pipeline materials were suitable for sour gas service. Encal cut out 6 samples of the pipeline along its 37 kilometre

length and examined each sample to determine if it met the sour service requirements. All circumferential welds on the samples were radiographically inspected. Dr. Ball noted that radiography was not an issue other than to confirm that the findings of radiographs completed on the 6 samples were consistent with the findings of the original radiographs completed during construction. Dr. Ball stated that the only reason radiography was done was to assess the weld profile, in particular the types of flaws that might be present at the weld root area, in order to ascertain the probability of the welding workmanship contributing to or promoting a corrosion failure in this pipeline. Examinations showed there were flaws and imperfections at the weld root. Therefore, Dr. Ball recommended that Encal batch inhibit the line prior to operation to minimize the potential for corrosion. Encal concluded the only concern with the pipeline may be corrosion.

Encal stated that the structural integrity of the line has been demonstrated by its continuous operation without failure since 1990, and by a recent pressure test of the pipeline. Dr. Ball completed a fracture mechanics analysis to address the concern that some of the original radiographs that were examined did not meet the CSA standard and to prove that the weld integrity is adequate for the intended purpose. He believed that the evidence shows that, while film quality was not consistently good, the film interpretation appeared to be fairly consistent and flaws that did not conform to the standard were being detected and identified for repair. Dr. Ball noted that poor radiography does not necessarily mean that the welds were also substandard. The fracture mechanics analysis showed that any flaws of potential concern would be detected by even the poorest radiographic quality, (the pipeline will meet a leak before rupture criteria), and radiographic sensitivity is not a concern. Dr. Ball stated, that on the basis of analysis, therefore, the Crystal pipeline is a structurally secure line.

Encal agreed that the CSA standard requires all welds in sour service to be radiographed, but stated that this requirement is only for new pipelines. The CSA standard is silent on converting a sweet gas pipeline to sour gas service. Dr. Ball stated that he believed radiography is used as a quality control measure to ensure the integrity of new welds. The stresses and strains the pipe and the weld undergo, while being placed into service, are much greater than those during subsequent operation. He noted that, while the CSA standard requirement is to radiograph 100 per cent of the welds, the pass/fail criteria for welds is the same for sweet or sour service. Therefore, he concluded that radiography is not intended to address corrosion concerns. Dr. Ball agreed that some companies specify more stringent pass/fail criteria on welds in sour service than sweet service. The more stringent criteria would not allow lack of fusion in the weld root area. However, he thought that these additional welding requirements are usually used because of corrosion concerns when wet sour gas is being transported. In this case, corrosion is of less concern because the gas would be dehydrated.

Part 2

Encal confirmed that the pipe conforms to the applicable requirements of the CSA Standard Z245. 1, "Steel Line Pipe ", based on the original pipe mill certificates and the results of the material testing program. Encal was satisfied that the pipe mill certificates are for the pipe that has been installed.

Encal proposed to implement a program to use an in-line magnetic flux leakage tool ("smart pig") to inspect the pipeline. This would necessitate the replacement of existing surface facilities. The new materials would meet sour gas requirements.

5.2 Views of the Interveners**Part 1... ISSUED 31 MAY 1996**

The Hannemans and Mr. Wheale submitted that the pipeline did not meet the CSA requirements for sour service pipelines because all the circumferential welds were not radiographed. Mr. Bronaugh said that CSA states that its requirements, including 100 per cent radiography of welds, are intended to apply not only to new construction, but also to existing facilities and upgrades. Mr. Bronaugh acknowledged that CSA does not specifically refer to sweet to sour conversion as upgrades. He believed that existing lines should meet the same stringent standards as new pipelines. Mr. Bronaugh did not believe an engineering critical assessment is suitable in this case, but acknowledged that the CSA standard allows engineering critical assessments in some instances. The interveners did not believe that sampling or engineering critical assessments were acceptable alternatives to 100 per cent radiography. Mr. Bronaugh stated that, although CSA pass/fail weld requirements are the same for sweet and sour service pipelines, CSA indicates that additional restriction on the internal surface imperfections may be warranted in sour service. Mr. Schmierer stated that he believed normal industry practice for building new sour gas lines does not allow flaws in the root weld. He believed that Encal should use the same criteria for a new line and the conversion of an existing sweet line to sour service.

The interveners indicated that some of the initial radiography did not meet even the minimum requirements, and that suggests good construction practices had not been used in building this pipeline. Mr. Schmierer stated that a large percentage of the existing radiographs were unsatisfactory and had not met the requirements for even a sweet gas system. Mr. Hanneman did not believe the pipeline would be safe because it does not meet the minimum standard of safety set by the CSA; not only does it not meet the sour service requirements, it does not meet the sweet service requirements.

Mr. Wheale was concerned that the pipeline was not built properly initially, but provided no documented evidence to support his belief. He believed that, when the line was originally constructed, the expected life was 6 to 10 years which might have affected the quality of materials and work. Therefore, he believed the pipeline would not be suitable for transporting H₂S. He believed that the same rules should be used for new and existing pipelines.

Part 2

Mr. O'Ferrall questioned the origins of the pipe and whether or not Encal had provided the correct pipe mill certificates.

Mr. Wheale re-stated his concern that the initial pipeline construction was not intended for the transportation of sour gas. He expressed a concern with a "tee" fitting, which may have been initially installed in the pipeline for a potential connection of another pipeline system. He was suspicious about the origins of the pipe used during construction and indications that the installed pipe may have had excessive internal corrosion.

Mr. Hanneman shared Mr. Wheale's concerns about the origins of the pipe, the excessive internal corrosion, and the construction of the pipeline. The performance of "smart pig" inspection would not alleviate their concerns about the installed pipe.

Mr. Bronaugh questioned the validity of Dr. Ball's claim that, if the pipeline failed, it would leak before it would rupture. Mr. Bronaugh suggested that Dr. Ball's analysis only shows the maximum allowable imperfection size, not whether or not the imperfection would leak before it would rupture.

5.3 Views of the Board

Part 1 ... ISSUED 31 MAY 1996

The Board is satisfied that the pipe used in the Crystal pipeline meets the to sour service requirements based on the pipe mill certificates. The Board is not convinced, however, that the existing above-ground facilities, that is the valves, flanges, and fittings, meet CSA sour service requirements. It notes that Encal was not certain these facilities meet CSA requirements. The Board is satisfied that the structural integrity of the pipeline is adequate for the applied-for maximum operating pressure. It notes that the pipeline has been operating at the maximum operating pressure and that a satisfactory pressure test to 1.4 times the licensed maximum operating pressure was recently completed. In addition, sour gas pipelines have many design and operating safety requirements unique to Alberta including: reduced operating stress to 60 per cent of the specified minimum yield strength (SMYS) for below-ground pipelines and 50 per cent of SMYS for above-ground pipeline; setback distances from the pipeline; and acceptable emergency response plans.

The Board notes that the CSA standard is silent on the requirements for sweet to sour conversion and allows for engineering critical assessments in some instances. The Board acknowledges the interveners' view that new and existing pipelines should meet the same design requirements, but believes that it would be impractical to require 100 per cent of the welds to be radiographed for below-ground pipelines that are being converted to transport a different substance. However, in this case, the evidence showed that not all radiographs completed during the construction of the pipeline met the minimum requirements of the CSA. That, in itself, means that inspection during construction of the line was deficient. More importantly, it leaves an open question, as raised by

the interveners, whether appropriate construction methods were used when the pipeline was initially installed. However, the associated uncertainties can be addressed by a thorough engineering critical assessment. The Board believes that an engineering critical assessment should consider material specifications, construction methods, pipeline conditions, and past and proposed future operation of the pipeline. The Board is satisfied that Encal has completed a detailed analysis of the pipeline material, construction methods, pipeline conditions, and past operation of the pipeline. That analysis confirms that the below-ground segments of the pipeline could be successfully converted to sour service. In particular, the Board accepts the results of the fracture mechanics analysis, which determined that the pipeline will leak before it will rupture. However, while the Board believes that the material testing program developed by Encal indicates that the pipeline is suitable for sour service, the valves, flanges, and fittings need further evaluation to determine their suitability for sour service. More importantly, the Board was not satisfied, from the evidence presented and response to questions at the hearing, that the applicant has thoroughly examined the proposed operation of the pipeline. This concern is addressed further below.

Part 2

The Board notes that all surface facilities would be replaced with sour service materials in accordance with the Pipeline Regulation. The Board also notes that Encal's material testing program and pipe mill certificates indicate that below-ground segments of the pipe are suitable for sour service. Encal believes that it has matched the mill certificates with the purchase orders and the tally sheets for the truck loads that were delivered to the pipeline construction site. The pipe mill certificates and the material testing program should relate to the installed pipe.

If the Board were to approve the Encal application, it would require Encal to submit, for Board approval, a detailed accounting of the purchased and delivered pipe along with the mill certificates which reflect the properties of the installed pipe. This would be required before starting operation in sour service. Encal would not be allowed to operate the pipeline in sour service if the Board were not satisfied with the submitted information.

Furthermore, when a segment of pipe or a weld is removed from the pipeline for any reason, Encal would be required to complete a metallurgical analysis and determine whether or not the findings are consistent with expected pipe and weld qualities. Encal would be required to maintain records of such analysis and evaluations, and notify the Board immediately of all unexpected findings.

The Board believes that "smart pig" inspection identifier anomalies such as "tee" fittings in the pipeline and produces a valuable baseline record which can be used to evaluate possible future inspections. Should the Board approve the Encal application for a change in service, it would require Encal to submit for Board approval prior to the start of operation in sour service, a summary of the "smart pig" inspection results, highlighting all anomalies, their evaluation, and proposed actions to deal with them.

The Board continues to be satisfied that a failure from a defect in the weld would leak before it would rupture, if the weld defect is oriented across the field weld. Dr. Ball's analysis shows that sufficiently large weld defects cannot be oriented across the field weld and remain completely

within the weld. The Board is not satisfied that Dr. Ball's analysis assesses conclusively whether or not a defect along a field weld would leak before it would rupture. However, the Board believes that, if corrosion were to occur in the weld defect, and if the corrosion was not detected, it would result in a leak, not a rupture. This would be mainly due to the restriction of the pipeline operating stress to 60 per cent of SMYS. Furthermore, the pipeline has operated successfully in natural gas service and was pressure tested to 1.4 times the licensed maximum operating pressure, suggesting that any existing defects in the field welds would be unlikely to rupture.

6 SAFETY OF THE PIPELINE

6.1 Views of Encal

Part 1... ISSUED 31 MAY 1996

Encal stated that it believes that the pipeline is safe to transport sour gas. Encal concluded that the only concern with the pipeline may be corrosion. It has addressed this concern by proposing to batch inhibit the pipeline, dehydrate the gas prior to entering the line, institute a continuous chemical inhibition program, and pig the pipeline when necessary. Encal acknowledged that dehydration equipment is not always reliable, therefore, free water is likely to get into the system at some time during its operation. This suggests that the operator should be prepared to pig the pipeline and have an ongoing inhibitor program to control corrosion. Encal indicated it could monitor the effectiveness of the inhibitor program with corrosion coupons, but an inhibition and monitoring program for the operation of the pipeline had not been developed. Encal stated that it would install a pig trap at the Rimbey plant to allow pigging of the south portion of the pipeline. It did not believe odour would be a concern during pigging operations, but it had not fully examined these operations.

Encal stated that the pipeline showed no evidence of internal or external corrosion. The samples showed no indication of corrosion and the pipeline has had cathodic protection since it was put into service. Encal agreed that it was possible that, between the cathodic protection stations, there may be areas not adequately protected, but saw no reason to complete an over-the-line potential survey because the external coating is very durable and there has been no change in the impressed current potential or electrical current demand in five years, which indicates that there has been no significant change in the cathodic protection requirements.

Encal stated that it did not have plans for leak detection on the pipeline. It did not propose to do additional testing or monitoring in areas where the pipeline is close to residences. Encal confirmed its intention to include the Crystal pipeline in the existing Gulf Homeglen Rimbey gas plant emergency response plan, but was unfamiliar with the details of the plan.

Part 2

Encal completed a 9-day and a 30-day corrosion test to examine the influence of incomplete fusion, incomplete penetration, and undercutting defects in the root pass on the corrosion mechanisms which could develop on the Crystal pipeline if it were operated under sour gas conditions. Test samples were actual pipe, removed from the Crystal pipeline, with simulated worst-case root pass defects. Encal acknowledged that it would have been preferable to use actual welds cut out during the material testing program. However, those samples were taken some time ago and were no longer available. Since there are no standard tests to conduct this specific evaluation, Encal developed test conditions adapted from industrial standards to produce an aggressive test media. The tests revealed no selective or concentrated forms of corrosion attack such as pitting, concentrated weld zone damage, or crevice corrosion.

Encal said that its main method to reduce corrosion would be to dehydrate the gas. It described the precautions and operating procedures it would use to ensure that the gas quality is within design parameters. In addition to requiring all gas to be dehydrated to prescribed levels, Encal would have (or require third parties delivering gas to have) three dehydrator alarms and/or shut-downs in place on systems delivering gas to the Crystal pipeline. The alarms and/or shut-downs would be:

- *high level alarm or dehydrator inlet shut-down on the integral separator,*
- *glycol no-flow alarm or dehydrator inlet shut-down, and*
- *flame failure shut-down with alarm or dehydrator inlet shut-down.*

If a call-out alarm were used instead of a dehydrator inlet shut-down, the call-out would be programmed to call the Encal answering service as well as the third-party operator. If no call-out were installed, the dehydrator would be configured to automatically shut in if the above upsets occur. Encal would periodically request a witnessed inspection on third party operated facilities to ensure the alarm and/or shut-down equipment are operating properly. Encal evaluated the possible volume and behaviour of water which could enter the pipeline under dehydrator upset conditions. Encal described the procedures to assess the impact of water entering the pipeline. If wet gas entered the pipeline for a continuous period of more than eight hours, Encal would pig the line to remove the water.

To address the possibility of wet gas entering the pipeline, Encal evaluated and provided details on various options to mitigate and monitor corrosion in the Crystal pipeline. Encal proposed to use film-forming inhibitors which would be applied before the start of operation. These would be reapplied after water removal, after 15 to 20 pigging runs, and after two years of continuous operation. Weight-loss corrosion coupons would be installed at all block valve locations. The coupons would be evaluated on a quarterly basis to assess general corrosiveness of the flow stream. Encal planned to conduct a "smart-pig" inspection of the pipeline before finalizing the corrosion control program and to obtain baseline data on the condition of the pipeline. Encal acknowledged that "smart pig" results are not reliable for the evaluation of girth weld defects. However, in Encal's view, the results would provide reliable information about pipe body

corrosion and any significant corrosion across the welds. Encal intended to complete a follow-up survey five years after the start of operation. However, the results of the corrosion monitoring would influence the timing of the next inspection.

Encal provided an outline of the issues which would be addressed in the Crystal Sour Gas Pipeline Operations Manual. This manual would cover many operational details including:

- *normal start-up, continued operation, and shut-down procedures,*
- *recording, retention, and evaluation of information,*
- *maintenance requirements for shutdown and over-pressure devices, and*
- *frequency and maintenance requirements for valves.*

The results of the "smart pig" inspection would be used together with final pipeline operating conditions to fine-tune the corrosion control program and the operations manual before the start of operation. The program and the manual would be applied, monitored, and administered by Encal. Encal would evaluate the effects of potential changes in operating conditions before the changes take place and implement appropriate modifications. Furthermore, Encal would regularly evaluate its corrosion control program and the operations manual for applicability and adjust them as necessary. Encal confirmed a common practice that any commitments or agreements made by Encal would apply to future owners of the pipeline.

Encal acknowledged that, if there was a major failure at a surface valve facility, the potential sour gas release volume could be double the volume estimated from a failure on the pipe. However, Encal stressed that this is unlikely since these facilities are built of much thicker pipe and are structurally stronger than the pipeline.

Encal would look for leaks by inspecting the surface facility after each pigging procedure, visually inspecting the pipeline right-of-way semi-annually, and conducting a flame ionization leak survey annually. Furthermore, each emergency shutdown valve and pressure switches would be operated at least once per month to ensure proper functioning. The pressure switches would be calibrated semi-annually. The results would be recorded in the pipeline operation log and be available for audit by the Board.

6.2 Views of the Interveners

Part 1... ISSUED 31 MAY 1996

Mr. Hanneman's main concern was one of safety for himself, his family, wildlife, and the environment. He believed there is only one right way to build a sour service pipeline and that this pipeline had not been built that way. Although, Encal has proposed to batch inhibit the pipeline prior to operation, to deal with the imperfections in the root weld, Mr. Hanneman believed that the pipeline would still corrode and that Encal has not presented evidence to show otherwise. Mr. Hanneman questioned how they could be assured that, if the pipeline changed ownership, the gas being transported would still be dehydrated.

Dr. Hepler, on behalf of the Hanneman's, said that corrosion will occur with or without water. He also said that Encal has not examined the rate of corrosion. He noted that inhibitors will never stop corrosion, only slow the process down, hopefully to an acceptable level. Mr. Schmierer believed that water produced in a dehydrator upset may not be removed during pigging operations and that it may actually replace the inhibitor in crevices, leading to subsequent corrosion. He stated that he did not believe that the inhibitor would reach all the crevices and eliminate any possibility of corrosion at the welds. He does not believe that Encal could properly inhibit the pipeline throughout its life. Mr. Schmierer did not believe that a corrosion coupon is representative of the corrosion occurring in the pipeline because corrosion would occur preferentially at weld areas because of the higher stresses, whereas coupons only reflect general corrosion.

Mr. Wheale did not believe that the pipeline was safe to operate in sour gas service. Mr. Wheale also questioned the number of residents that Encal reported were in close proximity to the pipeline. Mr. Wheale believed there are more than five residences within 200 m of the pipeline, in contrast to Encal's evidence that there are 5 residences within 200 m. He was concerned that Encal would be applying in the future to increase the maximum allowed H₂S concentration of the pipeline.

Mr. Wheale was concerned with the noise from the 1-4 compressor station. He was concerned that, although a noise survey has been completed, it was not completed for the worst case scenario. He stated that he has been affected by the noise of the compressor station for 6 years and still has not had a satisfactory solution from any of the previous pipeline owners.

Part 2

Dr. Plambeck and Mr. Bear stated that the corrosion tests conducted by Encal were not relevant to the evaluation of corrosion in weld crevices. Both stressed that the selected test procedures were intended to evaluate resistance to hydrogen-induced cracking and crevice corrosion of stainless alloys. Dr. Plambeck stated that one test method used is intended to measure bulk corrosion. However, he did not expect bulk corrosion to be a significant problem. He did not know of other tests which could have been used. Mr. Bear noted that crevice corrosion, pitting corrosion, or selective attack is very difficult to produce in tests, and that there are no standard tests to evaluate pitting and crevice corrosion attack. Both experts stated that there is no

question that the pipe is resistant to hydrogen-induced cracking. However, Dr. Plambeck stressed that the very high induced corrosion rates would mask all indications of any preferential corrosion. Dr. Plambeck emphasized that the crevice corrosion test is not indicative of the preferential corrosion in the pipe defects since the whole sample is immersed in the corrosive medium. He suggested that there could be wetness only in pipe weld defects, resulting in a small corrosive cell. Mr. Schmierer stated that the simulated root pass defects were significantly smaller than those shown on the radiographs of existing welds or those in the excavated welds. However, Mr. Bear noted that this would probably have very little effect on the results of the tests.

Mr. Bear noted that corrosion monitoring, dehydration of the gas, pigging any water out on dehydrator upsets, and an inhibitor program are absolutely mandatory if this pipeline were operated in sour gas service. However, he suggested that it would not be the ideal way to operate since all require very proactive actions on behalf of Encal and good diligence on behalf of all operators. He suggested that protecting the pipeline by dehydrating the gas will only work if the pipeline is kept totally dry. He had no faith that the effect of crevice corrosion in this line could be measured by corrosion coupons. He did not believe that it was possible to monitor the condition of the welds. Mr. Bear accepted that it is possible to use inhibitors under certain circumstances, but that it requires a proactive act. In his experience, some inhibitors will go into the crevice, some will not; all inhibitors have different characteristics and it should not be difficult to design a test that would provide some assurance that the inhibitor is effective. However, he suggested that the normal approach by the industry is to define defects such that a more inactive approach can be taken to the operation of the pipeline, without the need for ongoing action by operators to prevent corrosion.

Mr. Schmierer re-stated his concern with the feasibility of monitoring pit-type and crevice-type corrosion in the pipeline. He suggested that this type of corrosion would not be detectable in the analysis of the products removed during pigging. Furthermore, he noted that corrosion monitoring is proposed at the top of the pipe and at the top of the hill, whereas most failures occur in low areas where there is a build-up of liquids or dirt. Mr. Schmierer suggested that the heat-affected zone of a longitudinal pipe weld or a circumferential weld are prime suspects for preferential and isolated pit corrosion. He stressed that the area of concern is not the body of the pipe, but pitting in the circumferential weld or its heat-affected zone, where information from "smart pig" inspections is obliterated or cannot be guaranteed.

The interveners did not comment on Encal's proposed methods for detecting leaks on the Crystal pipeline.

6.3 Views of the Board

Part 1... ISSUED 31 MAY 1996

The Board is concerned that Encal has not fully examined the operation of the pipeline, an aspect which would play a major role in its safety. For example, Encal had not finalized the need for a pig trap at the Rimbey plant prior to the hearing. Yet, a major aspect of the safe operation of the pipeline is to pig the water out of the line in the event of a dehydrator upset. The Board believes that Encal should have developed corrosion control and monitoring programs in more detail. The Board agrees with the interveners that corrosion coupons do not specifically show the corrosion at the weld areas. Corrosion rates in the weld area may be different than corrosion in the pipe because of imperfections in the root pass of the weld.

The Board is satisfied the samples taken indicate that the external coating of the pipe is in good condition. The Board notes that Encal does not propose any leak detection or extra monitoring of the pipeline in general or near residences. Depending on the other aspects of the operation of the pipeline, this may be acceptable. However, the Board is not satisfied that Encal has prepared an effective corrosion control and monitoring program. In general, the Board believes it may be possible to operate this pipeline safely, but Encal has not provided sufficient evidence to convince the Board that it has thoroughly evaluated the operation and maintenance of the pipeline and has measures in place to ensure safe operation of the line.

With respect to Mr. Wheale's concerns regarding noise from the compressor station, the Board intends to follow up on that matter through its field surveillance group.

Part 2

The Board continues to believe that the method of operation plays a major role in safety of the pipeline and considers that the main factors for successful operation are:

- *a clear understanding of the unique operating aspects of the pipeline,*
- *documented operating procedures,*
- *compliance with the operating procedures,*
- *evaluation of the performance of the operating procedures, and*
- *adjustments to the operating procedures as necessary.*

In this context, operating procedures include the corrosion mitigation and monitoring program, and procedures documented in Encal's Pipeline Operations Manual (Pipeline Operations Manual).

The Board is satisfied that Encal has fully examined the operation of the Crystal pipeline in sour service and this knowledge will allow the company to develop appropriate procedures for the safe operation of this facility. The Board is also satisfied that Encal has done careful tests to

understand the behaviour of the Crystal pipeline under various operating conditions, and to consider the anomalies present in the pipeline. Even though there are no standard laboratory tests to simulate and evaluate the exact conditions expected on the Crystal pipeline, the Board is confident that the completed tests provide data which can be used - in conjunction with other information - to better understand the mechanisms of corrosion, and establish operational plans.

The Board notes that Encal and the interveners agree that reliable gas dehydration is very important to control corrosion inside the pipeline. Encal's plan to dehydrate the gas would apply to its gas and to all gas transported for other producers. The Board believes that minimizing the occurrences of "wet" gas entering the pipeline and learning from such occurrences is important. Therefore, should the Board approve Encal's application, the Board would require Encal to keep records of all incidents in which "wet" gas entered the pipeline and of the actions taken to address the situation. This information would be subject to future Board review.

The Board believes that to operate the Crystal pipeline reliably, Encal would have to implement successful gas dehydration along with complementary corrosion mitigation and monitoring. Encal has completed a thorough evaluation of expected operating conditions and presented an outline of the corrosion mitigation and monitoring program, and of the Pipeline Operations Manual. The Board concurs that the details of the program and the manual cannot be finalized until Encal knows the exact conditions it will face and has completed the "smart pig" inspection. However, Encal has placed great importance on the procedures it would follow to ensure successful operation of the pipeline. Therefore, should the Board approve the Encal application, the Board would require Encal to submit to the Board for approval the following evaluations, completed by an independent professional expert, suitable to the Board:

- prior to the start of operation in sour service, an evaluation of the finalized corrosion mitigation and monitoring program and the procedures in the Pipeline Operations Manual. The Board would require the evaluation to include recommendations for improvement, as appropriate, and for future evaluations of the effectiveness of the program and procedures in the manual, and*
- evaluations of the effectiveness of the corrosion mitigation and monitoring program and of the procedures in the Pipeline Operations Manual, along with all assessment of compliance with the program and the manual. The Board would consider specifying the frequency of such evaluations.*

The Board believes that it is important that all of its requirements for the operation of the Crystal pipeline apply to present owners as well as future owners of the pipeline. Therefore, the Board would attach appropriate conditions to the approval to ensure that the same requirements apply to all owners of the Crystal pipeline.

With proper operation of the Crystal pipeline, the Board does not expect that a failure would occur. However, in the unlikely event of a pipeline failure, the existing Pipeline Act and Regulation require that the operator must immediately inform the Board of the location and

other details as requested. If a failure were to occur on the Crystal pipeline, the Board would carefully review the integrity of the pipeline. The Board could require Encal to have an independent expert review the cause of the failure to assist in deliberations to determine whether or not the pipeline should resume operation.

7 RISK CONSIDERATIONS AND PUBLIC CONSULTATION

7.1 Views of Encal

Part 1... ISSUED 31 MAY 1996

Encal estimated the levels of consequence and risk that would be associated with the operation of the Crystal pipeline in sour gas service. Encal used consequence estimates to describe the effects to individuals who might be exposed to an accidental release of sour gas. Risk estimates were used to put this consequence into perspective by including an additional consideration of "how frequently accidents might be expected to occur."

Encal used "serious irreversible adverse health effects" to characterize the consequence associated with accidental failures. This level of consequence was estimated for a full rupture of the pipeline when the escaping plume is not ignited and for individuals located out-of-doors directly downwind of the release. Consequences were evaluated using the GASCON2 model over a range of meteorological conditions found in Alberta. The results of Encal's analysis showed that the level of consequence decreased sharply with distance from the pipeline. Under the worst case presented, serious irreversible adverse health effects could occur to individuals located less than 150 m from a pipeline rupture.

Encal prepared risk estimates on the basis of the consequence noted above and using the historical average rupture frequency for sour gas pipelines in Alberta. In Encal's view, the use of the average rupture frequency provided a conservative estimate of the risk as it included all reported failures covering a wide range of sour gas pipelines and pipeline operations. In its view, the relicensing and subsequent operation of the Crystal pipeline for sour gas service will meet or exceed current Board requirements. Encal calculated the maximum individual risk of a serious irreversible adverse health effect to be less than 10 chances in a million per year at the edge of the right of way when evaluated on the basis of a full rupture of the pipeline. Encal noted that there currently are residences located within 150 m of the pipeline. It estimated the risk at the closest residence (the Bunting residence, some 40 m from the pipeline) to be less than one chance in ten million per year. Encal considered this level of individual risk to be well within commonly accepted bounds, based on guidelines developed by the Major Industrial Accident Council of Canada and applied elsewhere in Canada.

Encal believed that it had done its best to keep local landowners and residents fully informed of its intentions and the safety risks involved.

Part 2

Encal retained EMPLAN Emergency Planners Ltd., to prepare a site-specific emergency response plan (ERP) for the Crystal pipeline in cooperation with other area operators. Encal determined the emergency planning zone to be 850 metres (m) for the longest pipeline segment, however, it conducted personal visits with all permanent residents within 1 kilometre of the pipeline. In some cases, individual resident notifications extended to 1.5 kilometres based on road access to the residence in relation to the defined emergency planning zone. During these visits, Encal's representative advised residents of the current status of Encal's application and reviewed the content of a resident information package. Encal provided more detailed information to those who requested it and offered to meet again to discuss that information. Encal believed that effective public involvement and communication has taken place and is committed to ongoing public communication for the life of the project.

Encal provided additional information on the emergency shut-down (ESD) valves that would be installed in the Crystal pipeline. The ESD valves would be activated in situations that would result from a failure or a large leak, when pipeline pressure falls below a minimum pressure setting. The type of ESD valves that would be used are devices designed to "fail closed", meaning they require effort to remain open. If the pipeline fails, the valves would close. These valves are mechanical and do not require an external power supply to be activated. Encal proposed to check the operation of these devices on a regular basis.

Encal indicated that the sour gas mixture to be transported in the Crystal pipeline would be lighter than air. If this gas mixture were to escape from the pipeline, it would rise and be dispersed. The H₂S component does not separate from the mixture and is dispersed along with the mixture, i. e., the H₂S would not accumulate in low-lying areas. Encal's environmental and public safety expert provided information that the major factor determining the extent of harm associated with a release of sour gas from this pipeline would be the way the gas escapes from the pipeline. Prevailing weather conditions would have little effect. The expert noted that sheltering in one's home provides significant benefits to residents during a release. Sheltering reduces peak concentrations and decreases the concentrations of H₂S that people would be exposed to if not sheltered. According to Encal's expert, in the case of this pipeline and the nature of the gas, sheltering is a preferred alternative to evacuation.

Encal considered the re-location of surface facilities which are near Mr. Hughes' and Mr. Bunting's residences and concluded that, from a safety standpoint, it would not be necessary to relocate these facilities. Notwithstanding, Encal looked at the feasibility of relocating the facilities, but the costs were prohibitive.

7.2 View of the Interveners

Part 1... ISSUED 31 MAY 1996

The interveners believed that the Crystal pipeline cannot safely be used for sour gas service. In their view, the integrity of the pipeline would be threatened if operated as a sour gas pipeline. They felt that the conversion would result in failures and would increase the risk. In their view, when a risk is imposed, it must be acceptable to those affected by the risk. In this case they believe the risk is unacceptable.

The interveners expressed opinions on Encal's desire to keep the residents informed of its intentions and of the risk associated with the relicensing of the pipeline. Mr. Hanneman believed that Encal's notification and consent process was not very straightforward and was one of deceiving landowners. Mr. Wheale indicated that he had not experienced the same circumstances. In his view, Encal had done its best to answer his questions. He noted however, that the onus had been on himself to ask the right questions. In the opinion of both interveners, however, contacts made by Encal were primarily for the purpose of fulfilling the Board requirements and were not directed at keeping the residents informed of Encal's intentions or of the risks involved. Mr. Wheale noted that only residents affected by pipeline crossing agreements had been contacted, and that other residents (within 200 m of the pipeline), who would also be affected by the risk had not been contacted.

Part 2

Mrs. Stevenson's residence is within 850 m of the pipeline. She was concerned about her safety and stressed that she was uncertain what Encal's operating policies and procedures would be to ensure that the pipeline would not be a threat to her safety. Furthermore, she was not confident that these policies and procedures would be followed in the future by Encal or by possible new owners. Similarly, Mr. Wheale suggested that Encal's operating policies and procedures should not be relied on too heavily to ensure that the pipeline would be safe. He did not believe that there had been sufficient evidence to guarantee that the inhibition and dehydration program would work.

Mr. Mosier's residence is within 850 m of the pipeline. His main concern was his safety and that of his family. Mr. Mosier questioned the effectiveness of staying indoors if there is a gas release from the pipeline. He also questioned the feasibility of an evacuation route which crosses the pipeline.

Mr. Hughes expressed a concern about a recent gas release at a surface facility about 60 m northwest from his residence. While he was not successful in contacting the operator to notify him of the leak, it was repaired the same day. Mr. Hughes said that he raises purebred horses. He suggested that his residence and his daily activities are too close to the pipeline and the surface facility. He stressed that, he was assured that it would never transport sour gas when he consented to the original sweet gas pipeline. Mr. Hughes stated that winds frequently come from the north and northwest. He was concerned that, the gas would be blown in the direction

of his yard and residence if there was a failure at the surface facility. His fears were not reduced by Encal's proposal to replace the surface facility.

Mr. Granger owns two quarter sections of land about 800 m south of the Crystal pipeline and closer than 800 m west of the pipeline. He resides in Edmonton, but has a rustic cabin on the south end of the south quarter section and about 1200 m west of the pipeline. His property is used for weekends, holidays, and throughout the year for various activities, including activities of Boy Scouts, who often visit the property. He was concerned that he was not notified of the pipeline conversion. He expressed several concerns about the health and safety of his children and the Scouting youth, and that he was not consulted about the evacuation plan for his property. Mr. Granger suggested that rescue personnel would not be aware that people were on his property and that Encal would be unable to contact them and in the case of an emergency.

Mr. Whitecotton is an elk and cattle rancher. The pipeline is approximately 500 m from his building site and runs completely through two quarter sections of land he owns. Safety of his family was his primary concern. He needed absolute assurance that they would not be at risk. He suggested that the Encal pipeline was not properly constructed and that he would not have the same concerns if it followed good practices. He would not have bought the land if he has seen an H₂S sign anywhere on that land. He was opposed to having a surface facility beside his driveway which would cut off his escape route from the property.

Mr. Whitecotton questioned why actual welds, cut out from the pipeline during the material testing program, were not used for the corrosion tests instead of using simulated weld defects. He suggested that actual pipe welds should have been used

Mr. Reid is a landowner whose property is within about 800 m of the pipeline. He said that he is a journeyman welder and that he reviewed some of the weld information provided. He believed that the welds were unacceptable. There is no permanent residence on his property, however, there are two cabins, one of which is winterized. Mr. Reid uses the property for recreational purposes and is out-of-doors much of the time. He was concerned with the integrity of the pipeline and the safety of himself and his family. Mr. Reid indicated that there is limited access to his property which is covered with bush. He believed that it would be difficult for responders to locate him in a timely fashion in the case of an emergency.

Mrs. Ollenberger's residence is about 800 m from the pipeline. She did not support the application and was concerned about the risk associated with the pipeline.

Ms. Becker stated that Ms. Schiefen's residence is about 300 m from the pipeline and that Ms. Schiefen will object to the proposed conversion unless it is safe.

Mr. Wheale expressed additional concerns about the possibility of adverse health effects, including fatalities, resulting from a sour gas release. He believed that the prevailing winds used in the risk study were not representative of the winds at his location. He was concerned that the properties of the gas that would ultimately be transported in the pipeline would be different than those represented in the risk study. Mr. Wheale was not assured that sour gas from a leak or failure would not settle into low-lying areas and become a hazard. He indicated

that he had negotiated the original agreement on the basis of a sweet gas pipeline, not on the basis of a sour gas pipeline.

7.3 Views of the Board

Part 1... ISSUED 31 MAY 1996

The Board has considered Encal's assessment of the potential consequences and risk, and accepts the results presented. The Board believes that, Encal has correctly assessed the potential consequence and risk for this Level 1 pipeline facility. The Board also believes that the existing integrity of the pipeline could be maintained under sour gas operations provided that Encal undertakes an effective corrosion mitigation program.

The Board notes Encal's acknowledgement that there is some potential for serious irreversible adverse health effects to individuals closer than 150 m from the pipeline. However, it notes that the severity of the effects, if the worst case conditions should happen, decreases sharply with distance from the pipeline and the associated probability that the worst case would occur, is extremely small. The outcome would be realized only during a full failure of the pipeline, by individuals located and remaining out-of-doors, during periods of poor atmospheric dispersion, for specific wind directions and when the dispersing gas plume is not ignited.

Although the Board recognizes that serious consequences could occur to individuals in the vicinity of the pipeline, it also recognizes that the level of risk is within the bounds of similar risks found by society to be acceptable for similar activities and land uses within Alberta and across Canada.

The Board notes that legislation in Alberta requires that people in the vicinity of a proposed development, who may be directly or adversely affected by energy development, must be given the opportunity to learn about the proposed development and its potential impacts. This includes providing residents with information about the nature of the hazard and actions, such as indoor sheltering, that can provide additional protection during the unlikely event that a pipeline failure does occur. Where a site-specific response plan is required prior to the start up of a facility, the Board expects that the public within the emergency planning zone will be notified prior to the application being made to the Board.

Part 2

The Board recognizes that changes in risk, either through new pipelines or land development, are growing in importance as the density of facilities in Alberta increases. In the Board's view, there is an inherent responsibility on the part of the developer to consider the risk and to ensure that public safety is appropriately addressed when there is all increased level of risk associated with a development.

All pipeline facilities, including sweet gas pipelines, have risks associated with their operation. These risks are generally well understood and accepted by industry, regulators, and the public. While the Board agrees that there would be an increase in the level of risk associated with the conversion and operation of the Crystal pipeline to a Level 1 sour gas facility, the incremental change in risk is small. The Board does not consider Level I pipelines to be high-risk facilities. According to Interim Directive ID 81-3, "Minimum Distance Requirements Separating New Sour Gas Facilities from Residential and Other Developments ", in order for a pipeline to qualify as a Level I facility, the maximum theoretical release of gas from a segment between two ESD valves must be less than 300 m³. The Crystal pipeline's maximum release is 285 m³. For a Level I pipeline, there are no required separation distances from permanent residences, other than the easement or the right-of-way. For Level 2 pipelines the maximum H₂S release volume under similar conditions is 2000 m³, with an associated 100-metre separation distance from permanent residences. For Level 3 pipelines the volume is 6000 m³, with a 100-metre separation distance. The volume is more than 6000 m³ for Level 4 pipelines.

In the case of this specific facility, transporting a gas containing low levels of H₂S with favourable dispersion characteristics, the Board believes that it is important to consider the way in which gas could be released from the pipeline, its dispersion into the atmosphere, and its effects on people who are exposed. The Board agrees with analysis provided by Encal that leaks would occur at slow release rates over long periods of time and would not result in direct, adverse effects to the public. Leaks would be found through odour complaints or through routine inspections. The Board also agrees that a rupture of the pipeline would result in a faster release rate over a relatively short time period (15 to 30 minutes). In the unlikely event of a rupture, people could suffer serious, irreversible effects only if located out-of-doors, directly downwind of the release, within close proximity of the pipeline, and if they take no action to protect themselves. The Board believes that in the case of either a leak or a rupture, taking shelter inside of one's home would substantially reduce the risk.

Estimates of risk provide guidance on the level of concern that should reasonably be associated with a hazard as well as providing a relative basis for comparing this proposal to other development alternatives. Safety is related to the acceptability of risk. This includes the acceptability of the frequency of failures, as well as associated consequences. Safety focuses on ensuring that specific activities, actions, monitoring, equipment, and training to minimize hazard (i.e., prevention, reduction, mitigation, and preparedness) have been considered and are being addressed.

Ensuring safety requires that the company and the public adjacent to the facility understand the nature of the risks and safety measures designed to mitigate risks. The company and the public must work together to ensure safety measures are effective.

In the case of the Crystal pipeline, the Board believes that the risk associated with the change of substance carried in the pipeline would be low and that the pipeline would be safe. The Board believes that Encal understands the risk and has taken appropriate measures to address and to communicate the level of risk and the provisions for safety. Nonetheless, the Board recognizes that an effective ERP must address specific details associated with public safety at specific locations along the pipeline route. The Board also recognizes that interveners have not accepted

the risk. However, the Board believes that Encal and the interveners can and should work together to develop a plan to effectively address all safety issues along the Crystal pipeline. With some effort by all parties, effective arrangements can be made to ensure everyone is prepared for any emergency. Prior to the start of operation - as for all sour gas pipelines - Encal would be required to submit to the Board its ERP. The Board would then verify that appropriate arrangements are in place.

The Board is satisfied that Encal notified all residents within the emergency response planning zone about the project and its potential impacts.

The Board has considered the location of the ESD valves and the concern of some residents about the perceived risks of sour gas being transported through the pipeline. The residents near existing surface facilities had little opportunity to influence the placing of the valves. Therefore, should the Board approve the Encal application for a change in service, it will require Encal to determine ESD valve locations on or near Mr. Hughes' and Mr. Whitecotton's properties in conjunction with them. If agreement on locations is not achieved, Encal could apply to the Board to resolve the issue.

8 SUMMARY AND CONCLUSIONS

The Encal application to change service in the Crystal pipeline from sweet to slightly sour gas has been challenging for all concerned. One reason is the fact that CSA standards do not deal specifically with a change in service from sweet to sour gas service. As a result, parties do not have clear written guidelines to direct their review of the application. From a general point of view, this situation is not unique. Because it is not possible to lay out every contingency in the technical arena of oil and gas development, an interpretive authority to adjudicate issues and settle disputes is needed. That is one of the reasons for the existence of the Board. With respect to this application, Z662-94 does not specifically address the proposed change to sour service. The Board remains convinced that it has the authority and the obligation to determine the appropriate approach in such situations.

The Board must make a broad assessment of the public interest in determining whether or not a change to sour service would be acceptable. This assessment considers the interests not only of the applicant and the interveners in a specific case, but also the interests of the public at large, who own the resources to be developed through the provincial government. If the Board is satisfied that a change to sour service is acceptable, the Board must determine whether or not conditions should be attached to an approval to achieve related objectives such as safety of residents near the pipeline.

In the case at hand, the Board must weigh economic, environmental, and safety interests of the applicants, other resource owners, including the public, and residents near the pipeline. The safety of residents near the pipeline is of paramount importance. The Board may achieve a desired level of safety in specific situations by imposing conditions on any approval.

The question of risk is complicated by the fact that the pipeline has been in sweet service and was not initially certified for sour service. The interveners asserted that initial radiography was deficient and raised questions as to whether the pipe in the ground is the same pipe for which mill certificates were provided. These are relevant issues that were extensively debated during the proceedings. Although the Board acknowledges the deficiencies in the initial radiography, it cannot accept this shortcoming as a reason, on its own, to deny the application. There are other means to determine the suitability of the line for sour service. As well, the Board places less emphasis on radiography for determining the suitability of the line for sour service than do the interveners because radiography is intended to ensure the quality of the welds during initial construction. To some extent, that quality has been tested in action for the Crystal pipeline through its installation and successful, regular operation over past years. Moreover, if the conversion were approved, the operating program would be enhanced to ensure that future corrosion in the vicinity of welds is controlled. The suitability of the pipe for sour service is important. The question was not fully resolved at the hearing because mill certificates did not cover the full length of the pipeline. That issue would have to be resolved before the pipeline could be operated for sour service.

Assuming the certificates confirm that the pipe in the ground is suitable for sour service, the Board is satisfied that the likelihood of a pipeline rupture would be low. This is important to safety because a leak would not pose a threat of serious adverse or irreversible effects. While a rupture is possible, it is unlikely. If it did happen, it would have to be accompanied by very specific circumstances to hold a threat of irreversible consequences. With proper operating safeguards, supplemented by the education of people in the vicinity on how to react in the event of an emergency, acceptable levels of safety are readily achievable.

The ERP should include procedures to protect transients in the neighbourhood of the pipeline, such as Boy Scout troops and others. There are many regions of the province where protection of transients is required. Because the concentration of H₂S to be carried is relatively small, the overall risk associated with a possible rupture of this pipeline is extremely small and is within norms found acceptable for industrial facilities within Alberta and across Canada.

The hearing was useful in identifying and highlighting the imperatives of successful operation of the Crystal pipeline in the presence of sour gas. Although the Board was concerned that Encal's initial presentation of operational issues was somewhat incomplete, the plans discussed during Part 2 of the hearing demonstrated that Encal had addressed the matter thoroughly. However, the Board recognizes that the details of corrosion mitigation programs, subsequent monitoring, and general operations cannot be finalized until Encal knows the exact conditions it will face and has completed the "smart pig" inspection. Therefore, because the manner in which the pipeline is operated is critical, any approval would be encumbered by extensive conditions designed to ensure that Encal, and any subsequent licensees or operators of the Crystal pipeline, maintain operational integrity.

In summary, the following factors were relied on by the Board in reaching its decision:

- *A means of transporting sour gas reserves in the region is necessary to enable full development of those reserves and the realization of significant value to the province.*
- *The alternative of flaring solution gas is less attractive, both economically and environmentally, than gathering and processing it at the Gulf facility.*
- *The alternatives to converting the Crystal pipeline are less attractive economically and would have a significantly greater impact on the environment than converting the Crystal pipeline.*
- *The sour gas content is relatively small; the line would operate under the Board's lowest level for sour gas pipelines, Level 1. For a new pipeline, a Level I designation means there would be no requirement for minimum separation distance from permanent residences beyond the pipeline right of way.*
- *Although the radiography associated with the initial installation of the line did not meet the standards required of sour gas lines, the pipeline's structural integrity has been demonstrated through years of operation. To transport sour gas, the line would operate at stipulated lower pressure, further reducing the possibility of rupture.*
- *A pipeline rupture is unlikely, an important consideration with respect to safety. Furthermore, a rupture would have to be accompanied by very specific circumstances to hold a threat of serious irreversible effects.*
- *Encal voluntarily chose to replace all surface facilities with materials that meet sour service requirements. This is significant because the possibility of adverse effects, are significantly higher for the surface facilities than for the underground portion of the pipeline in the unlikely event of a failure.*
- *Proper operational procedures are crucial for the safe operation of the pipeline. Encal has shown recognition of that fact. The Board would impose conditions on the approval to ensure such procedures are developed and followed.*
- *With changes to surface facilities and the assurance of proper operating procedures, the incremental risk associated with operating the Crystal pipeline as a Level I sour gas line would be well within norms of acceptability commonly applied in Alberta and Canada.*
- *The ERP would provide a vehicle through which residents may become informed of the proper response to any upset conditions, thereby enhancing safety.*

9 DECISION

The following was the decision by the Board at the conclusion of the first part of the hearing in February 1996.

Part 1... ISSUED 31 MAY 1996

The Board is not prepared to approve Application No. 951161 by Encal based on the information contained in the application and evidence presented at the hearing. The Board requires the following additional information to be submitted to itself and the interveners:

- description of pipeline alternatives and reasons for rejection of the alternatives,
- documentation indicating whether the above-ground facilities meet the CSA requirements and its proposed treatment of any deficiencies,
- description of the proposed operation and maintenance of the pipeline, including corrosion mitigation and monitoring program,
- confirmation that all residents within the emergency response planning zone have been notified about the project and its potential impacts, and
- a diagram showing the location of above-ground facilities and all existing residences within 150 m of the pipeline.

The information should be submitted as soon as possible. If it is not submitted by 1 September 1996, and if Encal cannot provide good reasons to extend the date, the application will be denied without prejudice.

The Board will provide the interveners with an opportunity to comment on any additional information submitted and may reopen the hearing to consider the above submissions.

Part 2

The following is the final decision. Having regard for the evidence and the views expressed, the Board is satisfied that the Encal application meets all the Board's regulatory requirements, and that it is in the public interest. Accordingly, the Board is prepared to approve the application subject to the following conditions:

1. *All applications to the Board for changes to the approval must be identified as non-routine.*
2. *All conditions, as set out here, are a part of the approval and apply to the pipeline in perpetuity, are transferable to future owners of this facility, and must be communicated to the potential purchasers of this facility by the licensee.*
3. *Encal must submit for Board approval, prior to the start of operation in sour service, a detailed accounting of the purchased and delivered pipe along with mill certificates which reflect the properties of the installed pipe.*
4. *When a segment of pipe or a weld is removed from the pipeline for any reason, Encal must complete a metallurgical analysis and determine whether or not the findings are consistent with expected pipe and weld qualities. Encal must maintain records of such analysis and evaluations and notify the Board immediately of all unexpected findings.*
5. *Encal must submit for Board approval, prior to the start of operation in sour service, a summary of the "smart pig" inspection results, highlighting all anomalies, their evaluation, and the proposed actions to deal with them.*
6. *Encal must keep records of all incidents where "wet" gas entered the pipeline and of the actions taken to address the situation. This information would be subject to future Board review.*
7. *Encal must:*
 - o *submit to the Board for approval, prior to the start of operation in sour service, an evaluation of the finalized corrosion mitigation and monitoring program and the procedures in the Pipeline Operations Manual. The Board would require the evaluation to include recommendations for improvement, as appropriate, and for future evaluations of the effectiveness of the program and of the procedures in the manual. The evaluations must be completed by an independent, professional expert, acceptable to the Board,*
 - o *submit to the Board for approval evaluations of the effectiveness of the corrosion mitigation and monitoring program and of the procedures, in the Pipeline Operations Manual, along with an assessment of compliance with the program and the manual. The evaluations must be completed by an independent, professional expert, acceptable to the Board within 12 to 15 months of the start of operation in sour service. The Board will use the results to determine the need for further evaluations.*
8. *Encal must determine ESD valve locations on or near Mr. Hughes' and Mr. Whitecotton's properties in conjunction with Mr. Hughes and Mr. Whitecotton. Encal must inform the*

Board of all ESD valve locations prior to the start of operation in sour service, or in the event agreement is not reached with any resident, apply to the Board for resolution.

DATED at Calgary, Alberta, on 14 April 1997.

ALBERTA ENERGY AND UTILITIES BOARD

[Original signed by]

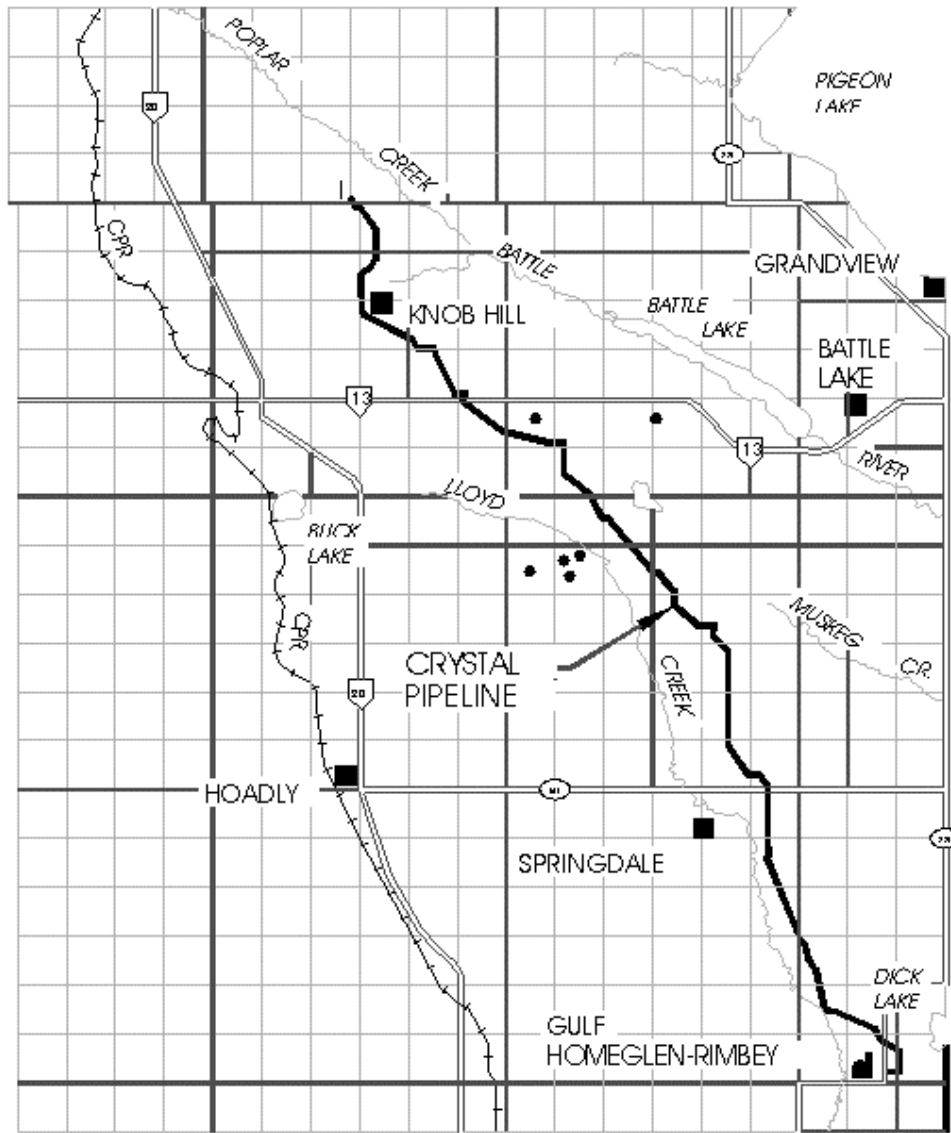
J. P. Prince, Ph.D.
Board Member

[Original signed by]

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

[Original signed by]

H. O. Lillo, P.Eng.
Acting Board Member



LEGEND

- Sour gas wells in the crystal area
- Gas plant
- | Compressor station

RIMBEY AREA

Application No. 951161

ENCAL ENERGY LIMITED

ALBERTA ENERGY AND UTILITIES BOARD

Calgary Alberta

ENCAL ENERGY LIMITED APPLICATION TO RE-LICENSE PIPELINE TO TRANSPORT SOUR GAS IN THE RIMBEY AREA

**Decision 96-1
Applications No. 951161**

1.1 Application and Hearing

Encal Energy Limited (Encal) applied to the Alberta Energy and Utilities Board (Board), pursuant to Part 4 of the Pipeline Act, for approval to change the substance authorized to be carried, from sweet natural gas to sour natural gas, for 37 kilometres of existing 168.3-millimetre outside diameter pipeline. The pipeline (referred to by Encal as the Crystal pipeline) would transport sour natural gas containing up to 18 moles of hydrogen sulphide (H₂S) per kilomole of natural gas (1.8 per cent H₂S) from an existing compressor station located in Legal Subdivision 1, Section 4, Township 47, Range 3, West of the 5th Meridian to the existing Gulf Homeglen Rimbey gas plant located in LSD 4-5-44-1 W5M (see attached figure). The pipeline would have potential maximum H₂S release of 285 cubic metres (m³) and would be a Level I facility according to Interim Directive ID 81-3, "Minimum Distance Requirements Separating New Sour Gas Facilities from Residential and Other Developments."

The application was opposed by P. and N. Hanneman, who own the W1/2 33-45-2 W5M and T. Wheale who owns the NW1/4 22-46-3 W5M.

The application and interventions were considered by Board Members J. P. Prince, Ph.D., J. D. Dilay, P.Eng., and Acting Board Member H.O. Lillo, P.Eng. at a public hearing on 7 and 8 February 1996 in Edmonton, Alberta.

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

Encal Energy Limited (Encal)

D. C. Linder

P. and N. Hanneman

M. Bronaugh

T. Wheale

Alberta Energy and Utilities Board staff

A. L. Larson, P.Eng.

T. J. Pesta, P.Eng.

I. P. Dowsett

T. Barrows, P.Eng.

B Forster, P. Eng.

B. Vermeulen

D. Webster, P. Eng. Of Corrpro Canada
Inc.

B. Ball, Ph.D., P.Eng of Ball Associates
Engineering Ltd.

M. Zelensky, P.Eng. of Bovar
Environmental

P. Hanneman

L. G. Hepler, Ph.D..

B. Schmierer, C.E.T. of Brian Schmierer
NDT Consulting Ltd.

M. Bronaugh

T. Wheale

2 ISSUES

The Board considers the issues to be:

- application of the Pipeline Act and Regulations,
- the need for relicensing the pipeline,
- suitability of the pipeline for sour gas service,
- safety of the pipeline, and
- risk considerations and public consultation.

3 APPLICATION OF THE PIPELINE ACT AND REGULATIONS

3.1 Views of the Interveners

Mr. Bronaugh, on behalf of the Hannemans, argued that it would be impossible for the Board to approve Encal's application without breaching its own regulations. Mr. Bronaugh stated that the regulations clearly require the Canadian Standards Association (CSA) standard CSA Z662-94, Oil and Gas Pipeline Systems (Z662-94), as the minimum standard for construction and operation of pipelines. He further stated that, because the CSA standard applies to upgrading of existing installations, it applies to the change of pipeline operation from sweet to sour service. Mr. Bronaugh stated that the CSA requirements should be applied to new and existing pipelines alike. He said that this application does not fit within any of the areas for which CSA allows engineering critical assessment.

3.2 Views of Encal

Encal believed that the Board could relicense the pipeline for sour service without any breach of the Board's regulations. It stated that the Board adopts the CSA standard through its regulations. It also said that the CSA standard allows for consideration of situations which are noted after construction that do not conform to the standard. In such cases, an engineering critical assessment, as provided for in the standard, must be used to determine the significance of the deviation from the standard. Encal stressed that the opening paragraphs of the standard give direction to use good engineering judgement when evaluating the system. Encal concluded that the standard is not a recipe to be followed in its entirety. It lays out minimum requirements only and does not preclude good engineering judgement. It argued that the standard does not deal with a change in service for a gas pipeline. Therefore, it is necessary to consider the intent of various paragraphs and the recognition in the standard of various techniques such as the engineering critical assessment. All of the codes that Encal is aware of have, in the preamble, or in the opening paragraphs, discussions about engineering judgement and reviews. It is not uncommon for a user of the standard to have to interpret the significance and relevance of specific sections. Encal said that change of service is a new area requiring that a judgement is made about the intent of the code, guided by the overriding concern for safety. Encal believed the Board clearly has jurisdiction to grant the relief sought.

3.3 Views of the Board

The Board requires the design, construction, testing, operation, maintenance, and repair of pipelines to be in accordance with the latest published edition of the appropriate CSA standard. The preface of the standard Z662-94 states that "requirements for abnormal or unusual conditions are not specifically provided for." Therefore, the standard does not address all possible situations that could arise in the lifetime of the pipeline. It also states that "although the intended primary application of this standard is stated in its Scope, it is important to note that it remains the responsibility of the users of the standard to judge its suitability for their particular purpose." The Board is satisfied that, as one of the users of the CSA standard, it can consider a specific situation and assess the suitability of the standard for that particular purpose. Clause 1.4 of the scope states that the standard is intended to establish essential requirements and minimum

standards for the design, installation, and operation of oil and gas industry pipeline systems. However, it stresses that the standard is not a design handbook and the exercise of competent engineering judgement is a necessary requirement to be employed concurrently with its use. Therefore, the Board can also accept arguments based on competent engineering judgement in determining how to apply the standard. The Board believes that the standard, as adopted by the Board in the Pipeline Regulation, has sufficient flexibility to allow the Board to deal with unique situations without necessarily contradicting its regulations. The Board utilizes such flexibility carefully with due regard for safe and efficient practices in the transportation of energy resources. The Board is satisfied that within Z662-94, it can accept measures proposed by an applicant or it can prescribe other appropriate measures to be taken in converting this pipeline from sweet to sour service.

Section 23(2) of the Pipeline Act states that, on application to change the licensed substance, the Board may amend the licence subject to any terms and conditions it prescribes. That allows the Board to determine and prescribe the appropriate measures, investigations, or actions to be taken by the licensee of the pipeline before the new product can be transported. Such terms and conditions can take the form of developing appropriate requirements or accepting a program proposed by the applicant.

Therefore, the Board believes that it has the authority to decide the appropriate requirements for the change in the transported substance.

4 NEED FOR RELICENSING THE PIPELINE

4.1 Views of Encal

Encal stated that the sweet gas reserves supporting this pipeline are depleting. Exploratory drilling in the area has produced significant volumes of non-associated and solution gas containing concentrations of hydrogen sulphide up to 1.8 per cent; these reserves are within a 5 kilometre corridor of the Crystal pipeline. It estimated that the remaining life of the sweet gas reserves is approximately 3 years. Encal noted that only 10 per cent of the pipeline capacity is presently being utilized.

Encal stated that it had considered alternative pipeline systems licensed to transport sour gas either to the Gulf Homeglen Rimbey or Minnehik-Buck Lake gas plants, but they were too far from the new reserves. Encal also stated that it had considered a new pipeline paralleling the existing pipeline which it estimated would cost \$3 million. Encal believed that a new pipeline would not be economic, although it had not completed a detailed evaluation. Encal stated that it believed that each of the alternatives would involve additional expense, landowner disturbance, and possible abandonment of an asset which it believed is entirely suitable for sour gas transmission. Encal believed the relicensing of the Crystal pipeline is the most practical alternative.

Encal stated that denial of the application would result in solution gas being flared rather than being conserved. It said that it would not continue its exploration in the area until there was additional development by other companies that would offer it another alternative to transport its sour product. Encal stated that it believed that the conversion represents orderly, economic, and efficient development that is in the public interest.

4.2 Views of the Interveners

The Hanneman's and Mr. Wheale did not question the need to transport sour natural gas out of the area. Mr. Hanneman stated that he was opposed to having the pipeline converted to sour gas and to the construction of a new pipeline. Mr. Wheale opposed the conversion of this pipeline, but would be agreeable to the construction of a new pipeline.

4.3 Views of the Board

The Board is satisfied that a pipeline system capable of transporting sour gas will be needed in the area if the sour gas reserves are to be produced. The conservation of sour solution gas is also in the public interest. The Board believes that the use of an existing pipeline system, providing it is technically suitable and safe, is preferable to the construction of a new pipeline since it minimizes costs as well as social and environmental impacts. However, the Board believes that, before applying for a specific pipeline project, operators should consider all reasonable alternatives and clearly demonstrate why the preferred option was selected. In this case, Encal has not convinced the Board that it fully examined all reasonable alternatives nor did it provide sufficient evidence to indicate why alternative routes were rejected.

5 SUITABILITY OF THE PIPELINE FOR SOUR GAS SERVICE

5.1 Views of Encal

Encal stated that it believed the pipeline is suitable for sour gas service. Encal noted that it had obtained a complete set of pipe mill certificates which indicate the pipe meets sour service requirements. Encal also stated that it completed a visual inspection of all above-ground facilities including pipe, valves, flanges, and fittings. The surface facilities were examined for identification markings and the representative welds were tested to ensure the hardness requirements were met. Encal concluded that the existing surface facilities are suitable for sour service even though it could not be certain that the valves, flanges, and fittings met the CSA sour service requirements. Encal was not planning to radiograph the surface welds, but during the hearing it acknowledged that a radiograph of these welds would provide reassurance that they were satisfactory.

Encal stated that it conducted a program of material testing to ensure the pipeline materials were suitable for sour gas service. Encal cut out 6 samples of the pipeline along its 37 kilometre length and examined each sample to determine if it met the sour service requirements. All circumferential welds on the samples were radiographically inspected. Dr. Ball noted that radiography was not an issue other than to confirm that the findings of radiographs completed on

the 6 samples were consistent with the findings of the original radiographs completed during construction. Dr. Ball stated that the only reason radiography was done was to assess the weld profile, in particular the types of flaws that might be present at the weld root area, in order to ascertain the probability of the welding workmanship contributing to or promoting a corrosion failure in this pipeline. Examinations showed there were flaws and imperfections at the weld root. Therefore, Dr. Ball recommended that Encal batch inhibit the line prior to operation to minimize the potential for corrosion. Encal concluded the only concern with the pipeline may be corrosion.

Encal stated that the structural integrity of the line has been demonstrated by its continuous operation without failure since 1990, and by a recent pressure test of the pipeline. Dr. Ball completed a fracture mechanics analysis to address the concern that some of the original radiographs that were examined did not meet the CSA standard and to prove that the weld integrity is adequate for the intended purpose. He believed that the evidence shows that, while film quality was not consistently good, the film interpretation appeared to be fairly consistent and flaws that did not conform to the standard were being detected and identified for repair. Dr. Ball noted that poor radiography does not necessarily mean that the welds were also substandard. The fracture mechanics analysis showed that any flaws of potential concern would be detected by even the poorest radiographic quality, (the pipeline will meet a leak before rupture criteria), and radiographic sensitivity is not a concern. Dr. Ball stated, that on the basis of analysis, therefore, the Crystal pipeline is a structurally secure line.

Encal agreed that the CSA standard requires all welds in sour service to be radiographed, but stated that this requirement is only for new pipelines. The CSA standard is silent on converting a sweet gas pipeline to sour gas service. Dr. Ball stated that he believed radiography is used as a quality control measure to ensure the integrity of new welds. The stresses and strains the pipe and the weld undergo, while being placed into service, are much greater than those during subsequent operation. He noted that, while the CSA standard requirement is to radiograph 100 per cent of the welds, the pass/fail criteria for welds is the same for sweet or sour service. Therefore, he concluded that radiography is not intended to address corrosion concerns. Dr. Ball agreed that some companies specify more stringent pass/fail criteria on welds in sour service than sweet service. The more stringent criteria would not allow lack of fusion in the weld root area. However, he thought that these additional welding requirements are usually used because of corrosion concerns when wet sour gas is being transported. In this case, corrosion is of less concern because the gas would be dehydrated.

5.2 Views of the Interveners

The Hannemans and Mr. Wheale submitted that the pipeline did not meet the CSA requirements for sour service pipelines because all the circumferential welds were not radiographed. Mr. Bronaugh said that CSA states that its requirements, including 100 per cent radiography of welds, are intended to apply not only to new construction, but also to existing facilities and upgrades. Mr. Bronaugh acknowledged that CSA does not specifically refer to sweet to sour conversion as upgrades. He believed that existing lines should meet the same stringent standards as new pipelines. Mr. Bronaugh did not believe an engineering critical assessment is suitable in this case, but acknowledged that the CSA standard allows engineering critical assessments in

some instances. The interveners did not believe that sampling or engineering critical assessments were acceptable alternatives to 100 per cent radiography. Mr. Bronaugh stated that, although CSA pass/fail weld requirements are the same for sweet and sour service pipelines, CSA indicates that additional restriction on the internal surface imperfections may be warranted in sour service. Mr. Schmierer stated that he believed normal industry practice for building new sour gas lines does not allow flaws in the root weld. He believed that Encal should use the same criteria for a new line and the conversion of an existing sweet line to sour service.

The interveners indicated that some of the initial radiography did not meet even the minimum requirements, and that suggests good construction practices had not been used in building this pipeline. Mr. Schmierer stated that a large percentage of the existing radiographs were unsatisfactory and had not met the requirements for even a sweet gas system. Mr. Hanneman did not believe the pipeline would be safe because it does not meet the minimum standard of safety set by the CSA; not only does it not meet the sour service requirements, it does not meet the sweet service requirements.

Mr. Wheale was concerned that the pipeline was not built properly initially, but provided no documented evidence to support his belief. He believed that, when the line was originally constructed, the expected life was 6 to 10 years which might have affected the quality of materials and work. Therefore, he believed the pipeline would not be suitable for transporting H₂S. He believed that the same rules should be used for new and existing pipelines.

5.3 Views of the Board

The Board is satisfied that the pipe used in the Crystal pipeline meets the to sour service requirements based on the pipe mill certificates. The Board is not convinced, however, that the existing above-ground facilities, that is the valves, flanges, and fittings, meet CSA sour service requirements. It notes that Encal was not certain these facilities meet CSA requirements. The Board is satisfied that the structural integrity of the pipeline is adequate for the applied-for maximum operating pressure. It notes that the pipeline has been operating at the maximum operating pressure and that a satisfactory pressure test to 1.4 times the licensed maximum operating pressure was recently completed. In addition, sour gas pipelines have many design and operating safety requirements unique to Alberta including: reduced operating stress to 60 per cent of the specified minimum yield strength (SMYS) for below-ground pipelines and 50 per cent of SMYS for above-ground pipeline; setback distances from the pipeline; and acceptable emergency response plans.

The Board notes that the CSA standard is silent on the requirements for sweet to sour conversion and allows for engineering critical assessments in some instances. The Board acknowledges the interveners' view that new and existing pipelines should meet the same design requirements, but believes that it would be impractical to require 100 per cent of the welds to be radiographed for below-ground pipelines that are being converted to transport a different substance. However, in this case, the evidence showed that not all radiographs completed during the construction of the pipeline met the minimum requirements of the CSA. That, in itself, means that inspection during construction of the line was deficient. More importantly, it leaves an open question, as raised by the interveners, whether appropriate construction methods were used when the pipeline was

initially installed. However, the associated uncertainties can be addressed by a thorough engineering critical assessment. The Board believes that an engineering critical assessment should consider material specifications, construction methods, pipeline conditions, and past and proposed future operation of the pipeline. The Board is satisfied that Encal has completed a detailed analysis of the pipeline material, construction methods, pipeline conditions, and past operation of the pipeline. That analysis confirms that the below-ground segments of the pipeline could be successfully converted to sour service. In particular, the Board accepts the results of the fracture mechanics analysis, which determined that the pipeline will leak before it will rupture. However, while the Board believes that the material testing program developed by Encal indicates that the pipeline is suitable for sour service, the valves, flanges, and fittings need further evaluation to determine their suitability for sour service. More importantly, the Board was not satisfied, from the evidence presented and response to questions at the hearing, that the applicant has thoroughly examined the proposed operation of the pipeline. This concern is addressed further below.

6 SAFETY OF THE PIPELINE

6.1 Views of Encal

Encal stated that it believes that the pipeline is safe to transport sour gas. Encal concluded that the only concern with the pipeline may be corrosion. It has addressed this concern by proposing to batch inhibit the pipeline, dehydrate the gas prior to entering the line, institute a continuous chemical inhibition program, and pig the pipeline when necessary. Encal acknowledged that dehydration equipment is not always reliable, therefore, free water is likely to get into the system at some time during its operation. This suggests that the operator should be prepared to pig the pipeline and have an ongoing inhibitor program to control corrosion. Encal indicated it could monitor the effectiveness of the inhibitor program with corrosion coupons, but an inhibition and monitoring program for the operation of the pipeline had not been developed. Encal stated that it would install a pig trap at the Rimbey plant to allow pigging of the south portion of the pipeline. It did not believe odour would be a concern during pigging operations, but it had not fully examined these operations.

Encal stated that the pipeline showed no evidence of internal or external corrosion. The samples showed no indication of corrosion and the pipeline has had cathodic protection since it was put into service. Encal agreed that it was possible that, between the cathodic protection stations, there may be areas not adequately protected, but saw no reason to complete an over-the-line potential survey because the external coating is very durable and there has been no change in the impressed current potential or electrical current demand in five years, which indicates that there has been no significant change in the cathodic protection requirements.

Encal stated that it did not have plans for leak detection on the pipeline. It did not propose to do additional testing or monitoring in areas where the pipeline is close to residences. Encal confirmed its intention to include the Crystal pipeline in the existing Gulf Homeglen Rimbey gas plant emergency response plan, but was unfamiliar with the details of the plan.

6.2 Views of the Interveners

Mr. Hanneman's main concern was one of safety for himself, his family, wildlife, and the environment. He believed there is only one right way to build a sour service pipeline and that this pipeline had not been built that way. Although, Encal has proposed to batch inhibit the pipeline prior to operation, to deal with the imperfections in the root weld, Mr. Hanneman believed that the pipeline would still corrode and that Encal has not presented evidence to show otherwise. Mr. Hanneman questioned how they could be assured that, if the pipeline changed ownership, the gas being transported would still be dehydrated.

Dr. Hepler, on behalf of the Hanneman's, said that corrosion will occur with or without water. He also said that Encal has not examined the rate of corrosion. He noted that inhibitors will never stop corrosion, only slow the process down, hopefully to an acceptable level. Mr. Schmierer believed that water produced in a dehydrator upset may not be removed during pigging operations and that it may actually replace the inhibitor in crevices, leading to subsequent corrosion. He stated that he did not believe that the inhibitor would reach all the crevices and eliminate any possibility of corrosion at the welds. He does not believe that Encal could properly inhibit the pipeline throughout its life. Mr. Schmierer did not believe that a corrosion coupon is representative of the corrosion occurring in the pipeline because corrosion would occur preferentially at weld areas because of the higher stresses, whereas coupons only reflect general corrosion.

Mr. Wheale did not believe that the pipeline was safe to operate in sour gas service. Mr. Wheale also questioned the number of residents that Encal reported were in close proximity to the pipeline. Mr. Wheale believed there are more than five residences within 200 m of the pipeline, in contrast to Encal's evidence that there are 5 residences within 200 m. He was concerned that Encal would be applying in the future to increase the maximum allowed H₂S concentration of the pipeline.

Mr. Wheale was concerned with the noise from the 1-4 compressor station. He was concerned that, although a noise survey has been completed, it was not completed for the worst case scenario. He stated that he has been affected by the noise of the compressor station for 6 years and still has not had a satisfactory solution from any of the previous pipeline owners.

6.3 Views of the Board

The Board is concerned that Encal has not fully examined the operation of the pipeline, an aspect which would play a major role in its safety. For example, Encal had not finalized the need for a pig trap at the Rimbey plant prior to the hearing. Yet, a major aspect of the safe operation of the pipeline is to pig the water out of the line in the event of a dehydrator upset. The Board believes that Encal should have developed corrosion control and monitoring programs in more detail. The Board agrees with the interveners that corrosion coupons do not specifically show the corrosion at the weld areas. Corrosion rates in the weld area may be different than corrosion in the pipe because of imperfections in the root pass of the weld.

The Board is satisfied the samples taken indicate that the external coating of the pipe is in good condition. The Board notes that Encal does not propose any leak detection or extra monitoring of the pipeline in general or near residences. Depending on the other aspects of the operation of the pipeline, this may be acceptable. However, the Board is not satisfied that Encal has prepared an effective corrosion control and monitoring program. In general, the Board believes it may be possible to operate this pipeline safely, but Encal has not provided sufficient evidence to convince the Board that it has thoroughly evaluated the operation and maintenance of the pipeline and has measures in place to ensure safe operation of the line.

With respect to Mr. Wheale's concerns regarding noise from the compressor station, the Board intends to follow up on that matter through its field surveillance group.

7 RISK CONSIDERATIONS AND PUBLIC CONSULTATION

7.1 Views of Encal

Encal estimated the levels of consequence and risk that would be associated with the operation of the Crystal pipeline in sour gas service. Encal used consequence estimates to describe the effects to individuals who might be exposed to an accidental release of sour gas. Risk estimates were used to put this consequence into perspective by including an additional consideration of "how frequently accidents might be expected to occur."

Encal used "serious irreversible adverse health effects" to characterize the consequence associated with accidental failures. This level of consequence was estimated for a full rupture of the pipeline when the escaping plume is not ignited and for individuals located out-of-doors directly downwind of the release. Consequences were evaluated using the GASCON2 model over a range of meteorological conditions found in Alberta. The results of Encal's analysis showed that the level of consequence decreased sharply with distance from the pipeline. Under the worst case presented, serious irreversible adverse health effects could occur to individuals located less than 150 m from a pipeline rupture.

Encal prepared risk estimates on the basis of the consequence noted above and using the historical average rupture frequency for sour gas pipelines in Alberta. In Encal's view, the use of the average rupture frequency provided a conservative estimate of the risk as it included all reported failures covering a wide range of sour gas pipelines and pipeline operations. In its view, the relicensing and subsequent operation of the Crystal pipeline for sour gas service will meet or exceed current Board requirements. Encal calculated the maximum individual risk of a serious irreversible adverse health effect to be less than 10 chances in a million per year at the edge of the right of way when evaluated on the basis of a full rupture of the pipeline. Encal noted that there currently are residences located within 150 m of the pipeline. It estimated the risk at the closest residence (the Bunting residence, some 40 m from the pipeline) to be less than one chance in ten million per year. Encal considered this level of individual risk to be well within commonly accepted bounds, based on guidelines developed by the Major Industrial Accident Council of Canada and applied elsewhere in Canada.

Encal believed that it had done its best to keep local landowners and residents fully informed of its intentions and the safety risks involved.

7.2 View of the Interveners

The interveners believed that the Crystal pipeline cannot safely be used for sour gas service. In their view, the integrity of the pipeline would be threatened if operated as a sour gas pipeline. They felt that the conversion would result in failures and would increase the risk. In their view, when a risk is imposed, it must be acceptable to those affected by the risk. In this case they believe the risk is unacceptable.

The interveners expressed opinions on Encal's desire to keep the residents informed of its intentions and of the risk associated with the relicensing of the pipeline. Mr. Hanneman believed that Encal's notification and consent process was not very straightforward and was one of deceiving landowners. Mr. Wheale indicated that he had not experienced the same circumstances. In his view, Encal had done its best to answer his questions. He noted however, that the onus had been on himself to ask the right questions. In the opinion of both interveners, however, contacts made by Encal were primarily for the purpose of fulfilling the Board requirements and were not directed at keeping the residents informed of Encal's intentions or of the risks involved. Mr. Wheale noted that only residents affected by pipeline crossing agreements had been contacted, and that other residents (within 200 m of the pipeline), who would also be affected by the risk had not been contacted.

7.3 Views of the Board

The Board has considered Encal's assessment of the potential consequences and risk, and accepts the results presented. The Board believes that, Encal has correctly assessed the potential consequence and risk for this Level 1 pipeline facility. The Board also believes that the existing integrity of the pipeline could be maintained under sour gas operations provided that Encal undertakes an effective corrosion mitigation program.

The Board notes Encal's acknowledgement that there is some potential for serious irreversible adverse health effects to individuals closer than 150 m from the pipeline. However, it notes that the severity of the effects, if the worst case conditions should happen, decreases sharply with distance from the pipeline and the associated probability that the worst case would occur, is extremely small. The outcome would be realized only during a full failure of the pipeline, by individuals located and remaining out-of-doors, during periods of poor atmospheric dispersion, for specific wind directions and when the dispersing gas plume is not ignited.

Although the Board recognizes that serious consequences could occur to individuals in the vicinity of the pipeline, it also recognizes that the level of risk is within the bounds of similar risks found by society to be acceptable for similar activities and land uses within Alberta and across Canada.

The Board notes that legislation in Alberta requires that people in the vicinity of a proposed development, who may be directly or adversely affected by energy development, must be given the opportunity to learn about the proposed development and its potential impacts. This includes providing residents with information about the nature of the hazard and actions, such as indoor sheltering, that can provide additional protection during the unlikely event that a pipeline failure does occur. Where a site-specific response plan is required prior to the start up of a facility, the Board expects that the public within the emergency planning zone will be notified prior to the application being made to the Board.

8 DECISION

9 DECISION

The Board is not prepared to approve Application No. 951161 by Encal based on the information contained in the application and evidence presented at the hearing. The Board requires the following additional information to be submitted to itself and the interveners:

- description of pipeline alternatives and reasons for rejection of the alternatives,
- documentation indicating whether the above-ground facilities meet the CSA requirements and its proposed treatment of any deficiencies,
- description of the proposed operation and maintenance of the pipeline, including corrosion mitigation and monitoring program,
- confirmation that all residents within the emergency response planning zone have been notified about the project and its potential impacts, and
- a diagram showing the location of above-ground facilities and all existing residences within 150 m of the pipeline.

The information should be submitted as soon as possible. If it is not submitted by 1 September 1996, and if Encal cannot provide good reasons to extend the date, the application will be denied without prejudice.

The Board will provide the interveners with an opportunity to comment on any additional information submitted and may reopen the hearing to consider the above submissions.

DATED at Calgary, Alberta, on 31 May 1996.

ALBERTA ENERGY AND UTILITIES BOARD

[Original signed by]

J. P. Prince, Ph.D.
Board Member

[Original signed by]

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

[Original signed by]

H. O. Lillo, P.Eng.
Acting Board Member