Rep: OEB
Doc: 11KVG
Rev: 0

E.B.R.M. 70 & 74

IN THE MATTER OF the Ontario Energy Board Act, R.S.O. 1980, c. 332;

AND IN THE MATTER OF the Petroleum Resources Act, R.S.O. 1980, c. 377;

AND IN THE MATTER OF certain references to the Ontario Energy Board by the Minister of Natural Resources in regard to applications by Dow Chemical Canada Inc. for permits to flood and maintain pressure in a geological formation where the points of injection are within 1.6 kilometres of the Seckerton and the Corunna Pools both of which are designated gas storage areas in the Township of Moore in the County of Lambton.

BEFORE: Richard R. Perdue, Q.C., Presiding Member

Donald H. Thornton, Q.C., Member

Denis A. Dean, Member

June 13, 1986

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# REPORT TO THE MINISTER OF NATURAL RESOURCES

## 1. INTRODUCTION

12

1.1 Dow Chemical Canada Inc. (Dow, the Company or the Applicant) is Canada's most diversified petrochemical company. In Sarnia, its 20 plant complex is situated on approximately 186 hectares and produces plastics, chlorinated products, energy systems and design products which, in addition to the domestic market, are exported to more than 40 countries. The Sarnia operations alone employ about 1,700 people.

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### Brine Well Drilling

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1.2 Dow's chlorine and caustic soda production requires the use of brine as a feedstock which comes from wells located on a further 1,400 hectares in the Sarnia area. Most of this property is in Moore Township in the County of Lambton and part of this land is the subject matter of this application.


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1.3 Dow commenced drilling brine wells in Moore Township in 1949. Since then it has drilled and mined 66 wells, 30 of which are still active while four are used for hydrocarbon storage.

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1.4 Dow's witnesses estimated that the replacement cost of its acreage in Moore Township is about $11.2 million with a further $8 million invested in the 48 kilometres of gathering and transportation lines used in the brining operations.

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1.5 They testified that the company's rock salt requirements are about 630,000 tonnes per year and that, because of the lead time necessary to develop a well, there is an immediate need to commence drilling additional brine wells.

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1.6 Dow's brining operations in Moore Township involve drilling into the Silurian A2 salt formation at an approximate depth of 1700 feet below sea level. Water is pumped to the site from the St. Clair River, injected into the well and then removed as brine.

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### Gas Storage

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1.7 Besides brine wells, Moore Township is also home to several of Ontario's gas storage


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reservoirs. These reservoirs or pools were originally gas bearing reefs but following production of all the

native gas, they were converted to gas storage pools and contained within designated boundaries called gas storage areas. Two of these areas are located within 1.6 kilometres of the wells Dow is now applying to drill. Figure 1 on the next page shows the relative positions of the proposed brine wells to the Corunna and the Seckerton Gas Storage Areas, both of which are legally designated as such by Ontario Regulation and owned by Tecumseh Gas Storage Limited (Tecumseh). Tecumseh is owned equally by Imperial Oil Limited and The Consumers' Gas Company Ltd. (Consumers') which is its sole customer.

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1.8 Besides the Corunna and the Seckerton Pools, the Dow Moore reef, which has the potential to become a gas storage reservoir is in close proximity to the proposed drilling but it has not been designated as gas storage area under the Ontario Energy Board Act. This hearing was only concerned with the effect of Dow's brining operations (including the subsequent abandonment of the wells) on the integrity of those lands legally designated as gas storage areas.

Was Page 4. See Image [OEB:11KVF-0:6]

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**Location of Proposed Dow Wells**

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Figure 1 LOCATION OF PROPOSED DOW WELLS

Was Page 5. See Image [OEB:11KVF-0:7]

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1.9 Witnesses for Tecumseh testified that storage provides a "vital component in Consumers' ability to match the pipeline's deliveries of gas to the varying demands of its customers, particularly its large base of heat-sensitive residential customers. In other words, on a cold winter day, about one-half of the total demand for gas in Consumers' distribution system is satisfied from the storage facilities at Tecumseh."

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1.10 Tecumseh's five storage pools, with an annual storage turnover volume of some 1,671 10(6)m(3), have been supplying storage service to Consumers' since 1964.

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The Approval Process and Dow's Application

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1.11 Section 13 of the Petroleum Resources Act requires any person wishing inter alia to flood a geological formation with water to apply to the Minister of Natural Resources (the Minister) for a permit. If the well is within 1.6 km of a gas storage area, the Minister is required to seek a Report from this Board prior to granting the permit.

Was Page 6. See Image [OEB:11KVF-0:8]

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1.12 Ontario Regulation 666/85 of the Petroleum Resources Act states that:

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No person shall complete or service or otherwise perform work of any kind, on a well within 1.6 kilometres of a gas storage area designated by order of the Ontario Energy Board pursuant to the Ontario Energy Board Act if the completion, servicing or other work will or is likely to fracture, or create communication with, the gas reef situated within the designated gas storage area.

31

1.13 On April 12, 1983 Dow filed an application to drill two wells Dow-Moore 73 and 74) into which it intended to inject water under sufficient pressure (hydraulic fracturing) to cause communication between the wells. During the brining operation, one of these wells would be used for water injection, and the second would be used for removal of the brine.

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1.14 On August 8, 1983 Dow applied to the Minister to drill and flood three more wells: Dow-Moore 77, 78 and 79. None of Dow's evidence pertaining to any of its proposed wells was filed with the Board until November and December, 1985.

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1.15 All five wells are within the prescribed distance of 1.6 km of the Seckerton or the Corunna Gas Storage Areas.

Was Page 7. See Image [OEB:11KVF-0:9]

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1.16 Dow's witnesses testified that in order to provide observation points between Dow-Moore 73 and 74 (which were to be connected through hydraulic fractured) and the two gas storage pools, they intended to drill Dow-Moore 77, 72 and 79 first.

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1.17 At the beginning of the hearing, however, Dow indicated that it did not intend to call any evidence in regard to the applications for hydraulic fracturing as it had abandoned its plans for drilling Dow-Moore 73. However, it requested that its applications in regard to the drilling and flooding of the other four wells (the Applications), continue.

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1.18 As no evidence in regard to the intended drilling of Dow-Moore 73 or hydraulic fracturing was presented at the hearing, the Board recommends that the Minister deny Dow's application in that regard. The precise location of each of the wells forming part of the Applications is contained in Schedule 1 to this Report.

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## The Hearing

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1.19 Following the appropriate notices to all interested parties as prescribed by order of the Board, a hearing on Dow's applications was held in Toronto on April 16, 17 and 18, 1986.

Was Page 8. See Image [OEB:11KVF-0:10]

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1.20 A copy of the verbatim transcript and all exhibits and argument presented at the hearing, are available for public inspection at the Board's offices.

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## Appearances and Witnesses

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1.21 Five counsel appeared representing the following parties:

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Leonard Riccnetti and

J. Sibley for Dow

John A. Campion Special Counsel

Peter Atkinson for Tecumseh

Andrew Mudryj for Union Gas Limited

1.22 Counsel for Dow called the following witnesses:

Donald Buchser Area Superintendent of wells, Dow

Jack V. Hill President, Reeftop Inc.

Dr. Shosei Serata Principal, Serata Geomechanics Inc.

Charles W. Querio Consulting Engineer, private practice

1.23 Counsel for Tecumseh called:

Robert J. Craig, Consumers' Manager of

Exploration,

Jack P. Elenbaas Petroleum Engineer, private practice

Was Page 9. See Image [OEB:11KVF-0:11]

## 2. THE EVIDENCE

2.1 Mr. Buchser testified on behalf of Dow that the proposed drilling and brining procedure for each of the four wells would follow the standard and accepted method in the industry. Phase one of the operation, he said, involved drilling each of the four wells to a minimum of about 700 feet apart into the A2 salt formation and extracting the salt by solution mining. Phase two, he said, was the abandonment of the caverns when they reach a diameter of 400 feet, and involves leaving them filled with brine and cementing the well to the surface. With the approximately 700 foot spacing between wellheads, there will be about 300 feet of salt formation remaining between each cavern just prior to and during abandonment which, Mr. Buchser testified, is one of the safety factors Dow imposes upon its brining operations.

57 2.2 He stated that the well casing in each well is then drawn up from this formation, through the A2 carbonate which is about 125 feet of rock. The opening through the carbonate is sealed with concrete and the drill casing is drawn into the B2 salt where a second cavern of the same dimensions is created by solution mining in that formation.

58 2.3 Mr. Buchser testified that in the past, Dow had successfully drilled and maintained a solution mining operation within 1.6 km of its gas reef the Dow-Moore reef, (which has not been designated as a gas storage area), and that in his opinion, the Company could do the same with the wells which form part of these Applications.

59 2.4 In cross-examination, Special Counsel raised the possibility of a failure of one of the abandoned caverns causing subsidence at the surface and a leakage of brine into nearby formations. Mr. Buchser testified that Dow had experienced no cavern failures and that the brine left behind in the abandoned cavern reaches an equilibrium with the salt. He pointed out that the size of the caverns does not continue to grow because the brine remaining in the cavern becomes saturated and after the well casing is removed, the bole is



60 filled to the surface with cement to prevent any leakage of the brine into other formations.

61 2.5 Mr. Buchser suggested that the Board recommended to the Minister that Dow be given approval to drill the four wells on the following conditions:

62 * Dow shall not initiate any fractures between or with any of the wells applied for;

63 * it shall ensure that the proposed caverns are developed in a fashion to ensure their long-term stability;

64 * it shall use the drilling and completion procedures outlined in Schedule 2 to this Report;

65 * the Company shall only flood the A2 and B salt formations with water, brine or pad material (used to facilitate solution mining);

66 * upon flooding, the pressure gradient in these formations shall not exceed .6 pounds per square inch per foot of depth; relief valves on Dow's system shall ensure that there is adequate protection against operation at greater pressures;



67 * Dow shall ensure, by the use of sonar logs, that the cavern diameter does not exceed approximately 400 feet;

68 * each of the four wells shall be hydrostatically tested to ensure the integrity of the casing and

cement prior to the brining operations and the Ministry of Natural Resources (the Ministry) shall be notified in advance of such testing; and

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* Dow shall not store any hydrocarbons in the caverns created by any of the four wells without first having obtained any and all necessary permits and approvals as required by the legislation in force at the time.

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2.6 Mr. Buchser testified that based on the research Dow has undertaken it is "completely satisfied" that there will be no adverse effect on either the Seckerton or the Corunna Pools during the drilling phase, the mining stage or even in the future when the caverns are abandoned.

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2.7 However, when asked by counsel for Tecumseh if Dow would give an indemnity to Tecumseh in the form requested by it for any damage to their gas storage pools caused by the brine caverns

Was Page 13. See Image [OEB:11KVF-0:15]

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even beyond the mining stage, Mr. Buchser replied that Dow was unwilling to do so chiefly because of the perpetual nature of such an agreement.

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2.8 Mr. Hill, a consulting geologist called by Dow as a witness, testified that in the area of the proposed wells the data showed that the B and A2 salt horizons are uniform in character, distribution and composition. He said there was no evidence of any pinnacle reefing in the well area and that the Corunna and Seckerton reefs have a high degree of integrity.

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2.9 He pointed out that there was a cap of A-2 anhydrite some 20 to 30 feet thick overlying the reefs and that it had almost zero permeability and serves as protective "armour plating" for the reef. "There is no real possibility, in my opinion, that Dow's passive solutioning operations could have any adverse impact on the Corunna or Seckerton reefs," he said.

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2.10 He also pointed out that Dow's proposed wells, although within the restricted distance for drilling near a gas storage areas are each about 1.6 km from the storage reef itself.

Was Page 14. See Image [OEB:11KVF-0:16]

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2.11 Mr. Hill testified that there was no "possibility whatsoever" of Dow's drilling or brining operations or even the final abandonment, causing a fracture or communication with the storage reefs.

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2.12 Dow also called Dr. Serata to testify on the rock mechanics of salt caverns and he concluded that it was;

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"inconceivable that the proposed caverns would have any effect on the Tecumseh reefs, let alone an adverse effect. Based on my quantitative assessment of the caverns, all of the caverns would achieve a naturally stable state ... after the solution mining. This cavern stability comes from the fact that the maximum stress to be developed around the cavern boundary is no more than the strength of the rock salt."

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2.13 He explained that this is the effect after proper abandonment of the well when stresses applied to the cavern by the rock salt, are counterbalanced by the brine filling the cavern. The stress decreases to the point where the difference between the pressure in the cavern and the stress around the cavern becomes minimal.

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2.14 Dr. Serata stated that the pressure of .6 Psi per foot of depth on the cavern walls exerted

Was Page 15. See Image [OEB:11KVF-0:17]

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by the insertion of water during the solution mining, is less than half the pressure required to fracture the formation and that the propose size and shape of the caverns would not create a damaging effect on the gas storage reefs even following an "extraordinary large tectonic stress [earthquake] in the Sarnia area."

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2.15 Mr. Querio, called by Dow to testify on the sub-surface engineering for the drilling, including the casing and the cementing, gave evidence that in his opinion: "there is virtually no possibility that the operations ... could have any effect whatsoever on the Tecumseh reefs."

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2.16 He submitted that the proposed caverns were small and very uniform compared to many formed during brining operations in the United States and that the monitoring and control procedures to be employed by Dow caused him no concern. He said that the distance between the closest Dow well and the gas storage reef was one of "the greatest barriers" of which he is aware. Mr. Querio stated that because of the characteristics and the depth of the salt bearing formations in the area and the strength and size of the caverns to be created, "it is inconceivable" that subsidence could manifest itself at the surface.

Was Page 16. See Image [OEB:11KVF-0:18]

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2.17 Mr. Elenbaas was called by Tecumseh as an expert on the design, development and engineering of underground gas storage reservoirs. He testified that no gas had been lost from Tecumseh's storage pools and that, in his opinion, the pressure in the reefs could be increased considerably without endangering the integrity of the reservoir. He also testified that although he was not a rock mechanics it was his opinion that the solution mining proposed by Dow would not have an adverse effect on Tecumseh storage pools.

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2.18 Mr. Craig on behalf of Tecumseh, testified that contrary to the evidence given by the Dow witnesses, there was not a 2,000 foot buffer between the reservoir and the boundary of the gas storage area. He pointed out that the A-1 carbonate which abutts the reef is often porous and permeable and in communication with the reef itself. This formation, be said, extends beyond the edge of the pinnacle reef but is still part of the gas reservoir system.

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2.19 Mr. Craig also pointed out that Tecumseh was not opposed to Dow's Applications but was only concerned that it receive a suitable form of indemnity agreement from Dow because it was concerned with the long term stability of the caverns.

Was Page 17. See Image [OEB:11KVF-0:19]

87

2.20 He agreed that Dow had convinced Tecumseh "that there will never be a problem either now or in the future if things are done as they propose and if [the] caverns behave as they predict... but

Dow doesn't have the power to have things turn out exactly as they predict. Tecumseh cannot afford a problem with its underground storage reservoirs. They simply are not replaceable," he said.

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2.21 In argument neither Tecumseh nor Special Counsel advocated that the Board recommend that Dow's Applications be denied. Special Counsel agreed with most of the points contained in Dow's suggested conditions of approval outlined on page 11 of this Report.

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2.22 However, he expressed concern about the lack of a specific notice period for the Ministry inspectors to attend the testing of the concrete casing on each well and suggested that the conditions contain a provision for a one week notice to be given by Dow. Mr. Ricchetti stated that the Ministry personnel have been satisfied with the words "reasonable notice" and he saw no reason to change it.

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2.23 Special Counsel also argued that because of the proximity of the storage reservoir, Dow be

Was Page 18. See Image [OEB:11KVF-0:20]

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required to seek approval from the Minister if in the future, it intended to use any of the salt caverns for hydrocarbon storage. Mr. Ricchetti pointed out that in such an event Dow was prepared to seek approval but argued that a particular minister should not be named in any conditions imposed on Dow's drilling, in the event that the ministerial responsibilities under the present legislation are changed.

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2.24 Special Counsel also expressed concern in regard to the drilling procedures (see Schedule 2), which Dow submitted as part of its suggested conditions of approval outlined on page 12 of this Report. He pointed out that they may have to be altered during the actual drilling operations because of unexpected problems and that the approval for any changes should therefore be left to the Ministry inspectors on the site. Special Counsel also proposed that certain conditions (outlined in Schedule 3), be imposed on any drilling permit granted by the Minister.

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2.25 The major issue which both Special Counsel and counsel for Tecumseh concentrated upon was the question of the wording of any indemnification agreement to be imposed upon Dow as a condition of Ministerial approval for drilling within the 1.6 km restricted area.

Was Page 19. See Image [OEB:11KVF-0:21]

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2.26 On behalf of Dow, Mr. Ricchetti argued that Tecumseh did not require an indemnification agreement because of Dow's evidence in regard to the long-term safety and stability of the caverns and if Tecumseh felt its storage reservoirs were damaged by Dow, it had the normal remedies at law.

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2.27 Dow, however, did offer a form of indemnity agreement prior to the hearing which obligated it to save harmless Tecumseh and any third party if damages should result from Dow's drilling and mining operations "or any other use by Dow of the caverns." However, Mr. Ricchetti objected to Tecumseh's request for an agreement which provided for indemnity for damages caused "without taking into consideration whose fault it is," in which case Dow would be forced to prove negligence on someone else's part in order to avoid liability.

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2.28 Mr. Atkinson argued that Dow should provide a comprehensive indemnity agreement similar in form to that provided by Petrosar Limited as a result of a recommendation to the Minister by this Board in E.B.R.M. 50. In that Report, the Board recommended to the Minister that Tecumseh and Petrosar enter into an indemnity agreement for the benefit of both Tecumseh and third parties. Although the specific wording was not

Was Page 20. See Image [OEB:11KVF-0:22]

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commented upon by the Board in that case, the effect of the recommendation was to provide Tecumseh with an indemnity agreement which in brief provides:

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* Tecumseh is not responsible for damages caused by its storage gas leaking into Petrosar's wells (or the subsequent underground storage cavern), unless there is negligence on the part of Tecumseh; and

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* Petrosar is to indemnify Tecumseh and any third party for all damages caused by gas leaking from Tecumseh's Pool through or into Petrosar's storage caverns or for any product leaking from Petrosar's storage caverns to Tecumseh's Pool unless either is caused by Tecumseh's negligence.

100

2.29 Special Counsel argued that the wording of the agreement may make it applicable even after Petrosar divests itself of the lands containing the well and thus provide indemnification for Tecumseh or its successors as long as the pool is used for gas storage.

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2.30 He supported such an agreement because it would provide assurance that any damage caused to the gas storage by Dow's brining caverns would be remedied. He also pointed out that the agreement would ensure that Dow maintains its

Was Page 21. See Image [OEB:11KVF-0:23]

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surveillance of abandoned caverns. He pointed out that if the indemnification agreement is still in force in 50 years, Dow may be encouraged to continue monitoring the wells even after abandonment, if improved technology is available.

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## 3. FINDINGS OF THE BOARD

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3.1 In the opinion of the Board, the continuing maintenance of an efficient and reliable gas transmission and distribution system mandates that all storage pools be protected from any potential interference from whatever source. Gas storage reservoirs are therefore in the public interest and must take precedence over commercial endeavours with which they may conflict.

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3.2 The importance of storage pools is recognized by the statutory restrictions placed on any drilling within 1.6 km of the boundary of a gas storage area and by Ontario Regulation 666/85 outlined on page 6 of this Report.

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3.3 The Board has heard extensive evidence in regard to Dow's proposed procedures during the drilling and mining phase as well as the results of its research into the future shape and stability of the abandoned caverns.

Was Page 23. See Image [OEB:11KVF-0:25]

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3.4 Neither counsel for Tecumseh nor Special Counsel challenged this evidence or argued that the Board recommend against Dow's intended drilling program

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3.5 For the following reasons, the Board recommends that, subject to the conditions outlined hereafter, the Minister issue the 4 permits applied for:

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* solution mining has, according to the evidence, become so precise that cavern shape during the brining operations, can be determined precisely;

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* computer modelling and actual observations appear to indicate that the long-term stability of the caverns is not a problem;

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* Dow's solution mining methods have never resulted in a cavern failure;

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* Dow has stated that it does not intend to fracture any of the wells or use the caverns for any kind of storage other than brine;

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* Tecumseh, the party most closely affected by Dow's intended drilling program, does not object to the brining operations or the long-term storage plans;

Was Page 24. See Image [OEB:11KVF-0:26]

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3.6 The Board recommends that the Minister impose as a condition of approval, most of those recommendations suggested by Special Counsel and outlined in Schedule 3 to this Report with the exception of item 1 in that schedule as Dow withdrew its application for any fracturing; item 3, as Dow did not apply for any dual well solution mining; and item 8, as there were no undertakings asked for or accepted during the hearing.

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With respect to the need for an indemnification agreement, the Board has concluded that, while the parties themselves may negotiate such an agreement if they so wish, it should not be a pre-condition to the Minister's issuance of a drilling permit. This conclusion is based on the following reasons:

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* there was no evidence that the brine caverns would ever cause a threat to the integrity of the Pools;

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* if the evidence bad disclosed such a possibility, the Board's recommendation would probably have been to deny the Applications rather than impose an indemnification agreement;

Was Page 25. See Image [OEB:11KVF-0:27]

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* an indemnification agreement of the type requested in this proceeding appears to be designed to protect Tecumseh's shareholders in the event of a loss of their assets rather than protecting the public interest in the integrity of the pools;

119

* to impose a perpetual indemnification agreement could prevent Dow, with no corresponding compensation, from drilling brine wells on any of its lands within the restricted area. This is not the purpose of the restrictive drilling zone surrounding a gas storage area;

120

* if Tecumseh is so concerned about the long-term stability of the caverns, it could bring an application to include the area within the boundaries of the gas storage area which would mean a virtual prohibition on drilling in return for compensation to Dow;

121

* by not recommending such an agreement the Board has not deprived Tecumseh of its normal rights under the law if, in the future, it is of the opinion that some damage has been occasioned by Dow's brining operations;

Was Page 26. See Image [OEB:11KVF-0:28]

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* the Board's recommendation can only be based on the information available to it during the hearing and by taking administrative notice of any other pertinent technological information. If in the future, any of the abandoned brine wells throughout Ontario proves to be an environmental danger or a threat to a gas storage area, legal or government action could be considered at that time. The Board finds this avenue preferable to having companies depend on indemnification agreements made years before as a condition of drilling.

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Costs

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3.7 Following calculation of the Board's costs, an order will issue charging them to the Applicant. No party requested costs and none are awarded.

Was Page 27. See Image [OEB:11KVF-0:29]

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Dated at Toronto this 13th day of June, 1986.

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<signed>
R.R. Perdue
Presiding Member

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<signed>
D.H. Thornton
Member

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<signed>
D.A. Dean
Member

Was Page 28. See Image [OEB:11KVF-0:30]
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SCHEDULE 1

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WELL NO. LOCATION (Township of Moore)

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73 - Lot 23, Concession No. XI - 547.7 metres South, 88.4 metres East

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77 - Lot 23, Concession No. XI - 492.9 metres North, 279.8 metres East

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78 - Lot 23, Concession No. XI - 278.8 metres North, 282.5 metres East

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79 - Lot 23, Concession No. XI - 171.78 metres North, 98.5 metres East

Was Page 29. See Image [OEB:11KVF-0:31]
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SCHEDULE 2

136

DOW CHEMICAL CANADA INC.'S PROPOSED

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DRILLING AND COMPLETION PROGRAM FOR WELLS 73, 77, 78 and 79

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1. -Install the well head at grade level. The well head Christmas Tree assembly will be to the American Petroleum Institute (A.P.I.) specification, having a 2,000 p.s.i. (138 Bar) rating.

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2. -Install the surface casing by drilling a 17 1/2" (445m) hole to 328 feet (100m) from the Kelly Bushing or the rig floor (K.B.).

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3. -Installing 318 feet (97m) of new J55 - 13 3/8" (339mm) - 54 lb. (81kg) casing. -Power tong at maximum A.P.I. recommended torque. -Cement annulus to the surface using high early class "C" cement with 2% calcium chloride. -Wait on the cement for 18 hours.

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4. -Install the Intermediate Casing as follows:

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-Install a blow-out protection device at grade level -Drill a 12¬" (312mm) hole to 1,968 feet (600m) from the K.B. -Conduct Gamma/Neutron and caliper log from the 1,968 ft. (600m) level back to 295 ft. (90m) -Install 1,925 ft. (587m) of new K55 - 9 5/8" (245mm) 36 lb. (53kg) casing -Power tong the new casing at maximum A.P.I. recommended torque -Install a guide shoe and seal weld -Install an insert float valve at the first joint off the bottom -Seal weld the first four joints off the bottom

Was Page 30. See Image [OEB:11KVF-0:32]
143

-Install centralizers (eight)

144

-Cement the intermediate casing to surface using class "G" "kalicrete" - salt saturated -Wait on cement for 36 hours. Test. -Pressure test the casing and head with 3450 kPa (500 p.s.i.q.) surface pressure using 4.6kg (1.2 kg/1.) mud

145

5. -Install the Production Strings

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Drill a 8 3/4" (222mm) hole to the bottom of the A2 salt at 2,493 ft (760m) (drilling break) -Conduct Gamma/Neutron, Density and Caliper logs from T.D. to 1,902 ft. (580m) -Review electric log data to confirm formation consistency with the surrounding geology -install 7" (178mm) k55 - 20 lb (29kg) casing to 15 ft (4.6m) off the bottom of the salt -install 4«" (115mm) casing to 5 ft. (1.53m) off the bottom of the salt

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6. -test resulting cavern by sonar logs to establish cavity shape and confirm development -adjust production strings as necessary

148

7. -remove production strings from A2 salt level -plug entire A2 carbonate level (from top of A2 salt to bottom of B salt - approx. 120 ft. (36.8) with cement

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8. -position production strings to bottom of B salt -repeat #6

150

9. -abandon well in accordance with Ministry of Natural Resources guidelines and approval

Was Page 31. See Image [OEB:11KVF-0:33]

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Schedule 3

152

Special Counsel's Proposed Conditions of Approval

153

1. There will be no fracturing between wells.

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2. Cavern design and development shall ensure long-term stability of themselves and the surrounding rock formation.

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3. For dual well operation, the separation of wells 73 and any other must be such that the maximum ultimate cavern size, in any direction, shall not exceed 600 ft.

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4. The cavern operating pressures will be such that the pressure gradient will not exceed 0.6 psi per foot depth.

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5. For single well operation, the maximum ultimate cavern size shall not exceed 400 ft.

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6. Each well be hydrostatically tested to ensure the integrity of the casing and cement, prior to the commencement of brining operations. The Petroleum Resources Section must be notified one week in advance of the test so that an inspector may be present if necessary.

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7. Any permits approved by the Board at this time are understood to be for the purpose of solution mining only. Any future use of the caverns for hydrocarbon storage must be first be approved by the Minister.

160

8. Dow Chemical undertakes to ensure the fulfilment of all conditions and undertaking by its witnesses.