Federal Court  Cour fédérale

Date: 20190506

Docket: T-1612-16

Citation: 2019 FC 581

Ottawa, Ontario, May 6, 2019

PRESENT: Mr. Justice Southcott

BETWEEN:

AUX SABLE LIQUID PRODUCTS LP,
AUX SABLE LIQUID PRODUCTS INC.
AND AUX SABLE CANADA LTD.

Plaintiffs

and

JL ENERGY TRANSPORTATION INC.

Defendant

JUDGMENT AND REASONS

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I. Overview

[1] This decision relates to an action by the Plaintiffs, Aux Sable Liquid Products LP, Aux Sable Liquid Products Inc., and Aux Sable Canada Ltd. [together, Aux Sable], to invalidate a patent identified as Canadian Patent No. 2,205,670 [the 670 Patent], related to the transportation of natural gas by pipeline, held by the Defendant, JL Energy Transportation Inc. [JL Energy].

[2] For the reasons explained in detail below, I find that claims 9-10 of the 670 Patent are invalid for overbreadth, inutility, anticipation and non-patentable subject matter. I do not find claims 1-8 to be invalid under any of the invalidity allegations raised by the Plaintiffs.

II. **Background**

[3] Aux Sable Liquid Products LP is a limited partnership formed under Delaware law and registered as an extra-provincial limited partnership in Alberta [Aux Sable LP]. Aux Sable Liquid Products Inc. is also a Delaware company and the general partner of the limited partnership [Aux Sable GP]. Aux Sable Canada Ltd. is an Alberta company and carries on business in the province and elsewhere in Canada [Aux Sable Canada].

[4] JL Energy is a company incorporated under the laws of Alberta and is the owner of the 670 Patent. By way of introduction to the technology that is the subject of this litigation, the Abstract of the Invention, set out in the 670 Patent, reads as follows:

> **Abstract of the Invention**
>
> At pressures over 1000 psia, it is advantageous to add to natural gas an additive which is a C_2 C_3 and C_4 hydrocarbon compound, CO, NH_3 or HF or a mixture of such additives. Above a lower limit (which varies with the additive being added and the pressure), this results in a smaller Z factor, or (M_wZ) product, representing increased packing of molecules, and therefore leading to a decrease in the amount of power needed to pump the mixture or to compress it.

[5] By way of further background explanation of the relevant technology, the following appears uncontroversial. Natural gas, in its naturally occurring form, is composed mainly of

methane, a hydrocarbon molecule with only one carbon atom. However, natural gas may also include smaller quantities of hydrocarbons with a larger number of carbon atoms, such as ethane (having two carbon atoms, designated as C_2), propane (having three carbon atoms, designated as C_3), butane (having four carbon atoms, designated as C_4), and other heavier hydrocarbons. All these heavier hydrocarbons have a higher molecular weight (a property designated by the term Mw) than methane, because their molecules are composed of more atoms. As such, the greater the concentration of such heavier hydrocarbons in a gas mixture, the greater will be its average molecular weight. However, it is a feature of gas behaviour that, at a given temperature and pressure, a gas mixture which includes increased quantities of the heavier molecular weight hydrocarbons C_2 and C_3 becomes more compressible, a property designated by what is called the "z factor". A lower z factor represents a more compressible gas.

[6] Directionally, heavier molecular weight hydrocarbons require more energy to be transported in a pipeline than does the lighter molecular weight methane. However, the increased compressibility (or lower z factor) of a mixture containing increased quantities of the heavier hydrocarbons C_2 and C_3 contributes directionally to less energy being required to transport the mixture. Beyond a certain threshold of increased quantities of these heavier molecular weight hydrocarbons, and at certain temperatures and pressures, this increased compressibility can "overcome" the effect of the heavier molecular weight. Therefore, treating a naturally occurring gas mixture (consisting primarily of methane and small quantities of ethane, propane, butane, etc.) by intentionally adding C_2 and/or C_3 can result in a reduction of the amount of energy required to transport the mixture in a pipeline.

[7] Whether such a reduction in the energy required to transport the mixture in a pipeline will actually result can be determined by calculating the product of the molecular weight (Mw) and the compressibility of the new gas mixture (z) and comparing that product (zMw) to the zMw product of the untreated gas. A lower zMw product indicates that a reduction in the energy required to achieve transport of the gas mixture will result.

[8] In June 1996, prior to filing the application for the 670 Patent, JL Energy (then called 665976 Alberta Ltd.) licensed certain technology, broadly of the sort described in general terms above, to one of the Plaintiffs, Aux Sable LP (then called Alliance Pipeline NGL LP) [the Licence]. In January 1999, Aux Sable LP assigned the Licence, with the consent of JL Energy, to Aux Sable Extraction LP, another limited partnership formed under Delaware law [Aux Sable Extraction]. Aux Sable Extraction is not a party to this litigation.

[9] In May 2016, JL Energy brought an action for breach of contract and infringement of the 670 Patent in the Court of Queen's Bench of Alberta against several defendants, including Aux Sable LP and Aux Sable GP [the Alberta Action]. The Alberta Action has not progressed, pending the outcome of the within action before this Court, although there is a pending application in the Alberta Action to add defendants, including Aux Sable Canada and Aux Sable Extraction.

[10] In response to the Alberta Action, the Plaintiffs commenced the within action in September 2016, seeking an order pursuant to subsection 60(1) of the *Patent Act*, RSC 1985 c P-4 [the Act] declaring that the 670 Patent is invalid, void and of no force and effect. It is

acknowledged by the Defendant that each of the Plaintiffs is an “interested person” for purposes of bringing a proceeding under s 60(1) of the Act.

[11] As will be explained in more detail below, the 670 Patent sets out 10 claims. Claims 1 and 9 are independent claims, with claims 2 through 8 depending on claim 1 and claim 10 depending on claim 9. The Plaintiffs raise invalidity arguments, in connection with all claims, related to obviousness, insufficiency, and unpatentable subject matter. They also argue that claims 9 and 10 are invalid for anticipation/novelty, overbreadth and lack of utility. The Defendant denies that any of the claims of the 670 Patent are invalid, for any of the reasons asserted by the Plaintiffs. The Defendant had also argued, as a consequence of the Licence, that the principles of licensee estoppel preclude the Plaintiffs from challenging the validity of the patent, but it did not pursue this argument at trial. The parties have agreed that, for purposes of the issues in this litigation, the 670 Patent was filed in Canada on May 16, 1997 and the claim date for the 670 Patent is November 18, 1996.

[12] Much of the documentary evidence in this action was admitted by agreement of the parties. Each of the parties supported its positions on the various grounds of invalidity through the evidence of expert witnesses. The Defendant also called the inventor of the 670 Patent and several other witnesses of fact to speak to the relationship between the 670 Patent and the so-called Alliance Pipeline, a pipeline between Northwest Alberta and Chicago, Illinois, which the Defendant had a role in developing and which it argues employs the technology of the patent. These witnesses also testified as to the disputed confidentiality of one of the prior art documents that the Plaintiffs had been relying upon in connection with anticipation and obviousness

arguments. However, during the course of trial, the Plaintiffs withdrew their reliance upon that document. As such, the confidentiality dispute and the evidence related to that issue need not be addressed any further. The evidence of the witnesses necessary to address the remaining issues in this action will be canvassed later in these Reasons.

III. **Issues**

[13] The issues to be decided by the Court in this action, ordered in the same manner as presented by the Plaintiffs in their closing submissions, are as follows:

A. Are claims 9-10 of the 670 Patent invalid based on the following grounds:

i. Overbreadth;
ii. Inutility;
iii. Anticipation; or
iv. Obviousness?

B. Are claims 1-8 of the 670 Patent invalid for obviousness?

C. Are claims 1-10 of the 670 Patent invalid based on the following grounds:

i. Insufficiency; or
ii. Unpatentable subject matter?

[14] The allegations of invalidity necessarily require identification of the person of ordinary skill in the art [the Skilled Person], to whom the 670 Patent is directed, and construction of the claims of the 670 Patent prior to consideration of the invalidity allegations. The obviousness allegation also raises a particular legal issue in the present case, surrounding whether the statutory amendment enacting s 28.3 of the Act removed the requirement, found in relevant jurisprudence, that prior art references proposed by the Plaintiffs in support of the obviousness allegations be locatable by a reasonably diligent search.

IV. **Witnesses**

[15] Each of the parties introduced expert evidence in support of its respective positions on construction of the claims of the 670 Patent and the various grounds of invalidity that are at issue, including opining on the credentials and characteristics of the Skilled Person, the relevant prior art, and the common general knowledge [CGK] of the Skilled Person. Each of the experts was found by the Court, without objection from the opposing party, to be qualified to provide opinions on all these issues. While the experts' evidence will be considered in more detail in connection with the individual issues to which it relates, the following are my general observations as to the reliability of the individual experts.

A. *Dr. Stephen Ramsay*

[16] The first expert to testify on behalf of Aux Sable was Dr. Stephen Ramsay. Dr. Ramsay is a professional engineer and senior consultant at an engineering consulting firm. His educational qualifications include a PhD in Engineering and Applied Mathematics and Theoretical Physics (Fluid Mechanics) from the University of Cambridge. Dr. Ramsay was an Assistant Professor, and later Adjunct Professor, at the University of Western Ontario as of the claim date and publication date of the 670 Patent. He has more than 35 years of experience in consulting, teaching, and research related to pipelines, oil and gas, energy, transportation and related industries. Dr. Ramsay submitted a principal report setting out his opinions on the issues in this action and a further report in reply to the reports of JL Energy's experts.

[17] JL Energy submits that, in areas of conflicting evidence, Dr. Ramsay's opinion should be given little weight. JL Energy argues that during cross-examination, Dr. Ramsay acknowledged multiple errors he had made in his expert reports, retracted multiple statements, and offered evidence contradictory to his reports. In support of this position, JL Energy also refers the Court to commentary by the British Columbia Supreme Court [BCSC] on Dr. Ramsay's role as an expert witness in *Drader v Abbotsford (City)*, 2012 BCSC 873 [*Drader*]. The BCSC found, at paragraphs 238 and 241, that Dr. Ramsay had tailored his calculations and analysis to achieve a particular outcome.

[18] While I note these comments by the BCSC, I agree with Aux Sable's submission that, in considering concerns of the sort raised in *Drader*, what matters is whether Dr. Ramsay's evidence demonstrates similar concerns in the present action. I find that it does not. Rather, as JL Energy notes, in cross-examination Dr. Ramsay made a number of concessions surrounding the evidence in his reports. I did not regard his testimony as argumentative or as demonstrating advocacy for the parties that had retained him. However, the concessions Dr. Ramsay made in cross-examination will be taken into account where relevant to considering the individual issues to which that evidence relates.

B. *Mr. Graeme King*

[19] Aux Sable's second expert, Mr. Graeme King, is a pipeline engineering specialist with more than 45 years' experience as a professional engineer. He has designed, constructed and maintained pipelines and facilities for transporting natural gas, dense phase gas, liquefied natural gas, oil, bitumen, sulphur, and steam in Canada, the United States, Mexico, Russia, Kazakhstan,

the Middle East, and Australia. Mr. King has published in this area, including on the dense phase (a concept which will be explained later in these Reasons), and has presented at numerous conferences. Like Dr. Ramsay, Mr. King submitted a principal report setting out his opinions on the issues in this action and a further report in reply to the reports of JL Energy's experts.

[20] Although JL Energy does not dispute Mr. King's credentials, it argues that he acted as an advocate for Aux Sable's positions. JL Energy submits that, throughout his cross-examination, Mr. King was difficult, inflexible, and intransigent, refusing to answer simple questions, and being intent on reiterating his views, regardless of whether those views were responsive to the questions he was asked.

[21] I find merit to JL Energy's characterization of Mr. King's evidence. On many occasions throughout his cross-examination, Mr. King did not answer relatively straightforward questions, at least when initially asked, and presented as instead being focused on advancing his opinions. For example, when asked whether the gas mixtures identified in one of the papers he authored contained butane in concentrations exceeding a particular concentration disclosed by the 670 Patent, rather than answering the question, Mr. King took issue with JL Energy's counsel's reading of the patent. When asked to confirm that the same paper does not expressly refer to the zMw product as a parameter to indicate when hydraulic efficiency gains are achieved though the deliberate addition of C_2 and/or C_3, Mr. King did not initially answer the question and instead provided an explanation of why measuring pressure loss in a pipeline amounted to the same thing.

[22] Similarly, when asked to confirm that his papers did not compare the zMw product for untreated gas versus gas to which C_2 or C_3 had been added, Mr. King described the role of that product in a flow equation, effectively reiterating one of the principal opinions expressed in his expert report, rather than answering the question asked. When asked whether he was aware of the 670 Patent's description of features of the so-called "energy hill" (which will be further explained later in these Reasons) as attributable to the rate of decrease of the z factor overcoming the rate of increase in density, Mr. King took issue with the patent's explanation rather than answering the question asked.

[23] There are other examples of this pattern in Mr. King's cross-examination. Despite Mr. King's undoubted experience and expertise in the technical areas that are the subject of this action, the concerns described above do raise reservations about relying on his opinions in connection with the issues where the parties' respective experts diverge.

C. *Dr. Mukul Sharma*

[24] Aux Sable's third expert, Dr. Mukul Sharma, is a professor, and past department chair, in the Hildebrand Department of Petroleum and Geosystems Engineering at the University of Texas. Dr. Sharma has taught natural gas engineering for over 32 years, including courses relating to the transportation of natural gas by pipeline and fundamental knowledge for engineers interested in such transportation. He has published more than 400 articles and conference proceedings and holds over 23 patents. Dr. Sharma is also the recipient of prestigious technical awards presented by the Society of Petroleum Engineers (SPE).

[25] JL Energy argues that Dr. Sharma's evidence should be given little weight, submitting that he prepared his report with a fundamental misunderstanding of the legal construct of the Skilled Person. JL Energy also takes the position that Dr. Sharma lacks pipeline experience relevant to the opinions he sought to tender.

[26] I find no deficit in Dr. Sharma's experience which would adversely affect the weight to be afforded to his evidence. JL Energy refers to Dr. Sharma's testimony that he is not familiar with high pressure pipelines that intentionally add C_2 and C_3, in the manner contemplated by the 670 Patent, and that his experience relates to pipelines in Texas. I do not find those limitations on Dr. Sharma's experience to undermine his qualifications to speak to the technical issues in this action. I also note that I found Dr. Sharma to present as a knowledgeable and articulate witness, without demonstrating defensiveness or a lack of objectivity in the manner in which he responded to questions in cross-examination.

[27] However, I do find merit to the concern that JL Energy raises about Dr. Sharma's understanding of the Skilled Person. Dr. Sharma was clear in his testimony that his conception of the Skilled Person was an engineer with an average level of inventiveness. This conflicts with the description of the Skilled Person by Mr. Justice Rothstein, in *Sanofi-Synthelabo Canada Inc. v. Apotex Inc.*, 2008 SCC 61 [*Sanofi*] at para 52, as a "… technician skilled in the art but having no scintilla of inventiveness or imagination …". As pointed out by Aux Sable, this concern arises in the context of an obviousness analysis, as it is the non-inventive technician through whose eyes Justice Rothstein explains the question of obviousness must be assessed. As will be addressed later in these Reasons, Dr. Sharma's incorrect understanding of the characteristics of the notional

Skilled Person is relevant to the weight that can be afforded to certain of his opinions in connection of the obviousness of the 670 Patent. However, I do not find this misunderstanding to undermine the weight to be afforded to other aspects of Dr. Sharma's evidence.

D. *Dr. Wayne Monnery*

[28] JL Energy called two experts. The first to testify, Dr. Wayne Monnery, is a registered professional engineer and currently the principal process engineer for Chem-Pet Process Technology Ltd., which position he has held since 1996. Dr. Monnery's educational qualifications include a PhD in Chemical and Petroleum Engineering from the University of Calgary. He has also lectured and instructed at a number of schools and was an adjunct associate professor at the University of Calgary, Schulich School of Engineering, between 1999 and 2016, lecturing on topics including thermodynamics, phase separator design, and gas processing. Dr. Monnery has over 30 years' experience teaching, consulting and conducting research in the area of thermodynamics and oil and gas processing.

[29] I should explain at this juncture the one dispute that arose at trial surrounding expert qualifications. While Dr. Monnery's expertise as described above was agreed, and Aux Sable did not object to him being qualified to give expert evidence in relation to the various issues that are before the Court, JL Energy sought to include among his qualifications that Dr. Monnery is qualified to give expert evidence with respect to the transportation of gas by pipeline. In that respect, JL Energy adduced evidence from Dr. Monnery as to his role in teaching undergraduate and graduate courses that included instruction in such transportation. Aux Sable objected to this area of qualification, not because Dr. Monnery does not have the requisite expertise, but because

all his teaching in this area was subsequent to November 1996 and therefore later than the date for assessing the prior art relevant to this action.

[30] I ruled at trial that Dr. Monnery's qualifications included this disputed area, with Aux Sable entitled to cross-examine Dr. Monnery and subsequently adduce arguments related to the weight that should be afforded to his evidence arising from the timing within which his expertise was acquired. While Aux Sable did subsequently raise arguments about the reliability of Dr. Monnery's evidence, the argument about the timing of acquisition of his expertise was not pursued.

[31] Aux Sable argues that Dr. Monnery was a combative witness and provided unresponsive answers to cross-examination questions in an effort to advocate for JL Energy's positions. I agree that there were aspects of Dr. Monnery's cross-examination that raise concern about him acting somewhat as an advocate for JL Energy. Aux Sables' counsel identified in cross-examination areas where he gave evidence that appeared prompted by consideration of the impact of his evidence rather than the particular questions being asked. For instance, when questioned about a figure in one of the prior art references relevant to the Plaintiff's anticipation allegations, Dr. Monnery volunteered his opinion that this figure was not intended to be read in conjunction with another figure. This answer was not responsive to the question asked and appeared intended to respond to what Dr. Monnery understood to be one of the Plaintiffs' anticipation arguments.

[32] Similarly, when questioned about another prior art reference that involved combining two different natural gas mixtures, Dr. Monnery referred to the term “added”, used by Aux Sable’s counsel in posing the question, as “a little bit of a loaded gun”. In the course of the same line of questioning, when asked by counsel to confirm that, as one moved through the mixtures in the prior art reference, the concentrations of natural gas liquids increased, Dr. Monnery responded that there was an increase but not a material one. Counsel pointed out that he had not asked about the materiality of the increase, Dr. Monnery confirmed that he had not stated in his report that there was no material increase, and he confirmed that he had heard the testimony of other experts on whether there was a material increase.

[33] I agree with Aux Sable’s argument that testimony of this nature demonstrates more of an effort to advance a position than the Court would prefer to see in the experts appearing before it. I do not find this concern with Dr. Monnery’s evidence to have permeated his testimony sufficiently to undermine the reliability of his evidence. However, I do take it into account in assessing the weight to be afforded to his evidence in areas where the opinions of the parties’ experts diverge.

[34] Aux Sable also notes that Dr. Monnery testified in cross-examination that he ascribed some level of inventiveness to the Skilled Person, describing the person as “not particularly inventive” or “not very inventive”. This is an error similar to that made by Dr. Sharma, as described above. The extent to which this affects the weight to be ascribed to Dr. Monnery’s opinions, in connection with the obviousness analysis, will be addressed when that allegation is considered later in these Reasons.

[35] Aux Sable also submits that Dr. Monnery was unaware of and did not cite the legal instructions he was meant to apply, that he improperly relied on work outside of his affidavit, that he misapplied fundamental legal principles including admitting that his Skilled Person did not read all of the prior art in this case, and that he was instructed not to conduct his own independent search of the literature. To the extent necessary to address the components of the invalidity allegations to which these aspects of Dr. Monnery's evidence relate, those arguments can be considered in connection with the analysis of such allegations.

E. *Mr. Mark Ryan*

[36] JL Energy's second expert, Mr. Mark Ryan, is a registered professional engineer and works for OEL Projects Ltd., with which he has been employed since 1993, currently as Vice President of Process Engineering, which position he has held for the past 11 years. He holds a Bachelor of Science in Chemical Engineering from the University of Calgary. During his time with OEL Projects Ltd., Mr. Ryan has executed over 11,000 projects, many of which involved pipeline design either as a primary scope or in association with related facility work.

[37] I found Mr. Ryan to be a forthright and straightforward witness, who testified clearly, did not appear to be defensive or to be advocating for either the party which had retained him or his own opinions. He readily acknowledged certain errors in his expert report. While those errors are relevant to the extent they relate to portions of his evidence that affect the analysis in these Reasons, I generally find Mr. Ryan to be a reliable witness, subject to certain specific concerns raised by Aux Sable as described below.

[38] In challenging Mr. Ryan's evidence, Aux Sable submits that he did not properly set out in his expert report the legal instructions which he received and was relying upon. They also argue that he admitted to errors in software modelling that he performed, omitted from his report certain results that he was required to include pursuant to the Code of Conduct for Expert Witnesses prescribed by Rule 52.2 of the *Federal Courts Rules*, SOR 98/106, and failed to conduct his own prior art search before giving his opinion. To the extent necessary, these arguments can be addressed when considering the portions of the invalidity allegations to which the relevant aspects of Mr. Ryan's evidence relate.

[39] As with some of the other witnesses, concerns have also been raised about Mr. Ryan's approach to the role of the Skilled Person. Mr. Ryan stated in cross-examination that he considered himself a proxy for the Skilled Person, in terms of academic and career experience at the relevant time in 1996, and that in his expert report he advanced opinions based on his own personal views, applying those views to the Skilled Person. In re-examination, Mr. Ryan also confirmed that he employed definitions of the Skilled Person supplied by JL Energy's counsel. JL Energy submits that Mr. Ryan's evidence indicates only that he is applying his own academic and work experience, which at the relevant time aligned with that of the Skilled Person, not that he is treating his own experience entirely as a proxy for the Skilled Person.

[40] I have considered JL Energy's submission but agree with Aux Sable's position that this aspect of Mr. Ryan's evidence potentially raises concerns. I do not find the re-examination evidence to particularly assist with this issue. The fact that he was working with an accurate legal definition of the Skilled Person does not remove the question raised by his evidence that, at least

to some extent, he relied on his personal views when undertaking tasks assigned by patent law to the Skilled Person. That question is whether his approach undermines the opinions expressed by Mr. Ryan in connection with those tasks. I consider that question later in these Reasons where it has the potential to bear upon areas in which the opinions of the parties' experts diverge.

F. *Fact Witnesses*

[41] As previously noted, JL Energy called as witnesses of fact the inventor of the 670 Patent, Mr. Ian Morris, and several other witnesses to speak to the relationship between the 670 Patent and the Alliance Pipeline. I found no issues with the credibility of any of these witnesses. However, their evidence was offered as relevant to secondary factors that can be considered in assessing the obviousness of the 670 Patent and, as will be explained below, I do not find it necessary to move to secondary factors to arrive at my conclusions on obviousness. As such, no further comment is required in relation to the witnesses of fact.

V. **The Skilled Person**

[42] As noted above, in relation to some of the parties' experts' opinions, there are concerns about the particular characteristics of the Skilled Person or the manner in which those characteristics were invoked by the particular expert. However, as between the parties, there does not appear to be any substantive disagreement as to the characteristics assigned by patent law to the Skilled Person. The Plaintiffs refer the Court to the following extract from the description of the Skilled Person, expressed in the particular context of the Skilled Person's role in an

obviousness analysis, in *Apotex Inc. v H. Lundbeck A/S*, 2013 FC 192 at para 83, quoting *Lilly Icos LLC v Pfizer Ltd*, [2000] EWHC Patents 49:

> The question of obviousness has to be assessed through the eyes of the skilled but non-inventive man in the art. This is not a real person. He is a legal creation. He is supposed to offer an objective test of whether a particular development can be protected by a patent. He is deemed to have looked at and read publicly available documents and to know of public uses in the prior art. He understands all languages and dialects. He never misses the obvious nor stumbles on the inventive. He has no private idiosyncratic preferences or dislikes. He never thinks laterally. He differs from all real people in one or more of these characteristics.
>
> …

[43] To similar effect, JL Energy's experts state that they were instructed by counsel for JL Energy to assume that the Skilled Person is a technician who has not a scintilla of inventiveness or imagination, is a paragon of deduction and dexterity, is wholly devoid of intuition, is not a dullard, and is a competent worker who keeps up to date with the relevant literature.

[44] There is also broad, although not complete, agreement among the parties' experts as to the credentials of the particular Skilled Person to whom the 670 Patent is directed. Dr. Ramsay described the Skilled Person as an individual with an undergraduate degree in applied science, engineering or a related area and 1-3 years of hands-on work experience related to the transportation of natural gas by pipeline. Mr. King described the Skilled Person, in similar terms, as an individual with an undergraduate degree in engineering or applied science with undergraduate courses in thermodynamics and fluid flow and 1-3 years of hands-on work related to the pipeline transmission of fluids including natural gas. Mr. King states that the Skilled

Person may also have worked for a few years designing and optimizing pipelines for the transportation of fluids like natural gas or possibly oil.

[45] Similar to the Plaintiffs' other two experts, Dr. Sharma described the Skilled Person as an individual with an undergraduate degree in applied science, engineering or a related area with 1-3 years of practical experience related to pipeline transportation of natural gas. However, Dr. Sharma also added a further description, stating that the Skilled Person may alternatively have an advanced degree related to the transportation of natural gas by pipeline and less work experience.

[46] Turning to the Defendant's experts, Dr. Monnery states in his expert report that he was instructed by JL Energy's counsel to adopt Mr. King's description of the credentials of the Skilled Person, with the exception of the possibility that the Skilled Person may have worked for a few years designing and optimizing pipelines for the transportation of fluids like natural gas or possibly oil. He also states that he was instructed to disregard Dr. Sharma's description of the Skilled Person's credentials, which includes the possibility of having an advanced degree related to the transportation of natural gas by pipeline.

[47] Similarly, Mr. Ryan states in his expert report that he was instructed by JL Energy's counsel to adopt a particular description of the credentials of the Skilled Person, which description appears to align with the instructions provided to Dr. Monnery.

[48] Notwithstanding some minor divergence in the above descriptions of the credentials of the Skilled Person, I agree with the submission of Aux Sable that JL Energy has not identified

any difference in the knowledge of the Skilled Person relevant to this action that would depend on which description is preferred. Indeed, I note the statement by JL Energy's expert Dr. Monnery that, even if he were to adopt the elements of the Skilled Person's credentials that he was instructed by JL Energy's counsel to disregard, this would not change the opinions set out in his report. For purposes of these Reasons, as neither party has identified anything material that turns on this issue, I adopt the description of the Skilled Person which is in substance common to the reports of all the experts, i.e. an individual with an undergraduate degree in engineering or applied science with undergraduate courses in thermodynamics and fluid flow and 1-3 years of hands-on work experience related to the pipeline transmission of fluids including natural gas.

VI. **Claim Construction**

[49] Having identified the Skilled Person, the next task is to identify how the Skilled Person would construe the claims of the 670 Patent. There does not appear to be any disagreement between the parties surrounding the principles applicable to claim construction. As explained in *Whirlpool Corp. v Camco Inc.*, 2000 SCC 67 at paras 43 and 49, the claims of a patent are to be construed once and for all purposes prior to consideration of validity issues. In *Mylan Pharmaceuticals ULC v Eli Lilly Canada Inc*, 2016 FCA 119 [*Mylan*] at para 39, the Federal Court of Appeal explained the process of claim construction as follows:

> … The rules of patent construction preclude reference to the specification when the claims are clear, and also improper if it varies the scope of the claims: *Hughes and Woodley on Patents*, p. 312:
>
> > In construing a patent, the claims are the starting point. The claims alone define the statutory monopoly and the Patentee has a statutory duty to

> state, in the claims, what he invention is for which protection is sought. In construing the claims, recourse to the rest of the specifications is (1) permissible to assist in understanding the terms used in the claims; (2) unnecessary where the words and plain and unambiguous and (3) improper to vary the scope or ambit of the claims.

[50] The evidence of experts offered by both parties confirms that the claims are clear and unambiguous. As such, the claims are to be construed by reference to the words of the claims themselves. Reproduced in full, the 10 claims of the 670 Patent read as follows:

> 1. A method of transporting natural gas by pipeline, which comprises:
>
> > (a) adding to such natural gas sufficient of at least one C_2 or C_3 hydrocarbon or a mixture of C_2 and C_3 hydrocarbons such so the hydrocarbon, together with the C_2 and C_3 hydrocarbon (if any) originally in the natural gas, forms a resulting mixture with a total C_2 or C_3 hydrocarbon content which is sufficient, at the pressure and temperature to be used for transporting, to reduce the product of the z factor and the average molecular weight of the resulting mixture to a level lower than the product of the z factor and the average molecular weight of the untreated natural gas, and
>
> > (b) transporting such resulting mixture by pipeline at a temperature of between -40° and +120° Fahrenheit and pressure greater than 1000 psia, said pressure and temperature being chosen so the resulting mixture has no coherent liquid phase at the temperature and pressure of transmission.
>
> 2. A method as claimed in claim 1, where the hydrocarbon is selected from
>
> > (a) between 26 and 40% of at least one C_2 compound if the pressure is about 1000 psia,

declining smoothly to about 6% to 15% of said C_2 compound if the pressure is about 2200 psia, or

(b) between 12% and 5% of a C_3 compound, if the pressure is about 1000 psia, declining smoothly to the C_3 amount which will not cause liquefaction at the pressure used when the pressure is above 1000 psia.

3. A method as claimed in either claim 1 or claim 2, in which there is not more than 1% by volume of carbon dioxide in the resulting mixture.

4. A method as claimed in claim 1 or claim 2, in which there is not more than 2% nitrogen in the resulting mixture.

5. A method as claimed in any of claims 1 – 4, in which the temperature at which the resulting mixture is transmitted is between -20°F and +120°F.

6. A method as claimed in any of claims 1 – 4, in which the pressure at which the resulting mixture is transmitted is between 2160 psia and 1150 psia.

7. A method as claimed in any of claims 1 – 6 in which the C_2 hydrocarbon added to the natural gas is ethane.

8. A method as claimed in any of claims 1 – 7 in which the C_3 hydrocarbon added to the natural gas is propane.

9. A gas mixture, for use in a pipeline at a pressure greater than 1,000 psia and a temperature of from -40 degrees F to +120 degrees F, which comprises:

(a) from 68 to 92% by volume of methane;

(b) from 6 to 35% by volume of ethane;

(c) from 0 to 9% by volume of propane;

(d) from 0% by volume of C_4 hydrocarbons to a percentage of C_4 hydrocarbons which does not liquify at the pressure used;

> (e) not more than 1% of carbon dioxide;
>
> (f) not more than 2% of nitrogen, the total being 100%, and such mixture being completely gaseous with no liquid phase at the temperature and pressure of intended operation.
>
> 10. A gas mixture as claimed in claim 9, said gas mixture being at a pressure of 1000-2200 psia and a temperature of from -20 degrees F to +120 degrees F.

[51] The parties and their respective experts now appear to be substantially in agreement as to the construction of the claims. Most material to the issues in this action, both parties agree that the independent claim 1, and claims 2 to 8 which depend upon claim 1, include the following elements:

A. The intentional addition to natural gas of a C_2 hydrocarbon and/or a C_3 hydrocarbon; and

B. Ensuring that the product of the molecular weight (Mw) and the z factor of the resulting gas mixture is lower than the zMw product prior to such addition.

[52] I therefore adopt the above agreement between the parties related to the construction of claims 1-8. Prior to trial, the parties appeared to disagree on claim construction with respect to claims 9 and 10. JL Energy took the position that those claims include the same two elements as described in the preceding paragraph, i.e. intentional addition of C_2 and/or C_3 and evaluation of the resulting change in zMw. Aux Sable's experts opined that claims 9 and 10 claim gas mixtures for transport in a pipeline, with certain composition, pressure and temperate ranges, and without any liquid phase present in the gas mixture, but do not include the two elements of adding C_2 and/or C_3 and evaluating zMw. However, this disagreement was resolved by the

conclusion of trial. In cross-examination, JL Energy's experts identified no disagreements with this aspect of the claim construction by Aux Sable's experts, and JL Energy's closing argument confirmed no such disagreement.

[53] I also note that I agree it would be improper to incorporate into the construction of claims 9 and 10 the requirements of claim 1 related to adding C_2 and/or C_3 and the evaluation of the resulting change in zMw. As explained by Justice Gauthier in *Eli Lilly & Co. v Apotex Inc.*, 2009 FC 991 at para 123 [*Eli Lilly*]:

> … If, by construing the claim, one were to limit or incorporate the elements of one independent claim into the elements of another independent claim, one would disregard the right of the inventors to adopt different ways of defining their monopoly and describing different aspects of an invention, which may or may not be too limited or too wide.

[54] I therefore adopt the construction of claims 9-10 provided by Aux Sable's experts, i.e. that claims 9 and 10 claim gas mixtures for transport in a pipeline, with certain composition, pressure and temperate ranges, and without any liquid phase present in the gas mixture.

[55] JL Energy raises an argument to the effect that Aux Sable's experts did not conduct an essential elements analysis with respect to claim 9 and 10, but this argument relates to the allegation of overbreadth and will be addressed when considering that ground of invalidity below.

VII. **Are claims 9-10 of the 670 Patent invalid based on the following grounds?**

A. *Overbreadth*

[56] Section 27(4) of the Act provides that a patent's specification must end with a claim or claims defining distinctly and in explicit terms the subject matter of the invention for which an exclusive privilege or property is claimed. Aux Sable refers the Court to the explanation, by the Supreme Court of Canada in *Canadian Celanese Ltd. v B.V.D. Co.*, [1937] SCR 221 at page 237, as to how a patent can be invalid due to overbreadth of its claims:

> 40 In the Canadian patent involved in this appeal before us the inventor did not state in his claims the essential characteristic of the actual invention though it does appear in the claims in his British and United States patents. No explanation is offered. We are invited to read through the lengthy specification and import into the wide and general language of the claims that which is said to be the real inventive step disclosed. But the claims are unequivocal and complete upon their face. It is not necessary to resort to the context and as a matter of construction the claims do not import the context. In no proper sense can it be said that though the essential features of the invention is not mentioned in the claims the process defined in the claims necessarily possesses that essential feature. The Court cannot limit the claims by simply saying that the inventor must have meant that which he has described. The claims in fact go far beyond the invention. Upon that ground the patent is invalid.

[57] This principle has been described more recently by the Federal Court of Appeal, in *Amfac Foods Inc. v Irving Pulp & Paper Ltd.* (1986), 12 CPR (3d) 193 (Fed CA) [*Amfac Foods*] at para 32, as follows:

> 32 … The weakness in the claim in issue here is that the claim failed to mention essential elements disclosed as part of the invention. As I see it, therefore, *Consolboard* cannot be relied on for the proposition espoused by appellants' counsel. While there can be no question that a patent must be fairly construed, if such fair construction reveals that an essential element (in this case a limitation) has not been claimed, the omission is fatal to the claim's validity.

[58] Aux Sable's argument, in relation to claims 9 and 10 of the 670 Patent, is that the claims are broader than the invention disclosed in the patent. As claims 9 and 10 claim natural gas mixtures regardless of whether ethane or propane was added to the mixture and regardless of whether the zMw product is reduced after such addition. Aux Sable argues that the elements necessary to limit claims 9 and 10 to the invention of the 670 Patent are missing.

[59] In support of this position, Aux Sable refers the Court to the "Summary of the Invention" contained within the specification of the 670 Patent, which reads as follows:

> Summary of the Invention
>
> It has now been found that, at pressures over 1000 psia, it is advantageous to add to natural gas an additive which is a C_2 or C_3 hydrocarbon compound or a mixture of such additives. Above a lower limit (which varies with the additive being added and the pressure), this results in a smaller product of the z factor times the average molecular weight of the gas (hereinafter called the zMw product) than would exist with methane alone, therefore leading to a decrease in the amount of power needed to pump the mixture or to compress it.

[60] Aux Sable also relies on the evidence of its experts. Dr. Sharma states in his report that the Skilled Person reading the 670 Patent as a whole would understand that the invention disclosed in the patent generally relates to the addition of a C_2 and/or C_3 hydrocarbon to natural gas, ensuring that the product of the average molecular weight and the z factor was lower for the resulting mixture, and achieving efficiencies by transporting the resulting mixture at the claimed pressures and temperatures. Dr. Sharma opines that claims 9 and 10 of the 670 Patent are broader than the invention described in the Patent, because those claims do not require the addition of C_2

and/or C_3 hydrocarbons, do not require a comparison of the gas mixture before and after the addition, and do not require that the zMw of the mixture be reduced as a result of such addition.

[61] Dr. Ramsay expresses similar conclusions in his report. I find nothing in the cross-examinations of Aux Sable's experts, or in the responding reports prepared by JL Energy's experts, which meaningfully challenges the analysis or conclusions expressed by Dr. Sharma or Dr. Ramsay in relation to the overbreadth of claims 9 and 10.

[62] JL Energy raises two principal arguments in response to this particular allegation of invalidity. First, it questions whether *Amfac Foods* remains good law, arguing that Aux Sable's overbreadth allegation amounts to an effort to apply a version of the promise doctrine which the Supreme Court of Canada in *AstraZeneca Canada Inc. v Apotex Inc.*, 2017 SCC 36 [*AstraZeneca*] found not to be good law. Second, JL Energy submits that Aux Sable has failed to provide the requisite evidentiary support for its argument, because its experts have not conducted an essential elements analysis necessary to support its overbreadth allegation.

[63] In relation to the impact of *AstraZeneca* upon *Amfac Foods*, JL Energy notes the cautioning by Justice Phelan in *Hospira Healthcare Corporation v Kennedy Trust for Rheumatology Research*, 2018 FC 259 at para 258 [*Hospira Healthcare*], that it would be inconsistent with *AstraZeneca* to have the promise doctrine resurface by importing it into an overbreadth analysis. I accept this point but do not regard it as supporting a conclusion that the law surrounding overbreadth as expressed in *Amfac Foods* has been changed by *AstraZeneca*. Indeed, *AstraZeneca* expressly states at paragraph 46 that an overly broad claim may be declared

invalid. The jurisprudence also demonstrates allegations of overbreadth being considered subsequent to the decision in *AstraZeneca* (see *Apotex Inc. v Shire LLC*, 2018 FC 637 at paras 146-148).

[64] JL Energy submits that the arguments raised by Aux Sable in support of its overbreadth allegation are similar to those it asserts in connection with its inutility allegation and would be more appropriately addressed through an inutility analysis. I agree that there are similarities in the arguments. However, in *Bombardier Recreational Products Inc. v Arctic Cat, Inc.*, 2018 FCA 172 at para 64, the Federal Court of Appeal cautioned against intermingling different invalidity allegations. I will address the inutility allegation in the next section of these Reasons but must separately address Aux Sable's arguments surrounding overbreadth.

[65] The thrust of JL Energy's submission, to the effect that Aux Sable's arguments represent an improper effort to import the promise doctrine into an invalidity allegation, is that Aux Sable is asking the Court to find claims 9-10 invalid because they do not meet the promise of a reduction in the zMw product resulting from addition of C_2 and/or C_3 hydrocarbons. JL Energy submits that, independent of that method disclosed by the 670 Patent for achieving efficient transport of natural gas, the patent discloses in a particular table in the specification a set of ranges for certain natural gas constituents, as well as temperature and pressure ranges, described as "the preferred composition of the resulting gas". JL Energy argues that, as claims 9-10 are not broader than this preferred composition, they are not broader than the invention disclosed by the patent.

[66] In response to this argument, Aux Sable submits that JL Energy is advancing this position without any evidentiary support from their experts. I agree with this submission. JL Energy's experts do not opine that the invention disclosed by the 670 Patent is or includes the range of compositions, temperatures and pressures set out in the table of the specification relied upon by JL Energy. Rather, the unchallenged evidence before the Court as to the nature of the invention disclosed is as described above, which includes the addition of a C_2 and/or C_3 hydrocarbon and ensuring that the zMw product is lower for the resulting mixture. I also find no merit to JL Energy's submission that Aux Sable is improperly attempting to import the promise doctrine into an overbreadth allegation. Aux Sable's argument is not that the invention fails to satisfy a promise made in the specification, but rather that the claims are broader than the invention disclosed in that specification, as interpreted by the experts though the eyes of the Skilled Person.

[67] I also note JL Energy's submission that Aux Sable has not presented argument or evidence that the inventors of the 670 Patent did not use the zMw parameter when selecting the ranges specified in claims 9 and 10. This submission is perhaps more applicable to the inutility allegation and will be considered in analysing that argument as well. However, I have also taken it into account in considering JL Energy's overbreadth arguments, because of the possibility that it could support a conclusion that the use of the zMw parameter, while not explicitly stated in claims 9 and 10, was determinative of the ranges specified in those claims.

[68] Relevant to that question, Dr. Sharma states in his main report, albeit in the context of the utility analysis, that, because of the very wide range of temperatures, pressures and

concentrations set out in claims 9-10, those claims include very inefficient selections, i.e. selections which would not achieve a more efficient transportation of a gas mixture.

[69] I appreciate that the Plaintiffs bear the burden of proving their allegations of overbreadth. I also recognize that Dr. Sharma has not included in his report calculations to support his conclusion that the ranges of claims 9-10 include inefficient selections. However, this conclusion appears to be unchallenged by JL Energy's experts. Indeed, in responding to the relevant paragraph of Dr. Sharma's report, Dr. Monnery refers to the value of using zMw as a guide to determining which conditions and compositions would be efficient. Dr. Monnery refers to the inventors showing and discussing inefficient versus efficient selections in the specification and states his opinion that the Skilled Person would have understood that the concept of using zMw as a guide was also applicable in claims 9 and 10. I read this evidence not as disagreeing with Dr. Sharma's conclusion but as explaining that the zMw parameter is to be used to avoid inefficient selections within the ranges of claims 9-10. I therefore find that the inventors of the 670 Patent did not use the zMw parameter when selecting the ranges specified in claims 9 and 10 and that concerns about overbreadth of those claims cannot be eliminated on that basis.

[70] I turn now to JL Energy's second argument, that Aux Sable failed to provide the requisite evidentiary support for its overbreadth allegation, because its experts have not conducted an essential elements analysis necessary to support that allegation. JL Energy relies on the language from *Amfac Foods* quoted above, which I repeat for ease of reference:

> 32 … The weakness in the claim in issue here is that the claim failed to mention essential elements disclosed as part of the invention. As I see it, therefore, *Consolboard* cannot be relied on for the proposition espoused by appellants' counsel. While there

> can be no question that a patent must be fairly construed, if such fair construction reveals that an essential element (in this case a limitation) has not been claimed, the omission is fatal to the claim's validity.
>
> [emphasis added]

[71] JL Energy submits that, in performing the required claim construction antecedent to consideration of invalidity allegations, Aux Sable's experts did not find the elements upon which the overbreadth allegation is based (i.e. addition of C_2 and/or C_3 and measurement of zMw) to be essential elements. In my view, this argument demonstrates a misunderstanding of the use by the Federal Court of Appeal of the phrase "essential element" in the above passage from *Amfac Foods*.

[72] I appreciate that, as explained in *Free World Trust v Électro Santé Inc*., 2000 SCC 66 [*Free World Trust*] at paras 20-23, it may be necessary, for consideration of both validity and infringement allegations, to identify essential and non-essential elements of the claims of a patent in the course of the antecedent claim construction. However, this is clearly not the same analysis that is contemplated by paragraph 32 of *Amfac Foods*. That paragraph refers to essential elements disclosed as part of the invention and the need to consider whether such elements are mentioned in the patent's claims. Such analysis does not involve whether a particular element is an essential or non-essential component of the claims (the process contemplated by *Free World Trust*), but rather considers whether the element is found in the claims at all.

[73] I nevertheless accept that the analysis contemplated by *Amfac Foods* requires that the element of the invention disclosed, which is alleged to be missing from the claims, itself be an

essential element of that invention. However, in that respect, I find no evidentiary deficiency in the expert reports upon which Aux Sable relies. While Dr. Sharma does not expressly state that the elements of the invention missing from claims 9-10 are “essential elements”, this is clearly the point being conveyed by his evidence. Indeed, in introducing his opinion on overbreadth, Dr. Sharma’s report refers to the advice he has received, presumably from Aux Sable’s counsel, that claims are overly broad if an element essential to the invention is omitted from the claims. Moreover, Dr. Ramsay’s report expressly refers to each of the addition of C2 and/or C3 and the zMw limitation as an “essential limitation” that is omitted from claims 9-10.

[74] In conclusion on this ground of invalidity, I find that Aux Sable has met its burden of establishing that claims 9-10 of the 670 Patent are invalid for overbreadth. Given this finding, it is not strictly necessary for me to consider other grounds of invalidity raised by the Plaintiffs in relation to these claims. However, I do so where such alternative analysis is logical and beneficial to perform, in case I have erred in the course of any of my reasoning.

B. *Inutility*

[75] Pursuant to the definition of “invention” in the Act, an invention must be “useful”. Aux Sable submits that claims 9 and 10 of the 670 Patent are invalid for lack of utility, because they lack the limitation, as found in claims 1- 8, of adding C_2 and/or C_3 hydrocarbons and ensuring a reduction of the zMw product in the resulting gas mixture. Aux Sable argues that claims 9 and 10 therefore claim broad gas compositions that will result in inefficient transport and are accordingly useless and invalid.

[76] The law now applicable to allegations of inutility is set out as follows in *AstraZeneca*:

> 52 The words in s. 2 of the Act ground the type of utility that is pertinent by requiring that it is the *subject-matter* of an invention or improvement thereof that must be useful. For the subject-matter to function as an inventive solution to a practical problem, the invention must be capable of an actual relevant use and not be devoid of utility. As stated by Justice Binnie in *AZT*, a patent "is a method by which *inventive solutions to practical problems* are coaxed into the public domain by the promise of a limited monopoly for a limited time" (para. 37 (emphasis added)).
>
> 53 Utility will differ based on the subject-matter of the invention as identified by claims construction. Thus, the scope of potentially acceptable uses to meet the s.2 requirement is limited — not *any* use will do. By requiring the usefulness of the proposed invention to be related to the nature of the subject-matter, a proposed invention cannot be saved by an entirely unrelated use. It is not sufficient for an inventor seeking a patent for a machine to assert it is useful as a paperweight.
>
> 54 To determine whether a patent discloses an invention with sufficient utility under s.2, courts should undertake the following analysis. First, courts must identify the subject-matter of the invention as claimed in the patent. Second, courts must ask whether that subject-matter is useful — is it capable of a practical purpose (i.e. an actual result)?
>
> 55 The Act does not prescribe the degree or quantum of usefulness required, or that every potential use be realized — a scintilla of utility will do. A single use related to the nature of the subject-matter is sufficient, and the utility must be established by either demonstration or sound prediction as of the filing date (*AZT*, at para. 56).

[77] Aux Sable emphasizes the principle, explained in the above passage, that the requisite utility is to be measured with respect to the subject matter of the invention (see also *Bristol-Myers Squibb Canada Co. v Apotex Inc.*, 2017 FCA 190 at para 35).

[78] As previously noted, Aux Sable's inutility arguments bear similarities to its arguments surrounding overbreadth. The expert evidence upon which it relies is also similar. Dr. Ramsay opines in his report that the Skilled Person would understand that the subject matter of the invention claimed in the 670 Patent involves an increase in the efficiency of the transportation of a natural gas mixture, expressed alternatively as a decrease in the amount of power needed to pump the mixture or to compress it. Dr. Ramsay further opines that the subject matter as claimed in claims 9-10 is not useful because those claims are not limited to gas mixtures that achieve any level of efficiency and include within their broad scope very inefficient gas mixtures for transportation by pipeline.

[79] To similar effect, Dr. Sharma states in his report that the invention described in the 670 Patent relates to methods of transporting natural gas, using the parameters of the claims, more efficiently. However, he opines that, because claims 9-10 do not contain the requirement of a reduction in zMw, those claims have no limitations which would require more efficient transportation. Rather, because of the very wide range of temperatures, pressures, and concentrations, very inefficient selections are included in these claims with no requirement that such inefficient selections be avoided. Dr. Sharma therefore concludes that claims 9-10 lack utility.

[80] Aux Sable submits, and I concur, that these conclusions surrounding inefficient mixtures or selections are not contradicted by the evidence of JL Energy's experts. As explained in my analysis of the overbreadth allegation, I read Dr. Monnery's report as explaining that the zMw parameter is to be used to avoid inefficient selections within the ranges of claims 9-10. As the

use of that parameter is absent from claims 9 and 10, his evidence supports a conclusion that those claims include inefficient compositions, temperatures and pressures, which therefore lack utility. I read Mr. Ryan's report as being to the same effect and therefore supporting the same conclusion.

[81] I appreciate that the 670 Patent is presumed to be valid and that the Plaintiffs therefore bear the burden, in connection with this particular invalidity allegation, of establishing that claims 9 and 10 lack even a scintilla of utility. However, JL Energy acknowledges that if there is any combination of composition, pressure and temperature, within the ranges prescribed by either of these claims, that lacks that scintilla of utility, then the claim is invalid. JL Energy submits that the relevant utility is either an increased hydraulic efficiency or merely being capable of transport in a pipeline.

[82] In relation to the first form of utility raised by JL Energy, increased hydraulic efficiency, my conclusion is that the evidence relied upon by Aux Sable, as described above, discharges its burden of establishing that there are inefficient combinations of gas composition, pressure and temperature within the ranges prescribed by claims 9 and 10. As noted in my analysis of the overbreadth allegation, I recognize that Aux Sable's experts have not included in their reports calculations demonstrating the inefficiency of a particular combination within the ranges of claims 9-10. However, their opinions on this point are clear, were not challenged in cross-examination, and are not contradicted by opinions offered by JL Energy's experts. Viewing utility as requiring increased efficiency, Aux Sable has established that such utility is lacking in claims 9 and 10 of the 670 Patent.

[83] The second form of utility proposed by JL Energy for consideration is use in a pipeline with the compositions and under the conditions specified by claims 9 and 10. In support of that approach, JL Energy submits that there is a distinction between claims 1-8, which are method claims, and claims 9-10, which claim a gas mixture for a specific use, i.e. use in a pipeline. However, I have difficulty concluding that the mere fact that such a gas mixture is capable of being transported in a pipeline represents the scintilla of utility contemplated by the *AstraZeneca* analysis.

[84] It must be recalled that the requisite utility is to be measured with respect to the subject matter of the invention claimed. Among the experts, it is Dr. Ramsay who most directly addresses the identification of the subject matter claimed. In the section of his report devoted to that question, he notes that, while claims 9-10 do not require reduction of the zMw product, they do require a minimum concentration of 6% ethane and a minimum pressure of 1000 psia. Based thereon, Dr. Ramsay concludes that, despite the absence of the zMw limitation, efficiency is still of concern to the inventors in relation to claims 9-10.

[85] Mr. Ryan's report responds to this conclusion by Dr. Ramsay. Mr. Ryan considers this conclusion to be contradicted by another conclusion by Dr. Ramsay, that claims 9-10 do not include the zMw limitation, which the Skilled Person understood would result in more efficiently transported natural gas, and are therefore not useful. I do not regard these conclusions to be contradictory. Rather, I understand Dr. Ramsay's opinion to be that the appearance in claims 9-10 of prescribed minima, which are consistent with minima found in some of claims 1-8, indicates that the subject matter of the invention is consistent throughout the claims and relates to

the efficient transport of natural gas, even though the means of achieving that efficiency, by measuring zMw, does not form part of claims 9-10.

[86] Returning to *AstraZeneca*, the Supreme Court explains at paragraph 53 that utility will differ based on the subject matter of the invention "as identified by claims construction". As previously noted, I am conscious that claim construction must be performed once for all purposes, antecedent to consideration of invalidity allegations. Therefore, if the above conclusions by Dr. Ramsay on the subject matter of the invention represented an effort to supplement the construction of claims 9-10, when considering the inutility allegation, this would be improper. However, I do not regard that to be the nature of his analysis. *AstraZeneca* also explains, at paragraph 49, that ultimately every invention pertains to a single subject matter:

> 49 The subject-matter of an invention can be multi-faceted, such that a single subject-matter can be described in many ways. As explained by David Vaver:
>
> > For simplicity's sake, the rule is "one invention, one application, one patent." But inventions are like a many-faceted prism: multiple claims (sometimes running into the hundreds) covering all facets are allowed in the same patent if a "single general inventive concept" links them.
> >
> > (D. Vaver, *Intellectual Property Law* (2nd ed. 2011), at p. 275)
>
> Yet, ultimately, every invention pertains to a single subject-matter, and any single use of that subject-matter that is demonstrated or soundly predicted by the filing date is sufficient to make an invention useful for the purposes of s. 2.
>
> [emphasis added]

[87] I do not read the above analysis by Dr. Ramsay to be augmenting the claim construction on which all the experts are materially in agreement. Rather, he is relying on that construction (i.e. that claims 9 and 10 claim gas mixtures for transport in a pipeline, with certain composition, pressure and temperate ranges, and without any liquid phase present in the gas mixture), and in particular certain minima employed in defining the ranges of such construction, to support his conclusion that the single subject matter of the invention relates to the efficient transport of natural gas. I agree with that conclusion and therefore do not accept JL Energy's argument that the mere fact that the gas mixtures contemplated by claims 9 and 10 are capable of being transported in a pipeline, at the pressures and temperatures contemplated by those claims, satisfies the utility requirement. Such an argument is not quite as extreme as submitting that an otherwise useless machine has utility as a paperweight (per paragraph 53 of *AstraZeneca*). However, in my view, it reaches in that direction.

[88] Finally, I note that I do not regard the assessment of the utility of claims 9-10, based on whether they include useless selections, to represent an application of the promise doctrine. These claims lack utility, not because the 670 Patent promises efficient transportation of natural gas, but because efficient transportation is the subject matter of the invention.

C. *Anticipation*

[89] Allegations of invalidity for anticipation or novelty are governed by s 28.2 of the Act, which provides as follows:

28.2 (1) The subject-matter defined by a claim in an application for a patent in Canada (the "pending application") must not have been disclosed

(a) more than one year before the filing date by the applicant, or by a person who obtained knowledge, directly or indirectly, from the applicant, in such a manner that the subject-matter became available to the public in Canada or elsewhere;

(b) before the claim date by a person not mentioned in paragraph (a) in such a manner that the subject-matter became available to the public in Canada or elsewhere;

(c) in an application for a patent that is filed in Canada by a person other than the applicant, and has a filing date that is before the claim date; or

(d) in an application (the "co-pending application") for a patent that is filed in Canada by a person other than the applicant and has a filing date that is on or after the claim date if

(i) the co-pending application is filed by

28.2 (1) L'objet que définit la revendication d'une demande de brevet ne doit pas :

a) plus d'un an avant la date de dépôt de celle-ci, avoir fait, de la part du demandeur ou d'un tiers ayant obtenu de lui l'information à cet égard de façon directe ou autrement, l'objet d'une communication qui l'a rendu accessible au public au Canada ou ailleurs;

b) avant la date de la revendication, avoir fait, de la part d'une autre personne, l'objet d'une communication qui l'a rendu accessible au public au Canada ou ailleurs;

c) avoir été divulgué dans une demande de brevet qui a été déposée au Canada par une personne autre que le demandeur et dont la date de dépôt est antérieure à la date de la revendication de la demande visée à l'alinéa (1)a);

d) avoir été divulgué dans une demande de brevet qui a été déposée au Canada par une personne autre que le demandeur et dont la date de dépôt correspond ou est postérieure à la date de la revendication de la demande visée à l'alinéa (1)a) si :

(i) cette personne, son agent, son représentant légal ou son prédécesseur en droit, selon le cas :

(A) a person who has, or whose agent, legal representative or predecessor in title has, previously regularly filed in or for Canada an application for a patent disclosing the subject-matter defined by the claim, or	**(A)** a antérieurement déposé de façon régulière, au Canada ou pour le Canada, une demande de brevet divulguant l'objet que définit la revendication de la demande visée à l'alinéa (1)a),
(B) a person who is entitled to protection under the terms of any treaty or convention relating to patents to which Canada is a party and who has, or whose agent, legal representative or predecessor in title has, previously regularly filed in or for any other country that by treaty, convention or law affords similar protection to citizens of Canada an application for a patent disclosing the subject-matter defined by the claim,	**(B)** a antérieurement déposé de façon régulière, dans un autre pays ou pour un autre pays, une demande de brevet divulguant l'objet que définit la revendication de la demande visée à l'alinéa (1)a), dans le cas où ce pays protège les droits de cette personne par traité ou convention, relatif aux brevets, auquel le Canada est partie, et accorde par traité, convention ou loi une protection similaire aux citoyens du Canada,
(ii) the filing date of the previously regularly filed application is before the claim date of the pending application,	**(ii)** la date de dépôt de la demande déposée antérieurement est antérieure à la date de la revendication de la demande visée à l'alinéa a),
(iii) the filing date of the co-pending application is within twelve months after the filing date of the previously regularly filled application, and	**(iii)** à la date de dépôt de la demande, il s'est écoulé, depuis la date de dépôt de la demande déposée antérieurement, au plus douze mois,

(iv) the applicant has, in respect of the co-pending application, made a request for priority on the basis of the previously regularly filed application.	(iv) cette personne a présenté, à l'égard de sa demande, une demande de priorité fondée sur la demande déposée antérieurement
(2) An application mentioned in paragraph (1)(c) or a co-pending application mentioned in paragraph (1)(d) that is withdrawn before it is open to public inspection shall, for the purposes of this section, be considered never to have been filed.	**(2)** Si la demande de brevet visée à l'alinéa (1)c) ou celle visée à l'alinéa (1)d) a été retirée avant d'être devenue accessible au public, elle est réputée, pour l'application des paragraphes (1) ou (2), n'avoir jamais été déposée.

[90] As explained by the Supreme Court of Canada in *Sanofi* at paragraph 28, anticipation considers whether there is single prior art disclosure which enables the Skilled Person to perform the invention. *Sanofi* also explains, at paragraph 25, that the requirement of prior disclosure means the disclosure of subject matter which, if performed, would necessarily result in infringement of the patent. Aux Sable also submits, and I agree, that Federal Court jurisprudence demonstrates that the prior disclosure of a point within a range prescribed by a patent is anticipatory (see, e.g. *Baker Petrolite Corp. v Canwell Enviro-Industries Ltd.*, 2002 FCA 158 [*Baker Petrolite*] at para 42; *Calgon Carbon Corp v North Bay (City)*, 2006 FC 1373 at [*Calgon Carbon*] paras 8, 153 and 163). However, there is disagreement between the parties as to the significance, for purposes of an anticipation analysis, of prior art which discloses a point within the ranges prescribed by a patent and yet teaches away from such point. This issue will be addressed below.

[91] In relation to claims 9-10 of the 670 Patent, Aux Sable submits that there are two anticipatory disclosures:

A. a document entitled “Resource Potential – Hydrocarbons, Optimum Transportation of Natural Gas under Arctic Conditions”, authored by D. Stinson and found in the Proceedings of the International Conference on Arctic Margins, held in Magadan, Russia in September 1994 [Stinson]; and

B. a document entitled “Handbook of Natural Gas Engineering”, published by McGraw-Hill Book Company with a copyright date of 1959 [the Handbook].

[92] JL Energy does not dispute that both Stinson and the Handbook are citable for purposes of the anticipation analysis under s 28.2.

Stinson

[93] By way of introduction, the Abstract in Stinson reads as follows:

> Moving large volumes of natural gas through areas with permafrost presents unusual problems. Current practice in Siberia already incorporates the use of large diameter pipelines operating at high pressures. Large diameter buried pipelines do not reach equilibrium with ground temperatures under normal compressor station spacing. Earlier studies have suggested that the use of refrigerated gas, buried pipelines and low temperature alloys will reduce the impact on the environment, the corrosion of the pipeline, and the cost of moving large volumes of natural gas. Lowering the flowing temperature of the natural gas will increase the capacity of the pipeline by reducing its volumetric flow rate not only by thermal contraction of the gas but also by enhancing the effectiveness of increasing pressure. This non-ideal behaviour of the gas is shown by low values of the compressibility factor.

[94] In conducting the study described in the Abstract, Stinson considers one particular natural gas mixture, at three different temperatures and several different pressures, and calculates the

compressibility factor for each combination, all as set out in a table and figure in the paper. Aux Sable points out that the composition of the natural gas mixture, and several of the pressure and temperature combinations, fall within the ranges of claims 9-10 of the 670 Patent. This position is supported by the evidence of Dr. Sharma, and I do not understand JL Energy or their experts to be taking issue with this point. In relation to enablement, Dr. Sharma also opines in his report that the Skilled Person would be able to read and understand Stinson and to put its disclosure into practice to make a gas mixture for transportation at pressures and temperatures claimed by the patent. JL Energy's arguments do not particularly focus on the enablement portion of the anticipation analysis.

[95] Rather, JL Energy argues that the Skilled Person would not have concluded that the gas composition referenced in Stinson, at the temperature and pressure ranges identified in Stinson upon which Aux Sable relies, were for use in a pipeline as required by claims 9-10. JL Energy submits that Stinson teaches away from the use of that gas composition at temperatures and pressures within the ranges of claims 9-10.

[96] JL Energy's counsel presented detailed arguments explaining how Stinson arrives at its conclusion that "[t]he use of low temperatures and higher than normal transmission pressures appears to be economically attractive under permanent conditions". Stinson calculates flow rates and horsepower requirements for pipeline transmission of the referenced gas mixture at various temperature and pressure conditions. The point of JL Energy's submissions was to demonstrate that, while the table in Stinson upon which Aux Sable relies disclosed and calculated the compressibility factor for the referenced gas mixture at a range of temperature and pressure

combinations, Stinson's conclusion as to the economically optimal temperature and pressure conditions for pipeline transmission of the gas mixture involved a combination of conditions that did not fall within claims 9-10 of the 670 Patent.

[97] While much of counsel's submission on this interpretation of Stinson was unsupported by references to expert evidence, I accept JL Energy's description of Stinson's conclusions and do not particularly understand Aux Sable to be taking issue with it. Rather, Aux Sable submits that whether Stinson teaches away from a temperature and pressure combination within claims 9-10, while potentially relevant to an obviousness allegation, is legally irrelevant to the anticipation analysis.

[98] In support of its position, Aux Sable first relies on Justice Snider's explanation in *Schering-Plough Canada Inc. v Pharmascience Inc.*, 2009 FC 1128 [*Schering-Plough*] at para 97, that the fact that a piece of prior art teaches formulations that would not infringe a patent, as well as formulation that do infringe, is irrelevant to assessing anticipation. In response to the specific argument that Stinson discloses a recommended temperature lower than the ranges in claims 9-10, Aux Sable refers the Court to *Merck & Co v Pharmascience Inc*, 2010 FC 510, in which Justice Hughes considered (among other issues) whether a prior patent, which disclosed the use of a particular drug (and identified a preferred dosage range), anticipated a use of the drug at a lower dosage. Justice Hughes found, at paragraphs 166-168, that the prior patent disclosed and enabled that which was claimed in the patent at issue, including the dosage. I agree that these authorities support Aux Sable's position. The fact that Stinson recommends a particular set of conditions for pipeline transmission of the gas composition referenced therein

does not support a conclusion that other sets of conditions disclosed in Stinson, which along with the composition fall within ranges in claims 9-10, do not anticipate those claims.

[99] I note, and similarly reject, JL Energy's related argument to the effect that Stinson teaches away from claims 9-10 of the 670 Patent in connection with the requirement in those claims that the gas mixture be in a completely gaseous state. JL Energy argues that there is no express statement in Stinson that the recommended case should be run in a pipeline such that it will not liquefy at the pressure and temperature of that case. However, in reference to the gas mixture in Stinson, the paper states that gas of that composition would not have a two-phase region above certain temperatures and pressures. Dr. Monnery testified in cross-examination that the composition would be in a single phase, the gas phase, at the particular temperatures and pressures in table 1 of Stinson that are within the ranges of claims 9-10. I find that this element of claims 9-10 is anticipated by Stinson.

[100] Finally, JL Energy raises a point about the Skilled Person's CGK, which it argues would influence how the Skilled Person would understand Stinson. While the Skilled Person's CGK will be addressed in more breadth and detail in connection with the obviousness analysis later in these Reasons, the current point raised by JL Energy is that the common practice with which the Skilled Person would have been familiar in the mid-1990s was that of transporting so-called "lean" gas with relatively low ethane concentrations not exceeding 6%.

[101] JL Energy refers to Dr. Ramsay's testimony as to the common practice, with which the Skilled Person would have been familiar, of stripping or removing C_2 and/or C_3 from natural gas,

both as a means of creating a lean gas (for transmission by pipeline) and as a means of recovering C_2 and/or C_3 for further processing, as these were valuable commodities. Dr. Ramsay agreed that higher concentrations of the heavier hydrocarbons in the pipeline (identified by JL Energy's counsel by reference to a 6% limit stated in the 670 Patent) could cause practical and safety issues associated with liquefaction and that, for conventional pipelines that were being operated in the mid-1990s, both practical and regulatory considerations therefore constrained the concentrations of C_2 and/or C_3 to be carried.

[102] Against the backdrop of that evidence, JL Energy submits that the Skilled Person reading Stinson would have noted the ethane (C_2) concentration of over 9% in the referenced gas composition and would have concluded that the analysis in Stinson was theoretical and that such composition was not intended for use in a pipeline.

[103] I accept JL Energy's description of the evidence related to this aspect of the Skilled Person's CGK. However, I cannot conclude therefrom that the Skilled Person would not read Stinson as disclosing a gas mixture (within the composition, temperature and pressure ranges of claims 9-10) for use in a pipeline. Dr. Monnery confirmed in cross-examination that Stinson describes the transportation of natural gas by pipeline in permafrost conditions. It is difficult to conclude otherwise than that the gas mixture disclosed in Stinson is for use in a pipeline, as the entire paper relates to pipeline transportation of natural gas. The fact that it discloses a gas composition that would be outside the Skilled Person's usual experience with conventional pipelines does not, in my view, mean that the Skilled Person would interpret Stinson in any other manner.

[104] In conclusion, I would note my view that, given the nature of claims 9-10 as previously construed (i.e. simply claiming a gas mixture within certain composition parameters, for use in a pipeline within certain pressure and temperature ranges, unguided by the evaluation of zMw before and after the addition of C_2 and/or C_3 hydrocarbons), other allegations of invalidity previously canvassed perhaps represent more apt analytical frameworks for the assessment of the validity of those claims. Nevertheless, based on the above analysis, I find that claims 9-10 are also invalid for anticipation based on Stinson.

Handbook

[105] Dr. Sharma described the Handbook as one of the most well-known and commonly referenced resources for the Skilled Person, commonly found on the bookshelves of those working in the field of transporting natural gas by pipeline. There was no dispute between the parties that the Handbook is a widely used resource in that industry.

[106] As with Stinson, Dr. Sharma opines that the Skilled Person would read Chapter 4 of the Handbook (entitled “Properties of Natural Gases and Volatile Hydrocarbon Liquids”) as disclosing a gas mixture (referred to as “Gas 1” in Table 4-10 of the Handbook) with all of the elements of claims 9-10 of the 670 Patent, as well as pressures and temperatures for that mixture (set out in Table 4-11 of the Handbook) within the ranges in those claims. In relation to enablement, he opines that the Handbook provides extensive details for the Skilled Person to understand the subject matter of claims 9-10 and transport of the natural gas of Gas 1 using the conditions of claims 9-10.

[107] I do not understand JL Energy to be disputing that the combination of Tables 4-10 and 4-11 of the Handbook discloses a gas composition (Gas 1) and pressures and temperatures within the ranges of claims 9-10. JL Energy does point out Dr. Ramsay's statement in cross-examination that he agreed that, while Gas 1 may disclose some of the elements of claims 9-10, it does not disclose each and every element of claims 9-10 in their entirety. However, the meaning of this acknowledgement must be understood in the context in which the cross-examination question was posed. JL Energy's counsel had taken Dr. Ramsay through the fact that he had performed simulations confirming that Gas 1 remained in an entirely gaseous state at temperatures of 32° F and 100° F (the two temperatures disclosed in Table 4-11) but that he did not perform such simulations at the -40° F and -20° F minimum temperature limits of claims 9 and 10 respectively. Dr. Ramsay had also previously confirmed that Gas 1 was not disclosed at other limits prescribed by the ranges in claims 9 and 10. It was in that context that Dr. Ramsay confirmed that Gas 1 did not disclose each and every element in their entirety of claims 9-10.

[108] I do not read this acknowledgement as detracting from Dr. Ramsay's opinion, consistent with that of Dr. Sharma, that some of the temperature and pressure combinations disclosed for Gas 1 fell within the claims 9-10 ranges. As previously noted, the prior disclosure of a point within a range prescribed by a patent is anticipatory (see *Baker Petrolite*; *Calgon Carbon*), and the fact that a piece of prior art teaches formulations that would not infringe a patent, as well as formulation that do infringe, is irrelevant to assessing anticipation (see *Schering-Plough*).

[109] In closing oral submissions, the principal arguments advanced by JL Energy were that the Skilled Person would not read Tables 4-10 and 4-11 together, that they do not disclose a gas

composition, pressures and temperatures for use in a pipeline, and that and they do not state that the gas must remain in the gaseous phase with no liquid phase at the temperature and pressure of intended operation.

[110] I find little merit to the argument that the Skilled Person would not have read together or combined Tables 4-10 and 4-11. Dr. Sharma opines in his report that the authors of the Handbook make clear that the tables are to be read together, with Table 4-11 setting out the computed and experimental values of the compressibility factor for the gases of Table 4-10. Indeed, in closing submissions, JL Energy's counsel took the Court through an explanation that the two tables relate to the effect of different nitrogen concentrations upon the z factor of a natural gas mixture over a range of pressures and temperatures. I also note Dr. Ramsay's confirmation on cross-examination that these tables are from a section of the Handbook that focuses on the behaviour of gases containing nitrogen, demonstrating the compressibility factor. It appears clear that the Skilled Person would understand that Tables 4-10 and 4-11 are related.

[111] With respect to JL Energy's submission that these tables do not disclose a gas composition, pressures and temperatures for use in a pipeline, I note that this position is supported by Mr. Ryan's statement in his report that the Handbook does not specify that the Gas 1 mixture is for use in a pipeline. I also note Mr. Ryan's testimony on cross-examination that the Handbook teaches the transportation of natural gas by pipeline in another chapter, Chapter 17, which is entitled "Transmission to Market", but that this is not taught by Tables 4-10 and 4-11, which form part of Chapter 4, entitled "Properties of Natural Gas and Volatile Hydrocarbon Liquids".

[112] JL Energy also relies on Dr. Ramsay's confirmation in cross-examination that Tables 4-10 and 4-11 do not expressly state, discuss or disclose that Gas 1 is being analysed in in the context of its transport or use in a pipeline. Rather, as previously noted, he explained that these tables are from a section of the Handbook that focuses on the behaviour of gases containing nitrogen and that the analysis in these tables relates to the compressibility factor. He also acknowledged that the tables do not expressly state that they are referring to pipeline conditions. Rather, in relation to the opinion in his report that the tables disclosed to the Skilled Person that Gas 1 was for use in a pipeline, Dr. Ramsay stated that he believed the Skilled Person could make that inference.

[113] Turning to Aux Sable's expert reports, both Dr. Ramsay and Dr. Sharma opine that the Handbook disclosed to the Skilled Person that Gas 1 was for use in a pipeline. Both appear to reach that conclusion based on the fact that Table 4-11 sets out z factors for Gas 1, with Dr. Ramsay explaining that the z factor was a common and required consideration for the transportation of natural gas as part of the CGK. I do not find that conclusion to be undermined by the cross-examination of Dr. Ramsay. His answers in cross-examination merely confirmed that Tables 4-10 and 4-11 do not expressly state that Gas 1 is for use in a pipeline and that his conclusion to that effect was an inference. This is consistent with his report, in which that conclusion was based on Table 4-11's disclosure of the z factor (which Dr. Ramsay reiterated in cross-examination was the parameter being analysed in Table 4-11) and the significance of that factor for transporting natural gas.

[114] JL Energy submits that one cannot employ an inference in performing an anticipation analysis. I disagree with that assertion, in a circumstance where the inference represents simply the process by which the Skilled Person's employs the CGK to interpret the prior art. Anticipation is assessed based on the prior art as the Skilled Person would understand it, and the Skilled Person can use his or her CGK as part of the analysis (see, e.g., *Eli Lilly Canada Inc v Novopharm Ltd*, 2010 FCA 197 at paras 44-45).

[115] I also accept that knowledge of the z factor, and its role in the transportation of natural gas by pipeline, does form part of the Skilled Person's CGK. Dr. Sharma opined in his report that the z factor was known to the Skilled Person as a variable modifying the so-called "ideal gas equation," to produce the equation PV = znRT (where P = absolute pressure, V = volume, z = the z factor, n = number of moles of gas, R = the universal gas constant, and T = absolute temperature) and that this equation was well known by the Skilled Person and is central to the transportation of natural gas by pipeline.

[116] Neither of JL Energy's experts took issue with these opinions. Indeed, Mr. Ryan referred to knowledge of the z factor itself being basic and required knowledge for the Skilled Person, and Dr. Monnery stated that the Skilled Person may have understood that a lower z factor would result in a lower pressure drop and lower power requirements for the same mass flow of gas. In relation to CGK of the z factor, JL Energy notes Dr. Monnery's opinion that the Skilled Person would not have appreciated that the basic concept behind the advantage of transportation of natural gas at high pressure or in the so-called "dense phase" is a density or z factor effect. However, while this point about the Skilled Person's level of understanding of the z factor and

its interaction with other parameters may be relevant to the obviousness analysis to be conducted in connection with claims 1-8, I do not consider it to detract from the conclusion that the Skilled Person's CGK included knowledge of the z factor and its centrality to the transportation of natural gas by pipeline.

[117] I also find little in Mr. Ryan's evidence (described above) which undermines the opinions of Aux Sable's experts on this issue. While he concludes that the Handbook does not specify that the Gas 1 mixture is for use in a pipeline, this observation is not inconsistent with the conclusions of Aux Sable's experts, which are based not upon express statements in Chapter 4 of the Handbook, but rather upon the role of the compressibility factor in pipeline transmission.

[118] JL Energy also submits that the conclusion of Aux Sable's experts, that the Handbook discloses use of Gas 1 in a pipeline, is not borne out by careful consideration of the purpose of the analysis performed in Tables 4-10 and 4-11, or by some of the concentrations and pressures employed in those tables. With respect to the purpose of Tables 4-10 and 4-11, JL Energy submits that such purpose is to evaluate the effect on the z factor of varying concentrations of nitrogen in natural gas, at different temperatures and pressures. I agree with this interpretation, which is consistent with Dr. Ramsay's cross-examination testimony as described above. However, in my view, that purpose does not detract from the reasoning of Aux Sables' experts that supports their opinions that the Skilled Person would interpret the data in the tables as related to gas for use in a pipeline.

[119] JL Energy also notes: (a) that the nitrogen concentrations of two other gas mixtures set out in the tables (Gas 2 and Gas 3) are higher than concentrations that would be reasonable for a gas mixture being transported by pipeline; and (b) some of the pressures examined in the tables (but not those upon which Aux Sable relies for its anticipation argument) exceed what would be in the Skilled Person's experience for pipeline transportation. I agree that the evidence at trial supports those submissions. However, JL Energy argues based thereon that the Skilled Person would therefore conclude that none of the gas mixtures, or pressure and temperature conditions, disclosed in Tables 4-10 and 4-11 were intended for pipeline use. JL Energy's experts do not advance that conclusion supported by that analysis. Even if one were to consider some of the combinations analysed in Tables 4-10 and 4-11 to be theoretical and without practical application in a pipeline, I do not find that to support a conclusion that the Skilled Person would not consider those combinations that do have practical application to be for use in a pipeline. Certainly, I would not reach that conclusion in the absence of expert opinion to that effect.

[120] Finally, JL Energy submits that Tables 4-10 and 4-11 do not state, as required by claims 9-10, that the gas must remain in the gaseous phase with no liquid phase at the temperature and pressure of intended operation. As previously noted, Dr. Ramsay acknowledged in cross-examination that he had performed simulations confirming that Gas 1 remained in an entirely gaseous state at temperatures of 32° F and 100° F (the two temperatures disclosed in Table 4-11) but that he did not perform such simulations at the -40° F and -20° F minimum temperature limits of claims 9 and 10 respectively. He also confirmed that Tables 4-10 and 4-11 do not expressly state that the gas compositions identified therein must stay in a gaseous state during their transmission in a pipeline.

[121] However, Dr. Ramsay's opinion that Gas 1 would remain entirely in the gaseous state at the temperatures and pressures of the simulations he performed (representing certain points within the claims 9-10 ranges) was unchallenged. Indeed, Mr. Ryan agreed with that opinion in relation to the simulation performed at 32° F. I agree with Aux Sable's submission that the Handbook does not fail to be anticipatory simply because it does not expressly state that Gas 1 must remain in a gaseous state, if it is clear that the gas will be in such a state at the temperatures and pressures upon which Aux Sable relies.

[122] In conclusion, having considered the expert evidence and the parties' respective arguments, I find that claims 9-10 are invalid for anticipation based on the Handbook.

D. *Obviousness*

[123] The Plaintiffs' obviousness allegation in relation to claims 9-10 is effectively an alternative argument to the effect that, if the claims are found not to have been anticipated by the prior art, then the differences between the prior art and the inventive concept of the claims constitute differences which would have been obvious to the Skilled Person. Aux Sable relies on the same prior art in support of its obviousness allegation as it does in connection with anticipation. Having found that claims 9-10 were anticipated by such prior art, there are no differences to be analysed and therefore no particular benefits to assessing the obviousness of those claims.

VIII. **Are claims 1-8 of the 670 Patent invalid for obviousness?**

A. *Analytical Framework*

[124] The provision of the Act governing obviousness as a ground of patent invalidity states as follows:

28.3 The subject-matter defined by a claim in an application for a patent in Canada must be subject-matter that would not have been obvious on the claim date to a person skilled in the art or science to which it pertains, having regard to	**28.3** L'objet que définit la revendication d'une demande de brevet ne doit pas, à la date de la revendication, être évident pour une personne versée dans l'art ou la science dont relève l'objet, eu égard à toute communication :
(a) information disclosed more than one year before the filing date by the applicant, or by a person who obtained knowledge, directly or indirectly, from the applicant in such a manner that the information became available to the public in Canada or elsewhere; and	**a)** qui a été faite, plus d'un an avant la date de dépôt de la demande, par le demandeur ou un tiers ayant obtenu de lui l'information à cet égard de façon directe ou autrement, de manière telle qu'elle est devenue accessible au public au Canada ou ailleurs;
(b) information disclosed before the claim date by a person not mentioned in paragraph (a) in such a manner that the information became available to the public in Canada or elsewhere.	**b)** qui a été faite, plus d'un an avant la date de dépôt de la demande, par le demandeur ou un tiers ayant obtenu de lui l'information à cet égard de façon directe ou autrement, de manière telle qu'elle est devenue accessible au public au Canada ou ailleurs.

[125] The analytical framework applicable to an obviousness allegation is as described in *Sanofi* at paragraph 67, in which Justice Rothstein endorsed the obviousness test from the United Kingdom cases *Windsurfing International Inc. v Tabur Marine (Great Britain) Ltd.* (1984), [1985] RPC 59 (Eng CA) and *Pozzoli SpA v BDMO SA*, [2007] FSR 37, [2007] EWCA Civ 588 (Eng CA):

> 67 It will be useful in an obviousness inquiry to follow the four-step approach first outlined by Oliver L.J. in *Windsurfing International Inc. v. Tabur Marine (Great Britain) Ltd.* (1984), [1985] R.P.C. 59 (Eng. C.A.). This approach should bring better structure to the obviousness inquiry and more objectivity and clarity to the analysis. The *Windsurfing* (1984), [1985] R.P.C. 59 (Eng. C.A.) approach was recently updated by Jacob L.J. in *Pozzoli SpA v. BDMO SA*, [2007] F.S.R. 37, [2007] EWCA Civ 588 (Eng. C.A.), at para. 23:
>
> In the result I would restate the *Windsurfing* questions thus:
>
> (1) (a) Identify the notional "person skilled in the art";
>
> (b) Identify the relevant common general knowledge of that person;
>
> (2) Identify the inventive concept of the claim in question or if that cannot readily be done, construe it;
>
> (3) Identify what, if any, differences exist between the matter cited as forming part of the "state of the art" and the inventive concept of the claim or the claim as construed;
>
> (4) Viewed without any knowledge of the alleged invention as claimed, do those differences constitute steps which would have been obvious to the person skilled in the art or do they require any degree of invention?
>
> [emphasis added.]
>
> It will be at the fourth step of the *Windsurfing/Pozzoli* approach to obviousness that the issue of "obvious to try" will arise.

B. *Common General Knowledge*

[126] Applying this framework, after identifying the credentials and characteristics of the Skilled Person (as done earlier in these Reasons), the next step is to identify the CGK of the Skilled Person. CGK means knowledge generally known by persons skilled in the relevant art at the relevant time (see *Sanofi* at para 37) and is the knowledge that the Skilled Person brings to

the various tasks assigned to him/her under patent law, such as the obviousness analysis. In *Eurocopter v Bell Helicopter Textron Canada Ltée*, 2013 FCA 219 at paras 64-65, CGK was described as follows:

> 64 Common general knowledge does not amount to all information in the public domain. While the common general knowledge of the skilled person certainly includes knowledge of patents, it does not include knowledge of *all* patents: *General Tire* at pp. 481 to 484. Nor does it include knowledge of all journal articles or other technical information: *British Acoustic Films Ltd. v. Nettlefold Productions* (1935), 53 R.P.C. 221 (Eng. C.A.), at p. 250, cited approvingly in *General Tire* at pp. 482-483.
>
> 65 Rather, it is well established that the common general knowledge is limited to knowledge which is generally known at the relevant time by skilled persons in the field of art or science to which the patent relates: *Sanofi* at para. 37; *Free World Trust c. Électro Santé Inc.*, 2000 SCC 66, [2000] 2 S.C.R. 1024 (S.C.C.) ("*Free World Trust*") at para. 31. Thus, accordingly, the common general knowledge is with respect to the subset of patents, journal articles and technical information which is generally acknowledged by skilled persons as forming part of the common general knowledge in the field to which the patent relates…

[127] Stated similarly in *Mylan* at paragraph 24:

> 24 The common general knowledge, in contrast, is the "knowledge generally known by persons skilled in the relevant art [skilled persons] at the relevant time": *Apotex Inc. v. Sanofi-Synthelabo Canada Inc.*, 2008 SCC 61, at para. 37, [2008] 3 S.C.R. 265. Unlike the prior art, which is a broad category encompassing all previously disclosed information in the field, a piece of information only migrates into the common general knowledge if a skilled person would become aware of it and accept it as "a good basis for further action": *General Tire& Rubber Co. v. Firestone Tyre & Rubber Co.*, [1971] F.S.R. 417, (1972) R.P.C. 457 at 483 (C.A.).

[128] Aux Sable's experts expressed materially similar opinions as to the content of the CGK of the Skilled Person. In its closing submission, Aux Sable relied upon Dr. Sharma's description

of the CGK as supporting the conclusion that the CGK, as at November 18, 1996, included the following:

A. Natural gas properties, such as compressibility, density and the effect of temperature and pressure on natural gas, would be well understood by the Skilled Person as they are critical to the operation of natural gas pipelines.

B. Natural gas pipelines had been operated above a pressure of 1150 psia and at temperatures between -20° F and +120° F.

C. The z factor varies with changes in gas composition, temperature, and pressure. Compressibility factor (z factor) charts were well known to the Skilled Person as they showed how the z factor changed for a gas over a range of pressures.

[129] I agree with Aux Sable's submission that JL Energy's experts did not identify any significant disagreements with these aspects of the CGK as described by Dr. Sharma.

[130] However, Aux Sable also submits that the CGK includes an understanding of various flow equations which govern the horsepower required to transport natural gas through a pipeline and that the Skilled Person would understand from such equations the relationship between the z factor and the molecular weight (Mw) and the use of the zMw product in performing calculations related to the flow of natural gas. While JL Energy does not dispute that the CGK includes

knowledge of flow equations, it takes the position that the CGK did not include an understanding of how the zMw product would respond to changes in gas composition, temperature and/or pressure, or the use of that product as a guide to identify when a change to a particular gas composition would achieve a reduction in the energy required to transport that gas.

[131] This is one of the principal points on which the opinions of the parties' experts diverge in an area significant to the obviousness analysis. As will be explained in greater detail later in these Reasons, Aux Sable argues that the understanding of the zMw the product which it ascribes to the Skilled Person can be derived from the prior art and/or the CGK. As such, and because of the significance of this point to the obviousness analysis, I will return to it at a later stage of the analysis, once the role of this point has been better framed in the context of the prior art relied upon by Aux Sable in support of its obviousness allegation.

C. *Inventive Concept*

[132] Step 2 of the *Sanofi* test requires the identification of the inventive concept of the claim in question or, if that cannot readily be done, the construction of the claim. The Federal Court of Appeal has recently provided the following guidance, surrounding this step of the test, in *Ciba Specialty Chemicals Water Treatments Limited v SNF Inc*, 2017 FCA 225 [*Ciba*] at paras 72-77:

> 72 The next issue is the identification of the inventive concept. We can find some guidance as to how to approach the inventive concept in *Pozzoli*. At paragraph 17 of the Court of Appeal's reasons, Lord Jacob quoted from his reasons in the Court of Appeal's decision in *Unilever v. Chefaro*, [1994] R.P.C. 567 (*Unilever*) at page 580:

> It is the inventive concept of the claim in question which must be considered, not some generalised concept to be derived from the specification as a whole. Different claims can, and generally will, have different inventive concepts. The first stage of identification of the concept is likely to be a question of construction: what does the claim mean? It might be thought there is no second stage - the concept is what the claim covers and that is that. But that is too wooden and not what courts, applying *Windsurfing* stage one, have done. It is too wooden because if one merely construes the claim one does not distinguish between portions which matter and portions which, although limitations on the ambit of the claim, do not. One is trying to identify the essence of the claim in this exercise.

73 This passage anticipates the Supreme Court's teaching on patent construction in *Whirlpool Corp. v. Camco Inc.*, 2000 SCC 67 at paragraph 45, [2000] 2 S.C.R. 1067, where it said:

> The key to purposive construction is therefore the identification by the court, with the assistance of the skilled reader, of the particular words or phrases in the claims that describe what the inventor considered to be the "essential" elements of his invention.

74 The reminder in *Unilever* that it is inventive concept of the claim which is in issue, "not some generalised concept to be derived from the specification as a whole," is very apt: *Unilever* at page 569. Part of the difficulty in the search for the inventive concept is the use made, or to be made, of the disclosure portion of the specification of the patent. In *Connor Medsystems Inc v. Angiotech Pharmaceuticals Inc.* [2008] UKHL 49, [2008] R.P.C. 28 (*Connor*), Lord Hoffman wrote at paragraph 19 that "[t]he patentee is entitled to have the question of obviousness determined by reference to his claim and not to some vague paraphrase based upon the extent of his disclosure in the description."

75 This emphasis on the claims is consistent with section 28.3 of the Act which stipulates that it is "the subject-matter defined by a claim" which must not be obvious.

> 76 Lord Jacob was alive to the possibility that difficulties in the identification of the inventive concept could lead to "unnecessary satellite debate". His counsel was that "if a disagreement about the inventive concept of a claim starts getting too involved, the sensible way to proceed is to forget it and simply to work on the features of the claim": *Pozzoli* at paragraph 19. Lord Hoffman wrote, once again in *Connor* at paragraph 20, that the inventive concept "is a distraction almost as soon as there is an argument as to what it is."
>
> 77 There may be cases in which the inventive concept can be grasped without difficulty but it appears to me that because "inventive concept" remains undefined, the search for it has brought considerable confusion into the law of obviousness. That uncertainty can be reduced by simply avoiding the inventive concept altogether and pursuing the alternate course of construing the claim. Until such time as the Supreme Court is able to develop a workable definition of the inventive concept, that appears to me to be a more useful use of the parties' and the Federal Court's time than arguing about a distraction or engaging in an unnecessary satellite debate.
>
> [emphasis added]

[133] Aux Sable advocates relying on *Ciba* to use the claim language, properly construed, for this step of the *Sanofi* test. I do not understand JL Energy to dispute that this step can be conducted in this manner, although there was some suggestion by JL Energy, supported by its expert evidence, to the effect that the inventive concept was achieving "hydraulic efficiency" by adding sufficient C_2 and/or C_3 to achieve a reduction in zMw.

[134] Guided by *Ciba*, I see little benefit to seeking to divine from the claims an inventive concept that is in any way distinct from the construction of the claims themselves. Indeed, I see little distinction between claims 1-8 as previously construed and the above articulation of the inventive concept as involving hydraulic efficiency. Either way, the focus is upon adding sufficient C_2 and/or C_3 to achieve a reduction in zMw. For purposes of the obviousness analysis, I

will rely on the construction of claims 1-8 performed earlier in these Reasons, the material elements of which are as follows:

A. The intentional addition to natural gas of a C_2 hydrocarbon and/or a C_3 hydrocarbon; and

B. Ensuring that the product of the molecular weight (Mw) and the z factor of the resulting gas mixture is lower than the zMw product prior to such addition.

D. *Test for a Citable Prior Art Reference*

[135] The next step in the *Sanofi* analysis is to identify what, if any, differences exist between the matter cited as forming part of the "state of the art" and the inventive concept of the claim or the claim as construed. This first requires identification of items that are citable as forming part of the prior art. On this issue, the parties disagree on the proper test to be applied.

[136] Aux Sable takes the position that, under the obviousness provision in s 28.3 of the Act, it need show only that a piece of prior art upon which it relies was disclosed, earlier than the relevant date prescribed by s 28.3, in such a manner that the information disclosed became available to the public, effectively the same test as applicable to an anticipation analysis under s 28.2 of the Act. I note that there is no issue in this case surrounding the date of the disclosure of the prior art references upon which Aux Sable relies.

[137] JL Energy takes the position that the test for a reference being citable for obviousness under s 28.3 of the Act is different from the test for a reference being citable for anticipation

under 28.2 and requires the party wishing to rely upon a reference to establish that the reference was locatable through a reasonably diligent search by the Skilled Person.

[138] At the outset, I should note that, unlike in some of the authorities to which the parties have referred the Court in the course of their argument on this issue, it is necessary to address this issue in the present case. JL Energy agrees that the prior art references upon which Aux Sable relies have been disclosed but, in relation to some, does not agree that they would be locatable through a reasonably diligent search. I must address the dispute as to the legal test because, if I were applying the reasonably diligent search test, I would find at least one of the prior art references upon which Aux Sable relies not to be citable for purposes of their obviousness allegation for claims 1-8. There are three pieces of prior art in dispute. They are Stinson (one of the papers canvassed above under the claims 9-10 anticipation analysis) and two versions of a 1973 publication by D.L. Katz and G.G. King (Aux Sable's expert, Mr. King) entitled "Dense Phase Transmission of Natural Gas". As there are no differences material to the obviousness analysis between the content of the two versions of the 1973 publication (one being a version of the other presented at a conference), I will refer to them together as the "Dense Phase Paper". For the reasons explained below, I am not satisfied that Aux Sable has met the burden it would face, if the reasonably diligent search test applies, of establishing that Stinson would be locatable under that test.

[139] I should note that, for purposes of the claims 1-8 obviousness allegation, I understand Aux Sable's reliance upon Stinson to be principally for the same purpose as in the claims 9-10 anticipation allegation, i.e. to establish disclosure of the transportation of a natural gas mixture

by pipeline at pressure and temperature ranges contemplated by the claims. With the benefit of the anticipation analysis earlier in these Reasons, it is not necessary to revisit those same issues in the claim 1-8 obviousness analysis, as the incremental issues raised by the parties in connection with claims 1-8 surround the obviousness of the addition of C_2 and/or C_3 and the evaluation of zMw before and after such addition. Therefore, Stinson will not play a primary role in the issues in dispute that will be addressed later in these Reasons when considering differences between the prior art and claims 1-8. It nevertheless plays a role in the obviousness allegation, and I have focused upon it because it is the reference in relation to which Aux Sable has the weakest case to establish locatability.

[140] In support of its position that Stinson would be locatable, Aux Sable relies on two admissions by JL Energy: (a) that Stinson was presented by Dr. Stinson at the 1994 International Conference on Arctic Margins in Russia in September 1994; and (b) that a copy of Stinson appears in the "1994 Proceedings International Conference on Arctic Margins", which has a copyright date of 1995. Aux Sable also points out that Stinson cites the Dense Phase Paper. As noted above, the Dense Phase Paper is another of the prior art references upon which it relies for its obviousness allegation in relation to claims 1-8, and it will be addressed in more detail below. However, for present purposes, Aux Sable's point is that Stinson forms part of the same body of literature as the Dense Phase Paper and is therefore more likely to be locatable than if it was authored or published in an unrelated field.

[141] My difficulty with Aux Sable's position is that it is unsupported by any evidence that bears on the particular question of locatability. Based on the presentation of Stinson at the 1994

conference in Russia and its subsequent publication in the proceedings resulting from the conference, JL Energy has agreed that Stinson was disclosed for purposes of s 28.3 of the Act. However, I agree with JL Energy's position that such presentation and publication speak to disclosure but, without more, bear insufficiently upon the question whether they would be locatable through a reasonably diligent search. There is no evidence as to how widely Stinson was circulated as a result of its 1994 presentation and subsequent publication. Aux Sable has led no evidence, through its experts or otherwise, either in relation to the nature of a search by the Skilled Person that would be considered reasonably diligent at the relevant time in 1996 or as to how such a search would have located Stinson.

[142] Aux Sable relies on one authority to support its position that Stinson would be citable even with application of the reasonably diligent search test. In *Alcon Canada Inc. v Cobalt Pharmaceuticals Co*, 2014 FC 462 [*Alcon*] at para 165, Justice Phelan found the prior art for purposes of an obviousness analysis to include abstracts and posters presented at industry conferences. Aux Sable argues that the facts in the present case are more compelling in favour of locatability than in *Alcon*, as they include the subsequent publication of Stinson in the relevant conference proceedings. However, Aux Sable's counsel rightly acknowledges that it is not clear from *Alcon* whether the locatability of the abstract and posters, or indeed the question whether they formed part of the prior art, was in issue between the parties in that case. In my view, this authority provides little assistance in supporting Aux Sable's position.

[143] I find that the evidence before me would be insufficient to conclude that Stinson is a citable reference for purposes of the obviousness allegation if the reasonably diligent search test

applies. Having reached that conclusion, it is necessary for me to address the dispute between the parties as to the applicable test, following the introduction of s 28.3 of the Act. The decision as to the applicable test will of course also apply to the Dense Phase Paper, upon which Aux Sable places substantial reliance in relation to the issues in dispute in the obviousness analysis.

[144] Turning to the analysis of the applicable test, I note that s 28.3 was enacted by s 33 of the *Intellectual Property Law Improvement Act*, SC 1993, c 15 [the Amending Act], which came into force on October 1, 1996. It is common ground that, prior to this amendment, Canadian law required a party alleging obviousness to meet the reasonably diligent search test. Aux Sable refers to the decision of the Federal Court, Trial Division to that effect in *Procter & Gamble Co v Kimberly-Clark of Canada Ltd* (1991), 49 FTR 31 [*Procter & Gamble*] at para 127:

> 127 Both counsel for the Plaintiffs and the Defendant made reference to the *General Tire* case (supra) as establishing the diligent level of search:
>
> > As regards diligent search, a phrase which we were given to understand originates from Lord Reid in Technograph (*supra*), we take this as apt to describe what research groups employed by large–scale concerns, such as those in the Technograph case and in the instant case, ought to know. Such researches, however, can involve not only heavy expenditure but also questions of priorities in the use of available manpower. What extent of search is appropriate in a given case and what would be its probable results are questions of fact. (pages 499-500)

[145] The authority to which *Procter & Gamble* refers is *General Tire & Rubber Company v Firestone Tyre & Rubber Company*, [1972] RPC 457 at 463 (EWCA) [*General Tire*], a 1971

decision of the England and Wales Court of Appeal, which the parties agree represented the law in the United Kingdom at that time. However, Aux Sable's position is that Canadian law changed with the 1996 introduction of s 28.3 of the Act (quoted above), which requires the obviousness analysis to be conducted "…having regard to … information disclosed … in such a manner that the information became available to the public in Canada or elsewhere". Aux Sable argues that this statutory amendment displaced the common law reasonably diligent search test, replacing it with the requirement only that the prior art be publicly disclosed. JL Energy disagrees, arguing that s 28.3 has not changed the applicable test.

[146] In support of its position, Aux Sable relies on principles of statutory interpretation, requiring legislation to be interpreted in light of its text, context, and purpose (see *Rizzo & Rizzo Shoes Ltd (Re)*, [1998] 1 SCR 27 at para 21). JL Energy does not dispute Aux Sable's position on general principles of statutory interpretation but argues that jurisprudence subsequent to the 1996 amendment demonstrates that the reasonably diligent search test continues to apply.

[147] Beginning with the text of s 28.3, Aux Sable submits that the plain meaning of the language captures all publicly available information, without qualification by the reasonably diligent search test. Turning to context, Aux Sable refers to s 28.2 (quoted at the beginning of the anticipation analysis earlier in these Reasons), which identifies the prior art relevant to an anticipation allegation in language identical to that employed by s 28.3. It is common ground between the parties that s 28.2 does not require that a prior art reference be locatable by a reasonable diligent search in order to be citable for an anticipation allegation. Aux Sable refers

the Court to *Baker Petrolite* at paragraph 42 (in particular the below quotation from page 133 of *Lux Traffic Controls Ltd v Pike Signals Ltd*, [1993] RPC 107 (Eng Patents Ct)):

> 42 For the purposes of analyzing anticipation in the context of disclosure by prior sale or use under paragraph 28.2(1)(a) and without detracting from the general principles in *Beloit v. Valmet, supra*, and *Free World Trust, supra*, I deduce the following principles relevant to this appeal from the United Kingdom and European Patent Office jurisprudence:
>
> ….
>
> 6 It is not necessary to demonstrate that a member of the public actually analyzed the product that was sold. In *Lux, supra*, Aldous J. stated at page 133:
>
> Further it is settled law that there is no need to prove that anybody actually saw the disclosure provided the relevant disclosure was in public. Thus an anticipating description in a book will invalidate a patent if the book is on a shelf of a library open to the public, whether or not anybody read the book and whether or not it was situated in a dark and dusty corner of the library. If the book is available to the public, then the public have the right to make and use the information in the book without hindrance from a monopoly granted by the State. [Emphasis added]
>
> Although the comments of Aldous J. use the example of prior publication to make the point, *Lux* was a prior use case and the principle derived from his example is equally applicable to prior use or sale as well as prior publication.

[148] To similar effect, JL Energy refers to *Wenzel Downhole Tools Ltd. v National-Oilwell Canada Ltd.*, 2012 FCA 333 [*Wenzel*] at paras 68-70:

> 68 My understanding, based on the relevant jurisprudence, is that becoming available means that, the public, as defined earlier, had an opportunity to access the information that is the invention. As previously mentioned, it does not require that one actually took advantage of this opportunity. Once the opportunity is established as a fact (here, for example, that: (i) Dreco had unrestricted access to the drilling tools, and any information derived from such access

> was not protected by confidentiality; and (ii) a method to open such tools and examine their internal structures was known), the Court applies the legal test for anticipation developed in *Sanofi* (full disclosure of all the essential elements of the invention and enablement) to the information that the fictional POSITA would derive from the fictional examination.
>
> 69 The Appellants disagree with the analogies used by the Judge, being: (i) a book in a public library (the reasons at paragraph 118); and (ii) the "lifting of the hood" (the reasons at paragraph 123). They say that the drilling tools in this case are not analogous to a book in a library, nor was the opening of the tools like the lifting of the hood of a car. Again, I cannot agree. Aldous J. in *Lux*, later quoted by Rothstein J.A. in *Baker Petrolite*, referred to the book in a public library even though he was looking at a case of prior use of a product, not anticipation by publication. The book in the public library could be in Japanese, even though the library is located in a remote village where no one speaks Japanese. This would still be a disclosure that would make whatever information it contained available, even though accessing the information that is available requires the use of a dictionary or even an interpreter that would not be available in that village. As for the lifting of the hood, it is true that opening the sealed joints to examine the internal structure may be a bit more tedious than lifting a hood but that does not detract from the validity of the analogy. As mentioned, this is not relevant; being available does not require that access to the information be easy, simply that it be possible using known methods and instruments.
>
> 70 Again, I reiterate that it is my understanding of the law as it stands now that even if the library listed in a ledger all those who entered the library and recorded each book they reviewed, and a defendant would accordingly be able to prove that nobody had actually accessed the book in the library, my conclusion would be the same. The presence of the book in the library is sufficient to make the information available, and thus to meet the requirements for anticipation within the meaning of section 28.2.

[149] While both *Baker Petrolite* and *Wenzel* relate to anticipation by disclosure of a product, the analyses therein rely on principles of anticipation by publication and support the position on the interpretation of s 28.2 on which the parties agree. As expressed by JL Energy in its written closing submissions:

> In the case of anticipation by prior publication, the publication may be distant, and may even require a dictionary or interpreter. As the reference is, in the literal sense, "available to the public", it will be considered to have been disclosed under subsection 28.2(1) of the *Patent Act*.

[150] Aux Sable therefore argues that Parliament's use of identical language in ss 28.2 and 28.3 requires that consistent meanings be given to that language in these two provisions. To interpret these provisions as enacting different tests would violate the presumption that consistent expression is intended to convey consistent meaning (see *Godbout v Pagé*, 2017 SCC 18 at para 115).

[151] Finally, Aux Sable submits that the purpose of s 28.3 was to provide a sturdier statutory basis for obviousness, as it was anomalous that this basic requirement of patent law previously had no express foundation in the Act. It is therefore Aux Sable's position that, as Parliament declined to use language to maintain the common law reasonably diligent search test, the legislative intention was to the ground the obviousness analysis in a clear test consistent with that employed for purposes of anticipation.

[152] As previously noted, JL Energy's response to these arguments relies on jurisprudence postdating the enactment of s 28.3, which it submits demonstrates that these arguments have previously been considered and rejected by the Federal Court and the Federal Court of Appeal. Focusing first on appellate jurisprudence, JL Energy refers the Court to *E Mishan & Sons Inc v Supertek Canada Inc*, 2015 FCA 163 [*Mishan*], arguing that in that case the Federal Court of Appeal rejected an argument by the appellants that the test for determining which documents are

to be included as part of the prior art is not based on whether a particular reference was locatable.

The relevant analysis is found in paragraphs 18-23 of the decision:

> 18 The Appellants submit that the McDonald Patent was not prior art forming the state of the art. The Appellants note in their memorandum that the Federal Court Judge stated in paragraph 91 that:
>
> > 91 In brief, McDonald was not only findable but found by those interested in expandable hoses. There is no evidence to the contrary.
>
> 19 The Appellants submit that the test for determining what documents are to be included as part of the relevant prior art is not based on whether a particular document was "findable" and, in particular, the fact that it was found by the lawyer for the Respondents should not lead to a conclusion that it would have been found by the Skilled Person.
>
> 20 In *Apotex Inc. v. Sanofi-Aventis*, 2011 FC 1486, [2011] F.C.J. No. 1813, Boivin J. (as he then was) stated that:
>
> > 603 […] the prior art must have been publicly available as of the [relevant] date […] - and it must further be locatable through a reasonably diligent search. The burden is on the party relying upon the prior art to establish that it could be found in a reasonably diligent search (*Janssen-Ortho Inc. v. Novopharm Ltd.*, 2006 FC 1234, 57 CPR (4th) 6), in this case, Apotex.
> >
> > (emphasis added)
>
> 21 While this Court disagreed with the conclusion of Boivin J. on obviousness, there was no disagreement expressed in relation to the test for determining what documents would be included as part of the relevant prior art (2013 FCA 186, [2013] F.C.J. No. 856, at paragraph 77). None of the parties in this appeal made any submissions in relation to whether section 28.3 of the *Patent Act*, R.S.C., 1985, c. P-4 changed the test for determining what documents would be included as part of the relevant prior art. Presumably any submissions based on this section would be that the scope of documents that would be included is broader and would include any information that became available to the public

> and not just restricted to documents that could be found by conducting a reasonably diligent search. In this case, since I have concluded that based on the test as described above, the Federal Court Judge did not err by including the McDonald Patent as part of the state of the art, there is no need to address the issue of whether section 28.3 of the *Patent Act* has changed this test.
>
> 22 The relevant prior art, based on the test as described above, will therefore include any document that the Skilled Person would locate by conducting a reasonably diligent search. In this case, the Skilled Person is *"*[a] *person such as an engineer or technician with experience in the manufacture and/or supply and/or use of hoses for various types of fluids"*. The Skilled Person is not restricted to a person who only has experience with garden hoses nor is such person restricted to a person who only has experience with hoses used to convey water.
>
> 23 The finding of the Federal Court Judge that the Skilled Person would have located the McDonald Patent if such person would have conducted a reasonably diligent search is a finding of fact or mixed fact and law that will stand absent a palpable and overriding error. While the Appellants indicate that there are certain facts related to the failure of Mr. Berardi and others to locate the McDonald Patent that would support the opposite finding, this would require this Court to reweigh the evidence as there was evidence that the McDonald Patent could have been found by the Skilled Person, who, as noted above, is a person with experience related to hoses and fluids, not just garden hoses. The relevant question to be determined by the Federal Court Judge was whether, based on the evidence as presented, the Skilled Person would have found the McDonald Patent by conducting a reasonably diligent search.
>
> [emphasis added]

[153] In my view, *Mishan* cannot be interpreted as JL Energy contends. Paragraph 19 states that the appellants submitted that the test for determining what documents are to be included as part of the prior art is not based on whether a particular document was "findable" (the term used by the trial judge in that case). However, it is clear from the decision that the appellants' overall position was that the trial judge had erred by including that document as part of the prior art. An

argument that a document need not be locatable through a reasonably diligent search, in order to form part of the prior art, would not have advanced the appellants' position. Rather, as I read the decision, the appellants were taking issue with the trial judge's use of the term "findable" and, more particularly, with the evidence on which the judge relied to conclude that the relevant document formed part of the prior art.

[154] As such, *Mishan* cannot be read as having decided the issue surrounding the interpretation of s 28.3 that is raised in the present case. This is abundantly clear from the portion of paragraph 21 emphasized above in which Justice Webb, speaking for the full panel of the Federal Court of Appeal, stated that none of the parties made any submissions in relation to whether s 28.3 had changed the test for determining which documents would be included as part of the relevant prior art. Justice Webb expressly noted the availability of an argument to the effect that s 28.3 removed the reasonably diligent search requirement. However, it was unnecessary for the Court to consider this issue, particularly in the absence of argument thereon, as the Court found no error by the trial judge in finding that the Skilled Person would have located the disputed prior art document. In the absence of such an error, an analysis of whether the reasonably diligent search test still applied following enactment of s 28.3 would not have changed the result on appeal.

[155] Therefore, the other paragraphs of *Mishan* quoted above, which rely on the reasonably diligent search test for purposes of the obviousness analysis, cannot be regarded as a conclusion by the Federal Court of Appeal that s 28.3 has left the test unchanged. To the contrary, I agree

with Aux Sable's submission that this case identifies a live issue, which the Court declined to address for the reasons explained above.

[156] This is also clearly the interpretation of *Mishan* drawn by Justice Wood in the dissent in the subsequent decision in *Ciba* at paras 99-100:

> 99 I have read the well-written reasons of the majority by Justice Pelletier and agree with my colleagues that this appeal should be dismissed. I also concur with the reasons, except that I would decline to provide an opinion on the issue discussed at paragraphs 51 to 63, above. This part of the analysis concerns the effect of section 28.3 of the Act on the determination of obviousness.
>
> 100 In my view, it is preferable for this issue to be left for another day, as it was in *E. Mishan & Sons, Inc. v Supertek Canada Inc.*, 2015 FCA 163, 134 C.P.R. (4th) 207 (F.C.A.) at paragraph 21. The issue is better addressed in an appeal where it is relevant to the outcome and in which the Court has the benefit of full submissions from counsel, which was not the case here.

[157] Of course, the fact that Justice Wood expressed the above dissent raises the question as to what the majority in *Ciba* decided on this issue. While JL Energy did not particularly rely on this case to support its position, Aux Sable acknowledges that different interpretations are available as to the conclusion by the majority on the issue identified by Justice Wood. It appears to me that the most relevant paragraphs of the majority's decision, written by Justice Pelletier, are as follows:

> 60 To conclude, a word about "the matter cited as forming part of the prior art", the phrase used in Pozzoli and Plavix. The matter cited as forming part of the prior art is simply the prior art relied upon by the person alleging obviousness. Obviousness is not determined by reference to the prior art at large. The person alleging obviousness must point to one or more elements of prior art which make the impugned invention obvious. <u>The choice of those elements of prior art is entirely in the hands of the party alleging obviousness, limited only by section 28.3 of the Act which</u>

> sets out the cut-off date for opposable prior art. In fact, the challenger may rely on a combination of pieces of prior art under the "mosaic" theory of obviousness: *Wenzel Downhole Tools Ltd. v. National-Oilwell Canada Ltd*., 2012 FCA 333 at paragraph 87, [2014] 2 F.C.R. 459.
>
> 61 The Federal Court's paraphrase of step 4 of the *Windsurfing/Pozzoli* framework also introduces, if not an error, then an oversimplification of the original statement of that step. At step 4, Lord Jacob inquired if the differences identified at step 3 constituted steps "which would have been obvious to the person skilled in the art or do they require any degree of invention?": Pozzoli, at paragraph 23. The Federal Court's formulation asks whether those differences require a degree of invention i.e. inventiveness or whether they are more or less self-evident. The error or ambiguity arises in the reference to "self-evident".
>
> 62 As has previously been pointed out, if the difference between the inventive step (or the claim as construed) and the prior art can be bridged by the Skilled Person using only the common general knowledge of such a person, the "invention" is obvious: *Bristol-Myers Squibb Canada Co. v. Teva Canada Ltd*., 2017 FCA 76 at paragraph 65, 146 C.P.R. (4th) 216. It is at this point that the common general knowledge is relevant. The Skilled Person can have recourse to their common general knowledge supplemented by those pieces of prior art which could be discovered by a reasonably diligent search: see, for example, *Uponor AB v. Heatlink Group Inc.*, 2016 FC 320 at paragraph 46, 139 C.P.R. (4th) 393; *Hoffmann-La Roche Ltd. v. Apotex Inc.*, 2011 FC 875 at paragraph 55, 104 C.P.R. (4th) 233. In my view, this inquiry goes beyond asking whether the relevant differences are self-evident or not.
>
> [emphases added]

[158] The passage of paragraph 60 emphasized above can be read as implicitly concluding that the only limitation, imposed by s 28.3 upon the prior art relevant to an obviousness analysis, is the cut-off date prescribed by the section, i.e. that there is no reasonably diligent search test. However, as Aux Sable acknowledges, it is not clear that this is the intention of the passage,

particularly as the locatability of a prior art document through a reasonably diligent search does not appear to have been the focus of the majority's analysis.

[159] The passage of paragraph 62 emphasized above could perhaps be read as drawing the opposite conclusion, as it refers to pieces of prior art which could be discovered by reasonably diligent search. However, I note that Donald H. MacOdrum, *Fox on the Canadian Law of Patents*, loose-leaf, 5th ed (Toronto: Carswell, 2017), ch 4:11(i), states that this passage may be referring to the type of prior art which can supplement the CGK. This interpretation appears consistent with the authorities cited in *Ciba* at paragraph 62 (i.e., *Uponor AB v Heatlink Group Inc*, 2016 FC 320 at para 46; *Hoffmann-La Roche Ltd v Apotex Inc*, 2011 FC 875 at para 55), which speak to such art forming part of the CGK.

[160] I would therefore not read *Ciba* as supporting JL Energy's position that the reasonably diligent search test remains unaffected by s 28.3. If anything, it supports Aux Sable's position. However, as noted by Justice Wood, that issue was not determinative of the majority's decision and was not the subject of full submissions by counsel. I therefore turn to the decisions of the Federal Court that have considered this issue.

[161] There are several Federal Court decisions, significantly postdating the 1996 introduction of s 28.3, which refer to or apply the reasonably diligent search test. As noted in *Mishan*, Justice Boivin stated in *Apotex Inc v Sanofi-Aventis Canada Inc*, 2011 FC 1486 at para 603, that prior art must be locatable through a reasonably diligent search. Previously, in *Eli Lilly*, at paragraph 104, Justice Gauthier referred to the distinction between CGK and prior art for the purpose of

assessing anticipation and obviousness tending to diminish in modern times, because of the sophistication of search engines and the availability of electronic publications and databases, but noted the continued relevance of *General Tire* to an obviousness analysis.

[162] In *Eurocopter v Bell Helicopter Textron Canada Ltée*, 2012 FC 113 [*Eurocopter*] at para 80, Justice Martineau relied on *Pfizer Canada Inc v Apotex Inc*, 2007 FC 971 [*Pfizer*] at para 108, in stating that the Court is entitled to look at all the patents and other publications that the skilled technician would discover in a reasonable and diligent search, to determine whether the resulting mosaic leads directly to the invention. In *Takeda Canada Inc v Canada (Minister of Health)*, 2015 FC 570 at paras 59-60, Justice O'Reilly endorsed the approach taken by experts who confirmed that certain art cited in support of the obviousness allegation would have been located on a reasonably diligent search.

[163] More recently, in *Hospira Healthcare*, at paragraph 213, Justice Phelan (citing *Mishan*) described the state of the art as comprised of what could be uncovered by the Skilled Person conducting a reasonably diligent search. In *Eli Lilly Canada Inc v Apotex Inc*, 2018 FC 736 at paras 99-100, Justice Manson endorsed the comments in *Allergan Inc v Apotex Inc*, 2016 FC 344 at paras 20-21, that the fact prior art references were collected by the party alleging obviousness was irrelevant given the evidence before the Court, including reasons provided by the experts as to why the references would have been easily located during a prior art search.

[164] These authorities all postdate, in some cases significantly, the 1996 amendments to the Act, and they all reference or demonstrate application of the reasonably diligent search test.

However, I agree with Aux Sable's position that it does not appear that the issue presently before the Court, i.e. whether s 28.3 eliminated the common-law test that applied before its enactment, was raised in any of those cases. Therefore, it is difficult to rely upon them for a conclusion that the Federal Court has rejected the statutory interpretation arguments currently being advanced by the Plaintiffs.

[165] In Aux Sable's submission, there are limited (and divergent) authorities that demonstrate this issue having been expressly raised by the parties. In *Novartis Pharmaceuticals Inc v Teva Canada Ltd*, 2015 FC 770 [*Novartis*] at para 53, Justice O'Reilly held as follows:

> 53 Teva argues that the *Patent Act* (s 28.3; see Annex I for provisions cited) no longer requires that the relevant prior art be discoverable on a reasonably diligent search – it merely has to be publicly available. Teva cites Barrigar, et al, *Canadian Patent Act Annotated*, 2nd ed loose-leaf (consulted on 1 April 2015 (Aurora, Ont: Canada Law Book, 1994) at PA-341 where the authors raise a question whether s 28.3 supersedes the previous case law on the accessibility of prior art. Teva also relies on the Federal Court of Appeal's discussion on anticipation in *Wenzel Downhole Tools Ltd v National-Oilwell Canada Ltd*, 2012 FCA 333 at paras 68-70 and argues this should apply to the law of obviousness. However, there is case law applying the usual "reasonably diligent search" criterion even after the enactment of s 28.3 (*Dow Chemical Company v NOVA Chemicals Corporation*, 2014 FC 844 at paras 232-236; *Eurocopter v Bell Helicopter Textron Canada Limitée*, 2012 FC 113 at para 80, aff'd 2013 FCA 219; *Eli Lilly and Company v Apotex Inc*, 2009 FC 991 at para 532; *Takeda Canada Inc v Canada (Minister of Health)*, 2015 FC 570 at paras 59-60). I see no reason to take a different approach here.

[166] *Novartis* clearly supports JL Energy's position. However, as Aux Sable points out, it does not appear that the Court in *Novartis* had the benefit of argument on the application of principles of statutory interpretation to s 28.3. Rather, the Court arrived at its conclusion based on the

jurisprudence that has applied the reasonably diligent search test even after the enactment of s 28.3. As canvassed above, it does not appear that the issue presently before the Court, i.e. whether s 28.3 eliminated the common law test that applied before its enactment, was raised in any of those cases.

[167] Aux Sable also submits that at least some of the jurisprudence on which *Novartis* relies draws on case law that was itself considering facts predating the application of s 28.3. *Eurocopter*, which was cited by *Novartis* when identifying the existence of case law applying the reasonably diligent search test after s 28.3 was introduced, relied on *Pfizer*, a 2007 decision of the Federal Court. *Pfizer* itself relied on *Illinois Tool Works Inc. v Cobra Fixations Cie / Cobra Anchors Co.*, 2002 FCT 829 [*Illinois Tool*] at para 100, which in turn relied on *General Tire*. *Pfizer* notes that *Illinois Tool* was affirmed by the Federal Court of Appeal at *Illinois Tool Works Inc v Cobra Fixations Cie / Cobra Anchors Co*, 2003 FCA 358, which varied the Federal Court's decision only in respect of costs.

[168] *Illinois Tool* was a 2002 decision, in which Aux Sable argues s 28.3 did not apply, because the Court was considering a patent that preceded its enactment. While I have no reason to doubt the accuracy of this submission, I cannot confirm it, as the transitional provisions introduced by the Amending Act turn on the filing and issuance dates for the relevant patent, and those dates do not appear in *Illinois Tool*. However, I have not been presented with any argument by JL Energy to support a conclusion that the timing of that patent was such that *Illinois Tool* was applying s 28.3.

[169] In contrast to the conclusion in *Novartis*, Justice Locke analysed this issue as follows in *Pollard Banknote Ltd v BABN Technologies Corp*, 2016 FC 883 [*Pollard*] at paras 192-198:

> 192 In addition to the common general knowledge of which the skilled person would have been aware, section 28.3 of the *Patent Act* provides that it is also relevant to consider "information disclosed before the claim date ... in such a manner that the information became available to the public". This goes beyond common general knowledge.
>
> 193 Jurisprudence indicates that prior art relevant for the purpose of assessing obviousness is limited to that which would have been revealed in a diligent search by a skilled person: *Eurocopter v Bell Helicopter Textron Canada Ltée*, 2012 FC 113 at para 80; *Pfizer* at para 108; *Illinois Tool Works Inc v Cobra Fixations*, 2002 FCT 829 at para 100, var'd on costs 2003 FCA 358. Doubt has been expressed as to whether it is correct to limit the scope of relevant prior art to the results of a diligent search since the wording of section 28.3 is not so limited: MacOdrum at 4:11(i); R.H. Barrigar, *Canadian Patent Law Annotated*, 2d ed (Aurora: Canada Law Book, 1994) at 28.3:640. However, this point was rejected in *Novartis Pharmaceuticals Canada Inc v Teva Canada Limited*, 2015 FC 770 at para 53. Moreover, the Federal Court of Appeal recently declined an opportunity to revisit the question: *E Mishan& Sons, Inc v Supertek Canada Inc*, 2015 FCA 163 at para 21.
>
> 194 A related consideration is that monopolies are associated in the public mind with higher prices, and a patent monopoly should be purchased with the hard coinage of new, ingenious, useful and unobvious disclosures: *Apotex Inc v Wellcome Foundation Ltd*, 2002 SCC 77 at para 37. Accordingly, in order to obtain a valid patent, it is not enough for a skilled person simply to make an obvious change to what is known in the art. This principle should apply to any information that was available to the public, even if it would not have been located in a diligent search. For example, should a skilled person be able to obtain a valid patent by simply searching a dusty corner of a public library for a document that describes a forgotten invention and making an obvious change to it? The fact that a prior art reference would not have been located in a diligent search may be more relevant where the obviousness allegation combines two references, neither of which is part of the common general knowledge. In that event, it would be necessary for the party alleging obviousness to explain how a skilled person having one of the references would have been led directly and

without difficulty to combine it with the other to arrive at the impugned invention.

195 In this case, the only prior art other than common general knowledge on which Pollard still relies for its allegation of obviousness is the Camarato Application. Because there is only one non-common general knowledge reference in issue, the concern about whether it would have been located in a diligent search should not be an impediment to Pollard's obviousness allegation.

196 Even if I was of the view that this reference's findability in a diligent search was a relevant consideration, I would nevertheless conclude that it is citable for obviousness. Firstly, the Camarato Application relates to instant lottery tickets, and indicates that it is placed under international class A63F-003/06 for classification purposes. This is precisely the same as one of the classes under which the 551 Patent indicates that it is placed. This suggests that the Camarato Application would have been found in a diligent search.

197 Also, the only expert evidence that the Camarato Application would not have been found in a diligent search is that of Mr. Finnerty. But I give his opinion less weight because of his admission that he completely misunderstood the Camarato Application, and also because of his somewhat undisciplined approach to his analysis.

198 SG notes that Pollard's experts who opined on the Camarato Application and its relevance to obviousness did not find it on their own. Instead, this reference, like all of the other prior art they were asked to review, was provided to them by Pollard's counsel. SG cites jurisprudence of this Court discussing the risk of an expert offering a hindsight opinion if the prior art for review is selected by counsel: *Uponor AB v Heatlink Group Inc*, 2016 FC 320 at paras 203-204; *Astrazeneca Canada Inc v Apotex Inc*, 2015 FC 322 at para 231. These decisions also highlight that a proper consideration of obviousness requires prior art that may point away from the patented solution. It would indeed have been preferable if Pollard's experts' opinions on obviousness had been based on prior art that they had located on their own. At a minimum, such an approach, if it had revealed the Camarato Application, would have assisted Pollard's argument that Camarato was findable in a diligent search. However, I have already explained that findability should not be a consideration in this case. I have also concluded that the Camarato Application would have been found.

[170] I should note that JL Energy argues that *Pollard* supports its position, not that of Aux Sable. JL Energy relies on paragraph 193 of *Pollard*, in which Justice Locke referred to the argument that s 28.3 of the Act had removed the reasonably diligent search test. The Court noted that this argument was rejected in *Novartis* and that the Federal Court of Appeal declined the opportunity to revisit the question in *Mishan*. I disagree with JL Energy's submission that this paragraph represents a rejection of the argument that Aux Sable is now advancing. Rather, I read this paragraph as Justice Locke canvassing jurisprudential developments prior to his consideration of the issue.

[171] This interpretation is apparent from the ensuing paragraphs of *Pollard*, in which the Court notes the importance of patent monopolies resulting only from new and unobvious disclosures. In commenting that a patent requires more than an obvious change to the prior art, Justice Locke observes, at paragraph 194, that this principle applies to any information that was available to the public, even if it would not have been located in a reasonably diligent search. This interpretation is further evidenced by paragraphs 196 and 198, which reiterate the Court's conclusion that "findability" in a reasonably diligent search is not a relevant consideration.

[172] JL Energy also notes the comment in paragraph 194 of *Pollard* that the fact that a prior art reference would not have been located in a diligent search may be more relevant where the obviousness allegation combines two references, neither of which is part of the CGK, as the party alleging obviousness would then need to explain how a skilled person having one of the references would have been led directly and without difficulty to combine it with the other to arrive at the invention. JL Energy submits that this reasoning detracts from the merits of the

statutory interpretation of s 28.3 for which Aux Sable advocates, because either s 28.3 removes the diligent search test or it does not. The argument by Aux Sable is based on consistency in the statutory interpretation of ss 28.2 and 28.3. Therefore, says JL Energy, whether s 28.3 removed the diligent search test cannot depend on the number of prior art references cited under s 28.3.

[173] Aux Sable's response to this submission is that *Pollard* should be read as rejecting the requirement for a prior art reference to be locatable through a reasonably diligent search to be citable for obviousness, but as still recognizing that, when subsequently (i.e. in step 4 of the *Sanofi* analysis) considering whether multiple prior art references can be combined to conclude that the impugned invention is obvious, their locatability may be relevant. I find this to be a compelling interpretation of the reasoning in *Pollard*, which is also consistent with Justice Pelletier's comment at paragraph 62 of *Ciba*, which again I read as relevant to step 4 of the *Sanofi* analysis, that the Skilled Person can then have recourse to the CGK supplemented by those pieces of prior art which could be discovered by a reasonably diligent search.

[174] I therefore read *Pollard* as supportive of Aux Sable's position on the issue of the test for a citable reference under s 28.3. I recognize that, like *Novartis*, there is no analysis in *Pollard* of the sort of statutory interpretation arguments that are advanced by Aux Sable in the case at hand. However, *Pollard* does provide the benefit of the reasoning, in paragraph 194 of that decision, to the effect that a patent monopoly should not result from an obvious advancement upon prior art, regardless of whether the prior art would have been located in a diligent search. In my view, this reasoning supports the conclusion for which Aux Sable advocates, that the identical language in ss 28.2 and 28.3 invokes access to the same prior art for both anticipation and obviousness

analyses. JL Energy has not offered any policy argument as to why the locatability of a piece of prior art should matter for purposes of obviousness if it does not matter for anticipation. Consistent with the reasoning in *Pollard*, I have difficulty seeing why the analysis as to whether a patentee has spent "the hard coinage of new, ingenious, useful and unobvious disclosures" should include as a prior art reference a forgotten invention described by a document in a dusty corner of a library, when considering anticipation, but should not do so when considering obviousness.

[175] Finally, I note JL Energy's submission that it is not within the Court's role in this action to change the law as it relates to the requirements for a citable reference under s 28.3 of the Act. In my view, Aux Sable is not asking the Court to change the law but rather to recognize that Parliament changed the law, from the previously applicable common law test, when it enacted s 28.3. The fact that the jurisprudence has not fully caught up with this statutory change appears to be a result of the fact, as noted by the Federal Court of Appeal in *Mishan* and the dissent in *Ciba*, that neither the Federal Court nor the Federal Court of Appeal has previously had the benefit of significant and substantive argument of the sort presented by the parties in the case at hand.

[176] In conclusion, I find Aux Sable's statutory interpretation arguments compelling, and I disagree with JL Energy's response that this issue has been settled in its favour by existing jurisprudence. For the reasons detailed above, I agree with Aux Sable's position as to the effect of s 28.3 of the Act, i.e. that a prior art reference which was disclosed to the public, prior to the applicable date prescribed by s 28.3, forms part of the prior art for purposes of an obviousness

analysis, regardless of whether the reference would have been locatable through a reasonably diligent search.

E. *Sanofi Steps 3 and 4*

[177] The result of the above conclusion is that all pieces of prior art, upon which Aux Sable presently relies for purposes of its claims 1-8 obviousness allegation, are citable references for purposes of analysis of that allegation. As previously noted, JL Energy agrees that such references were disclosed for the purposes of s 28.3. Therefore, in the absence of the locatability test, they are also citable. While Aux Sable has formally identified a longer list of such prior art references upon which it relies (in the interests of completeness, set out in Appendix "A" to these Reasons), and some of those references are also relied upon as contributing to the Skilled Person's CGK, its principal arguments as to what was disclosed in the prior art relate to the following three documents:

A. US Patent 3,407,613 [the 613 Patent];

B. the Dense Phase Paper; and

C. A paper entitled "Ultra-high gas pressure pipelines offer advantages for arctic service", authored by G. King and published in the Oil and Gas Journal in 1992 [the Ultra-High Paper]. Like the Dense Phase Paper, the Ultra-High Paper was authored by Aux Sable's expert, Mr. King.

[178] Returning to the construction of claims 1-8, adopted above in lieu of the inventive concept, it will be recalled again that these claims include the following elements: (a) the intentional addition to natural gas of a C_2 hydrocarbon and/or a C_3 hydrocarbon; and (b) ensuring that the product of the molecular weight (Mw) and the z factor of the resulting gas mixture is lower than the zMw product prior to such addition.

[179] With respect to the first of these elements, Aux Sable relies first on the 613 Patent as disclosing the addition of a C_2 and/or C_3 hydrocarbon. The 613 Patent states that the primary object of the invention disclosed therein is "…to provide a highly efficient and economical process for the transfer of C2+ hydrocarbons from one or more natural gas streams to another natural gas stream". I understand from the evidence at trial that the term "C2+" refers to hydrocarbons with at least two carbon atoms. Dr. Sharma states in his report that the Skilled Person would understand that the 613 Patent describes a method of selectively transferring hydrocarbons such as ethane or propane from one natural gas stream to another in order to increase the concentration of such hydrocarbons in the latter stream. Dr. Ramsay provides evidence in his report to similar effect.

[180] I agree with Aux Sable's position that the evidence of their experts on this point was not shaken in cross-examination. Rather JL Energy's position is that the 613 Patent does not teach the intentional addition of C_2 and/or C_3 to a natural gas as a benefit to increase hydraulic efficiency. While I agree, based on the evidence of JL Energy's experts, that the 613 Patent does not teach the addition of the heavier hydrocarbons for this purpose, I do not understand Aux Sable to be taking issue with that assertion. Rather, they argue that, unlike in the context of an

anticipation allegation, a prior art document relied upon for purposes of obviousness need not disclose all aspects of the inventive concept or claims of the patent being challenged. In other words, the 613 Patent need not disclose both the intentional addition of C_2 and/or C_3 and a resulting reduction in zMw in order to establish that the addition of the heavier hydrocarbons was known in the prior art. I agree with this position.

[181] Aux Sable argues that the Dense Phase Paper and the Ultra-High Paper also disclose this element. These papers will be explained in greater detail shortly, when analysing the extent to which they represent prior art relevant to the evaluation of zMw. For present purposes, it is sufficient to note that Mr. King, the author of both papers, gave evidence that the Skilled Person would understand the Dense Phase Paper to refer to adding hydrocarbons such as ethane and propane to natural gas that was being transported and that the Ultra-High Paper focused upon the addition of a mixture of natural gas liquids (i.e. a fluid with higher concentrations of heavier hydrocarbons) to a natural gas mixture with more typical concentrations of methane, ethane and propane.

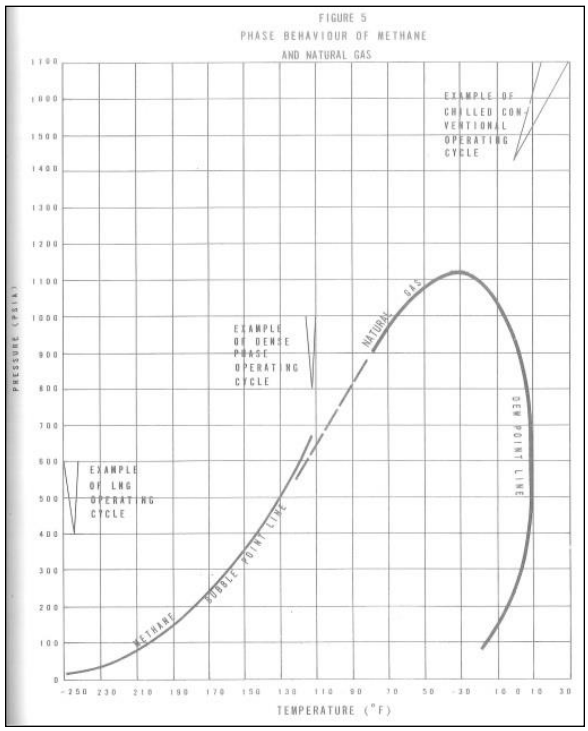
[182] In contrast, Dr. Monnery states in his report that, in the absence of details in the Dense Phase Paper as to the source of heavier hydrocarbons to add to the gas, references to adding heavier hydrocarbons do not relate to the intentional injection of hydrocarbons but rather to the variation of naturally occurring hydrocarbons in the gas. With respect to the Ultra-High Paper, Dr. Monnery's report also disputes that the paper contemplates intentional injection of C_2 and/or C_3 hydrocarbons, as opposed to the transportation of naturally occurring richer gases.

[183] There is no clear basis on which to choose between these competing expert interpretations of the two papers, particularly as the competing opinions come from the two experts who demonstrated the most inclination to give evidence as advocates for the positions that they, or the parties which retained them, were advancing. While Mr. King is the author of the papers in question, this is of little assistance given that the question is not what he was intending when he wrote the papers, but rather how the Skilled Person would read them. Nevertheless, I note that the Ultra-High Paper states that the two gas compositions on which the paper is based represent streams that would be available from the Arctic and that the paper later speaks of comingling lean gas with gas liquids (which I understand to be a reference to those same two compositions). On balance, I find this to support the interpretation offered by Mr. King more than that of Dr. Monnery. However, ultimately, little turns on this determination, as it is clear to me from the 613 Patent, as explained above, that the intentional addition of C_2 and/or C_3 hydrocarbons formed part of the prior art. In respect of that element alone, I find no gap between the prior art and claims 1-8.

[184] I now turn to the requirement, in claims 1-8 of the 670 Patent, of ensuring that the product of the molecular weight (Mw) and the z factor of the gas mixture resulting from the addition of C_2 and/or C_3 is lower than the zMw product prior to such addition.

[185] Focusing first upon the Dense Phase Paper, Mr. King explains in his report that its impetus was the discovery of large quantities of natural gas in the Arctic, which led to a search to discover the most efficient means of transporting that gas to market. The paper explored pipeline operation in the single phase region, referred to as the “dense phase,” extending from the liquid

phase, over the top of the two-phase region, to the gas phase. Figure 5 from the Dense Phase Paper, reproduced below, identifies at least qualitatively the location of the dense phase region (on a plot of temperature against pressure), positioned above the curve that encapsulates below it the two-phase region (i.e. the region of temperature and pressure combinations where a fluid will exist in both the gas and liquid phases).



[186] Mr. King explains in his report that the Skilled Person would have understood the necessity of avoiding a two-phase system when adding heavier hydrocarbons to natural gas prior to transportation by pipeline. (As previously noted, it was the undisputed evidence of several of the experts that the formation of liquids within a gas pipeline stream, i.e. the existence of two phases, created both operational and safety problems.) However, the dense phase represented a solution to this problem, as heavier hydrocarbons could be transported in that dense phase, which is still a single phase. Mr. King also explains that adding these hydrocarbons such as ethane or

propane would move the two-phase region shown in Figure 5 to the right (i.e. the temperature at the left hand side of the phase boundary would be increased), such that the mixture could then be transported more efficiently using a higher temperature. The paper refers to this effect upon the two-phase region as permitting both higher operating temperatures and lower operating pressures, both of which lower the transportation cost.

[187] It is undisputed that the Dense Phase Paper does not expressly teach the measurement of zMw following the addition of heavier hydrocarbons. However, Aux Sable submits that this paper teaches towards claims 1-8 of the 670 Patent, because of its discussion of one of the effects of adding hydrocarbons such as ethane or propane being the lowering of the cost of transportation.

[188] In response, JL Energy submits that the phenomena leading to the cost reduction referenced in the Dense Phase Paper are not the same as the subject of the 670 Patent. By way of background to this argument, JL Energy points out that the Dense Phase Paper represents a comparison between two pipeline systems, a system operating at conventional temperatures and pressures and a system employing temperatures and pressures that would transport natural gas in the dense phase. The paper refers to the latter system having advantages in that: (a) the greater density of the dense phase gas at low pressures permits a smaller, thinner-walled pipe; (b) the relative incompressibility and greater density of dense phase gas means it requires less compression or pumping power; and (c) the transportation of heavier hydrocarbons is possible in the dense phase without creating the problem of a two-phase system.

[189] JL Energy then relies in particular upon the following paragraph in the paper:

> One advantage of the dense phase system is that intermediate constituents between crude oil and methane may be included in the dense phase system with beneficial effects of moving the bubble point line, in Figure 5, to the right. This permits higher operating temperatures and lower operating pressures, both of which lower the cost of the scheme. The density and viscosity are increased nominally by adding such constituents, but there are no limits to the amount of propane, butane or even pentane which can be carried.

[190] Based on the forgoing, JL Energy submits that, while the Dense Phase Paper captures the fact that heavier hydrocarbons can be transported in the dense phase, with resulting cost savings, those savings do not relate to the increased compressibility (i.e. lower z factor) of the gas, which is the subject of the 670 Patent. While an advantage of the dense phase is that it requires less pumping power due to the density and relative incompressibility of the gas, the addition of heavier hydrocarbons has little impact on that advantage, because, due to the relative incompressibility of the gas, such addition increases the density only nominally. Rather, the cost saving from adding the heavier hydrocarbons results from moving the bubble point line (i.e. the temperature boundary on the left hand side of the two-phase region shown in Figure 5) to the right, such that the gas can be transported in the dense phase at higher temperatures and lower pressures. This reduces cost because both less cooling and less compressor power is required.

[191] In addition to the language of the Dense Phase Paper, JL Energy relies on the testimony of Dr. Ramsay in cross-examination to support the above understanding of the paper. I agree that such interpretation is supported by Dr. Ramsay's evidence, and indeed by Mr. King's own explanation of the paper. I therefore find that, other than teaching the addition of heavier

hydrocarbons as canvassed earlier in these Reasons, the Dense Phase Paper does not teach towards claims 1-8 of the 670 Patent as Aux Sable submits.

[192] Turning to the Ultra-High Paper, Mr. King explains in his report that he was proposing in that paper the use of ultra-high pressure natural gas pipelines to transport rich Arctic natural gas containing higher amounts of C_2, C_3 and C_4 hydrocarbons. He performed modelling studies comparing the behaviour of various natural gas mixtures (i.e. with different concentrations of C_2, C_3 and C_4 hydrocarbons) for a pipeline operated at a conventional pressure (1450 psia) and for a pipeline operated at ultra-high pressure (2900 psia).

[193] Mr. King explains in his main report that the data in the Ultra-High Paper demonstrated that, at ultra-high pressures and low temperatures, it was more economical to transport richer gas containing higher quantities of C_2, C_3 and C_4 due to the "volumetric shrinkage effect", i.e. that the richer gases are more compressible than lean gas. The data in the paper demonstrated this by measuring the pipeline diameter required to transport gas under a particular set of temperature and pressure conditions, the result being that the diameter decreased with an increase in the quantity of heavier hydrocarbons. Mr. King testified that this represents an increase in flow efficiency of the same sort as if one kept the pipe diameter constant with the required compressor horsepower decreasing instead. Aux Sable therefore relies on the Ultra-High Paper as teaching towards claims 1-8 of the 670 Patent.

[194] In response, JL Energy notes various differences between the gas compositions studied in the Ultra-High Paper and the ranges contemplated by the 670 Patent and, in particular, the fact

that the ultra-high pressure of 2900 psia studied in the paper significantly exceeds the maximum pressure in the patent's claims. However, in relation to pressure, Mr. King points out in his reply report that the decrease in mass of steel pipe required to transport a gas mixture at a given set of temperature and pressure conditions, resulting from adding natural gas liquids (i.e. heavier hydrocarbons), occurred for both the ultra-high and conventional pressure systems. Taking that into account, I find that, directionally, the Ultra-High Paper's demonstration of the reduction in required pipe diameter, resulting from the addition of heavier hydrocarbons and the richer gas being more compressible than lean gas, including at pressures contemplated by the 670 Patent, does teach towards claims 1-8 of the patent. I find that such effect was disclosed to the Skilled Person by the prior art.

[195] However, as with the Dense Phase Paper, it is undisputed that the Ultra-High Paper contains no express reference to the measurement of the zMw product following the addition of heavier hydrocarbons. Aux Sable submits that the evaluation of this product was taught by other prior art documents and/or forms part of the CGK, such that either there are no differences between the prior art and claims 1-8 or, if there is a difference, it constitutes a step that would be obvious to the Skilled Person without requiring any degree of invention.

[196] I note that, to the extent Aux Sable relies on CGK for purposes of the above position, JL Energy argues that CGK cannot be used in step 3 of the *Sanofi* test, in the determination of whether differences exist between the prior art and the claims as construed. Rather, JL Energy submits that it is at step 4 of the test that CGK is relevant to a considering whether such CGK can be used by the Skilled Person to bridge the differences. Aux Sable submits that the law does

not require the *Sanofi* framework to be applied as rigidly as suggested by JL Energy. However, Aux Sable agrees with JL Energy's submission as to where CGK fits into the analysis as framed by *Sanofi* and also submits that it does not matter for purpose of the Plaintiffs' arguments, on the particular fact of this case, whether the CGK is considered at step 3 or 4 of the test. I agree with Aux Sable's submission that, given the particular evidence and arguments advanced in this case, it matters little whether the analysis surrounding the role of the measurement of the zMw product in the obviousness analysis takes place in considering whether there is a gap between the prior art and the claims or in considering whether that gap can be bridged using the CGK.

[197] In making that comment, I am conscious of the point identified by the Federal Court of Appeal in *Ciba*, at paragraphs 43-59, to the effect that step 3 of *Sanofi* requires consideration of the differences between the prior art and the inventive concept, not the differences between the CGK and the inventive concept. However, in the present case, Aux Sable relies on prior art documents such as the Handbook and the "Engineering Data Book," published by the Gas Processors Suppliers Association [the Data Book], resources which it is undisputed are widely and frequently accessed by the Skilled Person, and expert testimony related thereto, to support its position that certain knowledge or understanding of the zMw product forms part of both the prior art and the CGK. The arguments of both parties rely on the same evidence, regardless of whether the question is viewed as one of prior art or of CGK, and I do not understand those arguments to differ in any way dependent on which view is adopted.

[198] As such, I regard the analysis required to address the parties' arguments to be consideration whether the role of the evaluation of the zMw product in claims 1-8 of the 670 Patent forms part of either the prior art or the CGK so as to make claims 1-8 obvious.

[199] Dr. Ramsay states in his main report, referencing the Handbook, that the Skilled Person's CGK included understanding and use of the z factor, as well as knowledge that the z factor could be derived by calculation and experiment. Dr. Ramsay also identifies, referencing the Data Book, flow equations such as the "Panhandle A Equation" and the "Weymouth Equation" which govern the horsepower required to transport natural gas across a pipeline and are taught to undergraduate engineering students. By way of example, the Panhandle A Equation reads as follows:

Panhandle A Equation

$$Q = 435.87 \left(\frac{T_b}{P_b}\right)^{1.0788} E \left[\frac{P_1^2 - P_2^2}{S^{0.853} L_m T_{avg} Z_{avg}}\right]^{0.5392} d^{2.6182}$$

Eq 17-25

[200] Dr. Ramsay identifies in particular the following three variables used in this equation:

A. "Q" represents the flow rate of the gas;

B. "S" represents the specific gravity of the gas, which is calculated by dividing the molecular weight (Mw) of the gas by the molecular weight of air; and

C. "Z_{avg}" represents the average compressibility factor of the gas.

[201] Dr. Ramsay notes that the flow rate Q, on the left hand side of either equation, relates directly to the horsepower required to transport natural gas and that, as the product of Z_{avg} and S (both of which appear in the denominator of the right hand side of the equation) decreases, the flow rate will tend to increase. Because zMw is proportional to the product of Z_{avg} and S, the Skilled Person would understand from the flow equation that, as zMw decreases, the efficiency of transporting the gas is increased.

[202] To similar effect, Mr. King explains that determining the molecular weight (Mw) of a natural gas mixture is a straightforward exercise within the Skilled Person's CGK, achieved by performing calculations based on information available in the periodic table. He states that the Skilled Person would have understood that the zMw product can be determined by calculating the mixture's molecular weight and multiplying it by the z factor. He then opines that the Skilled Person would have understood that the zMw product of the natural gas mixture could be compared to the zMw product of methane and, if it was found to be smaller, the Skilled Person would know that a volume of that mixture could be transported through a pipeline with less pressure loss than the same volume of methane. Mr. King explains in his report that pressure loss refers to the loss of pressure along the length of the pipeline (or more precisely between pumping stations) and that a reduction in pressure loss represents a reduction in the amount of compressor power required to transport the gas.

[203] Aux Sable also relies, again to similar effect, on Dr. Sharma's oral testimony. When asked in cross-examination to confirm that there is nowhere in any of the state of the art that says to multiply the z factor by Mw and use it as a guide or parameter to determine the effect on

horsepower, Dr. Sharma replied, with reference to the Weymouth equation, “It’s right there.” He explained that Mw can be substituted for S in the equation and that the equation then states very explicitly that the zMw product controls the pressure drop in the pipeline.

[204] Dr. Sharma also explained in his direct evidence that the Weymouth equation includes three different groups of parameters, the first group related to the physical pipeline (i.e. length and diameter), the second related to the operating conditions of the pipeline (i.e. temperature and pressure), and the third related to the gas itself (i.e. molecular weight and compressibility). Therefore, if the parameters in the first two groups are essentially constants, the only way to increase the flow (Q) is to increase the molecular weight of the mixture (i.e. by adding higher weight hydrocarbons such as C_2 or C_3) and see if the product of molecular weight times compressibility factor in the denominator of the equation is smaller as a result. I agree with Aux Sable’s position that Dr. Sharma’s evidence was unshaken on cross-examination.

[205] I do not understand JL Energy to be taking issue in particular with Aux Sable’s interpretation of how the flow equations operate or the role that the zMw product has in those equations. Rather, JL Energy’s position is that these equations do not directly teach the Skilled Person the behaviour of this product over varying gas compositions, temperatures and pressures, which understanding would be necessary to prompt the Skilled Person to employ zMw in the manner claimed in the 670 Patent.

[206] On this point, Dr. Monnery explains in his report that the zMw product is a function not only of composition, but also of pressure and temperature, because the z factor itself varies with

each of the composition, temperature and pressure of the gas. This makes the behaviour of zMw complex, such that it does not always decrease with the addition of C_2 and/or C_3. Rather, an increase in Mw through such addition often results in the zMw product increasing before it begins to decrease. Dr. Monnery refers to this behaviour as the "energy hill" shown by the 670 Patent, as a function of which (at least at certain pressure and temperature combinations) a sufficient amount of C_2 and/or C_3 hydrocarbons must be added to the untreated gas to produce the reduction in the zMw product claimed by the patent.

[207] This concept of an "energy hill" is described in the disclosure portion of the 670 Patent as follows, with reference to Figure 4 of the patent, also reproduced below:

> Figure 4 shows the effect on horsepower requirements per million cubic feet of gas being pumped through the same pipeline as used in Figure 3 when the pipeline gas contains different concentrations of ethane at 35°F.
>
> Figure 4 also shows the negative effect of adding ethane to a typical pipeline running at about 800 psia pressure and 35°F. Required power for pumping increases until the mix contains 26% ethane and then decreases for higher concentrations approaching the liquid phase limits. However, the decrease is not sufficient so that, by the concentration where liquefaction occurs (about 40%) there is any saving of horsepower over pumping ordinary natural gas. This energy hill however peaks at decreasing concentrations of ethane as operational pressure increases, e.g., 14% at 1150 psia, 8% at 1350 psia, 6% at 1475 psia. This is due to the rate of decrease in the value of the z factor overcoming the rate of increase in density.

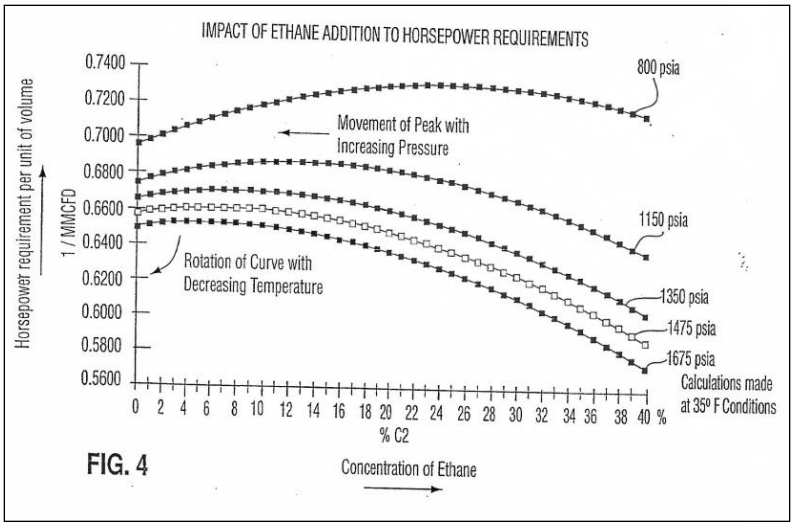


FIG. 4

[208] Mr. Ryan's report similarly describes the energy hill as representing a significant difference between the state of the art and the claims of the 670 Patent. I understand the thrust of both his and Dr. Monnery's opinions on this point to be that, as a result of the complex interactions among pressure, temperature, gas composition and the z factor, the effect of which is described in the patent as the energy hill, the specific behaviour of zMw with changes in those parameters would not have been known to the Skilled Person, either through the prior art or as CGK, and would have required calculation, inference and imagination to derive. They opine that, without such knowledge, the Skilled Person would have had no reason to turn to this product to evaluate the effect of adding heavier hydrocarbons to a gas mixture.

[209] In relation to the energy hill, I note that this term does not appear in the claims of the 670 Patent and that it is Aux Sable's position that it is therefore irrelevant to the obviousness analysis. I agree as a matter of law with the principle upon which Aux Sable relies, that it is only the claims as construed, and not other concepts that may appear in the disclosure of the patent, that are to be taken into account in assessing obviousness. However, in my view, this does not

undermine the analysis underlying the opinions of JL Energy's experts that the behaviour of the zMw product does not form part of the prior art or the Skilled Person's CGK so as to represent an obvious step from the prior art.

[210] Recall that claims 1-8 as construed require the evaluation of the zMw product, following the addition of C_2 and/or C_3 hydrocarbons, to ensure that such product has decreased as a result of such addition. Recall also that the prior art directionally teaches the advantage of a reduction in the horsepower required to achieve gas flow as a result of the addition of heavier hydrocarbons to create a more compressible richer gas. Why then is it necessary to measure zMw before and after such addition? This is because of the interactions among pressure, temperature, gas composition and the z factor, and the resulting complexities in the behaviour of zMw, such that the benefits taught by the prior art are not necessarily achieved by enriching the gas. Claims 1-8 require the measurement of zMw, before and after the C_2 and/or C_3 addition, in order to ensure that sufficient C_2 and/or C_3 has been added to achieve such benefits. In other words, the required decrease in zMw is included in claims 1-8 precisely because of the complex behaviour which elsewhere has been referred to as the energy hill. Therefore, in my view, the construction of the claims supports JL Energy's experts' consideration of the Skilled Person's knowledge of this behaviour.

[211] I also find merit to JL Energy's experts' opinions that the complex behaviour of the zMw product does not form part of the prior art or the CGK and would not be obvious to the Skilled Person. The objective aspects of the opinions of Aux Sable's experts in relation to the zMw product are sound both as to the physics reflected in the flow equations and the manner in which

they can be reorganized to identify the role of zMw. That is, the zMw product can be isolated in the flow equations and found to be proportional to the gas flow. However, as JL Energy's experts opine, these analyses do not explain what would motivate the Skilled Person to choose to evaluate that product in connection with the addition of C_2 and/or C_3 to natural gas. I agree with JL Energy's experts' opinion that the analyses by Aux Sable's experts, supporting Aux Sable's position that that use of the zMw product to measure gas flow in a pipeline following C_2 and/or C_3 addition forms part of either the prior art or the CGK, employ to some extent the use of impermissible hindsight (see, e.g., *Beloit Canada Ltée/Ltd. v Valmet Oy* (1986), 8 CPR (3d) 289 (Fed CA) at paras 20-21). Their analyses explain why that parameter works to ensure increased gas flow or reduced power requirements but, in the absence of an understanding of the behaviour of that parameter, do not explain what would have prompted the Skilled Person to use it in the first place in the context of enriching a gas mixture.

[212] I have considered the reply reports of Dr. Ramsay and Dr. Sharma, which again reference the information available to the Skilled Person, from flow equations and other common references such as the Handbook, as to the behaviour of the zMw product. However, in my view, the reply evidence does not establish that the Skilled Person would have been aware of the complexities of the behaviour of zMw in the absence of imagination, inference, and the performance of calculations motivated thereby.

[213] Finally, returning to my earlier observations on considerations that may affect the weight to be given to the opinions of the various experts, I would have some concern about acceding to the more subjective aspect of Dr. Sharma's opinion in this area of the obviousness analysis. He

opines that there is no difference between the state of the art and claims 1-8, because efficiency improvements from a reduced zMw are a direct consequence of the flow equations showing that zMw is proportional to the pressure drop needed to flow gas across a pipeline. It is at this stage of the obviousness analysis that the concern identified earlier in these Reasons, that Dr. Sharma's misconception of the Skilled Person as an engineer with an average level of inventiveness, potentially becomes relevant.

[214] I appreciate that Dr. Sharma's opinion is framed in terms of identifying the state of the art (step 3 of the *Sanofi* test), as opposed to considering whether differences between the art and the claims are obvious (step 4). However, I have previously explained the relationship between these steps of the obviousness analysis in the context of the particular arguments advanced by Aux Sable as to the role of the zMw product. As such, I do have concern that Dr. Sharma's misconception as to the Skilled Person's level of inventiveness could have influenced his opinion. My decision to prefer the opinions of JL Energy's experts on this particular issue is based principally on my analysis as set out above. However, the concern about Dr. Sharma's understanding of the Skilled Person's level of inventiveness further supports that decision.

[215] I am also conscious of the concerns identified with respect to JL Energy's experts' understandings of the Skilled Person, as explained earlier in these Reasons. Somewhat similar to Dr. Sharma, Dr. Monnery erred by ascribing some level of inventiveness to the Skilled Person, describing the person as "not particularly inventive" or "not very inventive". With respect to Mr. Ryan, the concern was that he relied on his personal views when undertaking tasks assigned by patent law to the Skilled Person. These concerns are unfavourable to the weight to be afforded to

the evidence of both witnesses, as the level of confidence the Court can have in an expert witness's opinion is bolstered by clear evidence that she or she fully understood the legal parameters of the assigned task. However, I do not find these concerns to undermine such confidence sufficiently to affect my decision to prefer the opinions of JL Energy's experts over those of Aux Sable in connection with this component of the obviousness analysis.

[216] I reach this conclusion in part because ascribing some degree of inventiveness to the Skilled Person, or relying on the expert's own views (and therefore possibly adopting a version of the Skilled Person which includes some degree of inventiveness) is logically of less concern when the expert is offering an opinion to the effect that the invention would not be obvious to the Skilled Person. However, this result also follows from the fact that my decision to prefer the opinions of JL Energy's experts on this issue turns principally on the above analysis as to the merits of those opinions, as opposed to turning on how reliable the experts appear to be as witnesses. For that reason, the other concerns raised by Aux Sable about the reliability of JL Energy's experts, including my finding that Dr. Monnery was acting to some extent as an advocate, also do not alter my decision to accept their evidence in this area of the obviousness analysis.

[217] Finally, I should note that each of the parties also advanced arguments on secondary considerations that could influence the obviousness analysis. These arguments involved evidence including how long it took the inventor to arrive at the concept underlying the patent and how much he was remunerated for his work, as well as the licence fees and meritorious recognition that JL Energy argues were received in connection with the technology underlying the patent.

However, both parties agree that such secondary considerations are relevant only in borderline cases, i.e. where the outcome of the obviousness analysis is not clear (see, e.g., *Teva Canada Limited v Janssen Inc*, 2018 FC 754 at para 91). As this is not, in my view, a borderline case, I will not proceed to reviewing the secondary factors.

[218] In conclusion on this issue, I find based on the above analysis that Aux Sable has not established, either through the content of the prior art or through the content of CGK intended to bridge differences between the prior art and the claims, that claims 1-8 of the 670 Patent are obvious.

IX. **Are claims 1-10 of the 670 Patent invalid based on the following grounds?**

A. *Insufficiency*

[219] Sufficiency, in connection with the validity of a patent, is assessed based on s 27(3) of the Act, which provides as follows:

27 (3) The specification of an invention must	**27 (3)** Le mémoire descriptif doit :
(a) correctly and fully describe the invention and its operation or use as contemplated by the inventor;	**a)** décrire d'une façon exacte et complète l'invention et son application ou exploitation, telles que les a conçues son inventeur;
(b) set out clearly the various steps in a process, or the method of constructing, making, compounding or using a machine, manufacture or composition of matter, in such full, clear, concise and	**b)** exposer clairement les diverses phases d'un procédé, ou le mode de construction, de confection, de composition ou d'utilisation d'une machine, d'un objet manufacturé ou d'un

exact terms as to enable any person skilled in the art or science to which it pertains, or with which it is most closely connected, to make, construct, compound or use it;	composé de matières, dans des termes complets, clairs, concis et exacts qui permettent à toute personne versée dans l'art ou la science dont relève l'invention, ou dans l'art ou la science qui s'en rapproche le plus, de confectionner, construire, composer ou utiliser l'invention;
(c) in the case of a machine, explain the principle of the machine and the best mode in which the inventor has contemplated the application of that principle; and	**c)** s'il s'agit d'une machine, en expliquer clairement le principe et la meilleure manière dont son inventeur en a conçu l'application;
(d) in the case of a process, explain the necessary sequence, if any, of the various steps, so as to distinguish the invention from other inventions.	**d)** s'il s'agit d'un procédé, expliquer la suite nécessaire, le cas échéant, des diverses phases du procédé, de façon à distinguer l'invention en cause d'autres inventions.

[220] In *Pfizer* Canada *Inc. v Novopharm Ltd.*, 2012 SCC 60 at paras 49-52, quoting in part from *Consolboard Inc. v MacMillan Bloedel (Saskatchewan) Ltd.*, [1981] 1 SCR 504, the Supreme Court of Canada reviewed the jurisprudence on sufficiency as follows (emphasis in original):

> 49 In *Consolboard*, this Court reviewed the Act's disclosure requirements, which at that time were found in s. 36. Although there are variations in wording between that section and the current s. 27(3), the substance of the disclosure requirements has remained the same.
>
> 50 Dickson J. discussed what the specification must contain in order to meet the disclosure requirements. He stated clearly that the nature of the invention must be disclosed and that the entire specification, including the claims, must be considered in determining the nature of the invention and whether disclosure was sufficient:

In essence, what is called for in the specification (which includes both the "disclosure", *i.e.* the descriptive portion of the patent application, and the "claims") is a description of the invention and the method of producing or constructing it, coupled with a claim or claims which state those novel features in which the applicant wants an exclusive right. The specifications must define the precise and exact extent of the exclusive property and privilege claimed.

Section 36(1) seeks an answer to the questions: "What is your invention? How does it work?" With respect to each question the description must be correct and full in order that, as Thorson P. said in *Minerals Separation North American Corporation v. Noranda Mines, Limited* [[1947] Ex. C.R. 306]:

> ... when the period of monopoly has expired the public will be able, having only the specification, to make the same successful use of the invention as the inventor could at the time of his application. [at p. 316]

We must look to the whole of the disclosure and the claims to ascertain the nature of the invention and methods of its performance, ... being neither benevolent nor harsh, but rather seeking a construction which is reasonable and fair to both patentee and public. There is no occasion for being too astute or technical in the matter of objections to either title or specification for, as Duff C.J.C. said, giving the judgment of the Court in *Western Electric Company, Incorporated, and Northern Electric Company v. Baldwin International Radio of Canada* [[1934] S.C.R. 570], at p. 574, "where the language of the specification, upon a reasonable view of it, can be so read as to afford the inventor protection for that which he has actually in good faith invented, the court, as a rule, will endeavour to give effect to that construction". Sir George Jessel spoke to like effect at a much earlier date in *Hinks & Son v. Safety Lighting Company* [(1876), 4 Ch.

> D. 607]. He said the patent should be approached "with a judicial anxiety to support a really useful invention".
>
> ... In my view it is a well established principle that a patent specification is addressed, not to the public generally, but to persons skilled in the particular art. I am further of the opinion that s. 36(1) does not impose upon a patentee the obligation of establishing the utility of the invention.[Emphasis added; citation omitted; pp. 520-21.]

Since *Consolboard*, the Court has constantly applied the principles stated by Dickson J., which is a testament to the soundness of his reasoning: see, e.g., *Monsanto Canada Inc. v. Schmeiser*, 2004 SCC 34, [2004] 1 S.C.R. 902 (S.C.C.), at para. 18; *Whirlpool Corp. v. Camco Inc.*, 2000 SCC 67, [2000] 2 S.C.R. 1067 (S.C.C.), at para. 52; *Pioneer Hi-Bred Ltd. v. Canada (Commissioner of Patents)*, [1989] 1 S.C.R. 1623 (S.C.C.) ("*Pioneer Hi-Bred*"), at p. 1636.

51 In *Pioneer Hi-Bred*, the Court referred to *Consolboard* in discussing the Act's disclosure requirements once again. Lamer J. (as he then was), writing for the Court, described those requirements as follows:

> In summary, the *Patent Act* requires that the applicant file a specification including disclosure and claims (*Consolboard Inc.*, *supra*, at p. 520). Canadian courts have stated in a number of cases the test to be applied in determining whether disclosure is complete. The applicant must disclose everything that is essential for the invention to function properly. To be complete, it must meet two conditions: it must describe the invention and define the way it is produced or built .... The applicant must define the nature of the invention and describe how it is put into operation. A failure to meet the first condition would invalidate the application for ambiguity, while a failure to meet the second invalidates it for insufficiency. The description must be such as to enable a person skilled in the art or the field of the invention to produce it using only the instructions contained in the disclosure ... and once the monopoly period is over, to use the invention as

> successfully as the inventor could at the time of his application (*Minerals Separation*, *supra*, at p. 316). [Emphasis added; citations omitted; pp. 1637-38.]
>
> 52 In *Consolboard* and in *Pioneer Hi-Bred*, the Court correctly analysed the disclosure requirements set out in s. 27(3) of the Act. The reasoning in those cases should be reaffirmed and applied in the case at bar.

[221] There is no disagreement between the parties as to the applicable test. In closing argument, the Plaintiffs' counsel expressed his agreement with the Defendant's articulation that, for a description in a patent to be sufficient, the description must be such as to enable a person skilled in the art or the field of the invention to produce it using only the instructions contained in the disclosure.

[222] Aux Sable explains that there is a relationship between their allegations of obviousness and insufficiency. As canvassed above, it has argued that the 670 Patent is obvious, because it does not teach the Skilled Person anything apart from what he or she already knew from the CGK or disclosure in the prior art. Under its obviousness allegation, Aux Sable took the position that the prior art and CGK enabled the Skilled Person to practice the invention claimed in the patent. However, it takes the alternative position for all of claims 1-10 that, in the event the claims were not found to be obvious (or, in the case of claims 9-10, anticipated), the patent is invalid for insufficiency, because the patent provides no new information, beyond the content of the CGK and prior art, that would enable the Skilled Person to put the invention into practice. As I have found claims 9-10 to be anticipated, I will consider Aux Sable's alternative argument, related to insufficiency, only in relation to claims 1-8.

[223] The thrust of the Plaintiffs' argument is that the 670 Patent does not teach the Skilled Person how to select each of the parameters (i.e. gas composition, temperate and pressure) within the ranges prescribed by the claims. It also does not teach how to mechanically perform the addition of C_2 and/or C_3 hydrocarbons or how to avoid the liquid phase in the gas mixture. As such, even with the 670 Patent in hand, there is no reduction in the amount of work required to be performed by the Skilled Person in order to determine the most efficient manner to transport natural gas by pipeline.

[224] Aux Sable submits that its position on insufficiency is supported by the evidence of its own experts, Dr. Ramsay and Dr. Sharma, and by that of JL Energy's expert, Dr. Monnery. In arriving at the opinion in his report that the operation of the invention is not sufficiently described in the 670 Patent, Dr. Ramsay states that the patent does not explain how to select or achieve the particular concentrations of the constituents of the gas mixture (including which specific C_2 and/or C_3 hydrocarbon to add and how much to add), the particular pressure, the particular temperature, or precisely how much to lower the zMw product through the addition of C_2 and/or C_3. Dr. Sharma makes similar observations, as well as noting that the 670 Patent does not provide guidance on how to avoid the liquid phase in the gas mixture.

[225] Aux Sable also refers the Court to the portion of Dr. Monnery's report which responds to these observations by Dr. Sharma, and to Dr. Monnery's evidence in cross-examination, as confirming that the process of optimally designing a pipeline was already known to the Skilled Person and the only new variable introduced by the 670 Patent was the addition of C_2 and/or C_3 hydrocarbons in order to lower the zMw product.

[226] I accept the evidence, upon which Aux Sable relies, as accurately reflecting what the 670 Patent does and does not teach. However, I do not agree with Aux Sable, or their experts to the extent they express this opinion, that this evidence supports a conclusion that the patent is invalid for insufficiency. Returning to the applicable test, whether the description in the patent is such as to enable the Skilled Person to produce the invention using only the instructions contained in the disclosure, my conclusion is that this test is met. It must be remembered that the invention in claims 1-8 is the addition of C_2 and/or C_3 hydrocarbons so as to lower the zMw product to a level below that of the untreated gas. The 670 Patent clearly teaches the Skilled Person how to accomplish that result, as the calculation of the zMw product, before and after the addition of the C_2 and/or C_3 hydrocarbons, is determinative of when that result has been achieved. In my view, the fact that there are a range of operating conditions and indeed gas compositions, within which that result can be achieved, does not translate into a conclusion that the Skilled Person does not have enough information to practice the invention.

[227] Aux Sable's counsel acknowledged in argument that it is permissible for a patent to claim ranges as does the 670 Patent. Aux Sable's position is not that the patent is insufficient because it claims ranges, but rather that it is insufficient for failing to provide the Skilled Person with instructions as to how to make selections within those ranges. The Plaintiffs refer to Dr. Monnery's evidence as identifying that the Skilled Person knows how to make such selections, based on the prior art and/or CGK, but reiterate their position that this means the 670 Patent is either obvious (because the Skilled Person already had the relevant information) or is insufficient (because the patent does not itself provide this information).

[228] Again, I believe this argument misses what the invention actually is. The 670 Patent provides the information necessary to practice the invention claimed (again, the addition of C_2 and/or C_3 hydrocarbons so as to lower the zMw product). Making design selections involving composition and temperature, the mechanical methodology for adding C_2 and/or C_3 hydrocarbons, and the avoidance of the liquid phase all form part of what Aux Sable submits is part of the Skilled Person's CGK. I have found above that this invention was not obvious to the Skilled Person, notwithstanding the CGK and prior art brought to bear on that analysis. However, that does not mean that the patent is insufficient simply because the Skilled Person relies on such CGK to practice the patent.

[229] I therefore find that the claims of the 670 Patent are not invalid based on insufficiency.

B. *Unpatentable subject matter*

[230] This ground of invalidity raises the issue of whether a claimed invention is proper subject-matter for a patent, i.e. whether it is an "invention" for purposes of the Act, as set out in s 2:

invention means any new and useful art, process, machine, manufacture or composition of matter, or any new and useful improvement in any art, process, machine, manufacture or composition of matter;	***invention*** Toute réalisation, tout procédé, toute machine, fabrication ou composition de matières, ainsi que tout perfectionnement de l'un d'eux, présentant le caractère de la nouveauté et de l'utilité.

Aux Sable refers the Court to the statement in *Abbott Laboratories (Bermuda) Ltd, Re*, 2014 FC 1251 [*Abbott*] at para 56, that claims to the exercise of professional skills are not inventions and

cannot be patented and monopolized. While allegations that patents are invalid because they claim non-patentable subject matter typically arise in the context of claims for medical treatment over a range of doses, *Abbott* referred to the applicable principle as not being limited to healthcare, and I do not understand JL Energy to be taking issue with that proposition. Indeed, I do not understand the parties to disagree on the law applicable to this issue. In oral argument, Aux Sable's counsel expressed agreement with the test set out by JL Energy (in reliance on *Abbott*) as follows its written closing submissions:

> Claims directed to the "exercise of professional skill" are not patentable. Every claim that involves a professional skill broadly is not unpatentable. Instead, the prohibition is directed to a specific definition of "professional skill" that involves the practitioner of the claim having to exercise some sort of judgment that will affect the successful outcome of the invention. The common phrase used when referring to "exercise of professional skill" is "professional skill and judgment".

[231] To be fair, the expression of agreement by Aux Sable's counsel referred in particular to the fact that it is "skill and judgment" to which this principle applies, i.e. that there must be an element of judgment involved in the professional's exercise of his or her skill in order for a claim to the exercise of that skill to be invalid. Aux Sable's counsel did not expressly confirm agreement with JL Energy's articulation of the test as applying only to the exercise of some sort of judgment that will affect the successful outcome of the invention. However, Aux Sable did not argue against this articulation of the test and, while JL Energy did not refer to authorities that expressly state the test in this manner, I agree that such articulation is logical and appears supported by the reasoning in the applicable case law.

[232] For example, in *Axcan Pharma Inc v Pharmascience Inc*, 2006 FC 527 [*Axcan*], one of the dosage cases upon which Aux Sable relies, the Court found that a claim to a pharmaceutical composition for treatment of a particular disease, based on a dose in a prescribed range (13 to 15 mg/kg/day based on the patient's weight), was invalid as it claimed a method of medical treatment. In arriving at this conclusion, Justice Harrington explained at paragraph 46 that it was up to the physician, based on his or her knowledge of the patient's rate of metabolism and other factors, to determine the appropriate daily dosage. As I understand the reasoning, it was the fact that the patent claim related to an area in which the physician was required to exercise professional judgment, in the selection of the appropriate dosage to treat the disease, which resulted in its invalidity. This supports JL Energy's submissions that the principle explained in *Abbott* is directed at circumstances where the exercise of professional judgment, i.e. making a good judgment versus a bad one, will affect the successful outcome of the invention.

[233] Turning to the circumstances of the present matter, Aux Sable argues that the 670 Patent claims a range of available choices for the Skilled Person, as a result of which the Skilled Person has to exercise his or her professional skill and judgment in applying the patent. In other words, as the claims of the 670 Patent do not prescribe a fixed gas composition or set of transport conditions (i.e. temperature and pressure), the patent requires the Skilled Person to use professional skill and judgment to select an appropriate combination of composition and conditions.

[234] As with its insufficiency allegation, Aux Sable relies on the evidence of its own experts, Dr. Ramsay and Dr. Sharma, as well as that of JL Energy's expert, Dr. Monnery, in support of its

position. Dr. Ramsay expresses the opinion that the claims of the 670 Patent are directed to the area of the professional skills of the Skilled Person. He supports this conclusion by identifying the range of hydrocarbons, concentrations of hydrocarbons, and pressures and temperatures claimed by the patent, stating that patent does not assist in making selections within those ranges, but rather claims the results of the Skilled Person's efforts in exercising professional skill to make those selections. Dr. Sharma expresses similar opinions, as well as reiterating that claims 9-10 do not relate to evaluation of the zMw product.

[235] With respect to Dr. Monnery, Aux Sable again refers to his report and evidence in cross-examination as confirming that the process of optimally designing a pipeline was already known to the Skilled Person and that the only new variable introduced by the 670 Patent was the addition of C_2 and/or C_3 hydrocarbons in order to lower the zMw product. Aux Sable also relies on cross-examination evidence in which Dr. Monnery states that the Skilled Person would rely upon his or her skill and judgment in setting temperatures and pressures and in altering the composition of the raw gas coming out of the ground before its transport.

[236] My analysis of this invalidity allegation is similar to the above analysis of the Plaintiffs' insufficiency arguments. I accept the evidence, upon which Aux Sable relies, as accurately reflecting areas in which the Skilled Person would be relying on his or her professional skill, rather than the teaching of the patent, in practicing the patent. However, addressing first claims 1-8, I do not agree with Aux Sable, or their experts in expressing this opinion, that this evidence supports a conclusion that the patent is invalid for claiming non-patentable subject matter. The Skilled Person is afforded ranges of compositions, pressures, and temperatures with which to

work, and I accept that professional skill will be required, relying on the Skilled Person's CGK, to make pipeline design decisions within those ranges. However, the Skilled Person, in practicing these claims, is not required to exercise judgment that will affect the successful outcome of the invention. The successful outcome is achieved by following the patent's instructions to add sufficient C_2 and/or C_3 hydrocarbons to lower the zMw product to a level below that of the untreated gas. No judgment is required to achieve that result.

[237] I appreciate that Dr. Monnery testified in cross-examination that the Skilled Person would rely upon his or her skill and judgment in relation to the ranges prescribed by the patent. However, the questions to which Dr. Monnery was responding did not articulate the meanings of the terms "skill" and "judgment", or the difference in the meanings of those terms which is significant for purposes of the present analysis, in a manner that would allow the Court to treat his use of the term "judgment" in his cross-examination testimony as particularly probative of the outcome of this analysis.

[238] With respect to claims 9-10, little turns on the outcome of this analysis, as I have already found these claims to be invalid under other allegations canvassed earlier in these Reasons. The distinction between those claims and claims 1-8, which is significant to the other invalidity determinations, is of course the absence of the evaluation of zMw before and after the addition of C_2 and/or C_3 hydrocarbons. In my view, other allegations canvassed earlier in these Reasons may represent more apt analytical frameworks for the assessment of the validity of claims 9-10 in the absence of that metric. However, Dr. Sharma does note the absence of that metric in his opinion on non-patentable subject matter, and I agree that claims 9-10 therefore bear similarities to the

dosage ranges found to be invalid in cases such as *Axcan*. Unguided by the evaluation of the zMw product, the Skilled Person's practice of claims 9-10 to a successful outcome within the ranges of compositions prescribed does depend on the exercise of professional judgment. As such, in my view, claims 9-10 are invalid on that basis.

X. **Conclusion and Costs**

[239] In summary, my conclusions are that claims 1-8 are valid, that claims 9-10 are invalid, and that the Plaintiffs are entitled to a declaration that claims 9-10 are invalid and void as contemplated by s 60(1) of the Act. My Judgment will so reflect.

[240] At the trial of this action, the parties proposed that costs be addressed following the Judgment on the merits, with the parties afforded 10 days either to reach agreement on costs and so advise the Court or to provide their respective written submissions, limited to 5 pages each. My Judgment will reflect this approach.

JUDGMENT IN T-1612-16

THIS COURT'S JUDGMENT is that:

1. Pursuant to subsection 60(1) of the *Patent Act*, RSC 1985, c P-4, as amended, claims 9-10 of Canadian Letters Patent No. 2,205,670 are declared invalid and void.

2. The Plaintiffs' action is otherwise dismissed.

3. The parties are afforded 10 days from the date of this Judgment either to reach agreement on costs and so advise the Court or to serve and file their respective written submissions on costs, limited to 5 pages each, supported by a proposed bill of costs.

"Richard F. Southcott"
Judge

Appendix "A"

Prior Art Reference Cited by Plaintiffs for Obviousness
US Patent No. 2,550,844 (Meiller)
US Patent No. 3,407,613 (Muller)
Contributions in Petroleum Geology & Engineering (Gulf Publishing Company, 1997), *Gas Production Engineering*, Volume 4, Chapters 2, 3 and 9, Sanjay Kumar
European Petroleum Conference, 25-28 October, 1982, FLAGS OffShore Gasoline Project (EUR 378), Douglas E. Broussard, Manfred D. Lux, Kees P. Havik
Engineering Data Book, Gas Processors Suppliers Association, 10th ed. (Tulsa, Oklahoma, 1987), Compressibility Factors for Natural Gas; Volume 1: Chapters 1, 2, 12, 13; Volume 2: Chapters 17, 21, 23, 24, M.D. Standing, D.L. Katz
Oil and Gas Journal (1992) 90:2; pp 79-86, Ultra-High Gas Pressure Pipelines Offer Advantages for Arctic Service, G. King
Handbook of Natural Gas Engineering (1959), Chapters 1, 3, 4, 7, 8, 17
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ICAM-94 Proceedings: Resource Potential-Hydrocarbons, Optimum Transportation of Natural Gas Under Arctic Conditions, D. Stinson

FEDERAL COURT

SOLICITORS OF RECORD

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APPEARANCES:

Timothy Ellam Steven Tanner Sanjaya Mendis	FOR THE PLAINTIFFS
Ariel Breitman Jonathan Bourchier Scott Davidson	FOR THE DEFENDANT

SOLICITORS OF RECORD:

McCarthy Tetrault LLP Calgary, Alberta	FOR THE PLAINTIFFS
MLTaikins LLP Calgary, Alberta	FOR THE DEFENDANT