JCPT

Ownership of Solution and Evolved Gas: Technical and Legal Perspectives

M.R. CARLSON
Applied Reservoir Engineering Ltd.
J.G. FRIESEN
McCarthy Tetrault

Abstract

Split title leases, in which oil rights and gas rights are divided, have resulted in disputes over solution gas ownership. A recent judgment of the Alberta Court of Appeal in Prism Petroleum Ltd. et al. vs. Omega Hydrocarbons Ltd.[1] affirmed earlier decisions including the Borys[2] case.

Relevant engineering and legal issues are discussed. The paper has been written as a "bridge" between engineering and law. In order to accomplish this objective, background information has been provided so that the material can be readily understood by those in either profession. This will, of course, be at the expense of including some basic material, which would not normally be included in a technical or legal paper.

Engineering issues include terminology, PVT behaviour, producing mechanisms, the significance of an initial GOR, how gas is evolved in the reservoir, concurrent production, classification of oil and gas wells, enhanced recovery requirements, solution gas conservation, and the effects of offset production. The impracticality of periodic testing of reservoir conditions is outlined.

Legal issues include previous case law, the specific wording of the lease considered in the recent decision and its interpretation, and issues where some uncertainty remains. These issues include the responsibility for costs of drilling, completion, surface facilities and operations where there has been a trespass or conversion, the related issue of unjust enrichment, estoppel (by deed, conduct and representation) and limitation periods. It is suggested that improvements could be made to agreements to more clearly define oil and gas rights.

Organization

This paper represents the experience gained in preparing for a specific litigation case. It has, however, been written to address problems that can arise in general. The organization is therefore as follows:

1. Split titles and how they arise.
2. A basic explanation of the relevant engineering issues.
3. The general legal issues are presented, followed by an explanation of these issues.
4. The background, legal process, technical preparation, trial results and appeal decisions of Prism et al. vs. Omega[1] are discussed in detail.
5. A number of issues that have not been resolved by the Courts are discussed.
6. Recommendations and Conclusions are made.

This paper has a number of purposes. First, to report the results of a recent decision. Second, we hope to show some of the problems that can occur with split title leases and to provide an overview of a complex issue. Finally, we recommend some changes which may mitigate some of these problems.

The paper is multi-disciplinary covering both legal and engineering issues. Wherever possible, an attempt has been made to make the paper suitable to be read by either discipline. The paper is not a substitute for legal or technical advice, and readers should seek such advice in relation to the unique circumstances that may be applicable to their work or cases.

Introduction

Split titles, where the natural gas rights and the petroleum (oil) rights have been separated, occur from three sources:

1. The Crown has the right to reserve either the oil or natural gas rights [e.g., Section 92(2)(a) and (b) of the Alberta Mines and Mineral Act[6]]. Hence split leases or licenses may be granted by the Crown.
2. An oil company may farm out a portion of its Crown Petroleum and Natural Gas (P&NG) lease to another operating company (or individual).
3. On freehold land, the lessor may sell part of its P&NG rights and reserve the remaining portion.

The latter situation has been most commonly associated with Canadian Pacific Railway (CPR) lands. The CPR sold large areas of land which, after 1902, reserved various mineral interests such as "petroleum" or "coal, petroleum and valuable stone." After 1912, all mineral and P&NG rights were reserved, the majority of which are now held by PanCanadian[3].

Recent legal cases deal with situations where gas is dissolved in the oil; i.e., initially the reservoir fluid is entirely a liquid, after which gas evolves with the reduction of pr essure caused by reservoir withdrawals. T after which is issue was the subject of Prism et al. vs. Omega[1]. The essence of the claim was that when a portion of the original reservoir changes phase, so does the ownership. The gas may segregate in what is commonly known as a secondary gas cap, or may be dispersed throughout the formation. Such a situation is shown in Figure 1.

There are two other situations where the authors envisage that these ownership issues could arise:

1. An oil reservoir is found that has a gas cap, such as is shown in Figure 2.
2. In rare circumstances, a reservoir may be found with the right combination of temperature, pressure, and composition; wherein it is very difficult to tell if the fluid in the reservoir is a gas or a liquid.

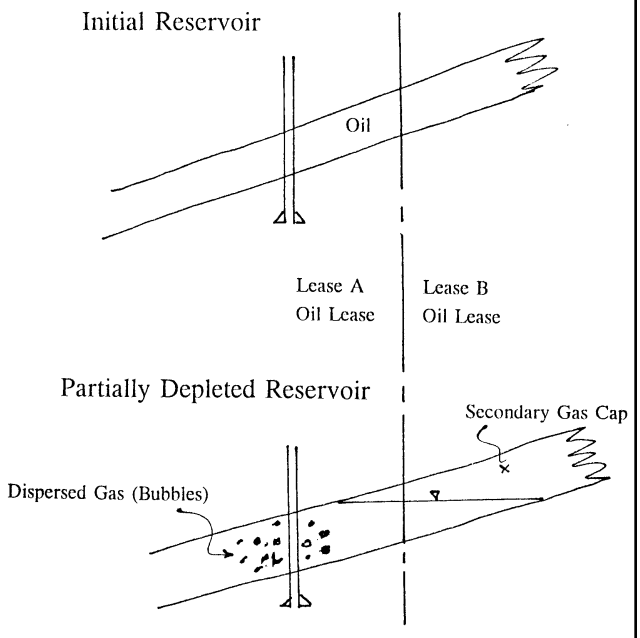

FIGURE 1: Changes in phase with production.

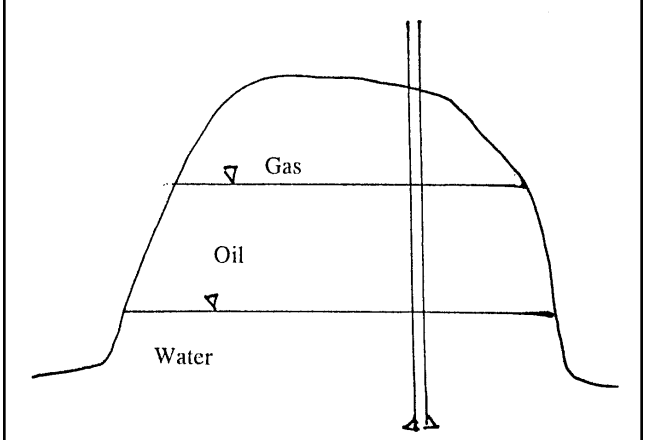

FIGURE 2: Oil reservoir with associated gas cap.

Technical

Before proceeding any further some basic explanations are required. Petroleum and natural gas are composed primarily of a mixture of naturally occurring hydrocarbons (organic compounds) and lesser amounts of inorganic chemicals such as Nitrogen, Carbon Dioxide, Helium, Sulphur, and Sulphur compounds (e.g., Hydrogen Sulphide or H_2S). The mixture can vary considerably, with some P&NG consisting almost entirely of smaller, lighter molecules or almost entirely of larger, heavier molecules.

In thermodynamics a distinction is made between extensive and intensive properties. Intensive properties are independent of the quantity of material present. Density, compressibility and viscosity are examples of intensive properties. Extensive properties depend on the total quantity of matter present. Mass, volume, and composition are therefore examples of extensive properties.

A phase is a homogeneous body of material which differs in its intensive properties from neighbouring phases. Ice, liquid water, and water vapour are examples of three different phases of the material "water." One particular phase need not be continuous. For example, ice may exist as several lumps in a glass of water.

A gas phase is characterized by low density, high compressibility and low viscosity. The liquid phase is characterized by high density, low compressibilities and moderate viscosities.

The phase in which a reservoir fluid exists is determined by pressure, temperature and composition. This is easy to relate to at atmospheric pressure, where water is ice below 0˚ C, liquid between 0˚ and 100˚ C and vapour (steam) above 100˚ C. At 0° and 100˚ a mixture of ice/liquid and liquid/steam exists, respectively.

Oil and gas reservoirs are not found at room temperature and pressure. Hence, a Pressure-temperature diagram is used to visualize behaviour over a wider range of pressure and temperature. An example is shown in Figure 3 which is for a single pure component. This type of data is determined by laboratory experiment.

Petroleum and natural gas, as previously discussed, are not pure components, but rather mixtures of different compounds. The phase diagram for a mixture is different as shown in Figure 4. Note that these diagrams were originally developed based on laboratory experiments. Key points are:

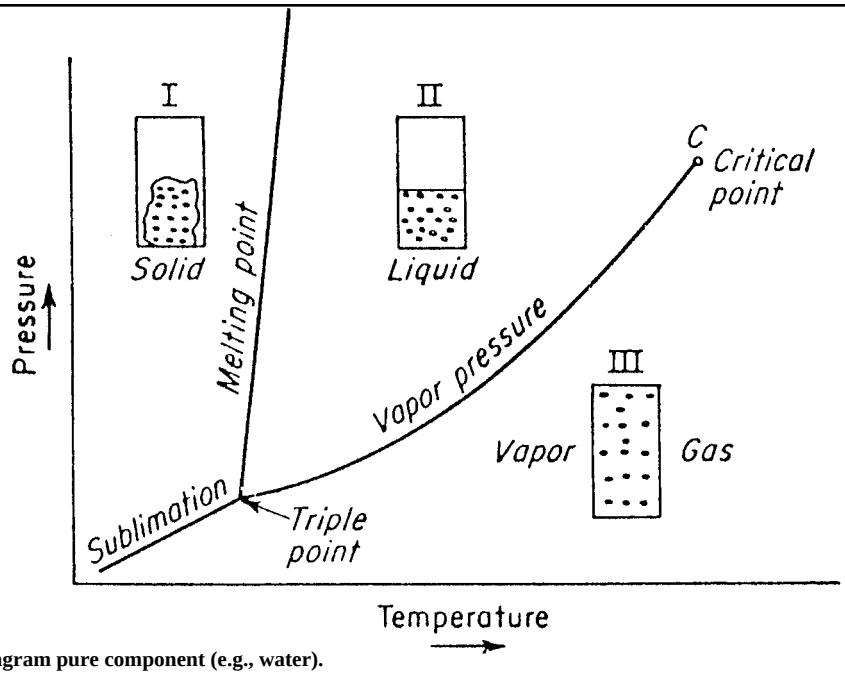

FIGURE 3: Phase diagram pure component (e.g., water).

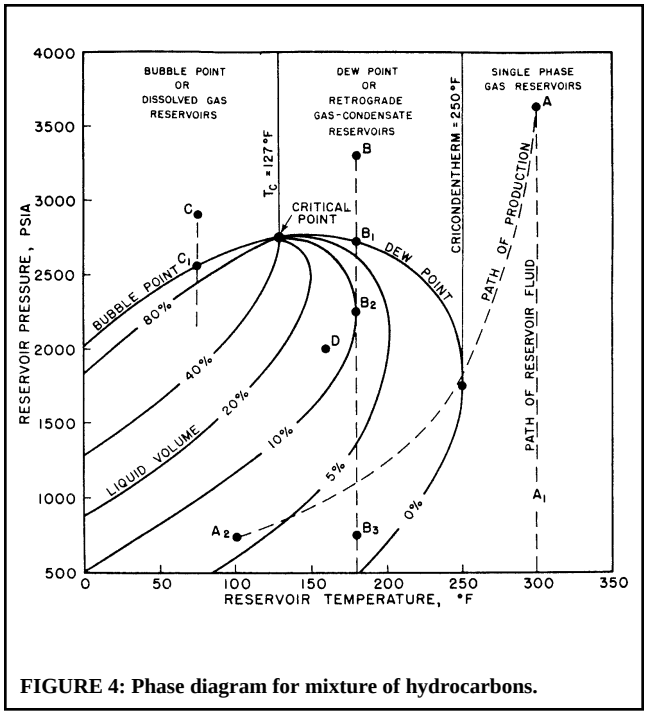

FIGURE 4: Phase diagram for mixture of hydrocarbons.

1. There is a region where two phases co-exist. This is called the two phase envelope. The proportion of liquid to gas on a volume basis is shown by what are termed quality lines.
2. The quality lines converge to a point on the outside of the two phase envelope which is called the critical point.

Because reservoirs are contained in rock, which has a low overall thermal conductivity and a high heat capacity, the production of a reservoir occurs under essentially constant temperature (isothermal) conditions. Hence, the process that takes place is represented by a vertical line on the above phase diagram.

A reservoir that is initially found at the temperature and pressure indicated by point C will, when pressure is reduced intersect point C1. At this point a small bubble of gas will appear at the top of the reservoir, or, if working on a laboratory sample of reservoir fluid, at the top of the test cell. Such a system is called a bubble point system.

A reservoir that is initially found with conditions that correspond to point A can be produced without a phase change occurring in the reservoir. Note that such a reservoir can produce both gas and liquids, since surface (plant or wellhead conditions) can exist at point A2.

Finally, a reservoir that is initially found with conditions that correspond to point B will, when pressure is reduced as a result of withdrawals, intersect point Bl. At this point small droplets of liquid will condense in the reservoir, or, if working on a laboratory sample, in the bottom of the cell. Such a system is called a dew point system.

The optimum production method depends on where this vertical line falls on the phase diagram. Accordingly, the classical treatment of reservoir engineering, such as that found in Craft and Hawkins[4], describes the appropriate calculation techniques and production methodology according to the classification described above.

Drive Mechanisms

The phase behaviour has a significant impact on how a reservoir is produced. The natural drive mechanisms are discussed below:

1. Gas Expansion: relies on the high compressibility of the gas. The gas occupies more space as the pressure is reduced due to withdrawals. This is a relatively efficient recovery mechanism and typically results in quite high recoveries, frequently over 80% of the original gas in place.
2. Liquid Expansion: occurs as oil is withdrawn from an oil reservoir above the bubble point. The compressibility of liquids is very low and, as a result, this production mechanism results in recoveries that are very low, typically under 3% of the original oil in place.
3. Dissolved Gas Drive: relies on gas coming out of solution (below the bubble point) and expanding to displace the oil out of the reservoir. This mechanism is more efficient than liquid expansion and results in recoveries typically in the 5 to 20% range. The vast majority of oil reservoirs contain significant amounts of dissolved gas.

As discussed earlier, some reservoirs contain both free gas (gas cap or associated gas) and an oil leg. The expansion of the gas cap will normally support reservoir pressure, displace oil, and hence increase recovery.

It is also possible to artificially introduce the effect of a gas cap by re-injecting produced gas, or injecting gas from another source. This approach has, in general, fallen out of favour in modern practice. AEUB data shows the average increment in expected recovery for this method to be 5%.

In some reservoirs there is natural water influx and the oil or gas is displaced by an artesian condition or water expansion from an extensive aquifer. In the vast majority of situations, recovery is reduced in gas reservoirs by water influx and increased in oil reservoirs.

The increase in recovery from water invasion can more than double the recovery of oil from a reservoir. Hence, if there is no natural water drive, operators frequently inject water through wells, which is known as a waterflood. Waterflooding has virtually replaced gas flooding (there are rare exceptions), since it is cheaper to implement and results in a larger increment in recovery.

Legal Issues

We have divided the legal issues into two main categories. The first category concerns the transactions and understandings directly between the parties. The second concerns the regulatory environment of the oil and gas industry.

Leases and Agreements

Some issues relating to agreements between parties are:

1. Wording Of Agreements. The agreements may not clearly specify ownership of the petroleum substances. Disputes as to the interpretation of agreements are resolved by the courts, or by arbitration.
2. Privity of Contract. A lessor may enter into two or more agreements with different parties. These agreements may describe ownership in different terms. In general, a party to one agreement is not bound by terms in another agreement to which he or she is not a party.
3. The Nature of the Oil and Gas Lease. The underlying nature is not obvious to the lay person. Most leases do not specifically state the actual nature, which is assumed based on common law precedents. In some jurisdictions, particularly in the U.S., there is the concept of ownership in place, and the lease is interpreted as actually conveying title to petroleum substances in the ground. The better view in Canada is that the rights given by a lease are only a “profit a prendre”—the lease only conveys the right to take a profit, and does not actually convey title in the ground [See Berkheiserl vs. Berkheiser[5] case].
4. Limitations. If an agreement is breached, there are time periods within which legal action must be taken, failing which recovery of any damages is barred.
5. Estoppel and Acquiescence. In very general terms, if a party to an agreement has by its conduct, representation or by another agreement, allowed certain things to occur, or has not objected to certain things, despite adequate opportunity

to do so, then that party may be prevented from relying on certain terms and conditions. This may usually only be used as a defense, and may override prior (written or oral) agreements.

6. Unjust Enrichment. In the absence of an agreement clearly specifying the rights of the parties, there may be an argument that it would be unfair for one party to be entitled to any substances recovered without paying a fair share of the costs of recovering and producing that substance.

Geological Uncertainty

Returning to the fundamental issue of whether an oil and gas lease is a "profit a prendre" or conveys ownership in situ, there is one other factor that should be highlighted. The nature of reservoir engineering is that reservoir properties are extrapolated over a large area based on extremely small sample sizes. Reservoirs are not uniform. They show many features such as:

1. Layering, related to deposition.
2. Shale lenses, which act to divert flow.
3. Areal variations in quality (an example would be a channel, which is a linear feature).
4. Alterations in porosity and permeability caused by groundwater and associated chemical changes.
5. Fractures and faults induced by tectonic action.
6. Quality variation due to biological activity.

This list is by no means complete. The key point is that there are a considerable number of unknowns that cannot be determined from well data. Infill wells have been drilled within established pools that have no net pay. Extending this further, how could ownership in place be established when it cannot be directly measured?

Rule of Capture

A "rule of capture" has been enunciated in a number of common law precedents:

1. Oil and gas and gas move underground according to the laws of nature and are not stationary. Historically these movements were likened to that of a wild animal, which moves freely from one area of land to another, without regard for the legal divisions of man. Hence, no one may claim ownership until it has actually been reduced to capture; i.e., oil in the stock tank.
2. If a well is drilled and reserves drained, it is not possible to directly observe where the oil or gas came from, or to prevent migration to or from an offsetting property. Hence the person who captures the gas or oil, like the wild aninial in the analogy, owns the gas or oil. The fundamental nature of the industry is therefore competitive.

Regulatory Environment

The second major area concerns the environment in which oil companies act. The oil industry is heavily regulated and statutes and regulations cover virtually every aspect of the business. Some of the purposes are:

1. To effect conservation, and to prevent waste, of oil and gas resources.
2. To establish standards of equipment, practices and operations which are safe (for the public and personnel within the industry).
3. To promote efficient development of provincial natural resources.
4. To ensure each owner has the opportunity of obtaining his share of production.
5. The recording and timely dissemination of information regarding oil and gas reserves.
6. To control pollution.

Mines and Minerals Act

In Section 90(2) of the Mines and Minerals Act[6], natural gas and petroleum are defined:

1. "Natural gas" means the production from any well that, in the opinion of the Minister, initially produces gas either alone or with oil at a gas-oil ratio of 1,800:1 or higher, but does not include any production that, in the opinion of the Minister, initially produces gas with oil at a lower gas-oil ratio.
2. "Petroleum" means the production from any well that, in the opinion of the Minister, initially produces oil either alone or with gas at a gas-oil ratio of less than 1,800:1, but does not include any production that may be obtained from any well that, in the opinion of the Minister, initially produces oil with gas at a higher gas-oil ratio.

Significance of Initial GOR

As implied above, many of the relevant provincial acts use a GOR of 1,800 m^3/m^3 (approximately 10,000 scf/bbl) as a dividing line. The authors are not sure where this originated. In fact, given that each provincial act is unique, there may not be a single source. We refer, however, to Standing, who is one of the early authorities on PVT aspects of reservoir engineering:

"The fact that oil field usage recognizes only two components, oil and gas, each of which is a multi-component system, makes generalizations difficult; nevertheless, the following qualitative statements can be made:

1. Systems existing in one phase and having gas oil ratios greater than 10,000 scf/bbl are likely to have higher concentrations of methane and the other light hydrocarbon components. Therefore the critical temperature of the system will be low (perhaps of the order of that of methane of -116° F). Consequently, at reservoir temperatures of 150 to 300° F, one may expect that such a system will exhibit isothermal retrograde phenomena.
2. Systems existing in one phase and having gas-oil ratios of less than 2,000 scf/bbl are unlikely to have critical temperatures higher than the reservoir temperature. These systems will have bubble points, and initial production will be by dissolved gas drive.
3. Systems in the intermediate range of gas-oil ratio may exhibit either bubble point or dew point behaviour. It is necessary to perform laboratory tests to determine the actual behaviour of the system at reservoir conditions."

This guideline has a number of interesting implications. First, the primary concern is the process in the reservoir. This is shown by Standing's references to isothermal retrograde condensation and dissolved gas drive. Second, the GORs given were only ever intended to be a guideline. Finally, lab tests may be required. It is interesting to contrast these definitions with those of the AEUB.

Oil and Gas Conservation Regulations

Regulations under the Oil and Gas Conservation Act also define oil and gas wells:

1. "Gas well" means a well which produces primarily gas from, a pool or portion of a pool wherein the hydrocarbon system is gaseous or exhibits a dew point on reduction of pressure, or any well so designated by the Board.
2. "Oil well" means a well which produces primarily liquid hydrocarbons from a pool or a portion of a pool wherein the hydrocarbon system is liquid or exhibits a bubble point on reduction of pressure, or any well so designated by the Board.

Note that these definitions are relatively new and concentrate on the process in the reservoir directly, rather than relying on inexact guidelines.

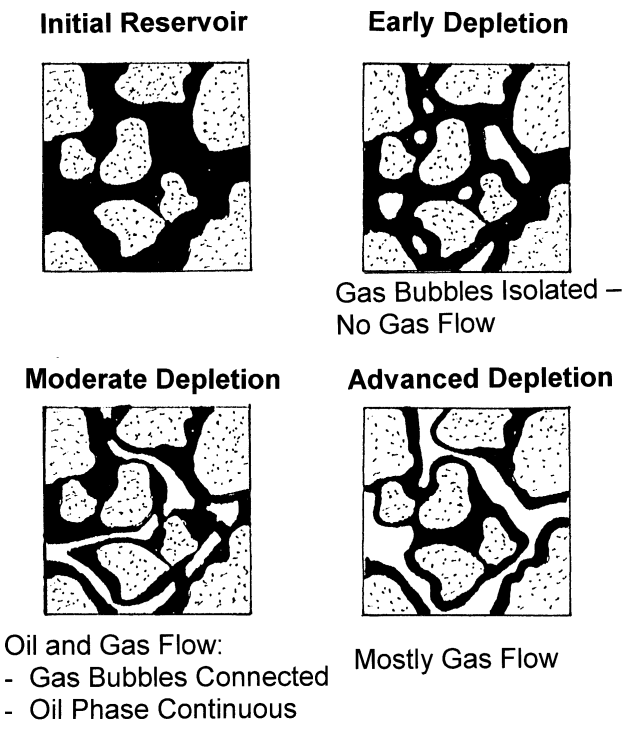

FIGURE 5: Flow of oil and gas on pore scale.

Effect of Production

What is not immediately obvious from the quotation from Standing is that he was referring to initial reservoir production. It is necessary to read the complete chapter to place his comments in context. Indeed this is the custom today. If one is referring to a discovery well, then the original well GOR and the original reservoir GOR are one and the same.

When two phases flow simultaneously, such as oil and gas, in a porous medium (i.e., rock) there is an interaction between the phases. The process is shown diagrammatically in Figure 5. In an oil reservoir, as the pressure drops due to withdrawals, the volume of the pores in the rock filled by gas increases. When this phase becomes continuous the gas will begin to flow. Since gas has a much lower viscosity, progressively more gas is produced than liquid. As a result the ratio of gas to oil increases for most of the life of a well.

There is another effect that should be pointed out here. Because the gas flows more easily, the chemical composition of the reservoir changes while conditions in the reservoir are in the two-phase region of the phase diagram. This situation, in which the reservoir composition changes with withdrawals, is known as a differential process. In the single phase region of the phase diagram the composition will remain constant as withdrawals are made. Examples of this are production of an oil reservoir above the bubble point or production of a single phase gas reservoir. These situations represent what is known as a flash process.

Obtaining a representative sample, with the proper ratio of gas to oil, is best done early in the life of the well. Proper sampling involves producing the well at low levels of pressure drawdown and steady production rates. This latter process is referred to as "conditioning a well."

When a well is drilled into a reservoir which is in an advanced state of depletion, the GOR can be greater than the guidelines given by Standing. The reservoir will still represent a dissolved gas drive process. In some cases the evolved gas may segregate by gravity into a secondary gas cap. In this case the infill well could be mistaken for a gas well since the may GOR exceed 1,800:1 m^3/m^3 or 10,000 scf/bbl.

Agreements Between Companies

The relevant government legislation and regulations rely on Ministerial or AEUB discretion in determining what is and what is not a natural gas or oil well. As outlined above, there are no hard and fast rules which can distinguish between an oil and a gas system in all cases. Without appropriate rules and with no arbitrator specified there can be difficulties. In many cases the AEUB becomes the de facto arbitrator, since the well can only be produced as an oil or as a gas well. This also extends to the plethora of other regulatory issues, which are discussed in the following.

Concurrent Production

Oil is a more valuable commodity than gas. Oil, or liquid fuels in general, are simpler to transport than gas. The latter requires a pressure tight vessel. Liquid fuels also contain more energy per unit volume, which means that less space is required. Therefore, the Oil and Gas Conservation Act[8] confers a favoured status on oil production. The relevant provision states that no well can be produced as a gas well from a pool that could be economically productive of oil without the permission of the Board [Section 29(l) of the Act]. Thus, the owners of oil rights have priority.

Gas Conservation

The AEUB can require that solution gas or other valuable products be recovered. This requirement appears to be based on total pool economics, even if the incremental economics (discounted cash flow net present value) of solution gas gathering facilities is negative.

Rateable Take

The Board may also restrict the amount of gas, or if there is a gas cap, the amount of oil and gas that can be produced from any well, pool or portion of a pool [Section 23 of the Oil and Gas Conservation Act[8]].

Common Purchaser

Two companies could have interests in a gas pool in which one has a gas sales contract and the other does not. The company with the gas contract would have a competitive advantage over the company which does not. The latter would then be drained and could not recover their gas at a later date. For this reason the Oil and Gas Conservation Act[8] requires that gas purchasers must buy gas from a pool without discrimination.

The remedy for such drainage is to make a common purchaser application to the AEUB. The Board has established some very clear guidelines on this:

1. There is an obligation on the drained party to drill a well and prove that there is productive formation under their land. Indeed, the obligation extends to completing and testing the well and even preparing it to be put on production.
2. The effective date to which drainage would apply is the later of the date that the well would be capable of production or the date that application is made.
3. The company applying for relief must have made a reasonable effort to get its own gas contract. A less favourable price is not grounds for the declaration of common purchaser; however, a fire sale price would not have to be accepted.

These guidelines are clearly intended to strike a balance of equity on matters beyond an operator's control and the competitive nature of the industry. It does not relieve an operator from making reasonable competitive efforts.

Enhanced Recovery

The AEUB may order that an enhanced recovery scheme be installed [Section 25 of the Oil and Gas Conservation Act[8]]. Production allowables, which increase substantially if an enhanced recovery scheme is installed, are used as an incentive.

The majority of enhanced recovery schemes are initiated by operators (seeking increased allowables). No enhanced recovery scheme can be installed without having the scheme approved by the AEUB [Section 26 of the Oil and Gas Conservation Act[8]]. This is normally accomplished by written application to the AEUB.

Priority of Oil and Gas Conservation Act

The Oil and Gas Conservation Act[8] has very widespread application. This may be found in Section 3, Section 9, and Section 27. The Act states that it applies to every well in Alberta, supersedes any contract or arrangement, and states that conservation orders and enhanced recovery orders or approvals may not be altered by the Courts.

Appeal

Under the Energy Resources Conservation Act[9] (Section 44), AEUB decisions can be appealed by applying to the Court of Appeal. The application must be made within one month of the order or decision and a judge of the Court of Appeal must give leave for the appeal to be heard. The appeal will consider questions of law and jurisdiction.

General Relief

There is a "catch all" provision for relief in Section 91(l) of the Oil and Gas Conservation Act[8]. A hearing may be ordered and a scheme proposed by the Board to provide compensation to those who are injured or suffer a loss by reason of any Board Orders.

Such a scheme may provide for compensation, liability and provides for a levy which can be applied against the assessed value of all of the oil and gas property to which the scheme applies.

Jurisdiction

Although the powers ascribed to the AEUB are very far reaching, they do not cover the right to determine the ownership of petroleum substances as between two parties. Questions of ownership therefore are decided by the Courts.

Prism et al. vs. Omega

The 1994 decision by the Alberta Court of Appeal in Prism Petroleum Ltd. et al. vs. Omega Hydrocarbons Ltd.[1] held that the solution gas produced with the oil was owned by Omega, which owned the oil rights. This decision reversed the finding of the trial judge, who had held that the solution gas was owned by the owners of the natural gas rights. Because numerous issues were discussed by the courts, it is important to examine the decisions in more detail.

Background

The dispute arose in the eastern part of Alberta. The subject Provost Viking pool has a very large areal extent (many townships) and, overall, contains mostly gas.

Development of the disputed area started in the 1950s. A number of gas wells were drilled on quite large spacings. Based on this limited development, a Gas Unit was formed in early 1964. A gas plant and gathering system were built by the Gas Unit to develop the property.

Based on oil recovery reported from a drill stem test (DST) on a well that was drilled but not produced, Omega Hydrocarbons Ltd. farmed in on a portion of the lands included in the Gas Unit. Subsequent drilling and testing proved up an oil pool, located within the gas field.

Subsequently, Omega made an application to the AEUB to waterflood the oil pool. The oil pool was also unitized, with the approval of the working interest owners, royalty holders and the Crown.

In approximately 1981 the AEUB ordered that solution gas be recovered. As a result, low pressure solution gas gathering was installed, along with a booster compressor. This was tied in to the Gas Unit gathering system, and the gas was processed on a custom processing basis.

Subsequently, the major interest in the Gas Unit was sold and the operatorship of the Gas Unit changed. The new operator, on its behalf and that of the Gas Unit working interests, filed a Statement of Claim contending that:

1. The solution gas belonged to the Gas Unit.
2. Omega should repay all monies received for the solution gas, less monies paid for custom processing and less monies paid for the booster compressor and tie-in.
3. Apart from the Gas Unit Agreement, the Plaintiffs also alleged trespass and conversion of property.

A counterclaim was filed, the major points of which are summarized as follows:

1. An order was requested dismissing the Gas Unit's action, with costs to Omega.
2. A declaration was sought that Omega was entitled to the solution gas, for a variety of legal reasons which are discussed in the following.
3. In the event that the Court found that the solution gas belonged to the Gas Unit, Omega requested that the Gas Unit should pay its full proportionate share of all costs, including all well and surface facility capital plus well and battery operating costs. This part of the counterclaim was based on the theory of unjust enrichment.

Legal Process

The legal process is started by the Statement of Claim. The process that occurs after this may include some or all of the following steps:

1. Other Pleadings, such as:
   a) Statement of Defense,
   b) Counterclaim.
2. Discovery of Documents of each party.
3. Examinations for Discovery.
4. Submission of Expert Reports.
5. Trial.
6. Submission of Briefs and Written Arguments.
7. Judgment.
8. Appeal.

Technical Preparation

In Prism et al. vs. Omega[1] there were a number of key issues contemplated before trial:

1. What phase was the fluid in the reservoir in at original conditions? How much gas had evolved (and hence might be claimed by the Gas Unit) at the time of the farmout?
2. How much gas was entrained in the oil; i.e., how much solution gas (Rs) was there?
3. A capillary pressure transition zone would exist between the oil and gas zones. The effect of this is that there is no sharp line or structural level above which only gas will be produced and below which only oil will be produced.

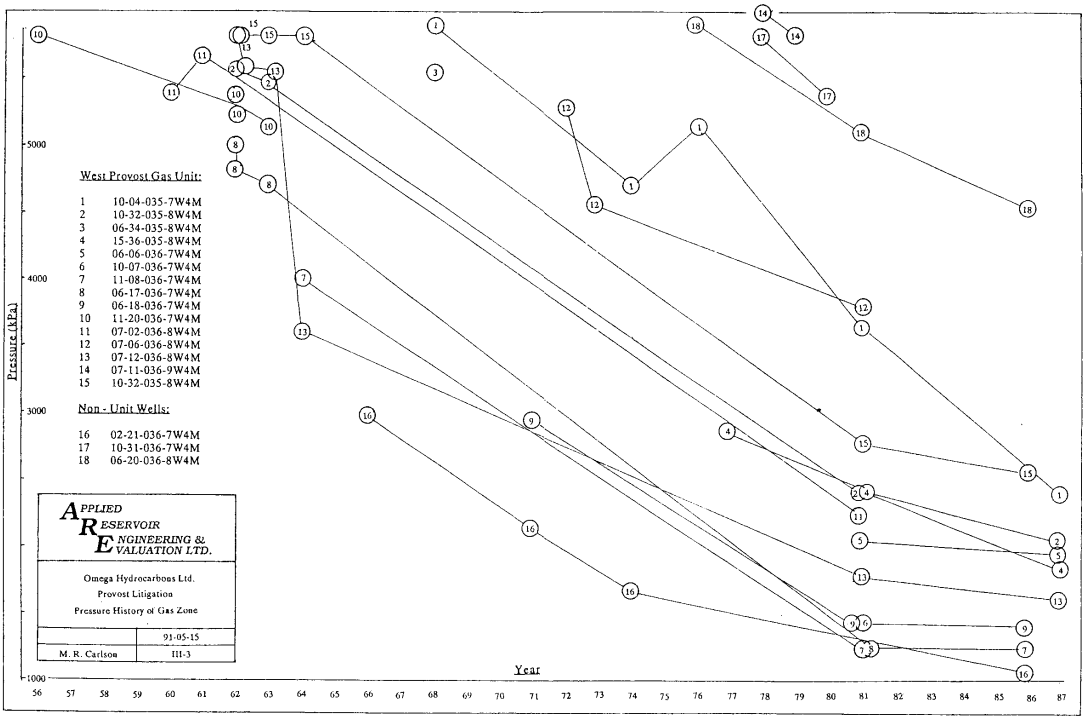

FIGURE 6: Pressure history of gas cap.

Specifying an exact "line of demarcation" is not possible. A reasonable estimate would have to be made of where the transition zone started and ended.

4. Waterflood response was lower than originally predicted. What caused this lower than anticipated response? Could the response have been reduced by significant gas breakout or was there some cap gas in what was originally thought to be completely oil?

Technical Approach

A threefold approach was used technically. The first part involved an area review of the oil pool and surrounding gas pool. Following this simulation was used to establish expected GOR behaviour. A cross-section was used to show the likely interaction between the gas cap and the oil leg.

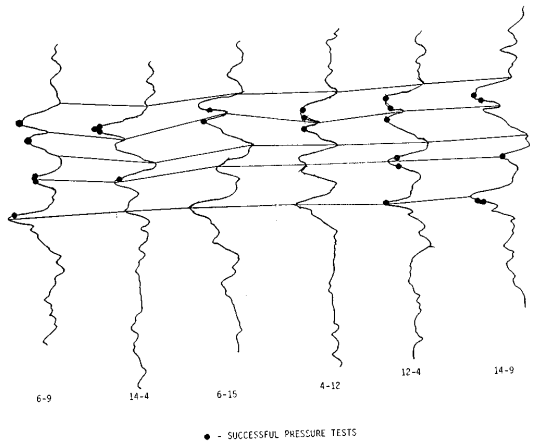

FIGURE 7: RFT pressure data.

Area Review

The pressure history of the gas cap was determined, as shown in Figure 6. The pressure in the oil leg at the time of discovery was determined from six different DSTs. Within the accuracy of

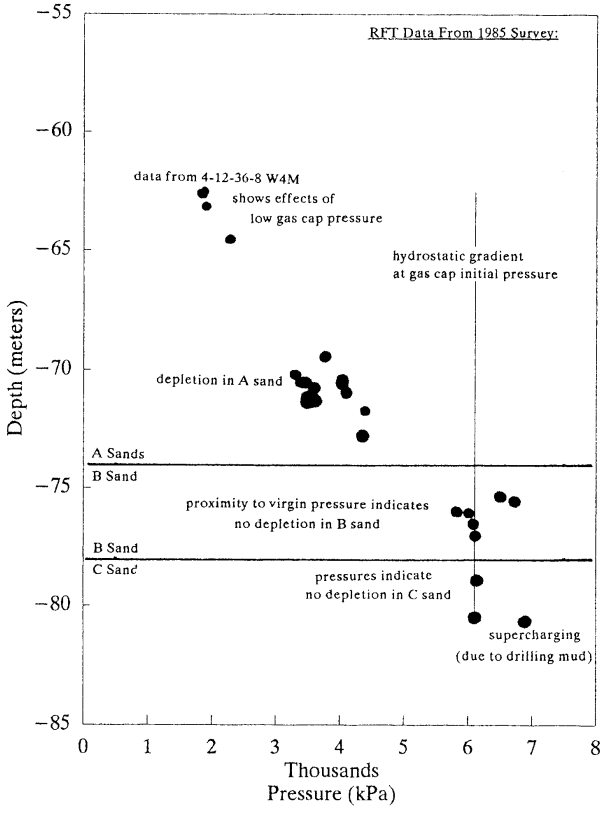

FIGURE 8: Correlation of initial producing GOR and gas saturation at time of start of production.

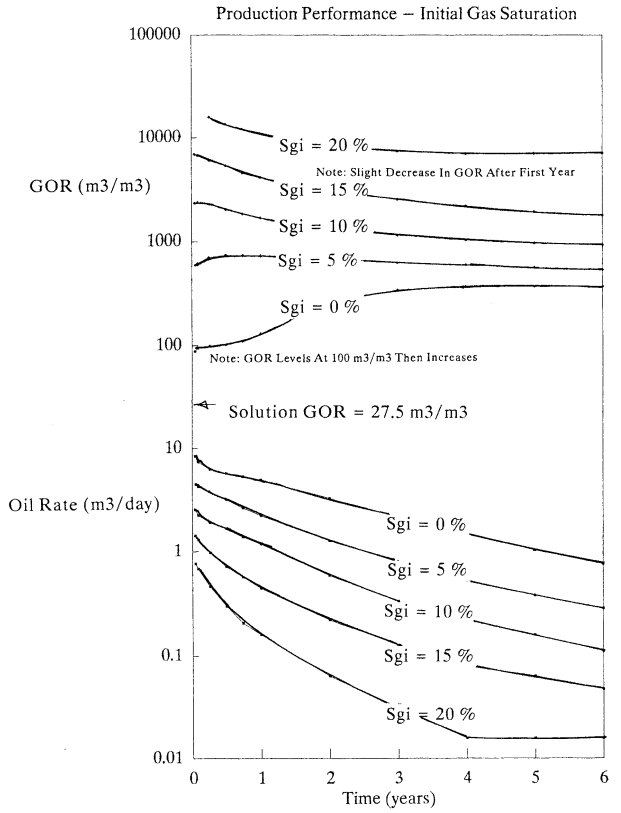

FIGURE 9: Correlation of initial producing GOR and gas saturation at start time of production.

the gauges it was established that no pressure drop had occurred within the oil pool as a result of gas production. This was consistent with the low permeability of the reservoir as well as the distance to the nearest producing gas well.

Repeat Formation Tester (RFT) results on infill wells were used to show that of the three sands present, only one, the upper or A sand, showed communication within the Oil Unit. This is depicted in Figures 7 and 8.

Type Model

A type model, utilizing an element of symmetry was developed. A hydraulic fracture was incorporated directly in the grid for modelling. This approach was similar to that used previously in the Dodsland Field of Saskatchewan[10, 11]. Note that the trend of GOR response for a hydraulically fractured well is different than for a radial flow case. GORs on fracced wells level off more than a non-fracced well.

The type model was initialized at different gas saturations and performance predictions were made. The GOR as a function of initial gas saturation is as shown in Figure 9. Based on this graph, it was possible to estimate the gas saturation at the time each well was put on production.

Cross-sectional Study

A cross-sectional model was also created, as shown in Figures 10 and 11. The cross-sectional study gives a quantitative estimate of how much gas would have come out of solution. The cross-sectional results confirm the DST results which indicated essentially no pressure decline. Further, because the Gas Unit went on production before the Oil Unit, the Gas Unit benefitted from evolved solution gas. This is shown in Figure 12.

Waterflood

The performance of the waterflood was examined next. The effects of hydraulic fractures as well as reservoir heterogeneity were taken into account. Pseudo relative permeability curves were used in the same manner as for the Dodsland Field[11]. A waterflood prediction is shown in Figure 13. This response is lower than previous predictions, which did not account for the effect of the hydraulic fracture and reservoir heterogeneity (layering). The producing wells showed the characteristic drop in GOR. The expected response for radial flow, with high levels of heterogeneity (layering), is shown in Figure 14.

Effects of Technical Work

The work described above established that the disputed lands did not have a gas cap present at the time of the farmout. The understanding of the waterflood performance was improved, an issue that was being considered by Omega, independent of the litigation. The lower than expected performance could be explained by an improved understanding of the complex reservoir characterization and not from the effects of solution gas breakout nor the presence of an initial gas cap. The plaintiff did not dispute that all of the gas was originally in solution.

Interpretation of the Agreements (at Trial)

The plaintiffs claimed entitlement to the solution gas based on

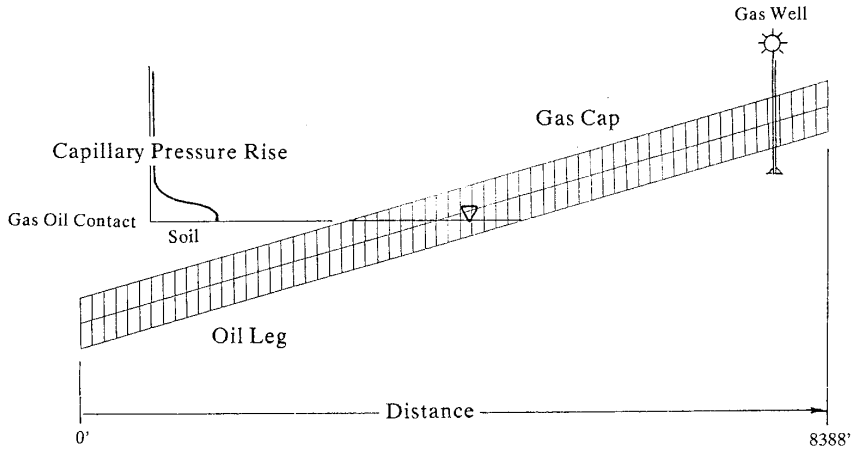

FIGURE 10: Cross-section utilized.

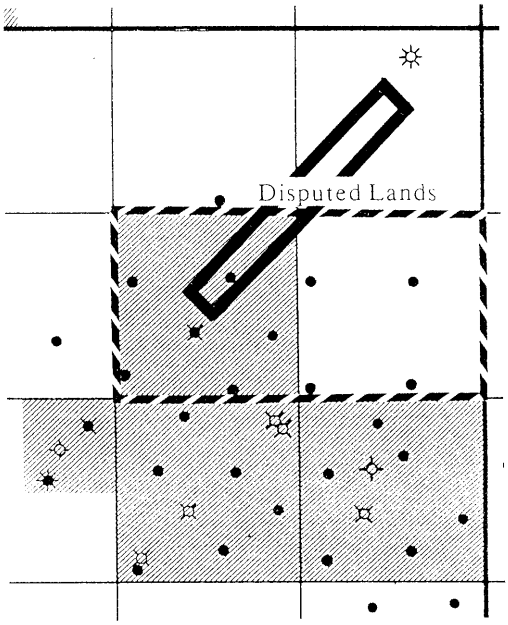

FIGURE 11: Location of cross-section.

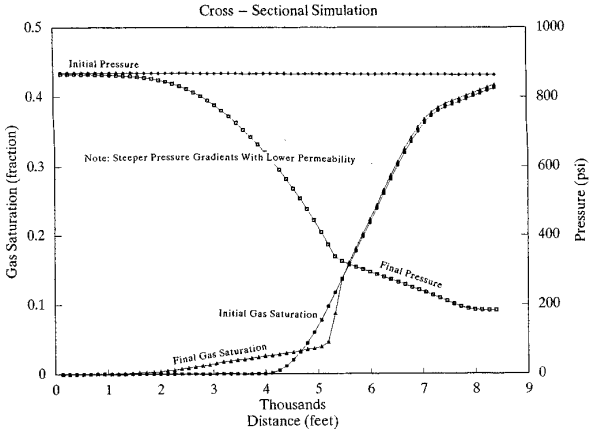

FIGURE 12: Results of cross-sectional study.

the wording of a Gas Unit Agreement. Omega claimed entitlement to the solution gas as part of the oil; if it were not part of the oil, Omega counterclaimed for a proportionate cost of producing the gas. Omega was not a party to the Gas Unit Agreement. The trial judge held that Omega obtained its oil interest after the execution of the Gas Unit Agreement and that therefore, Omega's ownership was limited to those rights remaining to be disposed of after the dedication of rights to the Gas Unit. The Gas Unit Agreement gave the Gas Unit all petroleum substances except those that were defined as oil. The case therefore turned on the definition of "Oil," which was defined as follows:

"Oil" means crude oil and other hydrocarbons regardless of gravity that are or can be recovered in liquid form from the Unitized Zone through a well by ordinary crude oil production methods.

If that definition is broken into its component parts, the issues in the case become clearer:

1. "All other hydrocarbons regardless of gravity": Omega argued that these words must include solution gas since solution gas is a hydrocarbon even though it is lighter than crude oil. The trial judge held that these words did not have to refer to solution gas, since the evidence disclosed that there were other hydrocarbons with different specific gravities than either crude oil or natural gas which were in a liquid phase at the surface.

2. "That can be recovered": The trial judge stated that the question of when a hydrocarbon is "recovered" was the focal point of the case. Omega submitted that recovery was to be looked at "in the reservoir"; the plaintiffs submitted it was "at the surface." The trial judge held that the intention of the parties to the Gas Unit Agreement in using the word "recovered" in the definition of oil was to be related to surface and not reservoir conditions.

3. "In liquid form from the Unitized Zone": Omega submitted that reservoir conditions were the determining factor. If the gas were liquid under the initial reservoir conditions, it was solution gas. The expert evidence, which included computer modelling and simulations, proved that the gas in the Zone was initially all in solution with the oil in the reservoir and that it was therefore initially in liquid form.

4. "Through a well": The Court held that these words do not define the point at which the determination of the nature of the hydrocarbon is to be made. The words "through a well" mean only "by means of a well" and do not refer to the surface.

5. "By ordinary crude oil production methods": The trial judge held that the gas could not have been produced except by the oil wells which were drilled by Omega.

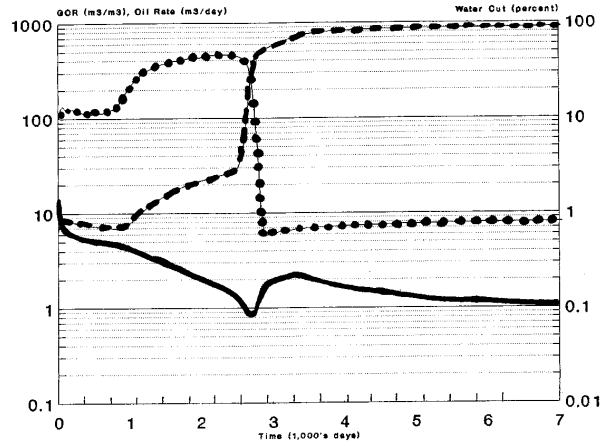

FIGURE 13: Waterflood performance. Hydraulically fractured well, high reservoir heterogeniety.

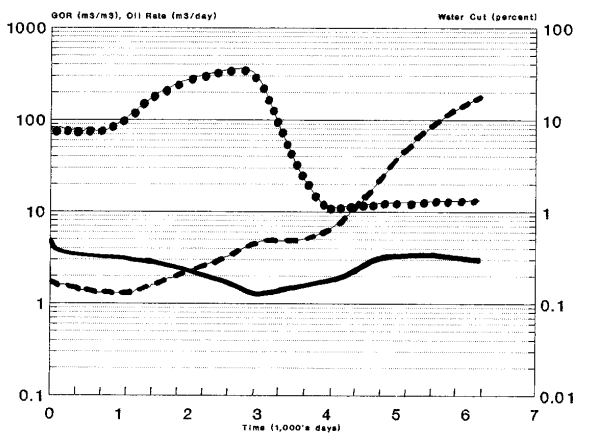

FIGURE 14: Waterflood performance. Radial flow (no frac), high reservoir heterogeneity.

Unjust Enrichment (at Trial)

Although the trial judge held that the owners of the natural gas were entitled to the solution gas, he also held that they must compensate Omega for the cost of producing that gas. If they did not, they would be "unjustly enriched." The cost of drilling and completing the wells and gathering and preserving the solution gas must be included in the total cost, since the gas could not have been produced except by the oil wells. If the plaintiffs were to receive a benefit, they were also required to share all the costs involved in producing the benefit. The trial judge stated that the share or proportion of the total cost that must be borne by the plaintiffs was 25.6%, which was the proportion of revenue from solution gas to the total revenue of the sale of oil and gas received by Omega. These costs payable by the plaintiffs were $835,641.54 greater than the proceeds of sale of the solution gas, and the trial judge noted that he would term this a "Pyrrhic victory" for the plaintiffs. The issue of unjust enrichment did not have to be decided by the Court of Appeal, because of the ruling that Omega owned the gas.

Decision by the Court of Appeal

The Court of Appeal reversed the trial decision, and held that the solution gas was indeed part of the oil and belonged to Omega. The court held that the trial judge erred in interpreting the definition of "oil" as focussing on surface rather than reservoir conditions. Some relevant portions of the appeal judgment are as follows:

". . . 'Oil' is defined, in brief, as all crude oil and other hydrocarbons . .'that are or can be recovered in liquid form . .' from the subject zone. Thus the focus is on the word 'recovered' and that word is linked directly to the 'Unitized Zone.' In other words, the definition of Petroleum Substances which the trial judge addresses in the quoted passage, is limited by and subject to the definition of 'Oil' and this latter definition directs us to reservoir conditions . . ."

"In our view the added words 'regardless of gravity' dispel any argument that 'oil,' by definition, includes only those substances with the same specific gravity as crude oil. The fact that other substances may also comply with that definition does not defeat that argument. I concede that the definition of 'oil' might well be similarly interpreted without those additional words, although certainly not, in themselves, deteminative of the ownership issue, serve to considerably strengthen the interpretation urged by Omega . . . "

"The words 'through a well' certainly must be interpreted in their proper context . . . Whether either of the two basic meanings, (that is by means of or from one end to another), is attributed to 'through,' in our view the subject phrase could not possibly be read as referring to surface conditions. On the contrary, either meaning lends substantial support to the interpretation that the focus of the phrase is on the reservoir . . ."

"The contention that 'recovery' occurs at the bottom of the well-bore in the reservoir is, in our view, fully supported by the Borys decision . . . Moreover, the Borys case has stood unchallenged for approximately 40 years. In the result the concepts of solution gas being part of the petroleum (oil) being recovered from a well and that one looks to reservoir conditions as the 'point of recovery,' have been part of the oil and gas law since that time."

The Court of Appeal therefore interpreted the Gas Unit Agreement in reference to the initial reservoir condition. Since solution gas is liquid in the reservoir, it was also recovered in liquid form." It therefore was held to be part of the "oil." The word "recovered," at least in the context of the agreement in question, does not mean the same as "produced." The Court of Appeal also relied on numerous U.S. authorities which included solution gas with "oil" or "petroleum."

Relevance of Prism et al. vs. Omega

The Prism et al. vs. Omega[1] decision is strong authority that the owner of petroleum rights also is entitled to solution gas. The decision was based on the wording of the Gas Unit Agreement in issue. Other agreements may lead to a different result. The case demonstrates how important it is to draft agreements clearly, and that courts will presume that parties intended their words to be understood in the "accepted legal sense."

Other Issues Dealt With at Trial

There were several issues dealt with at trial in Prism et al. vs. Omega[1]. Because of the reversal of the judgment on appeal with respect to ownership of the solution gas, the Court of Appeal did not have to deal with these issues.

Estoppel

In Prism et al. vs. Omega[1], Omega argued that it was entitled to rely on the fact that the operator of the Gas Unit had entered into a Gas Processing Agreement which acknowledged (in the recitals to the agreement) that Omega was entitled to the solution gas. Omega in fact paid fees to the plaintiffs for the processing of this solution gas. A novation agreement and a later Gas Processing Agreement (executed after the commencement of the action) were also relied upon.

Omega also argued that if the Gas Unit owners had felt that the farmout agreement gave them ownership of the solution gas, they should have objected to the enhanced recovery application. Waterflooding has the effect of reducing solution gas recovery in favour of oil recovery. Omega argued that this lack of action would indicate that Omega's ownership of the solution gas had been previously accepted. This would be consistent with farmout being contemplated in terms of the industry practice outlined earlier in the paper; i.e., that the solution gas rights were a part of the petroleum rights. Omega argued that if the plaintiffs were entitled to ownership, they were estopped from asserting their rights to the solution gas by the operation of the doctrines of "estoppel by deed" and "estoppel in pais or by conduct."

The trial judge held that this was not a case to enforce the Gas Processing Agreement, and that Omega could not rely on the statements in those agreements as to ownership of the gas. There was also no estoppel by conduct. However, Omega could get back the processing fees it had paid, as well as royalties paid on this gas. The issue of estoppel did not have to be decided by the Court of Appeal, because of the ruling that Omega owned the gas.

Limitations

Even if one can show that one's gas has been improperly produced by another party, the law imposes certain time limitations. After a certain period of time, no recovery is possible. In Prism et al. vs. Omega[1], Omega argued that the claims for solution gas were barred by reason of limitation periods. The trial judge held that the interest of the plaintiffs in the solution gas produced was an interest in land, and that the limitation period for that was ten years, and that the action had been commenced within ten years. It is difficult to see how the gas, which has been held to be a "profit a prendre," could be an interest in land. Based on the plaintiffs' claim of conversion, the limitation period would normally be two years. The same period of two years would apply to a claim for trespass. In the case of a breach of contract, the time period would normally be six years.

Mines and Minerals Act

In Prism et al. vs. Omega[1], Omega argued that the title to the petroleum and natural gas was derived from a Crown lease of

those substances and that therefore subsection 148(3) of the Mines and Minerals Act applied and limited the meaning of "natural gas" to what was produced from wells, which, in the opinion of the Minster, initially had a gas/oil ratio of 10,000 cubic feet per barrel or higher. The trial judge held that the section confined its application to disposition of natural gas owned by the Crown, and could not be used to interpret the terms of the Gas Unit Agreement. In any event, he held that there was insufficient evidence presented concerning what leases were granted by the Crown in the period during which the farmout was made.

Well Classification

Can the parties rely on the fact that the well from which the gas is produced is classified as an oil well or a gas well? Prism et al. vs. Omega[1] is authority that the GOR and the well classification are not determinative of ownership of the substance produced. The purpose of that section was to define, for conservation purposes, what is a gas well and what is an oil well. Again, this issue was not addressed by the Court of Appeal.

Other Legal Issues

There were a number of issues that were not specifically addressed in Prism et al. vs. Omega[1], as discussed in the following.

Ownership of Evolved Gas

The previous precedents and Prism et al. vs. Omega[1] are good authority that solution gas belongs to the owner of the petroleum or oil rights. What about evolved gas? Will it be treated the same way?

In their article "Ownership of Evolved Gas in Split Title Situations"[3], James M. Pasieka and N. Glenn Cameron argue that evolved gas does not belong to the owner of the petroleum:

"Where petroleum can be produced notwithstanding that evolved gas has escaped from the petroleum while the petroleum is still in the reservoir, there is no compelling practical reason or basis in law why the owner of the petroleum should continue to be entitled to such natural gas."

In support of this, they refer to the rule of capture, and cite the Borys[2] case (Rule of Capture):

"If any of the three substances (gas, oil and water) is withdrawn from a portion of the property which does not belong to the appellant but lies within the same container and any oil or gas situated in his property thereby filters from it to the surrounding lands, admittedly he has no remedy. So, also, if any substance is withdrawn from his property, thereby causing any fugacious matter to enter his land, the surrounding owners have no remedy against him. The only safeguard is to be the first one to get to work in which case those who make the recovery become owners of the material which they withdraw from any well which is situated on their property or from which they have authority to draw."

But this reasoning assumes that the gas can be produced independently from another well. Technical analysis and the regulatory environment may prevent such independent gas production. Who would then be entitled to the evolved gas?

Initial Conditions

It is submitted that it is most practical to determine ownership based on the initial reservoir conditions. The Prism et al. vs. Omega[1] case gives support to this approach in that it refers to initial reservoir conditions:

"It is common ground that solution gas is a hydrocarbon in liquid form under initial reservoir conditions, that is before the intervention of people. This substance emerges as gas at the surface or well head following drilling. It is clear from the evidence that solution gas differs from free gas, a substance which is in a gaseous state under initial reservoir conditions."

Based on this approach, any gas evolved from solution gas would also belong to the owner of the petroleum rights. This approach also gives more certainty as to the rights of owners of the petroleum and natural gas. The law generally interprets agreements as of the date that they were entered into; in the case of leases, this will most frequently be at the time of virgin reservoir conditions.

This approach is also more consistent with maximizing recovery.

Periodic Testing

Pasieka and Cameron argue that there should be periodic testing of reservoir conditions, and that ownership of substances should be determined based on such periodic testing. Their view appears to have been influenced the article by R.A. Midkiff which refers to, "Phase Severance of Gas Rights From Oil Rights" and certain U.S. cases referred to therein. One argument in favour of periodic testing is that it is more consistent with the rule of capture. However, even if that is so, the question remains, where is the petroleum substance captured? At the surface or in the reservoir? Prism et al. vs. Omega[1] is authority that "recovery" of the hydrocarbon occurs in the reservoir. Another argument in favour of periodic testing is that virgin reservoir testing is related to the initial classification of the well. During operation of the well, changes will occur in reservoir phase distribution, and that the gas owner therefore does not receive a fair share of production. This argument again seems to assume that the gas owner would be entitled to any evolved gas.

Pasieka and Cameron further state that "Periodic testing allows reservoir technicians to estimate the volumes of petroleum, solution gas, associated gas and evolved gas in a reservoir from time to time with a greater or lesser degree of accuracy." What is the level of accuracy of such estimates? Direct measurement of the relevant saturations in the reservoir is not possible. The determination would have to be done from indirect means, such as reservoir simulation. In our opinion the accuracy of a simulation would probably be within plus or minus 15 to 20%. With millions of dollars of revenue at stake, such a variation may not be appropriate. Simulation is also very time consuming and expensive to implement. For these reasons, we do not regard periodic testing as a practical solution. Greater certainty is based on accurate measurement of initial reservoir conditions and the well classification.

Trespass and Conversion

If it is determined that there has been production of gas which belongs to another party, does that amount to a trespass? What are the damages? There are many U.S. cases on trespass. Most of them are in the context of what royalties a landowner is entitled to when gas is produced improperly. The U.S. cases make a distinction between "good faith" trespassers and "bad faith" trespassers. If one is a "bad faith" trespasser, then the courts frequently order the royalties to be paid without any deduction for the costs of drilling or operating the well. However, it should be pointed out that many of these authorities on trespass seem to rely on theories of ownership of the hydrocarbons in place. Theories of ownership in place would tend to give the petroleum owner the rights to evolved gas as well as solution gas. Therefore these trespass cases are most applicable in cases involving free gas.

Waste or Flaring of Gas

At common law, the owner of the petroleum is entitled to flare the gas, or to waste the gas. This applies even to free gas, and would therefore also apply to evolved gas. See the Borys case, where the Privy Council held with respect to free gas:

"For the purpose of their decision their Lordships are prepared

to assume that the gas whilst in situ is the property of the appellant even though it has not been reduced into possession, but the question is not whose property the gas is, but what means the respondents may use to recover their petroleum . . ."

"The issue is rather as to the right of fortuitous abstraction of gas, leaving the surface as it was. Such a question, in their Lordships' view, gives rise to no consideration of the right of support, but only involves the right of taking from an orifice, bored under express power given in that behalf, fugacious material which makes its way to the surface as a result of natural affluxion. They agree with the Appellate Division that there is no obligation on the respondents to take steps to prevent its egress or to refrain from connecting the orifice with the oil bed."

Gas Conservation

What if a party is ordered to conserve the gas? Does the party then have to give it to the owner of the gas? Does that owner then have to pay for the cost of producing it? This raises the issue of unjust enrichment. It is suggested that here one of the factors that a court will look at is whether or not the gas could have been produced by means other than the oil well. If a gas well could not produce the same gas economically, there is a good argument that the owner of the gas should have to pay for a proportionate share of the cost of recovering such gas, based on the theory of unjust enrichment.

Errors in Payment

What is the effect of failure to pay the real owner of the hydrocarbon? There may be an effect on the validity of the lease, although normally a notice of default must first be given by the lessor. Can you get back money that was paid to a party who in fact does not own the substance? Here the courts distinguish between payments made under a mistake of fact (which are usually recoverable) and payments made under a mistake of law (which are not recoverable). The theory of unjust enrichment might also be used to obtain recovery of funds.

Implications of Litigation

From the proceeding it is clear that split title lease issues are very complex. From an operating company perspective a considerable amount of staff and management time will be spent on preparing for litigation. During the examination for discovery, company files must be disclosed to the other side. Preparation of outside expert reports is also time consuming and involves some expense. Management and employees will often be called to testify.

There are two ways that litigation can be avoided. One is by the clearer drafting of agreements to better define who is entitled to the substances recovered and produced. The second is to agree to some manner of dispute resolution other than litigation. Such alternative dispute mechanisms may include arbitration or mediation. Mediation is not binding, but may result in the dispute being resolved.

Agreements

Generally, the owner of the petroleum or oil rights will be entitled to the solution gas produced, although this will depend on the exact wording of leases. There are also good arguments that the owner of the petroleum or oil rights is entitled to any evolved gas. Even with respect to free gas, issues may arise as to what contribution to costs the owner of the natural gas should make if it can be shown that such gas could not have been economically produced by a gas well.

It is important to attempt to clearly address issues of ownership in new agreements.

It would seem that there are a number of changes that could be made to improve agreements. The wording in a split title P&NG lease should specify the nature of an oil and gas discovery in terms of the reservoir process, in a manner similar to those in the Oil and Gas Conservation Regulations. "Natural Gas" and "Petroleum" would each be defined in reference to the distinct phase in which these hydrocarbons exist under original reservoir pool conditions before production. For natural gas, the original reservoir temperature would be greater than the critical temperature of the original reservoir fluid. For petroleum, the original reservoir temperature would be less than the critical temperature of the original reservoir fluid.

If this approach is taken (i.e., defining the substances in relation to their reservoir conditions), one should also specify ownership of NGLs, which are liquid at surface or sales conditions.

In rare instances, where the original reservoir conditions are within a specified number of degrees of the critical temperature of the original reservoir fluid, and precise determination of a Natural Gas or Petroleum system cannot be made, then it could be agreed that the rights would be split evenly between the petroleum and natural gas owners.

Perhaps one of the fundamental deficiencies of the farmout agreement discussed is that it failed to anticipate the presence of both oil and gas. If natural gas rights are to be farmed out, a clause could be put in the agreement that specifically states that in the event that economic quantities of oil and gas are found, then the oil rights shall prevail.

If oil rights are to be farmed out and gas rights retained, the parties could specify a revenue sharing arrangement (which would be in accordance with whatever production scheme the AEUB could deem appropriate for production from the lands).

Summary

1. An outline of the issues relevant to split title leases is given.
2. The technical approach used for expert evidence is outlined.
3. The significance of a recent case is reported.
4. Unresolved issues are identified and discussed.
5. Recommendations are made to improve the wording of possible future agreements.

Acknowledgements

The authors would like to thank Omega Hydrocarbons Ltd. for their support in preparing this material.

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Authors' Biographies

Mike Carlson is president of Applied Reservoir Engineering Ltd. which provides independent engineering services in training, economic evaluations, reservoir engineering and numerical simulation. Prior to this, he worked for Gulf Canada Resources Ltd. as team leader-reserves management, was vice president-technical services for McDaniel & Associates Consultants Ltd. and he held various technical and supervisory positions for Scientific Software-Intercomp, Home Oil Company Limited and Amoco Canada Petroleum Ltd. Mr. Carlson founded Applied Reservoir Engineering & Evaluation Ltd in 1990. His experience covers operations, new well completions, drilling, exploitation, reservoir engineering, corporate evaluation, securities reporting, property evaluation, log analysis, reservoir simulation and instruction of industry courses; both internationally and domestically. Mike graduated from the University of Toronto with a degree in geological engineering in 1979. He is currently serving his second term on the National Board of the Petroleum Society and is co-chairman for the 1999 Annual Technical Conference. He is a past technical program chairman for the Petroleum Society's 45th Annual Technical Meeting, and also served on a publicity committee (newsletter advertising) for two years. He has written ten technical papers and has been invited to make many industry presentations. Mike was recently a Journal of Canadian Petroleum Technology distinguished author. He has appeared as an expert witness in Alberta Court of Queen's Bench. He is a member of the Petroleum Society, CWLS, CSPG, SPE, and APEGGA.

J.G. Friesen, no biography or photo available.