THE CONSERVATION OF OIL AND GAS

A COMPARATIVE STUDY OF ON-SHORE LEGISLATION IN AUSTRALIA[1] AND AMERICA

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A. INTRODUCTION

Because petroleum is a limited resource it must be conserved. Although the total world reserves are unknown they are inevitably diminishing, while the annual consumption of oil and gas continually rises.

Everyone condemns extravagance in developing a natural resource. Neverthless the concept of conservation is not constant. Sometimes it is used to mean the deferment of production of resources so that adequate supplies exist for future generations. This was how Theodore Roosevelt and other early conservationalists saw the problem. Their view was linked with the desire to control private enterprize, and prevent it from exploiting and despoiling the 'heritage of the people'.[2] Thus they emphasized preservation for further use, rather than efficient recovery of petroleum.[3] Conservation of this kind may be practised by complete or partial prohibition of use. For example, in the United States areas of land containing reservoirs were set aside for the use of the navy, with the object of conserving petroleum for the exigencies of war.[4] The use of petroleum in inferior, inefficient or unimportant processes may also be prohibited. For example, the use of natural gas for the generation of electricity could be forbidden where other suitable fuels were available.[5]

Although some legislative control of this kind exists today, conservation has come to mean something different. Emphasis is now placed on wise and efficient use of resources, rather than on deferment of use. Present generations are not to be inconvenienced for the benefit of those of the future. Undoubtedly, however, today's efficiency in production and avoidance of waste tend against early depletion of supplies. The main aim of modern conservation laws is not to slow down consumption but to protect petroleum reservoirs and to guard the vital reservoir energy.[6] Wasteful practices in the drilling, production and storage of oil and gas are prohibited. Since excess production often leads to waste, many countries limit production to market demand.[7]

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[1] Tasmanian provisions are not discussed. In that State petroleum mining is still regulated by the Mining Act 1826-1967 (Tas.) which is unsuited to oil search.

[2] Zimmerman, *Conservation in the Production of Petroleum* (1957) 28.

[3] *Ibid.*

[4] Williams, 'Conservation of Oil and Gas' (1952) 65 *Harvard Law Review* 1155.

[5] *Ibid.*

[6] This expression is explained below.

[7] Zimmerman, *op. cit.* 49-50.

Before conservation laws can be discussed an important factor must be noted. In Australia recent discoveries satisfy only 70% of our crude oil needs.[8] To some extent discussion of conservation is premature. Our legislation must not only prevent the waste of known resources but also seek to encourage the search for new petroleum reservoirs.

The political and industrial background to conservation legislation differs from country to country. Thus American measures designed to prevent waste may be unnecessary or unsuitable in Australia. Varying approaches to the problem lead to different but equally effective solutions. For this reason a simple comparison of legislative terms is not helpful. It must be preceded by a study of the important background influences.

B. THE PHYSICAL CHARACTERISTICS OF OIL AND GAS

Before conservation legislation can be discussed it is necessary to understand the mechanics of an oil or gas reservoir. Petroleum occurs naturally in either a gaseous, liquid or solid state. Its form depends sometimes on molecular composition but also on temperature and pressure conditions, which vary according to the depth below the surface at which it is situated.[9] Contrary to popular belief, petroleum reservoirs are not vast underground pools, but sections of porous rock or sand containing oil or gas in the pore spaces. For the oil or gas to be commercially exploitable the reservoir rock must be porous and permeable, so that the petroleum can move through it. Oil and gas production is almost always from sedimentary rocks like limestone and sandstone which possess these characteristics.[10] Petroleum has a natural tendency to move upwards through the pore spaces. Escape from the reservoir is prevented by a trap of impermeable rock 'folded, broken, or otherwise so formed as to stop the natural migration of the petroleum upward '.[11]Within the reservoir trap there may be petroleum in both its gaseous and liquid forms, and also water. Where each of these substances is present the gas will be on top of the oil, and the oil will lie over the water. (This is because the water has the greater density.) Not every reservoir has free gas in it, but there is almost always some gas dissolved in the oil.[12]

The oil contained in a reservoir cannot lift itself to the well by its own force. Energy is necessary to drive it through the well bore. This energy is supplied by water or gas associated with the oil, in the manner explained in the following paragraphs. Once the natural reservoir energy is depleted the oil can be produced only by pumping or processes known as secondary recovery. These operations are expensive. Usually they do not lead to the successful production of all the oil in the reservoir, and some

[8] Petroleum Information Bureau (Australia), *Petroleum Search in Australia* (1968) 2.
[9] Zimmerman, *op. cit.* 52.
[10] Williams, Maxwell and Meyers, *Oil and Gas—Cases and Materials* (1964) 2.
[11] *Ibid.* 3.
[12] *Ibid.* 8.

is irretrievable. The maintenance of natural reservoir energy is a vital part of conservation practice.

Petroleum reservoirs can be classified into three main groups corresponding with the mechanism supplying energy to move the oil. In a dissolved gas drive formation the reservoir is under pressure and for this reason the gas is dissolved in the oil. When a well is drilled pressure is reduced and the gas begins to come out of solution, providing the energy to move the oil upward. The gas is important in two respects. Not only does it provide energy, it also makes the oil less viscous, and thus capable of flowing easily. Control of the rate of production is very important. In the absence of control, escape of gas results in efficient production for some time. Eventually, however, the gas remaining free in the reservoir reaches a critical level and instead of remaining stationary in the pore spaces begins to escape from the well. Its escape increases the viscosity of the oil, and since the gas is more mobile than the oil it escapes more quickly. This reduces reservoir pressure further, more dissolved gas comes out of solution and the vicious circle continues. Eventually the gas is completely dissipated, leaving oil trapped behind it in the reservoir. Thus the efficiency and cost of production, and also the ultimate amount of oil recovered, depend on control of rate of production. The dissolved gas drive is an inefficient energy mechanism, because it must inevitably be depleted. Reservoir engineers attempt to utilize water or gas-cap drive if present or to create one artificially by fluid injection.[13]

In a gas-cap drive formation the gas is in a free state in the rock formation and exerts its pressure downwards. When the well bore pierces the reservoir the gas expands forcing the oil upward. If gas is produced from the gas-cap the energy available to move the oil is lost. Production of the gas also means that the space available for the remaining oil increases and oil flows into formerly dry sands in other parts of the reservoir. Part of the oil may be lost by adhesion. With a gas-cap field it is important that gas is not produced from the cap or is only produced in small quantities.[14]

In a water drive formation the pressure which forces the oil through the well bore is exerted upwards or sideways by water. Although water is only slightly compressible, if large volumes are present the energy supplied by water expansion when a well is drilled is considerable. The water drive is an efficient one, for as the water moves forward it washes the oil from the pore spaces. As in the gas-cap and dissolved gas drive reservoirs, control of the rate of production is necessary to ensure maximum recovery.[15] A balance must be maintained between withdrawal rates and the energy pushing the oil upwards. It is important that the water advances uniformly.

[13] Zimmerman, *op. cit.* 62-63. Zimmerman quotes from Murray, *Conservation in Production of Oil and Gas* (1952) a paper read before the Centennial at Engineering Convocation.

[14] Campbell, 'Oil and Gas Conservation in Illinois' [1959] *University of Illinois Law Forum* 570, 571.

[15] Williams, Maxwell and Meyers, *Oil and Gas—Cases and Materials* (1964) 8.

Uneven advance cuts off pockets of oil and thereby renders them unexploitable.[16]

No matter how carefully the rate of production is controlled, natural reservoir energy eventually begins to decline. Where pressure is just beginning to wane it may be kept up by the injection of water or gas into the reservoir. In this way production by use of natural reservoir energy is maintained. This operation is known as 'pressure maintenance' and is a feature of good oil field practice. Where a field is completely worn out, and the oil is being pumped, secondary recovery methods can be used to produce the oil.[17] The usual method involves the injection of water or gas into selected input wells.[18] The injected substance drives the oil before it towards the production well.[19] When methods of primary recovery and pressure maintenance are perfected, secondary recovery should become a technique of the past.

C. A BACKGROUND TO CONSERVATION LEGISLATION

(1) The United States

(a) *Introduction*

Conservation law originated in the United States.[20] Its enactment was a triumph for those who fought a bitter battle for controlling legislation, spurred on by the shocking waste of resources they saw going on around them. The form of American conservation law is influenced by both its genesis, and by other factors peculiar to the oil industry in that country. These influences are irrelevant to Australian conditions. As a result Australian petroleum legislation has few specific conservation provisions. With recent oil and gas discoveries in Australia we will probably turn to American law for guidance. Nevertheless some factors may cause our conservation laws to evolve in a different direction.

(b) *Causes of Waste*

(i) IGNORANCE

The science of reservoir engineering had not developed in the early days of American oil production.[21] Pioneer oil men did not realize that reser-

[16] Campbell, 'Oil and Gas Conservation in Illinois' [1959] *University of Illinois Law Forum* 570, 571.

[17] Williams, Maxwell and Meyers, *Oil and Gas—Cases and Materials* (1964) 11. This is the usual distinction drawn between pressure maintenance and secondary recovery. Sometimes, however, the term 'secondary recovery' is used to refer to both types of operations.

[18] Latimer, 'Perspective on Improved Oil Recovery' *Petroleum Management* Jan. 1965, 100. In this article other methods of pressure maintenance and secondary recovery are discussed.

[19] Williams, Maxwell and Meyers, *Oil and Gas—Cases and Materials* (1964) 11.

[20] Zimmerman, *op. cit.* 49.

[21] Zimmerman, *op. cit.* 101-103. This writer treats the modern era of discovery as beginning in 1901, with the discovery of Spindletop, the famous Texas gusher. Perhaps a more important date where conservation is concerned, is 1929, the year when the vast East Texas field was discovered.

voirs were exhaustible, though experience soon taught them. The role of gas as the provider of reservoir energy was not understood. Many people thought that the gas must be disposed of, before the oil could be produced. Wide open flow was universal, millions of cubic feet of gas were burnt or vented to the air, reservoir energy was lost and vast reserves of oil became irrecoverable.[22] Even during the 1920s, when the technology of oil exploration and production improved considerably, oil drillers and producers did not understand the results of this research, or were unwilling to implement it. Although equipment had improved, the technical means used to discover oil and produce it differed little from those used in 1859, when Colonel Drake sunk the first commercial oil well at Titusville, Pennsylvania.[23] It was not until reservoir engineering developed, and producers began to rely on it, that sophisticated conservation measures became feasible. Procedures such as control of the rate of production, pressure maintenance and secondary recovery have now become features of good oil field practice. This was not the case in the early days of the oil industry. Early conservationalists had both ignorance and stubbornness to contend with.

(ii) PRIVATE OWNERSHIP OF PETROLEUM, AND THE RULE OF CAPTURE

In Australia and many other countries, petroleum is vested in the State and exploitation of resources is authorized by a licence. Normally, therefore, only two interests exist in a reservoir; that of the licensee, who produces oil and pays a royalty for the privilege, and that of the owner of the petroleum, the State. Occasionally there may be more than one licensee with an interest in the reservoir, but this is unusual, for licences generally cover large areas.[24]

In America, however, application of the maxim *cujus est solum, ejus est usque ad coelum et ad inferos* gives the owner of a tract of land a proprietary interest in the underlying minerals.[25] If an area is divided into small lots many people have an interest in petroleum beneath the land. Land owners usually grant exploration companies the right to produce the oil, in return for a royalty. In turn these companies frequently sell part of

[22] The Engineering Committee, Interstate Oil Compact Commission, *An Introductory Guide to Production Techniques and Conservation Methods* (1951) 111.

[23] Williamson, Andreano, Daum and Klose, *The American Petroleum Industry 1899-1959 The Age of Energy* (1963) 313.

[24] In Australia exploration occurs in either two or three stages. The explorer first obtains a permit which entitles him to prospect over a large area and search for promising structures. He may also carry out test drilling. When he wishes to conduct more detailed survey work over a smaller area, and intensify his drilling efforts, he obtains a licence. If he finds commercial petroleum deposits he obtains a lease which entitles him to produce petroleum. It has been found that the permit and licence stages tend to overlap, and many States have now introduced a two-stage system. The names to the instruments authorizing search and production vary from State to State. For example, in South Australia the production authority is known as a petroleum production licence and in Queensland prospecting is conducted under an authority to prospect.

[25] Williams, 'Conservation of Oil and Gas' (1952) 65 *Harvard Law Review* 1155-7. Williams lists the few instances of mineral reservations by the States and Federal Government.

their holdings to spread their risks.[26] These practices lead to further division of ownership in oil and gas reservoirs.

The most efficient and economic way of exploiting a petroleum reservoir is as one unit. Divided ownership prevents this. Processes such as secondary recovery and pressure maintenance are impracticable without the consent of all owners, and this cannot always be obtained.[27] The results of divided ownership are exacerbated by the rule of capture. In the case of solid minerals allocation of ownership is simple, but the migratory character of oil and gas causes difficulties. Before a well is drilled the oil and gas remains stationary in the formation. When the reservoir is pierced petroleum inevitably migrates towards the well. If a reservoir lies under land owned by B and D, and B drills a well on his tract, he can produce from it not only the petroleum from under his land but that from under D's land also. Difficulties aris in reconciling this power with the theory of ownership of minerals.

The United States courts, in attempting to solve the problem, knew little about the nature of oil and gas. They drew analogies between percolating waters and wild animals, even to the extent of classifying oil as a mineral *ferae naturae*. The result was the evolution of the rule of capture,[28] which permitted a landowner to drill on his land where, and in what density, he chose; and to produce oil despite the fact that it had migrated from beneath his neighbour's property. The rule of capture was related to an obligation to drill offset wells. It was held that oil and gas leases contained an implied covenant by the lessee to protect the demised premises from drainage. This could be done only by drilling wells to offset the effect of those already drilled on the neighbouring tract.[29]

The rule of capture and the obligation to drill offset wells made it imperative for the lessee to drill large numbers of wells and to drain the land as quickly as possible. If he did not do so, the oil would be drained by his neighbour. Thousands of unnecessary wells were drilled, entailing great expenditure of capital and labour which could otherwise have been diverted to the discovery of new fields. Excess drilling and production resulted in the loss of reservoir energy and millions of barrels of oil became irrecoverable. Oil was produced in excess of market demands, and when it could not be sold it was stored where it was subject to loss by fire, evaporation and seepage. Gas for which there was no market was flared or vented to the air.[30]

[26] Zimmerman, *op. cit.* 95.

[27] Allen, 'An Argument for Enforced Unit Development of Oil and Gas Reservoirs in Utah' (1960) 7 *Utah Law Review* 197, 198.

[28] The difficulty in reconciling the rule that each owner owns to the centre of the earth, with the rule of capture, is obvious. Different American states evolved different theories of ownership to cope with this problem.
Masterton, 'A 1952 Survey of Basic Oil and Gas Law' (1952) 6 *Southwestern Law Journal* 1, 3.

[29] Ely, 'Conservation of Oil' (1938) 51 *Harvard Law Review* 1209, 1219; Zimmerman, *Conservation in the Production of Petroleum* 96-100.

[30] Williams, 'Conservation of Oil and Gas' (1952) *Harvard Law Review* 1155, 1159.

It can be seen that divided ownership, the rule of capture and the obligation to drill offset wells, coupled with ignorance of the mechanics of petroleum reservoirs, caused widespread waste.

(iii) OVERPRODUCTION

The history of American conservation law is closely linked with the problem of overproduction.[31] During the early days of the oil industry few laws concerned waste prevention. At this stage only the easily recognizable forms of waste were prescribed—improper abandonment of wells, dissipation of gas from gas wells and damage of petroleum-bearing strata. Oklahoma was the pioneer in a more advanced form of conservation, for she had to cope with excess production and uncontrolled flow at the Glenn pool in 1905, and the Healdton pool in 1913.[32] After various experiments, the Oklahoma legislature passed a general conservation law in 1915. The statute prohibited production of petroleum which resulted in waste. Waste was defined as including economic waste,[33] underground waste, surface waste and waste incident to the production of petroleum in excess of transportation or market facilities, or reasonable market demand. Each owner in a reservoir was to share proportionately in the total amount of oil and gas that could be produced from the reservoir without causing waste.[34]

Texas followed with a general conservation law in 1919 giving powers of regulation and enforcement to the Railroad Commission. Generally these early conservation laws were not enforced, and the oil industry went merrily along with its wasteful activities.[35]

Between 1929 and 1939 there were changes in conservation practice. In retrospect it appears that crude oil supplies began to build up after the end of World War I, but this was not so clear to contemporary observers. The demand for petroleum rose steadily, stimulated by the increase in car ownership. Government and industry were concerned about the adequacy of United States petroleum reserves. This concern, together with the financial incentives offered by the federal government to oil producers, stimulated exploration and led to important finds. 1929 and 1930 saw major discoveries at Oklahoma Field and East Texas. Gradually the rate of growth of demand for petroleum began to fall. The depression was approaching. Suddenly it became apparent that there were huge quantities of petroleum for which there was no market. Despite this surplus, producers did not slacken their efforts. Because of the rule of capture they were forced to continue production, lest their neighbours benefit. Overproduction, ignorance, and lack of legislative control led to enormous waste.[36]

[31] Zimmerman, *op. cit.* 135-84. In this writer's discussion of State conservation laws the close relationship between over-production and the enactment of conservation legislation can be seen.

[32] *Ibid.* 135-9.

[33] The expression 'economic waste' is explained in subsequent pages.

[34] Williamson, Andreano, Daum, and Klose, *The American Petroleum Industry 1899-1959 The Age of Energy* (1963) 321-7.

[35] Zimmerman, *op. cit.* 145.

[36] *Ibid.* 115-20.

Soon it became obvious to conservationalists that something must be done. During the 1920s and 1930s most major oil producing states introduced conservation laws. By 1940 the cause of conservation had become respectable and the industry was more co-operative.[37]

Usually an important part of legislation was control of production and its limitation to market demand. Such controls remain an important feature of American conservation law. In contrast it is unlikely that overproduction will become a problem in Australia in the foreseeable future.

(iv) INDIVIDUALISM

Conservation laws in America were, and to some extent still are, seen as necessary inroads on the principle that a man may deal with his property as he sees fit. Deficiencies in state legislation often arise from a reluctance to encroach on that principle. This attitude, stemming from private ownership of petroleum and *laissez faire* attitudes to economics, caused lessees strongly to resist legislative interference with their activities. There are many examples of this resistance.

Attempts to stem the tide of overproduction in the 1930s were strongly contested. Oil men argued that orders fixing production quotas were mere price-fixing measures, and thus contrary to the *laissez faire* spirit of the age. They could see no connection between excess production and physical waste. They ignored directives issued by conservation boards. They repeatedly challenged conservation laws and orders in court, and were sometimes successful. In Oklahoma and Texas in 1931, the situation caused by overproduction was so chaotic that martial law was imposed. Legislatures amended and re-amended laws to negate court findings and to ensure that power to control production and prevent waste existed in conservation boards.[38]

In America today the scene is a peaceful one. Oil men accept the need for legislation to prevent unnecessary waste. They acknowledge the relationship between overproduction and physical waste and are glad of the market stability resulting from production control.[39] Nevertheless the individualistic spirit of the American oil industry is not dead. It is still reflected in United States conservation law.

(c) *Some Features of American Conservation Laws*

(i) TERMINOLOGY

Textwriters on American conservation laws use certain terms which need explanation. Writers often describe the purpose of conservation laws as (a)

[37] Williamson, Andreano, Daum and Klose, *The American Petroleum Industry 1899-1959 The Age of Energy* (1963) 535-7; Myers, *The Law of Pooling and Unitization* (1961) 6. See Zimmerman, *Conservation in the Production of Petroleum* (1957) 140-84 for a history of state legislation.

[38] Williamson, Andreano, Daum and Klose, *The American Petroleum Industry 1899-1959 The Age of Energy* (1963) 540.

[39] *Ibid.* 535; Myers, *The Law of Pooling and Utilization* (1961) 6.

the prevention of waste and (b) the protection of correlative rights.[40] At first sight the second expression has little relation to the first, and it requires discussion.

The phrase has particular significance in the United States. It springs from the divided ownership of petroleum pools, the migratory character of oil and gas, and the implications of the rule of capture. It concerns the relationship between different lessees in one reservoir, and the rights and duties they have in relation to each other.[41] Conservation laws which merely prohibit activities, and do not go on to regulate the relationship among lessees, are self-defeating. If, for example, the state fixed the production allowable for a reservoir, and did not go on to allocate it among the individual producers, the result would be chaos.

In Australia, where leases are granted over much larger areas than is common in America, the exploitation of a petroleum pool by more than one lessee is less likely to arise. Thus, the protection of correlative rights will probably never become an important part of Australian conservation legislation.

Another distinction frequently drawn by text-writers is between physical and economic waste.[42] The meaning of the first term is self-explanatory. The second term is used in the context of legislation that copes with the problems of overproduction. When oil is produced in excess of market demand prices are depressed, exploratory activity is discouraged, and producers tend to take short cuts with production methods. Wells which are expensive to operate are abandoned, and recoverable petroleum is lost. The expression 'economic waste' is not a completely satisfactory one, for overproduction frequently leads to physical waste also.[43]

(d) *Structure of United States Conservation Control*

In America, conservation measures are enforced both directly and indirectly at several levels. The complex structure of this control needs description.

(i) STATE LEGISLATION

Direct control over exploration and production operations is imposed by state legislation. It has been frequently held that any provision reasonably relating to conservation of natural resources, or protection of correlative rights of owners is constitutionally valid.[44] State conservation laws fall into two main groups, with some overlap between the two. The older,

[40] *E.g.* Zimmerman, *op. cit.* 24; Ely, Conservation of Oil' (1938) 51 *Harvard Law Review* 1209, 1222-3.
[41] Masterson, 'A 1952 Survey of Basic Oil and Gas Law' (1952) 6 *Southwestern Law Journal* 1, 4.
[42] *E.g.* Lewis and Thompson, *Canadian Oil and Gas* (1954) i, § 170.
[43] *Ibid.*
[44] See the cases collected in Masterson, 'A 1952 Survey of Basic Oil and Gas Law' (1952) 6 *Southwestern Law Journal* 9.

self-executing Acts describe wasteful operations in specific terms, and prohibit their omission. The sanction may be criminal prosecution, or an action by the party injured. Today this kind of statute is usually reinforced by provision for supervision of drilling and production methods. In some cases exemptions from the requirements of the Act may be granted. The main defect in this type of conservation measure is its rigidity. Because exploration, drilling and production techniques improve, conservation laws must be specifically flexible to keep pace.[45]

Modern conservation Acts are of the regulatory type. They usually contain a general definition of waste, and delegate to some body the power to carry out the spirit of the statute by general regulation or specific order.[46] The conservation authority may be specifically created for the purposes of the Act, or, like the Texas Railroad Commission, be originally established for some other reason. Usually notice must be given to interested parties, and hearings held, before the conservation authority takes action. This reflects the great respect paid to individual rights by American legislatures. Inspectors are empowered to visit well sites and require testing to ensure that waste does not occur.[47]

Often laws of the modern regulatory type contain a few specific provisions carried over from the earlier era of self-executing laws.

(ii) INTER-STATE CO-OPERATION

Conservation also raises problems of inter-state co-operation. One state which does not impose production controls can flood the market with surplus oil, thus frustrating the other States' efforts to ensure market stability. If an oil reservoir crosses a state border one state's well-spacing and production requirements may be more stringent than those of the other. In February, 1935, Texas, California, Kansas, New Mexico, Colorado and Illinois entered into an oil conservation compact. All of the above States later ratified the compact except California.[48] It was approved by Congress in August 1935. Thirty states are now members of the compact and there are three associate members.[49] One aim of the compact was to ensure the enactment by all states of conservation laws dealing with all aspects of waste prevention.[50] Article V of the compact provides that it is not intended to authorize member states to limit production for the purposes of price control or for the creation of monopoly.[51]

[The compact is administered by the Interstate Oil Compact Commission, composed of the governors of member states. The duty of the Commission is to 'make enquiry and ascertain from time to time, such methods, practices, circumstances and conditions as may be disclosed for bringing

[45] Interstate Oil Compact Commission, *Conservation of Oil and Gas* (1963) 174.
[46] *Ibid.*
[47] Rister, *Oil, Titan of the South-West* (1959) 371.
[48] Ely, 'Conservation of Oil' (1938) 51 *Harvard Law Review* 1209, 1215-6.
[49] Interstate Oil Compact Commission, *Conservation of Oil and Gas* (1963) 9.
[50] *Ibid.* 9-10. Here the text of the compact is set out.
[51] *Ibid.* 10.

about conservation and the prevention of physical waste of oil and gas'.[52] Findings of the Commission are reported to the states. The Commission's main function is an educative and public relations one.[53]]

Closer inter-state co-ordination on conservation law would be desirable in Australia.

(iii) FEDERAL CONTROL

In America the States assume the main responsibility for petroleum conservation. However, in many indirect ways the federal government also plays a part. The role of the Federal Government is described below.

First, a large area of the United States is owned and administered by the federal government. This includes nearly 54% of land within the boundaries of the Westernmost States and also the Continental Shelf.[54] About five *per cent* of American oil is procured from federal land.[55] Congress have enacted conservation laws for these areas.[56] Federal lessees must also comply with the conservation laws of the state in which the land is situated.[57]

Secondly, the Federal Government itself practises one type of conservation by setting aside certain areas as petroleum reserves for the use of the Navy.[58] For a time it was thought sufficient that such reserves existed. They are now being explored and developed by production to be held in readiness for war.[59]

Thirdly, the Bureau of Mines makes forecasts of the amount of crude oil necessary to supply market demand in the succeeding month. These forecasts are not binding on the States but are used by conservation authorities as a basis for estimating production quotas.[60]

Fourthly, by virtue of the Natural Gas Act 1938, the Federal Power Commission has exclusive power to regulate and control interstate transportation and sale of natural gas. The production and gathering of gas not for interstate sale or transportation is left subject to State control.[61]

Fifthly, the Conally 'Hot Oil' Act, 1935, plays an important part in conservation. Under this Act oil produced, transported and withdrawn from storage in contravention of state conservation laws may be forfeited if interstate or foreign commerce is involved.[62]

[52] *Ibid.*

[53] Interstate Oil Compact Commission, *A Study of Conservation of Oil and Gas* (1956) xiv.

[54] Hubbard, 'The Application of State Conservation Laws to Oil and Gas Operations in the Public Domain' (1959) 32 *Rocky Mountain Law Review* 109.

[55] Zimmerman, *op. cit.* 187.

[56] Federal provisions relating to conservation are not discussed in detail in this article. Generally speaking all aspects of waste prevention are adequately covered.

[57] Hubbard, 'The Application of State Conservation Laws to Oil and Gas Operations in the Public Domain' (1959) 32 *Rocky Mountain Law Review* 109, 115.

[58] Williams, 'Conservation of Oil and Gas' (1952) 65 *Harvard Law Review* 1155.

[59] Zimmerman, *op. cit.* 188-189.

[60] *Ibid.* 192-4.

[61] Interstate Oil Compact Commission, *Conservation of Oil and Gas* (1963) 194-7.

[62] The Conally Hot Oil Act 15 *United States Code Annotated* xv, 715 *et seq.* Also Zimmerman, *op. cit.* 194-5.

Sixthly, the Federal Government controls importation of crude oil and petroleum products with the aim of encouraging and maintaining a healthy domestic industry, thus creating a proper climate for conservation measures.[63]

Seventhly, the Bureau of Mines and the United States Geological Survey, both agents of the Federal Government, carry out technical research, disseminate information and encourage a wider knowledge of petroleum technology.[64]

In Australia, the control of on-shore petroleum mining is left to the States. The Federal Government has little to do with conservation.

(2) Australia

The following discussion relates only to State legislation dealing with the exploration for and exploitation of petroleum on land.

Australian conservation laws do not fit neatly into any classification. It is not accurate to describe them as either self-executory or regulatory. The few sections which were drafted with the problem of conservation in mind, seem to fall into the self-executing class. On the other hand there are many indirect means by which waste-prevention measures can be put into effect. These have some resemblance to American laws of the regulatory kind.

(a) *Specific Conservation Provisions*

Most American Acts and the regulations made under them, control in great detail such matters as well-spacing, pressure maintenance and secondary recovery. In contrast Australian legislation is particularly sparse in specific conservation provisions. Existing Australian controls are usually directed at the more easily recognizable forms of waste, like the drainage of petroleum-bearing strata by the entrance of water. In this respect they resemble early American conservation laws.[65]

The obvious reason for this difference was the lack of exploitable oil in Australia. Legislators are unlikely to be concerned with conservation when little or no petroleum has been discovered in their State. The emphasis is on encouragement of the search for oil and gas, rather than on conservation of non-existent resources. The first state Petroleum Acts[66] were passed long before substantial discoveries were made and at the time when there was little technical experience and advice available to draftsmen. The

[63] The Interstate Oil Compact Commission, *Conservation of Oil and Gas* (1963) 197-8.

[64] Zimmerman, *op. cit.* 196.

[65] *Ibid.* 1; Walker, 'A Model Oil and Gas Conservation Law' (1952) 26 *Tulane Law Review* 272.

[66] Special provision for the mining of petroleum was first made in Queensland in 1912. (Mining for Coal and Mineral Oil Act 1912 (Qld)). Changes were made in the Petroleum Act 1915 (Qld). The first modern petroleum legislation was the Petroleum Act 1923 (Qld). Other States did not enact legislation dealing specifically with petroleum search and production until much later.

States which passed petroleum laws later,[67] tended to follow early precedents. Although some amendments were made in response to technical advances and changes in exploration, drilling and production techniques, there was little incentive to modernize conservation provisions while the problem remained a theoretical one. With the recent oil and gas discoveries in Queensland and South Australia it is likely that specific conservation provisions will begin to emerge.

(b) *Indirect Conservation Measures*

In the early days of American oil production the exploitation of privately owned petroleum was virtually unfettered. When the problem of waste became really serious legislation was passed to combat it. Thus, in America, conservation generally forms a separate and distinct chapter of oil and gas law, and is one of the few areas closely controlled by legislation. In Australia, by contrast, oil and gas exploration was conducted under an intricate network of controls almost from the beginning, and waste prevention was merely another aspect of this control.

Because of the close supervision exercised over all stages of petroleum search and production there are many indirect ways in which waste of oil and gas can be prevented. Despite the absence of detailed conservation provisions state legislation may not be so deficient as appears at first glance. Common examples of indirect waste prevention are given below.

An applicant for a permit, licence or lease must submit evidence of his technical and financial suitability, and these matters are taken into account by the Minister in considering the application. This means that irresponsible applicants who are likely to damage reservoirs through inexperience or unsuitable equipment are unlikely to obtain permits, licences or leases. Normally a condition to refrain from committing waste and to operate in a good and workmanlike manner is inserted in the permit, licence, or lease. The applicant must supply a bond which may be forfeited for non-compliance with the Act, conditions of the licence, or directions given by the Minister or an inspector. Explorers and producers must submit for the Minister's approval a scheme for the development of the area. If the Minister disapproves this scheme he may make amendments to it, or reject it absolutely.[68] One conservation provision is common to the petroleum legislation of all states. Operators are required to act in a good and workmanlike manner in accordance with good oil-field practice.[69] This require-

[67] Mine (Petroleum) Act (Vic.) 1935; Petroleum Act 1935 (W.A.). Mining (Petroleum) Act 1940 (S.A.). Petroleum Act 1955 (N.S.W.).

[68] Petroleum Act 1955-1967 (N.S.W.), ss 10(4), 11, 21; Petroleum (Prospecting and Mining) Ordinance 1954-1968 (N.T.), ss 20(1) (a), and (b), 25, 26B, 44(1) (a) (iii), and (2); The Petroleum Acts 1923 to 1967 (Qld) ss 14(5) and (6), 30; Petroleum Act 1940-1967 (S.A.) ss 7(4), 13, 16, 36(1)-(3); Petroleum Act 1958 (Vic.), ss 11(4) and (5), 17, 29, 44, 64(5) and (6), 70; Petroleum Act 1967 (W.A.), ss 31(1) (d), 32(1) (a) (ii), and (3) (b), 35(4), 59(4), (6) and (7), 60(c), 65(6) and (8), 108.

[69] Petroleum Act 1955-1967 (N.S.W.), ss 21A, 33(2), 66(1); Petroleum (Prospecting and Mining) Ordinance 1954-1968 (N.T.), ss 55(1) (b), 86(1); The Petroleum Acts 1923 to 1967 (Qld), ss 33(d), 49; The Petroleum Act 1940-1967 (S.A.), ss 36(3), 60; Petroleum Act 1958 (Vic.), s. 47(1); Petroleum Act 1967 (W.A.), s. 91(1).

ment at least has the virtue of flexibility, for as exploration and production techniques improve so will the duty become more onerous. It seems fairly clear that it prevents oil men from indulging in activities generally recognized as harmful or wasteful. On the other hand the requirement puts the operator in an unenviable position. He may disagree with officers of the Mines Department on what constitutes good oil-field practice. He may go ahead of his time in wanting to put a new technique into effect. Theoretically, of course, he can proceed as he wishes and run the risk that later developments will prevent his licence from being cancelled. In practice, this is not a satisfactory solution. The mines inspector has the upper hand, for he can give the operator directions, against which he usually has no right of appeal.[70] This requirement has the virtue of flexibility, but the overriding defect of uncertainty.

In most states the Minister may authorize a person to enter on land the subject of a permit, licence or lease and inspect operations.[71] Usually the Minister and his inspectors can direct operators how to carry out operations and order them to take steps to avoid waste.[72] Thus they can see that improper procedures are not carried out, and institute correct ones. In practice it is quite common for such directions to be given.

(c) *Regulations*

In all states and the Northern Territory, the Governor, Governor in Council, or Administrator, is empowered to make regulations to implement the petroleum legislation. This power is conferred in general terms which differ greatly from State to State but seem wide enough to authorize regulations directed at waste prevention.[73] In some states (South Australia, Victoria, Western Australia and New South Wales) specific powers are also conferred with respect to the making of regulations. Again, these differ from state to state, but some refer to methods of conservation such as well-spacing and others mention conservation generally.[74] These specific provisions will be mentioned in more detail later.

The powers conferred on the South Australian Governor are the most satisfactorily drafted and for that reason are quoted in full. The South

[70] For exceptions see: Petroleum Regulations (Land) 1966 (Qld), s. 16; Petroleum Act 1940-1967 (S.A.), s. 80t.

[71] Petroleum Act 1955-1967 (N.S.W.), s. 74; Petroleum (Prospecting and Mining) Ordinance 1954-1968 (N.T.), s. 92; The Petroleum Acts 1923 to 1967 (Qld), s. 53; Petroleum Regulations (Land) 1966 (Qld), s. 10(2); Petroleum Act 1940-1967 (S.A.), s. 67; Petroleum Act 1958 (Vic.), s. 51(1) (b); Petroleum Act 1967 (W.A.), s. 119.

[72] Petroleum Act 1955-1967 (N.S.W.), ss 21A(3), 66(3); Petroleum (Pospecting and Mining) Ordinance 1954-1968 (N.T.), s. 86(3); The Petroleum Acts 1923-1967 (Qld), ss. 49, 53; Petroleum Act 1940-1967 (S.A.), 80b; Petroleum Act 1958 (Vic.), ss 21, 47(2), 51(1) (a); Petroleum Act 1967 (W.A.), ss 94(2), 95, 101

[73] Petroleum Act 1955-1967 (N.S.W.), s. 86(1) (q); Petroleum (Prospecting and Mining) Ordinance 1954-1968 (N.T.), s. 117; The Petroleum Acts 1923 to 1967 (Qld), ss 54, 65(1); Petroleum Act 1940-1967 (S.A.), ss 80a, 86; Petroleum Act 1958 (Vic.), ss 52, 82 (o); Petroleum Act 1967 (W.A.), s. 153(1).

[74] Petroleum Act 1940-1967 (S.A.), s. 80a; Petroleum Act 1958 (Vic.), s. 82(k)-(n); Petroleum Act 1967 (W.A.), s. 153(2) (c) and (e)-(j); Petroleum Act 1955-1967 (N.S.W.), s. 86(1) (d) and (i), (j), (m), (n) and (o).

Australian Petroleum Act contains one part dealing solely with the problem of conservation.

'Waste' is defined as the loss, dissipation or destruction of petroleum either before or after recovery which might have been obviated by the implementation of sound and economic measures and the exercise of reasonable precautions. 'Wasteful operations' are also defined and include every possible activity contrary to good oil-field practice.[75] In section 80a the power of the Governor to make regulations is set out as follows:

> The Governor may make such regulations as he deems necessary to ensure the proper conduct of operations in connection with the exploration for or production of petroleum, and without limiting the generality of the foregoing, may make regulations in relation to—
>
> (a) the avoidance of waste and wasteful operations;
> (b) the proper drilling and completion of wells;
> (c) the number and position of wells that a licensee may drill or cause to be drilled upon any portion of the area comprised in the licence;
> (d) the rate at which petroleum may be recovered or allowed to issue from any well;
> (e) the implementation and conduct of operations designed to increase the capacity of a well or a pool to produce petroleum;
> (f) the prevention of the contamination of any water-bearing formation;
> (g) the prevention of the contamination of any petroleum-bearing formation;
> (h) the suspension of drilling operations and the abandonment of wells; and
> (i) the disposal of water, brine, sediment or other petroleum field waste.[76]

It is desirable that the position in other states be clarified by the insertion of a provision similar to that appearing in South Australia.

Despite the probable existence of a power to prevent waste by regulation, few regulations dealing with conservation have been made. The only important exceptions are the Petroleum Regulations (Land) 1966[77] made under the Queensland petroleum legislation.[78] These regulations cover most aspects of drilling and production in great detail.

(d) *Further Developments*

Recent oil and gas discoveries will probably lead to legislative amendment or the drafting of regulations which deal in more detail with specific operating practices. Nevertheless conservation legislation is not likely to become as important as it is in America. There are several reasons for this difference. As already pointed out, the size of licence and lease areas is much larger in Australia than in America, and conflicts between neighbouring operators are less likely to arise. The need to race the neighbouring lessee to production was always a major cause of waste in America.

[75] Petroleum Act 1940-1967 (S.A.), s. 3.
[76] Petroleum Act 1940-1967 (S.A.), s. 80a.
[77] Petroleum Regulations (Land) 1966 (Qld).
[78] The Petroleum Acts 1923 to 1967 (Qld).

Larger holdings mean that the lessee can plan to develop the reservoir in the most efficient manner possible, as one unit. Pressure maintenance and secondary recovery operations, which are too expensive on a small scale, become practical. Wells can be located without regard to property lines, in their ideal positions. Since the lessee is not in competition with his neighbour he can produce more slowly and so ensure greater ultimate recovery.

Even where there is divided ownership in a reservoir Australian legislation arrives at a satisfactory solution. Lessees are required to agree on a scheme for the development of the reservoir as one unit. If voluntary agreement is impossible to obtain, the Minister may prepare a scheme and force the lessees to accept it.[79] In America the reluctance of legislatures to interfere with property rights has prevented this easy solution. Most American State legislatures have refused to provide for compulsory unit development. Even the States which purport to do so require the consent of from 60%-85% of interest holders before proceedings for compulsory unit development can be put into operation.[80]

This comparison of unit development provisions also illustrates another important difference between Australia and America. Because petroleum is vested in the Crown in Australia, the government has the upper hand in determining the conditions on which oil and gas will be exploited. Its position is weakened to some extent by the desire to attract the necessary overseas capital to find and develop resources. Nevertheless Crown ownership of petroleum, and the fact that petroleum mining has been subject to legislative control from the beginning, means that the individualistic spirit common to the American oil industry is weaker in Australia.

In Australia the right to search for and produce petroleum is granted only to applicants who have produced some evidence of their financial stability and technical ability.[81] Generally the business of oil search is carried out by large companies with overseas backing and the best technical resources.[82] In contrast, the scene in America is dominated by smaller operators, though the picture is slowly changing. In 1967 sixty of the larger companies completed 9,368 wells and accounted for 60.3% of the total amount of crude oil production in America. Thousands of smaller concerns drilled 22,833 wells. Even ten years ago smaller companies were responsible for more than 50% of production.[83] The importance of the larger company in Australia is likely to lead to a more responsible attitude

[79] Petroleum Act 1955-1967 (N.S.W.), s. 68; Petroleum (Prospecting and Mining) Ordinance 1954-1968 (N.T.), s. 98; The Petroleum Acts 1923-1967 (Qld), s. 61C; Petroleum Act 1940-1967 (S.A.), s. 80c; Petroleum Act 1958 (Vic.), s. 63; Petroleum Act 1967 (W.A.), s. 69.

[80] Interstate Oil Compact Commission, *Conservation of Oil and Gas* (1963) 186.

[81] *Supra* n. 68.

[82] Bureau of Mineral Resources, Geology and Geophysics *List of Petroleum Exploration Companies* (1967). The number of companies at present actively engaged in exploration and production activities is smaller and shows an even greater predominance of large companies.

[83] Lambert, 'Small Operators Drill 70.3% of U.S Wells' July 1968 *World Oil.*

to waste prevention. Because there is no need to pinch pennies operations which are expensive to commence, but eventually worthwhile, can be put into effect.

A final reason why conservation will not become as important in Australia is the later stage at which development of resources has taken place in this country. Today, when the importance of reservoir engineering is understood, waste caused by ignorance is much less likely to occur.

D. LEGISLATION IN AUSTRALIA AND AMERICA

(1) Economic Waste

(a) *Pro-rationing*

The close link between excess petroleum production and physical waste has prompted many American States to enact comprehensive conservation laws. When the supply of oil and gas exceeds market demand, prices become depressed, operations become less profitable and the producer is discouraged from further exploration and development. In the long run this means that reserves are reduced. Wells that are only marginally profitable are abandoned, with the result that recoverable petroleum is lost. The producer has invested in expensive equipment and paid drilling costs, and he wants to recoup his expenses as soon as possible. For this reason he may operate his wells on wide-open flow and abandon expensive secondary recovery or pressure maintenance operations, or refuse to begin them. If he cannot sell gas he will flare it, and he may store large quantitites of oil on the surface, where it may be lost by fire, evaporation or seepage. Limitation of production to market demand insures against violent price fluctuations and contributes to the stability of the industry. This, in turn, creates a climate favourable to conservation and to the discovery of new reserves.[84]

In America the statutes of twelve oil-producing states expressly define waste as including the production of oil in excess of market demand.[85] Between them these states produce 75% of the nation's oil. In many of the other twenty oil-producing states the legislative terms are probably wide enough to permit limitation of production to market demand, though this is not expressly stated.[86]

Where the conservation authority has this power it usually fixes the production quota for the state at monthly intervals. The federal Bureau of Mines forecasts petroleum consumption for each month, assesses the amount of crude oil necessary to satisfy demand, and breaks it down among the producing States.[87] State conservation authorities rely on Bureau of Mines' estimates (though they are not bound by them) and on amounts

[84] Zimmerman, *op. cit.* 268-325.
[85] Interstate Oil Compact Commission, *Conservation of Oil and Gas* (1963) 63.
[86] *Ibid.* 176-80.
[87] Williams, Maxwell and Myers, *Oil and Gas-Cases and Materials* (1964) 632-3.

contained in nominations submitted by purchasers whose pipelines are connected with the fields. After determining the production quota they go on to allocate it among the fields, pools and individual producers within the State. The extent of the power to make such allocations varies from State to State. Because gas can be transported only by pipeline and gas prices tend to fluctuate from time to time and place to place, the allocation of gas production is more complex than the allocation of oil production. In some States there is no authority to allocate allowable production of gas among different pools but only within the same pool.[88]

The principle of allocation of allowables is to give each lessee an equal opportunity to produce the oil underlying his tract.[89] This arises in part from the desire to protect correlative rights. The State should not discriminate between pools, or between different properties overlying one pool. Although this principle is easy to state it is difficult to apply. Pools vary greatly in situation, structure, and the kind of crude oil they produce. Even within a single pool one property may be located in a particularly favourable position on the structure, compared with other properties,[90] and this may make allocation more difficult.

Various experiments have been made with allocation formulas in America. Early statutes tended to allot production among different properties in a pool in proportion to the number of wells drilled. This was obviously unsatisfactory because it led to unnecessary drilling. Another type of allocation was based on well potential, which involved a calculation of the amount of oil a well could produce in a given time. This again did not work well. The calculation was an unscientific one, the amount of oil produced was variable, and the drilling of unnecessary wells was encouraged.[91] Today conservation authorities lean towards using a complicated formula taking many factors into account. This is known as a 'yardstick allowable',[92] Relevant matters are acreage (or an area amounting to the reasonable drainage area of one well), bottom-hole pressure, the thickness of oil-bearing sand tapped by the well, and the amount of recoverable oil in place. Sometimes the number of wells and the well potential are also taken into account to achieve an equitable allocation.[93]

In Australia, the problem is to find enough oil to become self-supporting, not to limit excess production. This difference is reflected in state legislation. Provision for limitation of production to market demand is rare. Only in Western Australia, Queensland and South Australia is the situation contemplated.

[88] For a detailed analysis of the statutes see Interstate Oil Compact Commission, *Conservation of Oil and Gas* (1963) 179-80.
[89] *Ibid.* 63.
[90] See Zimmerman, *Conservation in the Production of Petroleum* (1957) 334-6 for a detailed explanation. For other difficulties in pro-rationing, see Lovejoy, 'Oil Conservation in a New Setting' (1964) 4 *Natural Resources Journal* 332, 338-40.
[91] Zimmerman, *Conservation in the Production of Petroleum* (1957) 331-2.
[92] Interstate Oil Compact Commission, *Conservation of Oil and Gas* (1963) 64.
[93] Zimmerman, *Conservation in the Production of Petroleum* (1957) 332.

In Western Australia the Minister is specifically authorized to order an increase or reduction in the rate at which petroleum is produced.[94] Even this provision is unsatisfactory. In effect the Minister can limit production to market demand but he can only do so piecemeal fashion. Presumably if he decides to discriminate against one purchaser he can. The Act does not provide that demand is to be allocated equitably among purchasers. In any case the Minister is given no guidance on a basis for allocation. The provision leaves in doubt the existence of a ministerial power to institute a properly organized state-wide pro-rationing scheme.

The Queensland petroleum legislation also seems to contemplate control of production, but this is far from clear. It provides

> If a conservation authority appointed under this Act restricts production from the lease then the selling value mentioned in paragraph (b) of this subsection shall be determined on production that, in the opinion of the conservation authority reasonably could have been expected from the lease had production not been so restricted.[95]

(The significance of the selling value is not relevant here).

This provision impliedly confers the power to limit production. However, its meaning is not clear, and it has the same defects as the Western Australian section. Where unit development is contemplated the Minister may also give directions as to the rate at which petroleum may be produced.[96]

In South Australia the Minister may require a licensee to do any act or thing in relation to a matter that the Minister is empowered to regulate under s.80a of the Act.[97] Under section 80a(a) the Governor may make regulations for the avoidance of waste and wasteful operations. Wasteful operations include the production of petroleum in a quantity in excess of that which can be stored and sold in an orderly manner.[98] The provision is similar in effect to the Western Australian provision. The power to give a direction relates only to specific licensees. It does not seem to extend to the institution of a State-wide pro-rationing scheme.

Despite the absence of specific provisions all states may be able to institute pro-rationing by passing regulations. In South Australia this power clearly exists.[99] Waste is not defined and might refer to physical waste only. In both Texas and California, courts have held that a conservation authority with the power to prevent waste may limit production to market

[94] Petroleum Act 1967 (W.A.), s. 68(3).
[95] The Petroleum Acts 1923 to 1967 (Qld), s. 34 (d). See also Petroleum Regulations (Land) 1966, ss 5, 14. The combination of these provisions may give the Minister power to give a direction of similar nature to that contemplated in the South Australian Act. The situation is not clear, as s. 14 seems to contemplate only physical waste.
[96] Petroleum Acts 1923 to 1967 (Qld), s. 61C(8).
[97] Petroleum Act 1940-1967 (S.A.), s. 80b.
[98] Petroleum Act 1940-1967 (S.A.), s. 3.
[99] Petroleum Act 1940-1967 (S.A.), ss 3, 80a (a).

demand, because of the close link between physical waste and overproduction. A similar argument could succeed in Australia.[1]

In both Victoria[2] and New South Wales[3] the Governor in Council and Governor respectively may make regulations with respect to the treatment of water underground, and at the surface and the prevention of waste or loss of water or petroleum or pollution of deposits of water or petroleum. The context in which waste prevention appears suggests it relates only to physical waste.

In all states[4] the Governor or Governor in Council's general power to make regulations to carry out the purpose of the Act may extend to the introduction of pro-rationing regulations. However, it can be seen that the situation is complex and far from clear. It is desirable that the Governor's power should be put beyond doubt.

Even if vast petroleum resources are discovered, excess production may not cause serious difficulties in Australia. Pro-rationing legislation may never have much importance. In America the overproduction problem is exacerbated by the rule of capture. Even if the market is flooded producers must continue operations lest their oil be drained by a more venturesome neighbour. In Australia competitive production from one reservoir is unlikely to arise. If it does, the operators can be compelled to enter into a scheme for unit development.[5] If supply of petroleum exceeds demand, the lessees can simply cut back production until the market stabilizes. Nevertheless reliance on voluntary self-restraint leaves too much to chance. Producers may have no access to pipelines, and may be denied their fair share of production. Industry stability is dependent on good fortune. If substantial petroleum reserves are discovered in Australia, it is suggested that pro-rationing will be essential.

(b) *Common purchaser and carrier provisions*

Even where a pro-rationing scheme is in force, the rights of the lessees in a petroleum reservoir are not sufficiently protected if they can be discriminated against by purchasers or transporters of crude oil or gas. If an operator produces his allowable quantity of oil and cannot get anyone to buy it or convey it, the oil is wasted. Access to transportation is particularly important for gas producers, because they can only store their product underground. To alleviate this situation some American States have passed common purchaser and common carrier provisions. Under a common purchaser statute all persons engaged in buying or selling oil within the State are declared to be common purchasers and are required to buy oil

[1] See the cases mentioned in Interstate Oil Compact Commission, *Conservation of Oil and Gas* (1963) 177.

[2] Petroleum Act 1958-1967, s. 82(k). The wording is slightly different from the N.S.W. Act, but the differences are immaterial.

[3] Petroleum Act 1955-1967 (N.S.W.), s. 86(1) (i).

[4] See discussion *supra* pp. 235-6. The Northern Territory Administration has similar power.

[5] *Infra* nn. 16-20, p. 255.

from each producer at a common source without discrimination. The Texas statute also prohibits discrimination between different fields.[6] Purchasers do not have to take more petroleum than they need, but if they cannot buy all that is tendered they must purchase ratably from each producer in the field. American common purchaser provisions sometimes deal with oil and gas separately, and sometimes relate only to one of these substances.[7]

At present no Australian jurisdiction has common purchaser legislation, though in the case of overproduction this may be necessary. Some State Acts do contain common carrier sections. These resemble common purchaser Acts.[8] They require pipeline carriers to transport oil and gas without discriminating between purchasers. The Australian common carrier provisions vary greatly in form. In Queensland a licence must be obtained to construct and operate a pipeline. During the currency of the licence the Governor in Council may declare that the licence is subject to the condition that the licensee will act as a common carrier, and will transport for hire petroleum belonging to other people.[9] The New South Wales Pipelines Act does not provide for the designation of a pipeline operator as a common carrier. However, if a person wants a substance to be conveyed through a pipeline and cannot get the pipeline owner to agree he can apply to the Minister for a direction. The Minister is empowered to direct the owner to permit that person to use the pipeline. A penalty is provided for non-compliance.[10] A similar provision appears in South Australia and Victoria.[11] In addition the Victorian Government can require a pipeline owner or operator to convey its petroleum at reasonable rates and without discrimination.[12]

It is difficult to predict what common carrier legislation will evolve in Australia. The speed and extent of recent oil and natural gas discoveries have put the industry into a state of rapid evolution. There are signs that transportation of natural gas will become a semi-governmental function. This has already happened in Victoria[13] and South Australia.[14] The entrance of the State into the business of buying and transporting gas may partially obviate the need for common purchaser and carrier provisions.

(2) Physical Waste

(a) *Inefficient use of reservoir energy*

Under the American interstate oil compact, States agree to pass laws prohibiting 'the inefficient, excessive or improper use of the reservoir energy in

[6] Low, 'Common Purchasers of Oil and Gas' (1960) 39 *Texas Law Review* 84-91.
[7] *Ibid.*
[8] *Ibid.* 87.
[9] The Petroleum Acts 1923 to 1967 (Qld), s. 45(3).
[10] Pipe-lines Act 1967 (N.S.W.), s. 23.
[11] Petroleum Act 1940-1967 (S.A.), s. 806. Pipelines Act 1967 (Vic.), s. 17(4).
[12] Petroleum Act 1958-1967 (Vic.), s. 42 (b).
[13] Victorian Pipelines Commission Act 1967 (Vic.).
[14] Natural Gas Pipelines Authority Act 1967 (S.A.),

producing any well'.[15] The dissipation of reservoir energy can be avoided in several ways. Improvement in reservoir engineering has led to development of the concept of the M.E.R. or maximum efficient rate. The M.E.R. is the maximum rate at which a reservoir can be exploited without reducing the ultimate amount of oil and gas recoverable.[16] If oil is produced too quickly from a gas-cap reservoir, energy is eventually lost. In the case of a water drive reservoir rapid withdrawals mean that water advances unevenly, and cuts off pockets of oil from the well.[17] The M.E.R. varies from reservoir to reservoir, well to well and drive to drive.

The M.E.R. is a maximum; it is not necessarily the *most* efficient rate, which could be lower still. It might be argued that production should be limited to the most efficient rate thus securing the greatest ultimate recovery of petroleum. This approach has two difficulties. First, it could lead to inadequate supplies for current needs, in which case the social cost of the policy would be great. Secondly, an extension of production time increases the operating expenses of the producer and means he must wait longer to recover his initial investment. This might discourage further investment in oil exploration. Weighing these disadvantages against the small amount of additional oil obtained by production at a rate less than the M.E.R., the requirement that operations do not exceed the M.E.R. is a practical compromise.[18]

The loss of reservoir energy can also be avoided by control of the gas-oil or water-oil ration.[19] The gas-oil ratio is the number of cubic feet of gas produced per barrel of oil. The oil-water ratio shows the relationship between the volume of water and volume of oil produced from a well. High gas-oil or water-oil ratios indicate the escape of too much gas or the excessively rapid influx of water into the producing structure.

In Australia two States expressly mention inefficient use of reservoir energy, though neither of them refer to production in excess of the M.E.R. or operations with a high gas-oil or water-oil ratio. In both South Australia and Queensland[20] waste as defined includes the inefficient or improper use or dissipation of reservoir energy, and the operation of a well in such a way as to reduce the amount of petroleum ultimately recoverable. In South Australia the Minister may give the licensee directions with respect to waste avoidance.[21] The Queensland Minister has similar powers.[22]

Even in the States which do not mention the inefficient use of reservoir energy, there is ample opportunity for this to be prevented. Control can be exercised at the stage when a scheme for development of the area is

[15] Interstate Compact to Conserve Oil and Gas, Article III (f).
[16] Zimmerman, *op. cit.* (1957) 69.
[17] Interstate Oil Compact Commission, *Conservation of Oil and Gas* (1963) 38.
[18] Zimmerman, *op. cit.* 70.
[19] Williams and Meyers, *A Manual of Oil and Gas Terms* (1964).
[20] Petroleum Act 1940-1967 (S.A.), s. 3. Petroleum Regulations (Land) 1966 (Qld), s. 5.
[21] Petroleum Act 1940-1967 (S.A.), ss 80a (a) and (d), 80b.
[22] Petroleum Regulations (Land) 1966 (Qld), ss 5. 14, 16, 210(2).

submitted to the Minister.[23] An inspector can prevent waste of this kind by giving a direction.[24] The operator's obligation to act in a good and workmanlike manner in accordance with good oil-field practice is also relevant.[25]

In Western Australia the Minister of Mines may direct a reduction in the rate of petroleum production. This provision is modelled on a similar section in the Commonwealth Petroleum (Submerged Lands) Act.[26] During the second reading of the Bill for that Act the section was said to provide for the case of a glut of petroleum.[27] However, there seems no reason why the Minister could not exercise the power if a lessee was producing in excess of the M.E.R.

In Western Australia, the Northern Territory and New South Wales[27] the operator is required to 'control the flow and prevent the waste or escape of petroleum'. He clearly cannot permit the well to run wild, though perhaps this provision does not require him to control the gas-oil or water-oil ratio or limit production to the maximum efficient rate. Similar comments can be made of the Victorian requirement that the permittee,[28] licensee and lessee[29] take reasonable precautions to prevent waste of petroleum.

Under all State Acts it is fairly clear that regulations can be made preventing the inefficient use of reservoir energy.[30] Under the South Australian Act the Governor is specifically authorized to make regulations in relation to 'the rate at which petroleum may be recovered or allowed to issue from a well'.[31]

(b) *Pressure maintenance, secondary recovery and cycling*

Regulation of these techniques is closely linked with the problem of conserving reservoir energy. Pressure maintenance and secondary recovery[32] have already been explained. In the cycling process valuable wet hydrocarbons (ethane, propane, butane) are extracted from the reservoir gas as it is produced. The remaining gas is compressed and injected back into the reservoir to maintain pressure. As the operation continues the injected dry gas progressively displaces the wet reservoir gas. Pressure must be carefully maintained. If it drops too far the wet components of the gas start to

[23] *Supra* n. 68. See especially Petroleum Act, 1940-1967 (S.A.), s. 36(1).
[24] *Supra* n. 72.
[25] *Supra* n. 69.
[26] Petroleum Act 1967 (W.A.), s. 68(3). *Cf.* Petroleum (Submerged Lands) Act, 1967 (Cth) s. 58(3).
[27] *Parliamentary Debates,* House of Representatives, 30 September 1967, 1961 *per* Mr Fairbairn.
[28] Petroleum Act 1967 (W.A.), s. 91(2) (a); Petroleum (Prospecting and Mining) Ordinance 1954-1968 (N.T.), s. 86(2) (a); Petroleum Act 1955-1967 (N.S.W.), s. 66(2) (a); Petroleum Act 1958 (Vic.), s. 75.
[29] Petroleum Act, 1958 (Vic.), s. 47.
[30] *Supra* nn. 73, 74.
[31] Petroleum Act 1940-1967 (S.A.), s. 80a (d). (Also see s. 80a (a) and s. 3.)
[32] For an interesting discussion on secondary recovery see Nevers, 'The Secondary Recovery of Petroleum' July 1965 *Scientific American* 35.

condense within the reservoir, and are left behind in the pure space of the rock.[33]

In America most major oil producing states control all injection operations to ensure they are carried out efficiently, are not wasteful, and do not injure the rights of other landowners.[34] Generally, however, this is as far as they go, for legislatures are loath to tell individuals how to carry out operations on their own land. Only in three States[35] can a conservation authority order that a fluid injection operation be commenced, and in two of these States[36] the direction can only order cycling, not secondary recovery or pressure maintenance. The only exception to this rule, is where fluid injection is taking place under a compulsory unit development scheme.

Despite the general absence of a power to order fluid injection, some States manage to achieve the desired result indirectly. If, for example, a conservation authority prohibits the flaring of gas, and shuts down the field until gas is sold and returned to the reservoir many operators re-inject the gas if they cannot find a market for it.[37]

South Australia and Queensland are the only two Australian States to provide specifically for enhancement of reservoir capacity. Under the South Australian Act the licensee can be required to undertake any operations which might, in the opinion of the Minister, increase the capacity of a well or pool to produce petroleum.[38] This clearly permits the Minister to order the licensee to begin pressure maintenance or secondary recovery. It is a substantial inroad on the operators' freedom of activity, and is in sharp contrast to the American approach. Both Queensland and South Australia define as waste, the failure to make timely use of measures which will increase the capacity of a well.[39] In both these States directions can be given with respect to waste prevention.[40]

In Queensland, secondary recovery may not be commenced without approval of the Senior Petroleum Technologist (the definition of secondary recovery is very wide; it probably covers pressure maintenance and may include cycling.)[41] An application for approval must be accompanied by sufficient data to enable the Senior Petroleum Technologist to come to an informed decision.[42] Oil and gas have been discovered in Queensland and South Australia. The presence of the provisions discussed above probably reflects the need to keep pace with modern developments.

[33] Interstate Oil Compact Commission, *Conservation of Oil and Gas* (1963) 28.
[34] *Ibid.* 183.
[35] Alabama, Louisiana, Washington.
[36] Alabama, Louisiana.
[37] Williams, 'Conservation of Oil and Gas' (1952) 65 *Harvard Law Review* 1155, 1179.
[38] Petroleum Act 1940-67 (S.A.), s. 80b (a).
[39] Petroleum Regulations (Land) 1966 (Qld), s. 5. Petroleum Act 1940-1967 (S.A.), s. 3.
[40] Petroleum Regulations (Land) 1966 (Qld), ss 13, 14, 16. Petroleum Act 1940-1967 (S.A.), s. 80b.
[41] Petroleum Regulations (Land) 1966 (Qld), s. 5.
[42] Petroleum Regulations (Land) 1966 (Qld), s. 211.

In all states[43] the ministerial power to give directions may extend to ordering pressure maintenance, secondary recovery or cycling. This power has startling implications. It is in sharp contrast with the respect shown for individual rights in America, though it may lead to more effective conservation. Usually the operator has no right to a hearing, and in only two states has he a chance of appeal. A fluid injection programme can be very expensive. The ministerial power should be hedged by limitations, and the operator given some opportunity to state his case. In all states, the duty to act in accordance with good oilfield practice[44] may require the institution of fluid injections or at least ensure that if instituted it is carried out efficiently. Thus, despite the sparsity of specific Australian provisions on this matter, air conservation practice may be more effective than that of the United States.

(c) *Protection of the reservoir*

If a petroleum reservoir is damaged waste occurs. The reservoir can be protected in several ways. Usually petroleum Acts impose requirements on the casing and abandonment of wells. These provisions ensure that oil and gas are not lost by escape from the strata in which they are encountered and that the reservoir is not injured by the entrance of water. Fresh water supplies are protected from pollution, and coal and other mineral deposits from damage. Casing of the well prevents collapse of the sides of the core, and permits control of well pressure.[45]

Most Australian states protect the underground strata adequately. Protective sections have appeared from early in the history of petroleum laws. That is because they deal with waste of an easily recognizable nature and because they were designed with several purposes in mind. For example, the plugging of abandoned wells protects people and stock from injury as well as preventing waste.

Nearly all states[46] require the operators to prevent damage to petroleum-bearing strata by the entrance of water. This general requirement probably means that the well must be adequately cased, and abandoned wells must be properly plugged. Slight differences appear to the wording of the obligation. In Victoria[47] and Queensland[48] only an entrance of water that will injure petroleum deposits is forbidden, whilst the Western Australian legislation prohibits all entrances of water or other matter except those in ac-

[43] *Supra* n. 72.
[44] *Supra* n. 69.
[45] Campbell, 'Oil and Gas Conservation in Illinois' [1959] *University of Illinois Law Forum* 570, 576-7.
[46] Petroleum Act 1955-1967 (N.S.W.), s. 66(2) (d); also see s. 66(2) (b) which requires the preservation of the land for productive operations. This may act to prevent the operator from damaging the reservoir. Petroleum (Prospecting and Mining) Ordinance 1954-1968 (N.T.), ss 86(2) (a) and (d); The Petroleum Acts 1923 to 1967 (Qld), s. 49(1); Petroleum Act 1958 (Vic.), s. 47(1); see also ss 19(2) and (3), 21; Petroleum Act 1967 (W.A.), s. 91(2) (e).
[47] Petroleum Act 1958-1967 (Vic.), s. 47(1).
[48] The Petroleum Acts 1923 to 1967 (Qld), s. 49(1).

cordance with good oil-field practice.[49] No such qualification appears in the New South Wales Act or Northern Territory Ordinance,[50] so that, technically, any entrance of water is forbidden, even if it is specifically designed to enhance the capacity of the well. These Acts should be amended so that the deliberate injection of water into a formation, for pressure maintenance or secondary recovery purposes, is not forbidden.

In Western Australia the operator is also obliged to prevent damage to petroleum-bearing strata, and to keep separate each pool discovered in the permit or licence area.[51] Within an area, there may be a series of petroleum-bearing strata, each of which produce different types or grades of oil or gas. The mingling of two pools can cause waste by loss of pressure. The Queensland Petroleum Regulations (Land) 1966 imposes a similar requirement to that in the Western Australian Act. A well is not permitted to produce oil, gas or water from several pools at the same time from the same spring, unless approval is given by the Senior Petroleum Technologist.[52]

As well as imposing general requirements, some states specifically regulate methods of well casing. A well is cased by the cementing in of heavy steel pipe, which seals off fluids from the hole and prevents it from caving in. Most wells have more than one string of casing. The surface pipe conducts drilling fluid to deeper formations, protects oil-bearing and water-bearing strata from pollution, and supports deeper casing strings. The surface pipe may have anchored to it a blow-out preventer which gives control over pressure in the well. The production string is used to conduct oil or gas to the surface and also confines fluids within the strata to which they belong. Some wells also have an intermediate string of casing. Its purpose is to protect sections of formations, which might be difficult to seal, during deeper drilling.[53]

New South Wales, Victoria and Queensland require that the well be cased in accordance with the best approved methods, banding and effectively cementing one or more strings of the casing in clay and other water-impervious strata, so that water is prevented from escaping or damaging petroleum deposits.[54] Only the Queensland Petroleum Regulations (Land) 1966[55] specify details on the length of casing, the manner of cementing it in, and other related matters. The Queensland requirements closely resemble those imposed in the Canadian Province of Alberta.[56] They give operators helpful guidance, rather than relying on vague terminology like

[49] Petroleum Act 1967 (W.A.), s. 91(2) (e).
[50] Petroleum Act 1955-1967 (N.S.W.), s. 66(2) (d). Petroleum (Prospecting and Mining) Ordinance 1954-1968 (N.T.), s. 86(2) (d).
[51] Petroleum Act 1967 (W.A.), s. 91(2) (c) and (d).
[52] Petroleum Regulations (Land) 1966, ss 205, 206.
[53] Williams and Meyers, *Manual of Oil and Gas Terms* (1964).
[54] Petroleum Act 1955-1967 (N.S.W.), s. 62; Petroleum Act 1958-1967 (Vic.), s. 48; The Petroleum Acts 1923 to 1967 (Qld), s. 50.
[55] Ss 131, 132.
[56] Oil and Gas Conservation Regulations 1967-1968 (Alberta), ss 507-510, see also s. 116.

'best approved methods'. Most American states make detailed provision of this kind.[57]

Curiously the South Australian Act contains neither general provisions on the protection of petroleum reservoirs, or specific provisions on casing of wells. The Minister can give the licensee directions on these matters.[58] The operator's obligation to act in a good and workmanlike manner is also relevant.[59]

All states except Western Australia make detailed requirements on well abandonment. The gist of these provisions is the same. The Minister must be given notice of the intention to abandon a well. Originally the period of notice required was sometimes as long as 30 days.[60] The impracticality of this requirement became obvious, and the period of notice was shortened. In South Australia only 24 hours' notice is now necessary.[61]

Well casing may not be removed without the Minister's consent. This provision enables the well to be used later for water. In South Australia and Queensland[62] any person thereafter using the well (for example as a water well) must compensate the owner of the casing. Wells must be securely plugged by an approved method to prevent the entrance of water into petroleum-bearing strata. The Minister may give directions or require that his representative be present to supervise plugging. The Queensland Regulations set out in great detail the principles to be observed in well abandonment.[63]

Only in Western Australia are there no specific provisions in well abandonment. However, in that State the Minister has general power to order the closing and plugging of wells and to conserve and protect the natural resources of the area when a permit or licence is discontinued.[64]

American states generally control well abandonment in great detail, specifying such matters as the number of plugs, amount of cement, and method of placement of cement. Generally a permit to abandon a well must be obtained and a report filed when the work is done.[65]

(d) *Storage of petroleum*

Oil can be stored in metal tanks, though there is risk of loss by evaporation or fire. In the days before pro-rationing in America millions of bar-

[57] Interstate Oil Compact Commission, *Conservation of Oil and Gas* (1963) 213-217.
[58] Petroleum Act 1940-1967 (S.A.), ss 3, 80b.
[59] Petroleum Act 1940-1967 (S.A.), ss 35(3), 60.
[60] Petroleum Act 1955-1967 (N.S.W.), s. 63; Petroleum (Prospecting and Mining) Ordinance 1954-1968 (N.T.), s. 90; The Petroleum Acts 1923 to 1967 (Qld), s. 51; Petroleum Regulations (Land) 1966 (Qld), ss 114, 115, 139; Petroleum Act 1940-1967 (S.A.), s. 65; Petroleum Act 1958 (Vic.), s. 49.
[61] *E.g.* Petroleum Act 1955-1965 (N.S.W.), s. 63(1) (a); Petroleum Act 1940-1967 (S.A.), s. 65.
[62] Petroleum Act 1940-1967 (S.A.), s. 65(1a); The Petroleum Acts, 1923 to 1967 (Qld), s. 51(2), (3) (1).
[63] Petroleum Regulations (Land) 1966 (Qld), s. 139.
[64] Petroleum Act 1967 (W.A.), ss 98(2) (d) and (e); 101(1) (b) and (c), 101(2) (b) and (c).
[65] Interstate Oil Compact Commission, *Conservation of Oil and Gas* (1963) 210-11.

rels of oil ran down creeks and river beds or were stored in earthern reservoirs. This kind of waste was clearly visible and so was the obvious subject for early conservation legislation.[66] Modern American[67] conservation laws go further and control storage methods generally.

It is impracticable to store natural gas above ground. In America underground storage of both natural gas and liquefied petroleum gas (usually consisting of propane and butane extracted from wet gas), is becoming increasingly common. Because of remoteness of large consumer markets from the major gas producing states,[68] gas must be transported for long distances by pipeline. Liquefied petroleum gas is also transported under pressure by truck and barge. Consumer demands fluctuate seasonally and this causes economic problems in pipeline management—'the gas pipelines are confronted with the problem of transporting gas across the country at uniform rates to a consumer that cannot use it at uniform rates'.[69] If the gas can be stored near the consumer market the problem is eased. Sufficient supplies then exist to cope with periods of high demand, and costs are reduced because continuous transmission is possible. Natural gas and liquefied petroleum gas are frequently stored in depleted oil and gas reservoirs or in artificially created caverns.[70]

Only a few American states regulate underground storage. Controlling provisions may require that a permit be obtained to store gas underground or to drill a well for the purpose.[71] Michigan permits or may authorize the conservation authority to make rules, regulations and orders classifying wells as suitable for underground storage.[72] Some states permit the compulsory acquisition of reservoirs for storage purposes.

No Australian provisions regulate in detail the underground storage of natural gas or liquefied petroleum gas. The obligation to conserve natural gas is imposed by the duty to abstain from waste and act in accordance with good oilfield practice.[73]

In nearly all States waste caused by inefficient storage is dealt with, sometimes in great detail, sometimes generally. South Australia and Queensland[74] include within the definition of waste 'the improper storage of petroleum'. Queensland specifically mentions 'inefficient underground storage'.[75] Some states prohibit storage of petroleum in earthern reservoirs except in emergency.[76] Some states require the operator to use methods

[66] Walker, 'A Model Oil and Gas Conservation Law" (1952) 26 *Tulane Law Review* 272.
[67] Interstate Oil Compact Commission, *Conservation of Oil and Gas* (1963) 176, 192.
[68] Kansas, Louisiana, Mississippi, New Mexico and Texas.
[69] Interstate Oil Compact Commission, *Conservation of Oil and Gas* (1963) 169.
[70] *Ibid.* 169-76. [71] *Ibid.* 192. [72] *Ibid.*
[73] *Supra* n. 69, p. 234.
[74] Petroleum Act 1940-1967 (S.A.), s. 3; Petroleum Regulations (Land) 1966 (Qld), s. 5; also see ss 13, 14, 122.
[75] Petroleum Regulations (Land) 1966 (Qld), s. 5.
[76] Petroleum Act, 1955-1967 (N.S.W.), s. 64(2); Petroleum (Pospecting and Mining) Ordinance, 1954-1968 (N.T.), s. 88(2); Petroleum Regulations (Land) 1966 (Qld), s. 214; Petroleum Act 1940-1967 (S.A.), s. 63(2).

customarily used in good oil-field practice to confine petroleum in suitable receptacles.[77] More general obligations are to keep apparatus in good condition (this would include storage tanks)[78] to control the flow and prevent the escape or waste of petroleum,[79] and to prevent the escape of petroleum into sources of water.[80] Probably these obligations were designed for a different purpose but they indirectly require efficient storage. Even where they are not imposed the general duty to act in accordance with good oil-field practice, and to avoid waste, is sufficient.[81]

In all states improper storage is a matter for regulation.[82]

(e) *Well spacing*

Dense well spacing was common in the early days of American oil production. The rule of capture and the obligation to drill off-set wells stimulated unnecessary drilling. Pro-rationing legislation attempted to control the situation but sometimes made it worse by allocating production on a pre-well basis.[83] Excess drilling was also caused by the belief that closely spaced wells increased oil recovery.[84] Many fields were a forest of derricks, covering every square foot of the area. Before 1920 one well to every one, two, or five acres was common. Usually wells situated forty or eighty acres, or even further apart would have been sufficient. Because gas is more mobile than oil, 640 acre spacing for gas wells would have effectually drained the whole reservoir.[85]

Unnecessary drilling wastes labour, materials and money which would otherwise be diverted to the discovery of new fields. It dissipates reservoir energy, involves some waste of oil and gas while the wells are being cleaned out, increases the hazards of fire or other accidents which cause loss of minerals or damage to the producing structure,[86] and gives an impetus to excess production leading to physical waste.[87] Control of well locations regulates neighbouring lessees' rights and stops the frantic race to production. It saves capital and labour, and in America has demonstrably in-

[77] Petroleum Act 1955-1967 (N.S.W.), s. 64(1); Petroleum (Prospecting and Mining) Ordinance, 1954-1968 (N.T.), s. 88(1); Petroleum Act 1940-1967 (S.A.), s. 63(1).

[78] Petroleum Act 1955-1967 (N.S.W.), s. 66(1) (a); Petroleum (Prospecting and Mining) Ordinance 1954-1967 (N.T.), s. 86(1) (a); Petroleum Act 1940-1967 (S.A.), s. 60; Petroleum Act 1967 (W.A.), s. 92 (a).

[79] Petroleum Act 1955-1967 (N.S.W.), s. 66(2) (a); Petroleum (Prospecting and Mining) Ordinance, 1954-1968 (N.T.), s. 86(2) (a); Petroleum Act 1923 to 1967 (Qld), s. 49; Petroleum Act 1958-1967 (Vic.), s. 47(1); Petroleum Act 1967 (W.A.), s. 91(2) (a).

[80] Petroleum Act 1955-1967 (N.S.W.), s. 66(2) (e); Petroleum (Prospecting and Mining) Ordinance 1954-1968 (N.T.), s. 86(2) (e); Petroleum Act 1967 (W.A.), s. 91(2) (c).

[81] *Supra* n. 69, p. 234.

[82] *Supra* nn. 73, 74, p. 235. Note especially: Petroleum Act 1955-1967 (N.S.W.), s. 86(1) (k); Petroleum Act 1940-1967 (S.A.), s. 80a (a), (for definition of wasteful operations see s. 3); Petroleum Act 1958-1967 (Vic.), s. 82(1); Petroleum Act 1967 (W.A.), s. 153(2) (c) and (2) (e).

[83] Zimmerman, *op. cit.* 331.

[84] *Ibid.* 336-7

[85] *Ibid.* 280-1.

[86] Williams, 'Conservation of Oil and Gas' (1952) 65 *Harvard Law Review* 1155, 1165.

[87] Zimmerman, *Conservation in the Production of Petroleum* (1957) 280-1.

creased average well production.[88] Well spacing legislation usually fixes a minimum permissible distance between wells and property lines, and provides a minimum acreage or spacing unit for each well. If the legislation is to adequately serve its purpose the spacing unit should be not less than the maximum area that can be drained efficiently by one well. In America, the spacing unit is often the same as the pro-ration unit which is 'the area attributable to the well for the purpose of allocating allowable production'.[89]

All American states having conservation statutes make some provision for well spacing. Commonly the drilling of unnecessary wells is condemned as wasteful, and the conservation authority is authorized to space wells or to establish well spacing units. Probably because of a reluctance to give the conservation authority too much power to interfere with individual rights, some statutes limit the size of well spacing units. This leads to unnecessary rigidity.[90] The tendency is towards wider spacing. Nowadays a unity of forty, eighty or even one hundred and sixty acres may be established for oil wells,[91] and three hundred and twenty or six hundred and forty acres for gas wells.[92]

Although well spacing is a respected means of conservation many defects exist in American practice. Sometimes the conservation authority's power is limited by statute or court decision, sometimes it is weakened by a self-denying ordinance of the authority itself. Restrictions of this kind originate from reluctance to tell operators how to develop their own land, particularly when development rights existed before the making of the well spacing order. For example, the Texas Supreme Court has held that where land existed as a separate tract before a well spacing order was in operation, the tract, no matter what its size, is entitled to at least one well. It is felt that any other conclusion would result in unfair confiscation.[93]

Although Australian legislators would not have similar scruples there are no specific well spacing requirements in Australia.[94] However, in most states wells cannot be drilled within a minimum distance from the boundary of the granted area.[95] The purpose of this requirement is to prevent

[88] *Ibid.* See also Ely, 'The Conservation of Oil' (1938) 51 *Harvard Law Review* 1209, 1232-4.

[89] Interstate Oil Compact Commission, *Conservation of Oil and Gas* (1963) 57.

[90] *Ibid.* 180-1.

[91] 'Texas gets first 320-acre oil spacing' 18 June 1962 *The Oil and Gas Journal* 62.

[92] Interstate Oil Compact Commission, *Conservation of Oil and Gas* (1963) 60.

[93] Zimmerman, *op. cit.* 338-43; Ely, 'The Conservation of Oil' (1938) 51 *Harvard Law Review* 1207, 1231; Williams 'Conservation of Oil and Gas' (1952) 65 *Harvard Law Review* 1155, 1163-8; Lovejoy, 'Oil Conservation in a New Setting', (1964) 4 *Natural Resources Journal* 332, 334; Myers, *The Law of Pooling and Utilization* (1957) 11-12.

[94] See however definition of waste: Petroleum Act 1940-1967 (S.A.), s. 3; Petroleum Regulations (Land) 1966 (Qld), s. 5. Directions can be given with respect to these matters.

[95] Petroleum Act 1955-1967 (N.S.W.), s. 61(2) (a) (330 feet); Petroleum (Pospecting and Mining) Ordinance 1954-1968 (N.T.), s. 85 (a) (325 feet); The Petroleum Acts 1923-1967 (Qld), s. 48 (200 feet); Petroleum Act 1940-1967 (S.A.), s. 59 (325 feet); Petroleum Act 1958 (Vic.), s. 46 (150 feet); Petroleum Act 1967 (W.A.), s. 94(1) (1000 feet).

competition between neighbouring lessees, rather than to fix well locations. This view is confirmed by the New South Wales Act and the Northern Territory Ordinance which go on to prohibit directional drilling so that the bore penetrates the boundary of the granted area.[96] Since licences and leases may be granted over very large areas, the limitation as to distance from the boundary does not significantly control well location. Even if the tracts were much smaller wells could be densely grouped in the middle of the land, with only narrow undeveloped corridors around the borders.

Despite the absence of well spacing requirements, well location can be controlled indirectly. When the licensee is making his plans for development the Minister can impose well spacing by refusing to approve a scheme under which bores are too close together.[97] In some states the Minister or other relevant authority must be notified before a well is drilled,[98] and in certain cases his approval to the proposal must be obtained.[99] This again gives some control over well location. An operator may have to exercise self-denial in drilling wells because of his obligation to conform with good oil-field practice. This provision leaves him in an uncertain position. If he wants to drill on a forty-acre spacing pattern, he may wonder whether this is a sufficient distribution. His position would be clarified if uniform units were established by regulation.

The general regulation-making power seems wide enough to cover the establishment of a state-wide spacing scheme.[1] In some states regulations on this problem are specifically contemplated.[2]

(f) *Unit development*

In the United States an oil field is normally developed competitively. The lessee's right to exploit underlying mineral wealth is both limited and protected by laws on well spacing, gas-oil ratios, M.E.R.'s and related matters. Nevertheless there is still a conflict of interests. On the one hand is the lessee's natural desire for profit. Within the framework of existing conservation laws he wants to produce as much oil as he can. He is not concerned with the interests of other owners, or the good of the whole reservoir, except insofar as these matters affect him directly. On the other hand, the state has an interest in maximizing oil recovery in the most economic way possible.[3] This conflict is particularly marked where, as in America, there is private ownership of petroleum, and the reservoir is divided into many small tracts.

[96] Petroleum Act 1955-1967 (N.S.W.), s. 61(2) (b); Petroleum (Prospecting and Mining) Ordinance 1954-1967 (N.T.), s. 85 (b).
[97] *Supra* n. 69, p. 234. See especially Petroleum Act 1940-1967 (S.A.), s. 36(1) (1) (6).
[98] Petroleum Act 1955-1967 (N.S.W.), s. 69; Petroleum Regulations (Land) 1966 (Qld), ss 114, 116; Petroleum Act 1958 (Vic.), ss 20 70(2) (a).
[99] Petroleum Regulations (Land) 1966 (Qld), s. 114; Petroleum Act 1958 (Vic.), ss 20, 70(2) (a).
[1] *Supra* nn. 73, 74, p. 235.
[2] Petroleum Act 1955-1967 (N.S.W.), s. 86(l) (m); Petroleum Act 1940-1967 (S.A.), s. 80a (c).
[3] Interstate Oil Compact Commission, *Conservation of Oil and Gas* (1963) 60-1.

One way of partly resolving the problem is by unit operation (unitization). The oil reservoir is naturally one unit. Division of the unit, and competitive production from it, is an imperfect method of exploitation. Under unit operation development is planned so the reservoir can be exploited as an entity. This avoids wasteful duplication of labour and materials.[4] Wells can be located ideally and without regard to property lines. An example of this can be seen where a water injection programme is carried out. In fields with multiple ownership, a five spot pattern was originally evolved for well location. Four input wells were situated on the corners of a square, and a producing well drilled in the centre. This system was far from perfect, but it was an adaptation to split ownership. Where the reservoir is unitized the water injection programme can be planned for the whole field; and the five spot pattern is rejected for more satisfactory well distribution.[5]

Under unit operation, inequities are eliminated and each owner receives his fair share of production. This means that drilling is not motivated by fear of adverse drainage. Secondary recovery, pressure maintenance and cycling operations are often too expensive for a single lessee to carry out. In any case he is unlikely to pay for a programme when others will share part of the benefit. Unit operation makes the institution of these techniques practical.[6] Each owner shares in the expense and reaps part of the advantage. Owners of previously uneconomic tracts on the fringe of the reservoir are given their share of oil or gas produced.[7]

Unit development has been a favourite cause of conservationists for decades. Back in 1926 Henry L. Doherty argued that the federal government should introduce compulsory unitization to curb the widespread waste. His views were fiercely opposed by the industry.[8] Today in the United States continual education has meant an increase in voluntary unit development. Between 1948 and 1952 the number of unitized projects (excluding those to satisfy well spacing requirements) rose from about one hundred to nearly sixteen hundred.[9] Most states with conservation laws expressly sanction voluntary unit development for processes such as fluid injection. Even in the States which do not refer to voluntary unit development, there is no reason why it should be illegal. It has been suggested that agreements for the purpose violate the anti-trust laws but the consensus of opinion is that this objection is unfounded.[10]

Despite the success of voluntary unit development, compulsory unitization is strongly resisted. Oil men do not want legislatures to tell them how to run their business and are reluctant to give other lessees a say in their

[4] Myers, *The Law of Pooling and Unitization* (1961) 2.
[5] *Ibid.* 25-6.
[6] Allen, 'An Argument for Enforced Unit Development of Oil and Gas Reservoirs in Utah' (1960) 7 *Utah Law Review* 197.
[7] Interstate Oil Compact Commission, *Conservation of Oil and Gas* (1963) 61.
[8] Myers, *The Law of Pooling and Utilization* (1961) 13-14.
[9] Interstate Oil Compact Commission, *Conservation of Oil and Gas* (1963) 62.
[10] *Ibid.* 184-5.

affairs.[11] Legislatures have similar reservations about compulsory unitization. Compulsion is seen as an unwarranted restriction on the freedom of the individual. It is argued that the needs of conservation and individual freedom are adequately balanced by pro-rationing, well spacing and other waste prevention regulations.

Opponents of compulsory unitization contend that if the idea has so many advantages it should be simple to persuade operators to make voluntary agreements. This overlooks many practical difficulties. One or two people can block a scheme even though everyone else is in favour of it. Operators may gamble that their tract of land is on a favourable part of the structure and 'take their chances that the entire production from their land will be more valuable than an undivided interest in production from a much larger unitized tract'.[12] There may be disagreements on the shares which operators will receive. Sometimes an interested person cannot be found, or is incapable of entering a voluntary agreement. There may be doubt about the validity of his claim. All these problems could hold up voluntary agreement indefinitely.[13]

Despite these problems the individualistic American philosophy is illustrated by the scarcity of compulsory unitization laws. In 1931 the federal government passed a statute compelling unit development on federal land if it was required for efficient operations.[14] Only nineteen of the thirty-seven States with conservation laws have followed suit. Even in the States with so-called 'compulsory unitization' the provisions have blunt teeth. Where a specified percentage of owners of both working and royalty interests desires unitization it can force it on an unwilling minority. The majority required ranges from sixty to eighty-five per cent. Only in Alabama, Louisiana and Washington can unit development be required regardless of the number demanding it. In the first two States the power is limited to unitization for gas cycling. Where fluid injection is concerned approval of a specified percentage of interest holders is necessary.[15]

Australian unit development provisions contrast sharply with their American counterparts. Every state can compel unit development, and the element of compulsion is not illusory. Australian petroleum legislation has been less influenced by any philosophy of individual freedom. The right to exploit a reservoir is hedged round by myriad controls, of which compulsory unitization is only one. Although compulsive power exists, it is less likely to be significant as in America. Divided interests in a reservoir may not occur. If there is multiple ownership, only two or three lessees will be concerned. In these circumstances voluntary agreement is easier to achieve.

[11] Myers, *Law of Pooling and Unitization* (1961) 13.
[12] Williams, 'Conservation of Oil and Gas' (1952) 65 *Harvard Law Review* 1155, 1173.
[13] Interstate Oil Compact Commission, *Conservation of Oil and Gas* (1963) 185.
[14] Rocky Mountain Mineral Law Foundation, *Law of Federal Oil and Gas Leases* 424-6.
[15] Interstate Oil Compact Commission, *Conservation of Oil and Gas* (1963) 186.

State unit development provisions are similar in form. The Minister's power arises when land comprised in an authority granted under the Act forms part of a single geological structure extending beyond the granted area. In some states it must also appear that it is desirable for reasons of economy, efficiency and waste avoidance, that all the land be worked as one unit.[16] The land lying outside the granted area may or may not be comprised in another authority issued under the Act. If it is not, the Minister is, in some states,[17] expressly empowered to vary the authority to include the additional area. Even where this situation is not expressly mentioned, he may have power to vary the authority under another part of the Act.[18] Where the geological structure underlies two areas already granted, the Minister may require the neighbours to prepare a joint scheme for the development of the area as one unit. If the scheme is not prepared, or is disapproved, the Minister may impose a scheme on the parties.

Some anomalies exist in the various Acts. Some states have unit development requirements where the reservoir underlies land comprised in a permit, licence or lease. Other states only provide for when the geological structure is partly comprised in an authority permitting petroleum production.[19] This may be based on a judgment that unit development only becomes important when the land is productive.

The Western Australian, Queensland and New South Wales statutes take the precaution of expressly approving voluntary unit development, though this seems unnecessary. The Minister's powers may be set in motion by a licensee's application. These provisions do not appear in other states' legislation. Strangely, this Act requires only the approval of the agreement for unit development, and not the submission of a scheme. The scheme is only required if the agreement is not entered into or not lodged for approval. This requirement is clumsily worded and seems to complicate matters unnecessarily. No provision is made for the preparation of a scheme by the Minister and its imposition on the licensees, though he may give certain directions to secure more effective petroleum recovery.[20]

(g) *Pooling*

The introduction of well spacing in America led to difficulties in the case of small or irregularly shaped tracts. If these did not qualify for a well, then owners were deprived of a fair share of production. If acreage was an element in determining production allowables owners were pena-

[16] Petroleum (Prospecting and Mining) Ordinance 1954-1968 (N.T.), s. 98(1) (b); Petroleum Act 1940-1967 (S.A.), s. 80c(1); Petroleum Act 1958 (Vic.), s. 63(1) (b).

[17] Petroleum (Prospecting and Mining) Ordinance 1954-1968 (N.T.), s. 98(1) (c); Petroleum Act 1940-1967 (S.A.), s. 80c(1) (a); Petroleum Act 1958 (Vic.), s. 63(1) (i).

[18] Petroleum (Prospecting and Mining) Ordinance 1954-1968 (N.T.), s. 70; Petroleum Act 1958 (Vic.), ss 25, 26; Petroleum Act 1967 (W.A.), s. 97(1) (i).

[19] Petroleum Act 1955-1967 (N.S.W.), s. 68(1); Petroleum Act 1940-1967 (S.A.), s. 80c; Petroleum Act 1967 (W.A.), s. 69.

[20] Petroleum Act 1955-1967 (N.S.W.), s. 68(2); Petroleum Acts 1923 to 1967 (Qld), s. 61C(2). Petroleum Act 1967 (W.A.), s. 69(2).

lized by having their allowables cut, when wells were drilled on an area smaller than the permitted one. It was not a satisfactory solution to exempt owners from well spacing requirements. This was unfair to other operators and led to excessive drilling causing waste.[21]

For this reason the practice of 'pooling' tracts to satisfy well spacing regulations grew up. Each owner who pooled his lease had the opportunity of getting a share of production, and paid a corresponding proportion of the costs. Most American states with conservation laws expressly authorize voluntary pooling and provide for compulsory pooling to make their conservation laws effective.[22]

In Australia, no comprehensive well spacing requirements are in force, and for this reason pooling is unnecessary. The Victorian and Queensland Acts[23] permit the Minister to approve the union of two leases. Presumably this provision could apply to voluntary pooling. The Northern Territory and all states[24] except Western Australia recognize the existence of joint drilling agreements. Under these agreements holders of authorities under the Act may agree to share their resources for the drilling of a well on land specified in the agreement. Joint drilling agreements must be sanctioned by the Minister. These provisions could also be adapted to voluntary pooling.

The regulation-making power of the Governor[25] may extend to control of voluntary pooling for waste avoidance. Since compulsory pooling is a strong step involving intrusion of individual rights, express authorization might be necessary before the regulations introducing it could be made.

(i) *Supply of information*

Most conservation legislation requires the lessee to make tests, take samples, and to file reports, well-logs, samples and well-cores with conservation authorities.[26] These provisions permit the state to build up a general body of knowledge about reservoir conditions, and to keep a check on operators' activities.

Australian petroleum legislation is adequate in this respect. Requirements vary from State to State, but their aims are similar, and the formal differences immaterial. The main fault in most State Acts is that the demands imposed tend to be clumsily drafted and excessively repetitive.

[21] Interstate Oil Compact Commission, *Conservation of Oil and Gas* (1963 181-2.
[22] *Ibid.*
[23] Petroleum Act 1958 (Vic.), s. 61; The Petroleum Acts 1923 to 1967 (Qld), s. 61B.
[24] Petroleum (Prospecting and Mining) Ordinance 1954-1968 (N.T.), s. 100; Petroleum Act 1955-1967 (N.S.W.), s. 67; The Petroleum Acts 1923 to 1967 (Qld), s. 61B; Petroleum Act 1940-1967 (S.A.), s. 73; Petroleum Act 1958 (Vic.), s. 62.
[25] *Supra* nn. 73, 74.
[26] *E.g.* Petroleum Act 1955-1967 (N.S.W.), ss 21(6), 70, 71, 72, 73; Petroleum (Prospecting and Mining) Ordinance 1954-1968 (N.T.), ss 26B(1) (f) and (2), 55(2), 81, 82, 83; The Petroleum Acts 1923 to 1967 (Qld), ss 22(3), 37, 47; Petroleum Regulations (Land) 1966 (Qld), ss 14, 68, 69, 70, 117, 124, 125, 126, 127, 133, 135, 136, 204, 208, 209, 210, 219; Petroleum Act 1940-1967 (S.A.), ss 18b, 37, 55, 57, 58; Petroleum Act 1958 (Vic.), ss 17(6), 19(4), and (5), 33(1) (a), 34, 45, 70(1), 75; Petroleum Act 1967 (W.A.), ss 44, 45, 109, 114, 115.

Because petroleum search is a competitive business, most companies would like to keep geological information secret. The requirement that they supply the Mines Department with records, is in conflict with this desire. Most states attempt to solve the problem by providing that, within certain limits, the information supplied is confidential.[27]

E. CONCLUSION

Until recently little oil or gas had been discovered in Australia. For this reason State legislation contains few specific conservation provisions, and those which do appear are fairly punitive. Nevertheless indirect means of waste prevention are typical of Australian oil and gas law. For example, reliance is often placed on the ministerial power to approve schemes of development, and to give directions on methods of operation. Although this indirect control has the virtue of flexibility, it has the defect of uncertainty. Operators cannot always predict the legal consequences of their actions and may be discouraged from further development.

The paternalistic Australian approach springs from Crown ownership of petroleum. It contrasts with the more individualistic American philosophy, which places great emphasis on the individual's freedom to develop his land. In America general regulations and specific orders spell out the operator's obligations in great detail. Often decisions are not made until after a hearing on the particular problem, or some consultation with the industry. Sometimes the reluctance to interfere with vested rights decreases the efficiency of conservation practice. In Australia the desire to attract overseas investment, and increasing consultation with the exploration industry may lead to some change. Nevertheless the tendency to grant discretionary powers, and the accompanying lack of emphasis on individual rights, will probably leave some stamp on future conservation laws.

[27] Petroleum Act 1955-1967 (N.S.W.), s. 73(3); Petroleum (Prospecting and Mining) Ordinance 1954-1968 (N.T.), ss 84, 108; Petroleum Act 1940-1967 (S.A.), s. 82; Petroleum Act 1958 (Vic.), s. 77; Petroleum Act 1967 (W.A.), s. 112.