REPORT OF THE CONSULTATIVE COMMITTEE ON SAFETY IN THE OFFSHORE PETROLEUM INDUSTRY

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INTRODUCTION

On 6 July 1988 a series of explosions and fires aboard the Piper Alpha oil and gas production platform in the North Sea claimed the lives of one hundred and sixty-five (165) of the two hundred and twenty-six (226) persons on the installation and two of the crew of a rescue craft. The death toll was the highest of any accident in the history of offshore operations.

In Australia, it was immediately apparent that there were lessons to be learnt from the UK inquiries. The then Minister for Resources, Senator Cook, therefore formed a Consultative Committee on Safety in the Offshore Petroleum Industry (COSOP) to advise him on safety issues which are relevant to offshore operations in the Australian offshore area.

The Minister asked the Committee to give priority to reviewing the reports of the inquiries into the Piper Alpha accident. The first task undertaken by the Consultative Committee after its formation in October 1988 was the examination of the Petrie technical report. Petrie had identified seven main areas of concern as a result of his investigation:

- permit to work systems
- automatic initiation of fire fighting systems
- operability of liferafts
- evacuation routes
- integrity of emergency systems
- venting of explosions
- pipeline shut-down systems.

The Consultative Committee decided that these areas also warranted on-going review or investigation in Australia to make sure that procedures and practices here are adequate to protect the safety of personnel and facilities.

Since October 1988, the Committee has met on ten occasions, evaluating and acting on the findings of the technical investigation into the disaster by the head of the UK Department of Energy's Safety Directorate, Mr J R Petrie, and the public inquiry by Lord Cullen.

The Committee's terms of reference and its membership are shown at Appendices A and B respectively.

EXECUTIVE SUMMARY

Although Australia's safety record has generally been acceptable, COSOP considers that there is no room for complacency. The Piper Alpha accident, in a sense, provided the catalyst to a thorough examination of the effectiveness of offshore safety systems operating in this country. In fact, a number of offshore incidents in Australia since Piper Alpha have served to demonstrate flaws in safety systems and procedures. Some of these could easily have had more serious outcomes.

The Committee has reviewed the Australian offshore safety regime and discussed offshore safety issues with industry, trade union and State/Territory regulatory representatives. It has monitored and documented the action taken by Australian offshore operators in response to the Piper Alpha disaster and produced several guidelines for operators on subjects identified in the UK inquiries as contributory to the disaster.

Reviews of Australian offshore petroleum operations were conducted by operating companies in conjunction with the State/NT Designated Authorities. They have resulted in the implementation of new procedures and amendments to existing procedures on some of the offshore facilities. In a number of cases modifications have been planned and carried out to equipment and associated facilities.

In the interests of widely disseminating offshore safety issues COSOP has made the document outlining the Australian response to Piper Alpha, as well as two of its guideline documents readily available to sectors of the offshore petroleum industry, including workers employed on offshore installations. In addition COSOP also circulated its discussion paper (Appendix F) to industry, union and other persons with an interest in offshore safety, and held meetings with wider audiences of industry and union representatives. Written submissions were invited..

The Committee has also examined the circumstances, causes and the recommendations made by Esso's Investigation relating to the fire on the Tuna platform in April 1989 and provided a report on this to the Minister for Resources.

While there were some significant differences between the the Tuna accident and the Piper Alpha disaster, both demonstrated the need for greater attention to the management of safety in a number of areas of offshore operations. They also strongly demonstrated the need for adequate safety training. The Committee has therefore prepared guidelines on Work Permit Systems, Emergency Shutdown Systems, Escape Routes, Fire Protection Systems and Emergency Training for Offshore Installations. In addition, the Committee examined new UK Regulations governing the isolation of pipelines, and has recommended their adoption in Australia with minor modifications.

The Committee believes that significant improvements to the offshore safety regime can be achieved by adoption of relevant recommendations from the UK Cullen inquiry into the Australian offshore petroleum industry. This will enhance the protection of personnel on Australian offshore installations and the integrity of the installations themselves.

One of the major recommendations of the Cullen Report was the adoption of the Safety Case concept. The Committee recommends that this concept also be adopted for Australian offshore petroleum operations. The Safety Case will require the operator of a facility to formally document how safety is to be managed within the facility, to demonstrate that the major hazards of the installation have been identified and appropriate controls provided, and to demonstrate that adequate provision has been made to ensure safe evacuation, escape and rescue in the event of an emergency. The Committee has prepared a guideline which defines the documentary evidence which must be provided. The Safety Case, as prepared by the operator and approved by the regulatory authority, will constitute the primary means of identifying the measures taken for ensuring that installations are operated in a safe manner.

Another major recommendation of the Cullen Report was the adoption of objective setting rather than prescriptive regulations, whereby the onus of responsibility for the management of offshore safety rests clearly with the operator. The Committee recommends that this approach be adopted here. However, at the same time it was recognized that in the Australian context a certain level of prescriptive regulation will also be required in order to provide minimum standards. A blend of prescriptive and objective regulation is recommended. The objective approach to offshore legislation as recommended by Cullen represents a significant change to the existing system and will therefore need time to implement.

Other recommendations of major importance are:

- that the Commonwealth Occupational Health and Safety (OH&S) provisions be applied in those State / Northern Territory adjacent areas where no current OH&S provisions apply;

- the establishment of a single point of contact and responsibility in each State/Northern Territory for the administration of safety in offshore petroleum operations;

- the provision of adequate and on going training programs for all personnel working offshore; and

- adequate resourcing and training of State/Northern Territory authorities to enable them to develop expertise within their inspectorates for the assessment of Safety Cases.

The Committee recommends that the Australian Minerals and Energy Council Sub-Committee on Offshore Petroleum Legislation facilitate the

adoption into legislation of recommendations made in this report. This should be done in consultation with the industry and the unions.

The Committee considers that it is important that the effectiveness of its recommendations is kept under review, and also that new developments overseas in the field of offshore safety are properly examined and assessed. It therefore recommends that a means of ensuring adequate future consultation between governments, industry and unions, possibly in the form of a committee with a similar membership to COSOP and with specified terms of reference, be established.

THE PIPER ALPHA DISASTER

At about 10 pm on 6 July 1988 an explosion occurred in the gas compression module on the Piper Alpha platform, 176 km north east of Aberdeen. This initial explosion put the main control room and main power supplies out of action and caused extensive damage to hydrocarbon processing equipment. It was followed immediately by a large fire in the oil separation module, which gave rise to a massive plume of black smoke which engulfed the north end of the platform. This fire was fed by oil from the platform and a leak in the main oil line to the shore, to which the pipelines from the Claymore and Tartan platforms were connected.

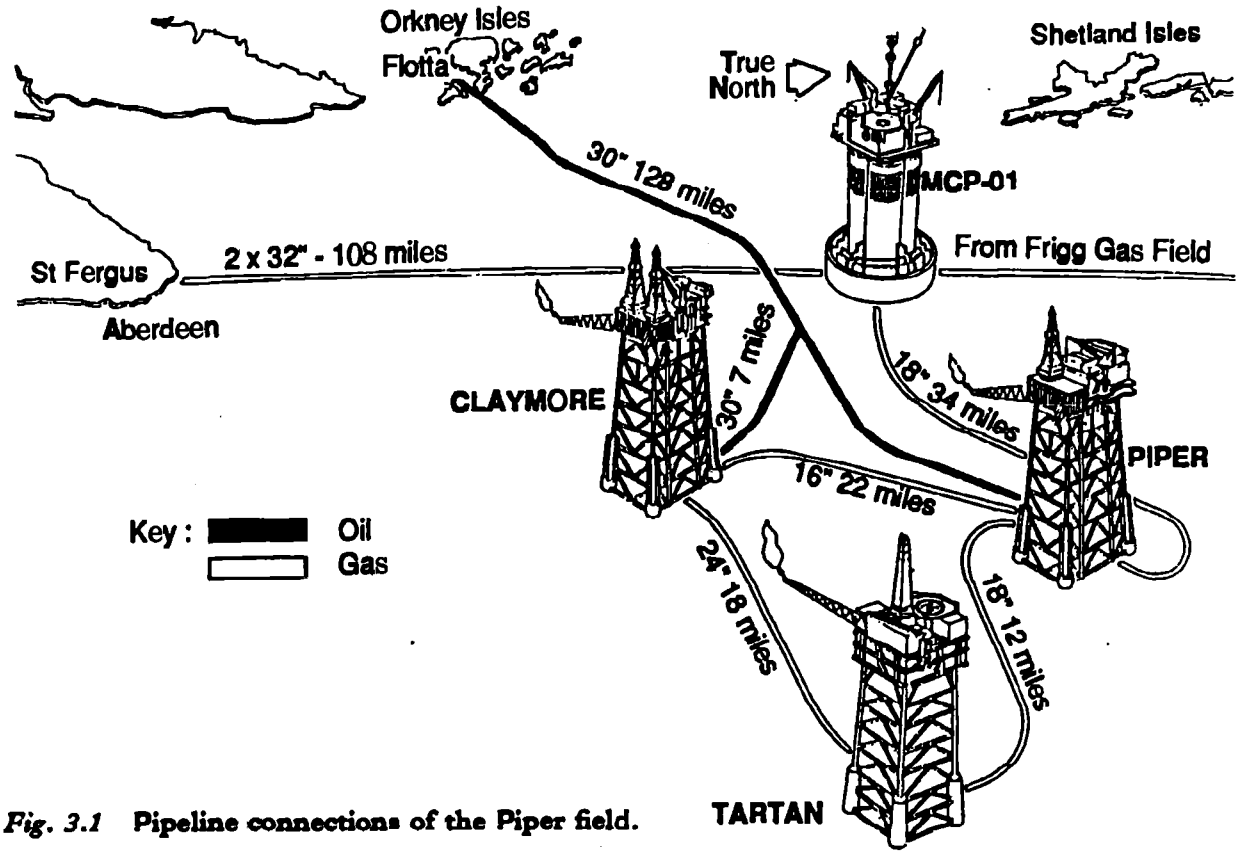

Fig. 3.1 **Pipeline connections of the Piper field.**

Diagram showing location of Piper and neighbouring platforms

At about 10.10 pm there was a second major explosion which caused a massive intensification of the fire. This was due to the rupture of the riser on the gas pipeline from Tartan. Ruptures of risers on the gas disposal pipeline to Frigg and the gas pipeline connecting Piper with Claymore further intensified the fire on Piper.

There is evidence that the emergency shutdown system was activated and emergency shutdown valves on the gas pipeline risers probably closed, although extended flaring pointed to the failure of a valve on the Claymore riser to close fully. The other emergency systems on the

platform failed immediately or within a short period of the initial explosion. In particular, the fire water system was rendered inoperative either due to physical damage or loss of power. At the time of the initial explosion the diesel fire pumps could not be started remotely as they were in manual mode.

The platform structure collapsed as a result of the explosions, initially forcing men to jump into the sea out of shelter on the pipe deck. The east quarters module lost its structural support and tipped to the west, crushing the west quarters module, and then tipped northwards into the sea. Between 10.30 pm and 12.15 am the centre of the platform collapsed. The risers from the gas pipelines and the main oil pipeline were torn apart. The north side of the platform slowly collapsed until the additional accommodation module slipped into the water.

There were two hundred and twenty-six (226) men on the platform at the time. Sixty-two (62) were on nightshift duty while the remainder were in the accommodation. The system for control in the event of a major emergency was rendered almost entirely inoperative, smoke and flames outside the accommodation made evacuation by helicopter or lifeboat impossible.

Diving personnel on duty escaped to the sea along with other personnel on duty at the northern end and the lower levels of the platform. Other survivors who were on duty made their way to the accommodation, and a large number of men congregated near the galley on the top level of the accommodation. Conditions there were tolerable at first, but deteriorated greatly owing to the entry of smoke. A number of personnel, including twenty-eight (28) survivors, reached the sea by use of ropes and hoses or by jumping off the platform at various levels. At no stage was there a systematic attempt to lead men to escape from the accommodation.

To remain in the accommodation ultimately meant certain death. Sixty-one (61) persons from Piper survived. Thirty-nine (39) had been on night shift and twenty-two (22) had been off duty. One hundred and thirty-five (135) bodies of the one hundred and sixty-five (165) persons who died were later recovered. The principal cause of death in one hundred and nine (109) cases (including seventy-nine (79) recovered from the accommodation) was inhalation of smoke. Fourteen (14) apparently died in an attempt to escape from the platform. Few died of burns. Two members of the crew of a fast rescue craft were also killed.

RESPONSE TO THE DISASTER

Industry

The extent of death and injury resulting from the Piper Alpha disaster was of great concern to the offshore petroleum industry worldwide, since it demonstrated the vulnerability of personnel on offshore installations in the event of a major accident.

The immediate reaction of the major Australian operators after the Piper Alpha accident was to undertake wide ranging reviews of safety equipment and emergency response procedures in consultation with the relevant government authorities. The reviews, to a large extent, confirmed that Australian facilities were equipped to standards consistent with international practice. Safety related issues were pursued by the offshore operators as they came to hand from overseas parent companies and affiliates.

Documentation of the work undertaken by Australian offshore operators is contained in the Australian Response Document (Appendix C).

UK Government Initiatives

In the UK a technical investigation team, headed by Mr J R Petrie, Director of Safety, Petroleum Engineering Division of the UK Department of Energy, commenced work immediately after the accident. A public inquiry, undertaken by Lord Cullen at the request of the Government, was commissioned on 13 July 1988 to establish the circumstances of the accident.

In mid-September 1988, Petrie released an interim report which described preliminary findings on the most likely cause of the Piper Alpha accident. He found that the most probable cause of the initial explosion was an ignition of gas (condensate vapour) from a section of pipework in the gas compression module (Module C), following an earlier process disturbance. The condensate was probably released from the site of a pressure relief valve which had been removed from pipework associated with the isolated condensate injection pump 'A'. He found it probable that this pipework was inadvertently pressurised whilst operators were dealing with a plant disturbance and were unaware that the pressure relief valve had been removed.

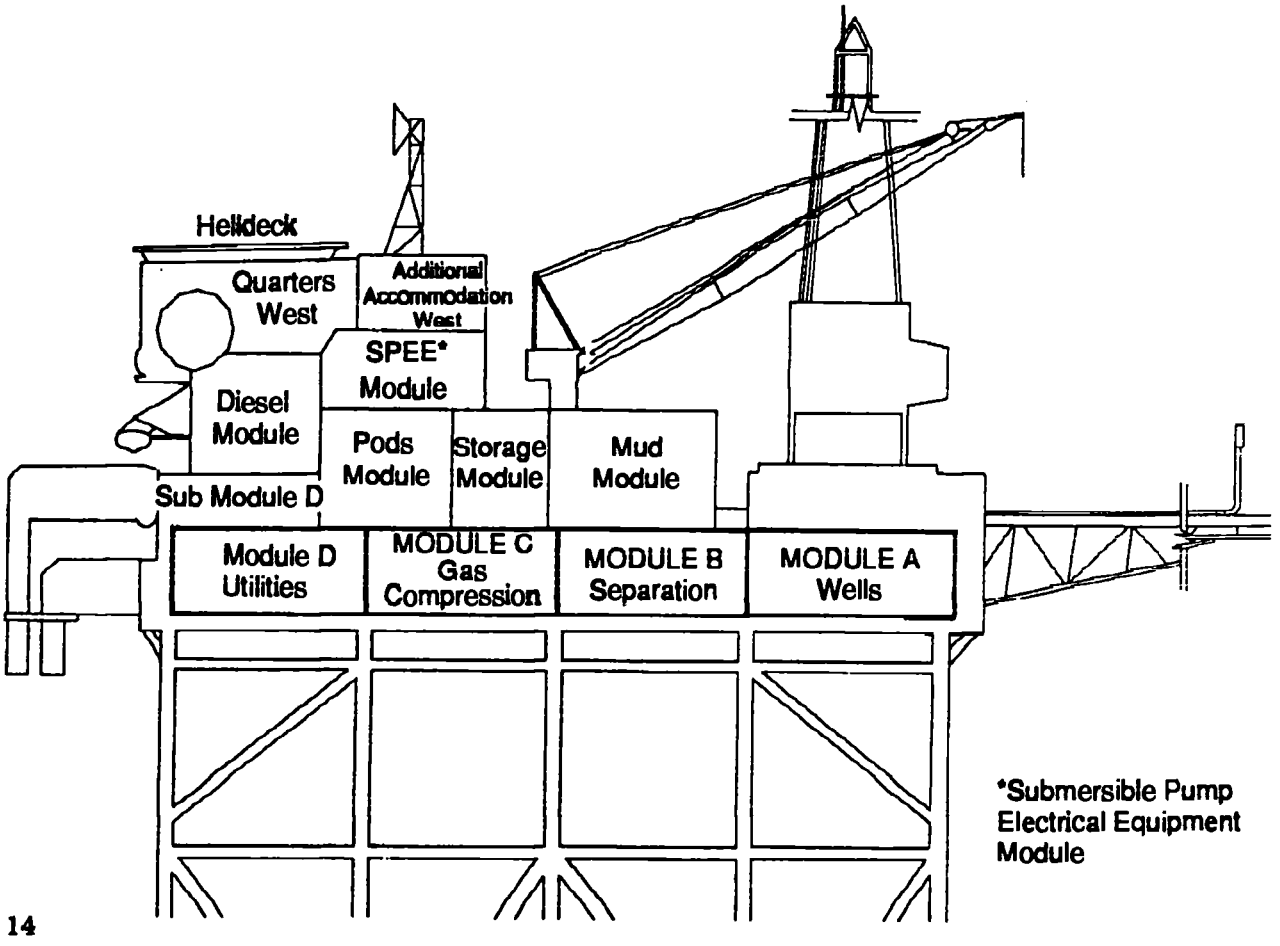

Fig. 3.2 The Piper Alpha platform: west elevation (simplified).

Diagram showing Piper Modules

Petrie identified seven key areas in the safety management systems on Piper Alpha as contributing to the accident:

. Work Permit Systems;

. Automatic Initiation of Fire Fighting Systems;

. Life Raft Operability;

. Evacuation Routes;

. Integrity of Emergency Systems;

. Venting of Explosions; and

. Platform Emergency Shut-down Systems - Pipelines.

Petrie's second, and final report, was released on 20 December 1988. It confirmed the likely possible explanations for the accident considered in

the interim report and left further consideration to the public inquiry being conducted concurrently.

The public inquiry by Lord Cullen commenced hearings in January 1989, with the report (known as the the Cullen Report) being presented to the UK Government in November 1990. A summary of the report is presented on page 19.

The Cullen Report has been endorsed by the UK Government which has accepted all 106 recommendations on 24 subjects. As a result of this endorsement, the regulation of offshore safety is undergoing extensive restructuring, with the primary onus of responsibility for offshore safety being shifted towards the operating companies and away from the regulatory authorities. It is expected that it will be several years before the new regulatory regime is fully implemented.

On 1 April 1991, the UK Government announced that the Health and Safety Executive (HSE) had taken over the responsibility for offshore safety from the Department of Energy. The HSE is giving immediate priority to drafting a Safety Case for offshore installations with a view to having a consultative document by late December 1991 outlining the philosophy of approach and proposed regulations.

Australian Government Initiatives

Australian oil and gas production facilities are located in Bass Strait, off the coast of Western Australia and in the Timor Sea. Some aspects of these facilities are comparable to those encountered in the North Sea, and the Government took action to confirm that a similar disaster was unlikely to occur in Australian waters. Shortly after the Piper Alpha accident the then Minister for Resources, Senator Peter Cook, sought and received assurances from all Australian offshore operators that all safety equipment on platforms had been checked and that procedures were in place to respond to any emergency.

After consultation with State and Northern Territory Government Ministers, senior industry and union representatives, Senator Cook decided to establish a consultative committee to advise him on safety issues relative to offshore petroleum operations in the Australian offshore area. The Consultative Committee on Safety in the Offshore Petroleum Industry (COSOP) commenced work in October 1988. It consists of two representatives from the Commonwealth Government, and a representative from the Northern Territory government and from each of the two State Governments with active offshore petroleum production programs, three representatives from unions covering workers in the offshore industry, and three representatives from the major offshore operators. The Chairman is from the Department of Primary Industries and Energy which also provides secretariat and research support for the Committee.

AUSTRALIAN OFFSHORE SAFETY LEGISLATION

Australian offshore petroleum safety regulations are the joint responsibility of the Commonwealth and the States/Northern Territory. The Petroleum (Submerged Lands) Act delegates all day-to-day matters to the State/Northern Territory Designated Authorities. These day-to-day matters include detailed inspection and monitoring of the activities of offshore operators to ensure compliance with the safety standards.

The Schedule of Specific Requirements as to Offshore Petroleum Exploration and Production-1990 (the Directions) under the Petroleum (Submerged Lands) Act 1967 (PSL Act) specify the broad framework of safety requirements. Where specific standards have been developed by reputable bodies such as the Australian Standards Association and widely accepted international bodies such as the American Institute of Petroleum, these are applied under the Directions. The provisions in the Commonwealth legislation apply beyond the three mile territorial limit, while the States/Northern Territory legislation applying within the territorial limit mirror the Commonwealth legislation. Other Commonwealth and States/Northern Territory legislation is also applicable to offshore petroleum operations, including occupational health and safety, maritime, aviation, and communications legislation.

The PSL Act requires operators to conduct their operations in a proper and workmanlike manner, in accordance with good oilfield practice, securing the safety, health and welfare of those at work. "Good oilfield practice" is defined as all those things that are generally accepted as good and safe in the carrying on of exploration for petroleum or in operations for the recovery of petroleum.

Specific safety regulations are also enforced by the majority of States and the Northern Territory through occupational health and safety (OH&S) legislation. State and Territory OH&S provisions apply to relevant adjacent areas by virtue of section 9 of the PSL Act which projects State or Territory law offshore. The OH&S laws vary significantly between States and Territories, and in some States petroleum operations are currently excluded from the ambit of OH&S legislation. Table 1 on page 11 shows a comparison of the principal OH&S provisions in the various jurisdictions.

While the Directions to the PSL Act establish broad principles and procedures for safety, provide many prescriptive safety regulations and require the preparation of safety and emergency response manuals to be approved by the Designated Authority, they do not address safety management aspects as outlined by Cullen. They also generally prescribe detailed requirements on many specific operational aspects. They do not apply the principle of objective setting through an integrated safety management system as recommended by Cullen.

TABLE 1

COMPARISON OF OH&S PROVISIONS

	VIC	NSW	SA	WA	QLD	TAS	NT	C'wealth Employ
Employers general duty of care provisions	Y	Y	Y	Y	Y	Y	Y	Y
Manufacturers duty of care	Y	Y	Y	Y	Y	Y	Y	Y
Employees duty of care	Y	Y	Y	Y	Y	Y	Y	Y
Elected safety representatives	Y	N	Y	Y	Y	Y	Y	Y
Safety reps issue prov prohibition notices	Y	N#	Y	N	N	N	N	N
Safety reps issue prov improvement notices	Y	N	Y	N	N	N	N	Y
OH&S Committees	Y	Y	Y	Y	Y	N	Y	Y
Inspectors able to enter & inspect	Y	Y	Y	Y	Y	Y	Y	Y
Prohibition & improvement notices	Y	Y	Y	Y	Y	Y	Y	Y
Inspectors able to prosecute	Y	Y*	Y	Y*	Y	Y	N	Y
Prosecutions under summary jurisd'ion	N$	Y	Y	Y	Y	Y	Y	Y
Appeal mechanism	IRC	N	R C	IRC	AT	AT	WHC	AIRC

* - if authorised
\# - Secretary of industrial union able to issue notice
$ - provisions set by regulation are under summary jurisdiction

IRC = Industrial Relations Commission
RC = Review Committee
AT = Appeals Tribunal
WHC = Workers Health Court
AIRC = Australian Industrial Relations Commission

COSOP WORK PROGRAMS

The Australian Response document

To expedite work while the Cullen inquiry progressed COSOP undertook the preparation of an interim report on the actions taken in Australia in response to the findings of the Petrie investigations. This report, known as the "Australian Response Document", (Appendix C) provided the basis for identifying issues arising from the Petrie reports which required further consideration and/or investigation in the Australian context. The document was updated following each meeting to reflect reports on progress made and further issues raised by members at the meetings. COSOP members considered it important that all persons with an involvement in the offshore petroleum industry were kept informed of developments in safety issues and agreed that the most satisfactory method to achieve this was by wide dissemination of the Response Document.

The Response Document addressed the seven areas of concern identified by Petrie in letters to the offshore industry in September 1988. These areas were:

- Work Permit Systems
- Automatic Initiation of Fire Fighting Systems
- Life Raft Operability
- Evacuation Routes
- Integrity of Emergency Systems
- Venting of Explosions
- Platform Emergency Shutdown Systems - Pipelines.

The background to each subject was described, current arrangements of relevance in Australia listed, and the relevant matters identified for action at the inaugural meeting were documented, actions to date summarised and further work identified.

Tuna Fire Report

In April 1989 a fire broke out on the Tuna Platform in Bass Strait as work was being carried out on a main oil line pump and associated valves. Four persons were injured.

The then Minister for Resources, Senator Cook, asked COSOP, as part of its work program, to examine the implications for offshore operations of the findings of the investigations into this incident. Senator Cook also wrote to Mr J Schubert, the Chairman and Managing Director of Esso, asking that Esso report to the Committee on the incident.

The Esso representative on COSOP reported on the findings of Esso's Investigation Committee and on progress in implementing that Committee's recommendations.

COSOP submitted a report to the Minister on this matter in August 1990. However, as the Victorian Coroner has yet to report on its investigation into the incident, the report could not be considered truly definitive as to the causes of the incident and the failings it identified.

In some respects there were marked similarities between Tuna and the Piper Alpha disaster, and the incident serves to reinforce, while at the same time providing an adjunct to, the lessons that can be learnt from that accident.

Petrie's Technical Investigations into Piper Alpha and the investigations into the Tuna fire revealed the following similarities:

1 Weaknesses in the operation of the Work Permit System. A breakdown in the work permit procedures appears to have been a major factor in both cases.

2 In both accidents, there appear to have been deficiencies in the operability of the firewater deluge systems. However, whereas one fire pump was eventually activated on Tuna, there is evidence that both pumps on Piper Alpha (which had been switched to manual control and were probably severely damaged in the initial explosion) failed to start.

3 In both cases the accommodation quarters were adversely affected by dense smoke, which hindered emergency response in the case of Tuna and both emergency response and personal evacuation in the case of Piper Alpha.

4 The technical investigations into both pointed to deficiencies in the fire walls. The Tuna fire experience demonstrated to Esso the value of fire walls, but without apertures which, if inadvertently left open, could jeopardise the integrity of the services module and living quarters. The Piper Alpha accident highlighted the importance of providing blast protection in addition to firewall protection.

5 The emergency shut-down systems on Piper Alpha were found to be deficient, while those on Tuna, with the exception of the quarters' smoke detectors either failing to detect the smoke and/or failure of the dampers to operate, were found to be operating effectively. Nevertheless Esso's investigators utilised the opportunity to recommend certain modifications to the system to further improve its reliability.

As a result of both the Tuna and Piper Alpha accidents the Committee recognized the importance of ensuring that adequate Occupational Health and Safety legislation is applicable to offshore petroleum operations and the need for adequate safety awareness and training.

Guidelines

COSOP's terms of reference include providing advice to the Minister on the need to amend the current administrative arrangements, standards and procedures to ensure the safety of operations under the Petroleum (Submerged Lands) Act 1967.

To fulfil this term of reference, the Committee undertook work on the safety philosophies which it anticipated would be followed in the future design of offshore facilities which would operate in Australian waters.

This included the preparation of appropriate guidelines to assist operators in Australia, particularly new operators.

All of COSOP's guidelines have been referred to the Australian Minerals and Energy Council (AMEC) Sub - Committee on Offshore Petroleum Legislation with the recommendation that they be incorporated into the Schedule of Specific Requirements as to Offshore Petroleum Exploration and Production-1990 (the Directions) of the Petroleum (Submerged Lands) Act 1967.

The work undertaken by COSOP prior to the release of the Cullen report corresponds with several of the subjects on which Cullen made recommendations. In a number of those areas, where there are additional aspects raised by Cullen, COSOP has responded by amending the guideline documents where necessary and formulating an additional guideline based on the Safety Case concept.

The following guidelines (Appendix D) have been prepared:

<u>Work Permit Systems</u>

Work permit systems are designed to ensure that an adequate system of checks and balances exists so that all work activities which have a potential for affecting safety are properly controlled and co-ordinated. As stated above, deficiencies in the Work Permit System were identified as a major factor in both the Piper Alpha disaster and the Tuna accident.

The guideline prepared by COSOP sets out the philosophy for operating arrangements of work permit systems and the application of these principles and the procedures to be followed. The guideline sets out a general approach around which operators can develop relevant components of their safety manuals in consultation with the State/NT Designated Authorities and employee representatives. Both the Piper Alpha and Tuna accidents demonstrated the need for adequate communication and training in work permit procedures, and these aspects are covered in the guideline.

The aim of the system is to ensure the following:

(a) the personal safety of those carrying out the work;

(b) the safety of other persons is not endangered by the work being carried out; and

(c) the overall safety and integrity of the offshore petroleum facility is not endangered.

Safety Manuals specify key elements of the Work Permit system and set procedures to be followed in approving permits to carry out maintenance or new construction work on offshore petroleum facilities. The guideline recommends that manuals be developed and agreed between the regulatory authority, companies and employee representatives. Clause 201(1) of the Directions provides that operations shall not be carried out unless they are in accordance with an approved safety manual.

An essential element of the Work Permit system is a requirement that an appropriate person should co-ordinate and control the issuing and return of Work Permits. That person should be in a position to take an overview of all operations underway and planned for the offshore petroleum facility. This requirement is essential so that potential hazards are not compounded.

The guideline describes the administrative responsibilities for operating the Work Permit system, the duties of the person in command of the platform, the duty production operator and the supervisor of those performing the work.

Emergency Shutdown Systems

The initial explosion on the Piper Alpha platform was sufficient to disable all emergency and essential services almost immediately. As a result, communications and alarm systems failed to function.

The guideline describes the requirements for reliable emergency shutdown (ESD) systems on manned offshore oil and gas production facilities.

An oil and gas production facility should typically contain a process shutdown system, an ESD system, a fire and gas detection system, and a fire protection system. These systems perform different functions within the facility, but are inter-related.

The basic function of a process shutdown system is to prevent an abnormal process condition from developing into situations which could endanger personnel, the environment and the integrity of the installation.

It is an integrated system of automatic monitoring devices that perform the following functions:

. initiate alarms when controlling conditions are exceeded;

and
- initiate shutdown of equipment, subsystems or the entire process to stop production and prevent or minimise the effects of abnormal operating conditions.

These actions are initiated either automatically by the control/ESD systems, or manually at designated stations.

Emergency shutdown systems are those required to function in an emergency to meet the following requirements:

- provide protection for personnel and equipment and the environment by the safe shutdown of critical equipment;
- minimise quantity of flammable products released if leakage does occur;
- remove potential sources of ignition for any escaped flammable products; and
- prevent escalation of a single incident to other areas of the plant.

Escape Routes

As a result of the examination of the reports of the UK inquiries and the Tuna accident, COSOP members believe that a principal requirement of safety on offshore petroleum operations is the provision of adequate evacuation routes to muster stations and survival craft.

The basic principles of this guideline are based on the draft Norwegian Det Norske Veritas recommended practice RP C 103 for escape routes.

The guideline outlines basic principles to be considered in the design and operation of escape routes. Factors that are covered include the requirement for escape routes to be as direct and straight as possible, that there should be at least two escape routes from any work station, that escape routes should be well marked and unobstructed and that there should be regular training in escape drill exercises.

Fire Protection Systems

Fire protection systems are recommended for every manned offshore facility. The guideline outlines the objectives to be achieved through passive (firewalls, blast protection, equipment layout and design), and active (detection, deluge and other fire extinguishing) systems.

Evaluation of fire protection systems by scenario based fire risk assessment is advocated, the methodology and acceptance criteria to be agreed by consultation between the regulatory authority, and the operator. Whenever there is an issue involving risk assessment reference should be made to the Safety Case.

Guidelines are also laid down for the testing and maintenance of the fire

protection system.

Pipeline Isolation Systems

Piper Alpha provided a vivid demonstration of the need for suitable systems to isolate pipelines containing hydrocarbons from installations in an emergency.

In 1989 the UK adopted new Regulations, Offshore Installations (Emergency Pipe-line Valve) Regulations, designed to provide for such isolation. The Regulations require the fitting of emergency shut-down valves on pipeline risers serving offshore installations together with the periodic inspection and testing of these valves and their control systems.

The Regulations were assessed by the Consultative Committee which has recommended that they be incorporated, with minor modifications, in the Directions to the PSD Act. A copy of the UK Regulations, together with modifications agreed by COSOP, is at Appendix D.

Emergency Safety Training for Offshore Installations

The need for an overall training strategy for the offshore oil industry has been recognized by COSOP and specified as one of the important elements of the Safety Case which must be prepared by the operator.

The strategy needs to address the role of training in the promotion and maintenance of safe working practices offshore, be preventative in emphasis and cover the main areas of training (induction, work practice, skill, emergency response, specialist duty training and ongoing up-grading).

To assist with this task, COSOP has prepared Guidelines for Emergency Safety Training (APPENDIX D), which emphasise the importance of training to minimise the risk of injury in response to emergencies. As stated above, Guidelines for Work Permit Systems have also been prepared. Training in this and other areas necessary for the effective and safe undertaking of work is emphasised.

The Safety Case

The Safety Case concept results from the recommendations made by Cullen to bring UK offshore safety management systems into line with existing onshore legislation. The guideline is based on the UK Control of Major Accident Hazards (CIMAH) Regulations (1984), elements of the Cullen Report, views expressed as a result of consultation with offshore industry management, unions and regulatory authorities, and the Australian Petroleum Exploration Association.

The CIMAH regulations require demonstration of safe operation, notification of major accidents, a written report (the Safety Case),

updating of the report, an obligation to suppply the regulatory authority with additional information if needed, preparation of an on-site emergency plan and provision of information to the public. The onus is on management to evaluate the hazards, take measures to control them adequately and then to present the arguments to the regulatory authority.

CIMAH Regulation 4 requires an operator to provide documented evidence to the regulatory authority that steps have been taken to identify the major accident hazards, and adequate steps taken to prevent such accidents and to limit their consequences to persons and the environment. A further requirement is that persons working on the site are to be provided with the information, training and equipment necessary to ensure their safety.

This document (Appendix D) defines the Safety Case as it would apply in the Australian offshore context, describing the Safety Case objectives for the operator of an offshore installation, the content and elements of a Safety Case to be documented and the techniques by which that documentation should be achieved.

The three objectives of the Safety Case are:

- a demonstration by the operator/company to the regulatory authority that major hazards of an installation have been identified and that appropriate controls have been provided;
- to demonstrate that the safety management system of the operator and that of the installation are adequate to ensure that the design, construction, operation and maintenance of the installation and its associated services, are safe; and
- to demonstrate that adequate provision has been made for ensuring safe evacuation, escape and rescue, in the event of a major emergency.

The guideline defines the required documentary evidence to be presented to the regulatory authority so that the latter can determine whether the significant risks have been identified and are being properly managed. It requires operators to introduce mechanisms which will ensure that the preparation, implementation and monitoring of the Safety Case will be undertaken in consultation with representatives of the workforce.

The five earlier guidelines mentioned above will be taken into account by the operator in the preparation of the Safety Case, but the primary objective is the overall safety of a particular installation.

THE CULLEN REPORT

As indicated earlier, Cullen confirmed in his report the results of the technical investigation by Petrie and made 106 recommendations (Appendix E) which can be grouped roughly into three main areas:

- safety assessment and the regulatory system (Recommendations 1-31);
- prevention and mitigation measures (Recommendations 32-54); and
- evacuation, escape and rescue (Recommendations 55-106).

Safety Assessment and the Regulatory Regime

The recommendations relating to safety assessment and the regulatory system stem from Cullen's view that existing detailed and prescriptive regulations were inflexible. He considered that the responsibility for offshore safety should be put more clearly on the companies rather than the regulator. By requiring a formal safety assessment (FSA) from the operator of any offshore installation, mobile or fixed, a more objective framework for regulation could be established.

The FSA encompasses the whole life cycle of a project, from feasibility study through design, construction, operation, and abandonment. Its need arises because the combinations of mechanical and human failures are so numerous that a major accident hardly ever repeats itself. The techniques used include hazard and operability (HAZOP) studies, quantitative risk assessment (QRA), fault tree analysis, human factors analyses, and safety audits.

Cullen recommended that the UK offshore safety regime should be administered by a single regulatory body because there are clear advantages in the coordination of work of regulation, and in the future there will be a greater burden on the expertise, judgement and resources of the regulator. The regulatory body should employ a specialist inspectorate with the ability to evaluate the operator's Safety Case.

Prevention and Mitigation Measures

Prevention measures addressed in recommendations 32-40 are aimed at improving aspects of the permit to work (PTW) system.

Recommendations 41-54 cover other prevention measures including a requirement that the regulatory body maintains a database on incidents involving hydrocarbons for the benefit of industry. Mitigation measures include Control Room capabilities and operations, hydrocarbon inventory control, provision against hazards from risers and pipelines, fire and gas detection, emergency shutdown systems, and fire and explosion protection.

Evacuation, Escape and Rescue

Recommendations in the third group cover a wide range of subjects. They include accommodation, provision of a temporary safe refuge (TSR), escape routes and embarkation points, emergency centres and systems, pipeline emergency procedures, evacuation, escape and rescue, helicopters, totally enclosed motor propelled survival craft (TEMPSC), means of escape to the sea, personal survival and rescue equipment, standby vessels, command in emergencies, drills, exercises and precautionary musters and evacuations, and training for emergencies.

COSOP CONSIDERATION OF THE CULLEN REPORT

Consultation with the Offshore Industry

COSOP has reviewed Cullen's report and recommendations in detail to determine the relevance of its findings for the Australian offshore petroleum industry. Each recommendation has been reviewed and the appropriate action for the Australian offshore regime is indicated in Appendix E.

A discussion paper (Appendix F), summarising the recommendations of the Cullen Report and actions taken by COSOP in response to the earlier technical investigations by Petrie, was circulated to industry, union, and other persons with an interest in offshore safety. The paper also identified issues for alternative approaches to the Australian offshore safety regulatory regime.

The fundamental change in the UK offshore regulatory system recommended by Cullen meant that some adjustment of COSOP's guidelines was necessary. Additionally, there was a need to evaluate the concepts of objective regulation and the Safety Case.

The issues raised by Cullen were discussed with a wider audience of industry and union representatives at meetings in Canberra (5 March 1991) and Perth (30 April 1991). At these meetings written submissions were invited and were subsequently received from maritime unions, the offshore construction industry and the Australian Petroleum Exploration Association (APEA).

Three issues became apparent as being of importance to those with interests in the offshore oil industry:

- the treatment of the offshore service industry (workboats, standby vessels) in regard to the Safety Case;
- the need for employee participation during the formulation of safety management systems; and
- uniform interpretation of regulations by States regulatory authorities if the Safety Case concept were adopted.

There was a general consensus at the meetings that major features of the Cullen recommendations, including the transfer of the onus of responsibility for safety to the operator and the concept of a Safety Case, had advantages for Australian offshore operations.

There is a perceived confusion by maritime unions and industry management in the application of the P(SL) Act and the Navigation Act in respect of workboats and other vessels operating in the vicinity of offshore mobile drilling rigs, construction and production facilities. At COSOP's request, the Department of Primary Industries and Energy has raised this issue with the Department of Transport and Communications and the Australian Maritime Safety Authority

(AMSA), which administer the Navigation Act, for further consideration.

AMSA is facilitating dialogue between the Australian National Maritime Association, the Australian Mines and Metals Association, the maritime unions and the Australian Council of Trade Unions, with a view to developing legislation spelling out the obligations and rights of employers and employees with regard to occupational health and safety. This will include training in responding to incidents on offshore petroleum facilities.

Safety Management Issues

A successful safety management system needs the active participation of the workforce. COSOP has recognised the importance of discussion between management and the workforce. COSOP supports the view that such interaction is beneficial to the success of the safety management system if undertaken during the design and construction of an installation where possible, and crucial to the success of the safety management system when undertaken during the operation and eventual decommissioning of an installation.

The Committee has also recognised the importance of verifiable safety training for all personnel who work offshore (in particular, leadership training for persons in supervisory positions on platforms) and the on-going nature of safety awareness. These factors are considered to be essential features of safety management.

COSOP notes that there are additional factors in the application of the Safety Case offshore which are not found onshore. The position of living quarters relative to the drilling and/or production facilities, the confined space of the facilities and difficulty in evacuating personnel in adverse weather conditions, create special hazards.

The Committee endorsed the thrust of Cullen's philosophy, ie a move to objective legislation and the formalisation of the safety management system which is included in the Safety Case. It considers that many of the aspects of the Safety Case (such as Safety Manuals, Emergency Response Manuals) already exist in the P(SL) Act Directions. The current technical standards are sound and the safety management system approach can provide a holistic framework for future regulations. There should be emphasis on objective setting regulation while at the same time retaining the standards required in the P(SL) Act Directions.

The Committee considers that the Safety Case should be a documented "case" by the operator to the regulatory authority, primarily aimed at regulatory interface and control, which defines the safety management system and safety aspects of an installation. The Safety Case should be such that the safety plans, and functions and duties of the support groups (supply boats, divers etc) would fit into the overall Safety Case. The Safety Case for a fixed or floating production facility, including

Floating Production Storage and Offloading Facilities (FPSO's), should include all services, satellite platforms and pipelines. The Safety Case for mobile drilling rigs or construction facilities should also include all services, and once accepted offshore by one State/Northern Territory it should be automatically accepted by the others where it can be demonstrated that the operational requirements and environmental conditions are similar. However, evacuation, escape and rescue analysis should be reviewed regardless of whether environmental conditions are similar.

Another issue considered by COSOP was the application of Occupational Health and Safety (OH&S) legislation offshore Australia. COSOP felt that the OH&S legislation applying offshore should be consistent with that applying in the adjacent onshore area.

The relevant parts of the Commonwealth OH&S Act could be made to apply to only those adjacent areas where State or Northern Territory OH&S legislation does not apply. This approach would ensure that a OH&S regime applies in all offshore areas.

Relevant parts of the Commonwealth OH&S Act are as follows:

- the general duties relating to occupational health and safety;
- workplace arrangements; and
- investigations and inquiries.

The establishment of an incident recording data base would ensure that lessons learned from accidents and near misses can be circulated widely, thereby reducing the risk of further incidents and assisting those designing and modifying facilities. An investigation of the potential for linking this data base with others overseas should also be undertaken.

COSOP considers that it is important that information derived from this data base, as well as other data and initiatives in the area of offshore safety, be examined and assessed as required.

In addition, COSOP recommends that a forum for ensuring future tripartite consultation between governments, industry and unions on signficant offshore safety issues as identified by the Commonwealth Minister for Resources, and with specified terms of reference, be established.

Structure and training of the Inspectorate

At the meetings on 5 March and 30 April 1991, union representatives expressed support for a single agency to take the place of the existing State authorities to cover both onshore and offshore health and safety. This view was supported by industry representatives who saw a single authority as a method of overcoming the difficulties encountered when dealing with more than one Department or with Departments with responsibilities which differ between States. A single authority could be

the vehicle for the application of uniform OH&S regulations and provide a consistent approach to inspections and audits.

COSOP notes that a single national inspectorate covering both the PSL Act Directions and the OH&S regulations would offer certain advantages in that separate State/Northern Territory inspectorates each having its own group of experts would be avoided.

It was recognised, however, that the States/Northern Territory currently have constitutional responsibilities which would need to be re-assessed before a single agency could be established. In addition, if a single Commonwealth agency were to take over responsibility in this area it would have to maintain State offices, and this would not resolve the potential for differences in interpretation of regulations.

COSOP is of the view that it is desirable that in each State/NT there be a single authority responsible for offshore safety covering both the P(SL) Directions and OH&S Regulations. Cooperation between the States/Northern Territory inspectorates and the Commonwealth would be necessary to achieve a consistent national approach.

COSOP also notes that adoption of objective setting regulation would create new demands on the resources of the States/Northern Territory inspectorates and that appropriate funding would be needed to enable them to acquire the expertise necessary to evaluate Safety Cases.

The question of the training of inspectors is also an important matter that was raised in the Cullen Report. COSOP considers that a standardised, cross - jurisdictional approach to the training or re-training of regulatory staff is highly desirable. A standardised training program will assist in promoting the uniformity of approach referred to above. In addition Cullen was critical of the fact that there appeared to be no adequate set instructions / guidance for inspectors. COSOP recommends that consideration be given to the development of a standardised set of instructions for the use of inspectors.

RECOMMENDATIONS

The Committee concludes that the Directions to the PSL Act are adequate to meet the immediate needs of the offshore petroleum industry. In the longer term, COSOP believes that adoption of the Safety Case principle, the use of the existing guidelines and standards as applied through the PSL Act Directions, together with the implementation of those prescriptive regulations on issues identified by Cullen and agreed by the Committee, will enhance the safety of personnel on Australian offshore installations.

The objective approach to offshore legislation offers enhancement to the existing, more prescriptive system, but presents a significant change to the existing system and will therefore need time to implement. Endorsement of the relevant Cullen recommendations may have significant implications in terms of resources required by governments and thereby cost of administration. Until objective legislation can be framed and enacted, safety standards must be retained through prescriptive legislation.

Current OH&S provisions applicable to Australian offshore operations fall short of being ideal and this has added to the difficulties for offshore operators. COSOP found that there appears to be considerable support both within the industry and the unions for a single point of contact for offshore safety matters. There was also considerable concern on the part of the maritime unions as to their coverage by appropriate OH&S provisions.

The provision of adequate, verifiable and on going training programs for all personnel working offshore is essential to maintain the safety record of the industry at a high level.

COSOP specifically recommends

- the progressive introduction of objective setting regulation in the offshore petroleum industry at the same time retaining standards required in the P(SL) Act Directions

- that approval of all new offshore installations be subject to the presentation of a Safety Case which satisfies the regulatory authority and retains minimum standards as required by the P(SL) Act Directions

- that operators of existing installations be required to submit a Safety Case for approval of the regulatory authority within two years of the adoption of the recommendations relating to the Safety Case into regulations

- endorsement of Cullen recommendations where it has been agreed that they apply to Australian offshore petroleum facilities (Appendix E refers)

- that the Commonwealth require that general OH&S provisions, as contained in the Occupational Health and Safety (Commonwealth Employment) Act 1991 be applied in those States' adjacent areas where general OH&S provisions do not already apply, unless those States concerned move to extend the coverage of their OH&S requirements to cover petroleum operations. (The OH&S provisions in the Commonwealth OH&S Act are modelled on existing State/Territory legislation)

- the establishment of a single point of contact and responsibility for all offshore occupational health and safety matters in each State/Territory

- that authorities be resourced adequately to enable them to develop expertise within their inspectorates for the assessment of Safety Cases, including audits and on going reviews, that consideration be given to the development of a standardised training program for inspectors, and that expertise developed be shared between inspectorates

- that an incident data base be established which would be accessible to the offshore industry generally

- that the recommendations in this report be referred to the Australian Minerals and Energy Council Sub Committee on Offshore Petroleum Legislation for adoption in legislation where appropriate in consultation with the unions and industry, and that COSOP's work be considered completed

- that a forum for ensuring future tripartite consultation between governments, industry and unions on significant offshore safety issues as identified by the Commonwealth Minister for Resources, and with specified terms of reference, be established.

APPENDICES

APPENDIX A

CONSULTATIVE COMMITTEE ON SAFETY IN THE OFFSHORE PETROLEUM INDUSTRY

TERMS OF REFERENCE

The Consultative Committee will advise the Minister for Resources on safety issues, referred to it by the Minister, of relevance to offshore petroleum exploration, development and production activities in the Australian offshore area under the jurisdiction of the Commonwealth's Petroleum (Submerged Lands) Act.

Its purpose is to ensure that the Minister has available a specific source of timely and effective advice on the basis of tripartite consultations involving the State/Territories with active offshore exploration, development or production programs, the unions representing the workers in the offshore industry, and the industry operators.

As a priority the Committee will review the reports of the inquiries into the Piper Alpha North Sea accident which were announced by the UK Secretary of State on 7 July 1988; report to the Minister on the relevance of the findings and recommendations for the offshore industry in Australia; and advise the Minister whether any modifications may be needed to the current administrative arrangements, standards or procedures to ensure the safety of operations under the Petroleum (Submerged Lands) Act.

APPENDIX B

CONSULTATIVE COMMITTEE ON OFFSHORE SAFETY
MEMBERSHIP

CURRENT MEMBERS

Mr Bob Alderson (Chairman)
First Assistant Secretary
Petroleum Division
Department of Primary Industries
and Energy

Mr Ken Gardner
Director, Petroleum Division
Department of Industry and Economic
Planning, Victoria.

Mr Keith Gammie
Deputy Director, Petroleum Division
Department of Mines, Western Australia.

Mr Bill Tinapple
Director of Energy
Department of Mines and Energy, Northern Territory.

Mr Paul Pike
Manager, Safety, Environment and Regulatory
Esso Australia Limited.

Mr Dave Agostini
General Manager, Karatha
Woodside Offshore Petroleum Pty Ltd

Mr Harold Stibbs
Manager, Topsides Facilities
BHP Petroleum

Mr Robert Outhred
Union Organizer
Australian Workers' Union

Ms Renata Musolino
Occupational Health & Safety Officer
ACTU

Mr Joe McConville
Amalgamated Metal Workers Union

Dr Colin Grant
Director of Standards
National Occupational Health and Safety Commission

PREVIOUS MEMBERS

Mr Alan Smart, Chairman
First Assistant Secretary
Petroleum Division
Department of Primary Industries and Energy

Mr Dennis Ives
former Executive Director
Department of Primary Industries and Energy

Mr John Lesslie
Esso Australia Limited

Dr Robert Edwardes
Esso Australia Limited

Mr Denys Goggin
Manager, Production
Woodside Offshore Petroleum Pty Ltd

Mr Neil Ferguson
BHP Petroleum

Ms Elana Rubin
ACTU

Mr Bob Iverach
Amalgamated Metal Workers' Union

Mr Robert Elliott
Australian Workers Union

Dr Chris Winder
National Occupational Health and Safety Commission

Dr Michael Stevenson
National Occupational Health and Safety Commission

SECRETARIAT

Mr Mike Hitchens
Assistant Secretary
Exploration and Development Branch
Petroleum Division
Department of Primary Industries
and Energy

Ms Jeanne Lang
Petroleum Division
Department of Primary Industries and Energy

Mr David Hine
Petroleum Division
Department of Primary Industries and Energy

Mr Dennis Wright
BMR

Mr Val Vukovic
BMR

APPENDIX C

PIPER ALPHA ACCIDENT IN THE NORTH SEA

AUSTRALIAN RESPONSE TO

THE INTERIM FINDINGS OF THE PETRIE INQUIRY

COSOP

SEPTEMBER 1991

EXECUTIVE SUMMARY

. The purpose of this document was to provide an ongoing statement of the status of actions taken in Australia in response to the Piper Alpha accident.

. In response to the Piper Alpha accident in the North Sea and the findings from the interim report by Mr Petrie of the UK Department of Energy of the technical investigation into the causes of the accident, wide-ranging reviews of Australian offshore petroleum operations were conducted by the operators in consultation with the relevant Government authorities.

. The reviews, to a large extent, confirmed the view that Australian facilities employ a high level of technical sophistication in emergency planning and control consistent with current international practice.

. In the light of information available from the "Petrie Inquiry" into the Piper Alpha accident, a number of areas were identified for ongoing review or investigation to ensure that procedures and practices in Australia are adequate to protect the safety of personnel and facilities. The main areas for attention included:

- Work Permit procedures
- Escape routes
- Emergency shutdown systems
- Blast and fire wall protection systems
- Pipeline isolation systems

. Following completion of a number of these reviews new procedures were implemented, existing procedures were amended, and modifications were carried out to a number of offshore installations where problems had been identified.

. In addition the Consultative Committee monitored information as it became available both from the reviews in Australia and from the UK Department of Energy discussion documents and proposals and the "Cullen Inquiry", and developed proposals for appropriate action.

- Work was also undertaken on the safety philosophies that are expected to be followed in designing offshore facilities in Australia including preparation of appropriate guidelines and, where necessary, amendments to the Directions and Manuals, to assist operators in Australia, particularly new operators.

- In most cases operators commenced programs to upgrade or enhance the safety of their operations in consultation with the relevant State authorities shortly after the inception of the Committee.

PETRIE REPORT RECOMMENDATIONS - AUSTRALIAN RESPONSE

- The Petrie Report identified a number of areas of concern which can be broadly categorised as procedural, design or equipment failure/maintenance.

- The following sections address the implications for Australian operations of each of the six main areas of concern identified by Mr Petrie in his letter to offshore operators of 29 September 1988 (see Attachment A), as well as pipeline isolation systems which were the subject of a separate letter from Mr Petrie to the UK industry (see Attachment B).

- Under each of these 7 broad headings the background to the particular concern is described, current arrangements in Australia of relevance are listed, and actions taken since the the inception of the Consultative Committee on Safety in the Offshore Petroleum Industry (COSOP) identified.

(i) WORK PERMIT SYSTEMS

Background

- Petrie identified the release of condensate from a pressure relief valve (PSV) which had been removed from a section of pipework in Module C as the most probable cause of the initial explosion. This occurred because the operators inadvertently pressurised this pipework while probably unaware that the PSV had been removed for maintenance.

Current Arrangements

- In Australia safety manuals, developed and agreed between State/NT Departments, companies and employee representatives, set out procedures to be followed in approving permits to carry out maintenance work on offshore platforms. Direction 201(1) provides that operations shall not be carried out unless they are in accordance with an approved safety manual.

Initial Actions Identified

- COSOP agreed that as an initial action the adequacy of existing procedures should be reviewed and assessed to ensure that

supervisory staff and production control operators were aware of all work in progress and consequent variations to emergency responses.

. It was also agreed that procedures should be re-assessed to determine whether they should include physical securing of valves and switches to isolate piping and equipment for maintenance purposes.

Actions Taken

. All offshore operators and relevant Mines Departments carried out reviews of the existing work permit systems designed to check that the logic behind these systems was in fact being implemented in an effective manner.

. In most cases the reviews concluded that the existing systems provide a satisfactory level of assurance that:

- all isolations that are required are being effected;
- incompatible activities are not allowed to occur simultaneously;
- all persons with a need to know are advised appropriately, with particular attention being paid to shift handovers and incomplete work; and,
- the authority of those persons responsible for the equipment and activities has been received.

. The reviews undertaken by the companies also resulted in the identification of improvements that would result in a more effective system:

- Esso conducted a comprehensive review of work practices and procedures through the newly created Production Standards Group. As a result, the work permit system was revised and documented in the Offshore Work Management Manual (OWMM). The new system is now operational, after completing induction training for over 1000 employees and contractors.
- the implementation of revised work permit systems on North Rankin 'A' and the FPSO Acqua Blu.

. Suggestions put forward by field personnel to improve these systems were evaluated by the operators concerned. Some operators carried out comprehensive audits of their systems and have implemented improvements as a result. Requirements for isolation, security locks

and danger tags are defined in Esso's Offshore Work Management Manual (OWMM). A number of amendments have been implemented by operators to improve work permit systems including the introduction of a Cold Work Permit system on Jabiru Venture and increased isolation distances for conducting hot work (without a pressurised habitat) on Bass Strait platforms.

The Committee examined the July 1988 UK Department of Energy document on proposals for Work Permit Procedures on Offshore Installations. Suggested Guidelines have been prepared on the Work Permit System for possible inclusion in the Directions (Specific Requirements as to Offshore Petroleum Exploration and Production) or the Administrative Guidelines to the Petroleum (Submerged Lands) Act 1967.

(ii) AUTOMATIC INITIATION OF FIRE FIGHTING SYSTEMS

Background

The fire pumps on Piper Alpha did not start automatically because they were on manual control as divers were in the water near the inlet caissons for the pumps. In addition, the fire pumps were located in a module near the initial explosion and are thought to have been damaged.

Current Arrangements

Direction 322 provides for the Director to approve the type, number and locations of the fire extinguishing equipment on each platform. There is considerable variation from platform to platform in Australia. Directions 248 and 830 list a series of actions that shall not be undertaken during diving operations - it does not at present specifically address the operation of fire extinguishing equipment.

Initial Actions Identified

COSOP agreed that an initial action should be the re-assessment of the adequacy of existing fire extinguishing systems, including the location of pumps, access to pumps under emergency conditions, protection from fire and blast risk areas, automatic initiation of pumps and protection of emergency power supplies to pumps.

. It was also agreed that existing regulations/manuals should be examined to determine whether they required amendment to provide clearer guidance on these aspects.

Actions Taken

. Reviews of the adequacy of existing fire extinguishing systems concluded that these systems met international industry specifications for such equipment.

. The degree of fire protection varies depending on whether the production facility is manned or not. On unmanned facilities, the reviews of automatic initiation systems indicated that current arrangements are adequate or further improvements are being made.

. Reviews conducted indicated that:

- the degree of protection of the fire extinguishing systems provided by physical separation from other facilities and enclosure within walls was generally adequate while still allowing access to them. Improvements to the strength/capacity of some fire walls have been identified and further assessments are underway. A programme of firewall sealing is underway on Bass Strait platforms. The Tuna platform fire in Bass Strait demonstrated the importance of fire walls but without apertures - nine firewall doors on Bass Strait platforms have been replaced by fire panels.

- procedures are in place for manual operation of fire pumps, but attention needs to be given to these procedures when diving operations are underway near inlet systems

- the isolation from other systems of the power supply to fire pumps for start-up is effective in each case and back-up power supplies are in place including, where appropriate, independent fuel sources

- Woodside identified that various manuals required updating and this work is being progressed.

. Work is planned on some platforms to fully isolate firewater pumps from other platform service systems.

- Esso is installing new electronic firepump engine control panels to enhance operational reliability over existing pneumatic control panels. Firepumps are being relocated on

three platforms into a dedicated safe area on cellar deck, to ensure their integrity and accessibility in emergencies. Deluge systems have been upgraded on seven platforms by replacing carbon steel deluge piping with copper-nickel and revising system layout to improve operational reliability.

- A draft Guidelines document has been prepared on Fire Protection Systems for possible inclusion in the Directions (Specific Requirements as to Offshore Petroleum Exploration and Production) or the Administrative Guidelines under the Petroleum (Submerged Lands) Act 1967.

(iii) LIFE RAFT OPERABILITY

Background:

- Two inflatable life rafts which were launched failed to inflate successfully.

Current Arrangements

- Direction 319 specifies the requirements for survival craft, including the appropriate number, location, standard of construction, etc. and is compatible with the provisions of Marine Orders Part 25 issued under the Navigation Act 1912. At present the Direction only requires that survival craft be available for inspection at least once each year by an appropriate body or person determined by the Director.

Initial Actions Identified

- COSOP agreed that all survival craft be inspected and tested to ensure that they are were serviceable and capable of being launched under emergency conditions

  - the adequacy of the inspection procedures and frequency of inspections was also identified as an area that should be reviewed.

Action Taken

- COSOP found that life rafts and other emergency escape systems are inspected and tested on a regular basis by operators and by regulatory bodies. Operating companies are required to present a maintenance schedule of safety equipment to the Designated Authority (DA) every 12 months. The statutory authorities ensure that full maintenance and inspections of all escape craft are conducted annually. Companies provide written reports on the drills they conduct of their emergency response operating procedures.

- Reviews resulted in the relocation of some equipment, including escape craft. Reviews are continuing. For the Challis Venturer a Free Fall Lifeboat was selected which enables the boat to be launched away from the vessel rather than at the vessel's side without the use of mechanical equipment. In each case, the minimum Department of Transport requirements are being met or exceeded.

- Esso's Offshore Survival Enhancement Study Group (OSES) examined the reliability and operability of Bass Strait escape equipment and facilities. As a result, Esso has embarked on a program to enhance the operability of existing escape craft by installing auto-release hooks and self-righting kits, and increasing the clearance (between the escape craft and platform) on some platforms. Davit - launched liferafts are also being installed at the north end of all manned Bass Strait platforms, to provide a reliable dry evacuation alternative to the primary escape craft (located at the south end of each platform). Lastly, sea survival and escape craft training facilities and an emergency drills training program are being developed and/or enhanced to provide platform personnel with the skills needed to respond to emergencies and evacuate platforms safely.

(iv) EVACUATION ROUTES

Background

- Petrie commented (Piper Alpha Technical Investigation Interim Report - 10.1.9) that during the 20-minute period between the initial explosion and the rupture of the Tartan gas import pipe-line, the evacuation of the accommodation modules was not accomplished and suggests that this was probably due to the envelopment of the accommodation module in dense black smoke and flame. The Petrie

Report has not examined this aspect in any detail and has recommended further work on this aspect.

Current arrangements

- Directions 312 details requirements for walkways and stairways for access to survival craft, and Direction 319 requires, inter alia, survival craft (which under the Direction includes all types, both rigid, totally enclosed capsules and free floating liferafts) to be located on two opposite sides of the platform.

Initial Actions Identified

COSOP identified a need to:

- Assess the adequacy of evacuation routes to the accommodation and survival craft muster points, including their proximity to hazardous areas,
- Assess whether additional escape routes and/or additional protection should be provided for these escape routes,
- Assess the adequacy of provisions in the safety manuals relating to escape and abandonment procedures, and to
- Consider whether the Directions require amendment to more clearly specify requirements for escape and abandonment.

Actions Taken

- In consultation with the relevant State/NT authorities all offshore operators re-examined the adequacy, location and protection of evacuation routes on offshore petroleum production facilities.
- This wide-ranging examination included the following activities, many of which are ongoing:
  - the testing of a number of alternative muster points and escape routes - evaluation of the results of these trials will contribute to the optimum combination of muster points and escape routes. Modifications to escape routes were made to three WA offshore installations giving access from two directions.

- assessment of the adequacy of protection for the escape routes which has in some cases (eg Bass Strait) resulted in additional fire wall protection along the routes or alternative routes which use existing fire walls. In Bass Strait, in response to both the Petrie report and the recommendations arising out of the report on the fire on the Tuna platform, the operator has sealed doors and gaps in fire walls to retain their integrity. Additional escape routes, incorporating additional doors and stairways, for access to escape capsules have been installed on three Bass Strait platforms (Marlin, Cobia and Fortescue). For the Challis development a deluge system manually operated from within the living quarters has been added for cooling the front wall of the quarters and the escape accessway, a radiation shield to the main lifeboat has been installed, and improved fire rating protection installed for the accommodation quarters and central control rooms.

- a review of the marking of escape routes throughout the platforms - Woodside have provided clear marking of escape routes through North Rankin A platform and further enhancements are planned.

. Modifications to evacuation procedures have been implemented in a number of cases to improve safety of personnel.

. One operator (Woodside) is further evaluating the effect of smoke in enclosed areas on evacuation ability and has been examining and implementing appropriate changes such as the provision of closed-in access to muster points on North Rankin. An internal escapeway from the accommodation area was installed on North Rankin A in the final quarter of 1990.

- in the light of the Piper Alpha experience, COSOP considers that other operators should consider the need for similar reviews. Note that Esso conducted a comprehensive review of fire and smoke hazards, and several facilities' improvements address this issue - firewall / door sealing, deluge system and fire pump upgrades, ESD upgrades. Esso is also installing smokehoods in platform living quarters for those who are required to remain in the quarters to respond to an emergency.

. A draft guidelines document has been prepared on the integrity of escape routes on platforms, which COSOP recommends be included in the Directions for the benefit of operators designing new facilities.

(v) INTEGRITY OF EMERGENCY SYSTEMS

Background

Evidence indicated that the initial explosion was sufficiently powerful to cause substantial damage to the main control room, electrical power generators, power distribution systems, and the uninterruptable power supply (UPS) systems such that all essential and emergency services were disabled almost immediately. As a result, communications and alarm systems failed to function.

Current arrangements

Apart from the general requirement for the certification of the platform design (Direction 308) and details of the communication system (Direction 323), there is no specific reference to the need to locate emergency services in places which increase the chance of surviving accidents. Facilities have back-up communications and power supply systems to ensure retention of communications and the avoidance of shut-downs triggered by inadvertent power loss.

Initial Actions Identified

COSOP agreed that there was a need to assess the ability of emergency control systems to survive accidents, including consideration of their physical protection against damage and the use of separately located back-up systems.

Actions Taken

Reviews of the emergency control systems have been made by operators. All critical emergency systems on offshore facilities in Australia are based on fail-safe design principles (loss of signal or power results in the safety devices returning to the safe position). The ability to survive accidents is based primarily on early detection of problems through a range of detectors or initiators. The fail-safe systems do not rely on any other external power supply to reach the safe state.

. Loss of control or confinement of hydrocarbons is monitored at a number of levels depending on the complexity of the facility - normal control system, shut-down system, gas detection, fire detection, and automatic initiation of deluge systems.

. As a result of an earlier incident, some modifications were made on the North Rankin-A platform to upgrade the reliability of the Fire and Gas System by installing a duplicate Operator Control Panel. Two further areas were identified as needing improvement, i.e. increased access to communication system and increased fire pump survivability. This work was completed in 1989, and further system enhancements are planned to the North Rankin A public address system

(1) elimination of 'feedback' when using hand-held radio for public communication

(2) provision of additional fixed PA transmit facilities at the southerly and northerly ends of the platform

In relation to fire pump serviceability, improvements to the fire pump enclosure will be implemented with North Rankin A blast wall upgrading project..

. All Western Australian offshore operators have carried out safety audits with particular emphasis being given to the fail safe system

- these have been reviewed by the WA Department of Mines, and a number of modifications have been implemented, including the relocation of ESD valves on the North Rankin A and Harriet A platforms.

. A comprehensive review of the control logic associated with ESD systems in Bass Strait was undertaken by Esso. This review involved the development of a preferred "model" for ESD logic to assess existing systems on all platforms. Esso made the document, outlining the specifications for platform safety and shutdown systems adopted as a result of the review, available to members of the Committee

- the system is specific to Bass Strait and may therefore not suit all operators.

. BHP Petroleum is addressing matters raised in an independent safety audit for Jabiru, and has incorporated areas addressed by Petrie, together with experience on Jabiru, in the Challis development

. A suggested guideline on emergency shutdown systems has been prepared by the Committee.

(vi) VENTING OF EXPLOSIONS

Background

- The Petrie Report suggested that the location of blast and fire walls on Piper Alpha may have contributed to the degree of damage from the initial explosion.

Current Arrangements

- Apart from general design approvals, the Directions do not specify any requirements in relation to blast and fire walls. This issue is addressed by the certifying authorities in assessing platform design. Australian production platforms typically employ open module designs which, by their design configuration, reduce the hazards of explosions.

Initial Actions Identified

COSOP agreed that there was a need to:

- Assess the adequacy of existing blast and fire walls, between and within modules, and to
- Consider whether the Directions/manuals needed amendment to clearly provide for the review of design requirements with regard to the venting of explosions.

Actions Taken

- Operators have undertaken reviews of blast and fire wall protection both for existing platforms and for future design specifications. The need for upgrading of existing fire walls was identified in some cases. Needs for upgrading have been identified by Woodside on North Rankin A platform. Engineering design work is in hand with final completion targetted for early 1993.
- The results of the reviews have been examined by the State/NT authorities. Consideration will be given to amendments to Directions

and the need for guidelines to establish minimum design standards, concepts, etc.

. Operators in Australia are moving towards separation of the living quarters from the hydrocarbon processing areas. One is utilising the "safe haven" concept in living quarters.

. Improvements to natural ventilation to minimise the potential for, and the impact of, explosions have been and are being carried out on a number of installations and these features are being incorporated in the design of new facilities

- a number of older platforms have been modernised, for example, by the removal of obsolete production equipment and the relocation of process equipment

. Woodside has identified some areas where there is a need for additional protection and Goodwyn A will incorporate new design features

- on North Rankin platform changes include the removal of temporary living quarters (which will be completed in 1991). Improvements to blast/fire walls and improvements to open venting are scheduled for 1992. Engineering design of these improvements is in hand.

(vii) PLATFORM EMERGENCY SHUT-DOWN SYSTEMS - PIPELINES

Background

. Petrie suggested that the closure of pipeline emergency shut-down (ESD) valves on Piper Alpha was designed to be initiated primarily by manual intervention or by loss of uninterruptable power supply (UPS). The emergency shut-down system did not provide for closure of the gas pipeline valves. The gas from the pipeline to the Tartan field contributed significantly to the intensity of the fire and damage.

Current Arrangements

. Direction 607 requires that all wells capable of producing petroleum by natural flow be equipped with an approved sub-surface safety device which closes off automatically the flow of petroleum or water from the well if the wellhead or production equipment is damaged in

such a way that would allow the escape of petroleum from the well. The Directions do not specify the need for ESD valves on pipelines, although most Australian platforms have them installed albeit on one of the platform decks.

Initial Action Identified

COSOP agreed that there was a need to:

- Assess the adequacy of pipeline ESD valves, including their operation and location, to minimise damage which could result in the release of hydrocarbons from the pipeline in the event of an explosion or fire on the platform, and to

- Consider the provision of passive protection for existing pipeline isolation valves and activation systems, including

  - an assessment of the desirability of installing subsea ESD valves

  - a re-assessment of inspection, test, service procedures for sub-surface valves

  - consideration of the adequacy of Directions with regard to pipeline isolation system requirements in emergency situations.

Actions Taken

- A number of reviews of the adequacy of ESD values were undertaken with a view to ensuring the protection of platforms from a release of the pipeline hydrocarbon inventories in the event of a platform-based incident. The general approach adopted by operators in Australia is to locate ESD valves below the lowest deck which supports process equipment and as close to the top of the vertical riser as possible. This is designed to locate the valves in a relatively protected but accessible position.

- Woodside installed a 40" ESD valve at the 16 metre level of the North Rankin A platform in May 1989 as an immediate step. This will not preclude any further decision about sub-sea ESD valves.

- Esso conducted a comprehensive review of pipeline isolation valves, in relation to valve hardware, physical protection and control logic.

A total of 30 isolation valves will be upgraded in this program, including the relocation of 8 isolation valves to the top of the vertical riser below cellar deck.

Specific reviews undertaken include:

- review of ESD valves in relation to present-day standards. Where necessary, valves are to be either relocated to optimum locations or passive protection systems added to protect the valve and its control system from hazards and to ensure relatively reliable operation in an emergency

- review of means of protecting the installations from pipeline/riser inventories with particular focus on the future connections of pipelines.

The adequacy of inspection procedures for ESD systems as part of the routine inspection program was considered by most operators and administrative authorities to be adequate.

The Committee has proposed that the UK Offshore Installations (Emergency Pipe-line Valve) Regulations 1989 be adopted in Australia, with some minor amendments (see Appendix D). These Regulations require emergency shut-down valves on pipeline risers serving offshore installations.

It has been proposed that the Directions should address the requirement to provide adequate isolation of pipelines from platforms so that the hydrocarbon inventory of a pipeline does not constitute an unacceptable risk to a platform. The means of isolation to achieve this objective will vary and will therefore be installation specific, and the Committee considers that this particular requirement should be addressed in the operator's Safety Case.

APPENDIX D.

COSOP GUIDELINES

- WORK PERMIT SYSTEMS
- EMERGENCY SHUTDOWN SYSTEMS
- ESCAPE ROUTES
- FIRE PROTECTION SYSTEMS
- EMERGENCY SAFETY TRAINING
- SAFETY CASE
- UK REGULATIONS - OFFSHORE INSTALLATIONS (EMERGENCY PIPE-LINE VALVE) REGULATIONS, INCLUDING COSOP'S AGREED MODIFICATIONS

WORK PERMIT SYSTEM GUIDELINE

A. Philosophy for Operating Arrangements

Safety Manuals set out procedures to be followed in approving permits to carry out maintenance work on offshore petroleum facilities. It is recommended that manuals be developed and agreed between State/NT Departments, companies and employee representatives. Clause 201(1) of the Directions (Specific Requirements as to Offshore Petroleum Exploration and Production) provides that operations shall not be carried out unless they are in accordance with an approved safety manual.

2. The Safety Manual will specify key elements of the work-permit procedures.

3. The operator's work permit system must form a part of its safety management system (SMS).

4. The purpose of this Guideline is to outline the requirements of a work permit system that controls all work activities which may present a particular hazard. The aim of the system will be to ensure the following:

(a) personal safety of those carrying out the work,

(b) the safety of other persons is not endangered by the work being carried out; and

(c) the overall safety and integrity of the offshore petroleum facility.

5. An essential element of the work permit system is a requirement that an appropriate person should co-ordinate and control the issuing and return of work permits. That person should be in a position to take an overview of all operations underway and planned for the offshore petroleum facility. This requirement is essential so that potential hazards are not compounded.

6. It will be the responsibility of the person in command of the platform to ensure this co-ordination and control either by being the person undertaking this function or by appointing an appropriate person to carry out the function. When hot work is being undertaken a 'Responsible Officer' as provided by AS 1674-1980 should supervise the work site.

B. Application of Principles and Procedures

7. All permit to work systems must incorporate a mechanical isolation procedure which involves the physical locking off and tagging of isolation valves.

8. The isolation, both mechanical and electrical, must remain in force until the work is sufficiently complete for the permit to be signed off and the equipment returned to operation.

9. The administrative responsibilities for operating the work permit system will be :

(a) The person in command, who must provide written guidance specifying work permit procedures and must ensure that:-

(i) work permit procedures are established and maintained;

(The detailed work permit procedures are to be incorporated into
a) the safety manual and
b) relevant operating manuals.)

(ii) delegation of responsibility be established to a specified individual(s) to ensure control and coordination of work permit procedures;

(The safety and operating manuals should clearly specify the responsibilities of individuals. The control positions should also be nominated on the actual work permit.)

(iii) work permit procedures are explained to all personnel;

(This explanation would be by reference to material contained in some or all of the following -
a) induction training programme
b) on-board training programme
c) safety manuals
d) pre-shift meetings
e) operating procedures
f) specific training programmes
g) other safety meetings.)

(iv) appropriate training in work permit procedures is given to all personnel;

(Appropriate training would normally take place during some or all of the following -
a) induction training programme
b) training in operating procedures
c) specific training programmes on procedures
d) on the job training.)

(v) day to day operation of the work permit procedures on the installation/FPF is monitored regularly by both the person in command of the platform and a person familiar with the work permit system who is not based on the platform to ensure that the procedures are being correctly carried out;

(Monitoring by the person in command of the platform would normally be confirmed by his signature on the permits. Monitoring by off platform personnel would normally generate a written report which would be available to an Inspector.)

(vi) work permit procedures are reviewed regularly to assess their effectiveness, and amended and updated as necessary; (This review should be conducted in conjunction with the relevant Government authority.)

and

(vii) records of all work permits issued, suspended and executed are retained in a location and for a period as agreed with the Designated Authority. Copies of all issued permits to work must be displayed at a convenient location and in a systematic arrangement such that process operating staff can readily check which equipment is under maintenance and not available for operation.

(b) The person in command of the platform, who must ensure that:-

(i) all work requiring permits is identified;

(ii) all work permits are approved in accordance with the installation owners guidelines;

(iii) work permits for work activities that may interact are cross referenced effectively;

(iv) all other work, which if undertaken concurrently would adversely affect safety, is suspended;

(v) limitations on the timing and scope of the work are defined;

(vi) all personnel engaged in the preparation of work permits for, supervision of, and performance of the work are identified and authorised. The names of all personnel involved should be recorded on the permits; and

(vii) in cases where procedures allow a permit to extend beyond a shift, the effectiveness of the operation of work permit procedures is not impaired by shift handovers. In such cases the person in command should also ensure that information is communicated to the incoming shifts in a timely manner about work for which

there is a work permit and which has not been completed before the shift ends. To this end log books should be used to ensure a clear and certain handover.

(c) The duty production operator who must ensure that:-

(i) the work site has been examined, and all precautions, including isolation, which should be taken before the work can commence have been actioned and will remain effective during the period that the work permit remains in force. Isolation should include the use of tagging and lock outs as appropriate. A record book should be maintained in the case where isolation takes place longer than to the end of any one shift;

(ii) the work permit specifies if necessary how the work should be suspended and resumed;

(iii) the work site is examined at the time of suspension of the work and prior to its resumption and finally when the work is completed to ascertain that the work site is in a safe condition; and

(iv) the operator or his named representative is notified of the suspension or completion of the work and any other fact relevant to safety.

(d) The supervisor and those performing the work, who must:-

(i) start or recommence work only when given a work permit to do so;

(ii) satisfy themselves that they fully understand the instructions they have been given and that all equipment needed to carry out the work safely and in accordance with the work permit are available;

(iii) comply rigidly with the instructions given; and

(iv) notify the person in command of the platform, or his named representative, immediately on suspension or completion of the work and of any fact relevant to safety.

GUIDELINES FOR EMERGENCY SHUTDOWN SYSTEMS

These guidelines describe the general requirements for design, installation and testing of Emergency Shutdown (ESD) and related safety systems on manned offshore oil and gas facilities. They are intended to provide the essential elements of good industry practice. These guidelines therefore complement other applicable local or international standards and do not replace them.

These guidelines do not address the normal process control system whose function is to maintain the process within the normal bounds of the process. Also, the requirement for these measures on unmanned installations should be determined by qualitative or quantitative risk assessment.

1. General

The ESD System is intended to react to abnormal conditions that could endanger the safety of personnel, the integrity of the installation, and the environment.

The ESD System should typically contain one or more of a number of safety layers that contain and control an emergency condition. Typical of these safety layers are:

- Fire and Gas Detection System, and its related Firewater Protection System, and
- Process shutdown (ESD) system.

These systems perform different functions within the facility, but are inter-related as described below.

2. Fire and Gas Detection System

The Fire Detection System comprises thermal detectors, for example, heat and or smoke detectors, located in the machinery, process, utilities, and personnel accommodation areas. The fire detectors are connected to a system which initiates audible and visible alarms together with the appropriate level of emergency action. The fire detection system should also have call points for manual initiation of the fire system.

The Gas Detection System comprises gas detectors located in the machinery, process, utilities, and air inlets to the personnel accommodation areas which, upon detection of flammable and or toxic products at predetermined limits, initiates audible and visible alarms together with the appropriate level of emergency action.

3. Emergency Shutdown (ESD) System

An ESD system is an arrangement of automatic monitoring and manual initiating devices and systems, the basic function of which is to:

- Provide protection for personnel, equipment, and the environment by the safe shutdown of critical equipment,
- React to an abnormal condition to avoid it developing further,
- Minimise the uncontrolled release of flammable and or toxic products
- Remove potential sources of ignition for escaping flammable products, and,
- Prevent escalation of a single incident.

In order to achieve the function described above, the ESD system should

- Initiate alarms when predefined conditions are exceeded or abnormal equipment conditions exist, and,
- Initiate shutdown actions of equipment, subsystems or process trains to stop production and prevent or minimise the effects of undesirable operating conditions.

In addition to ESD, emergency depressurising (EDP) may be necessary. This applies in particular to manned operations, where gas pressures are high and the equipment contains appreciable quantities of LPG components. Depressurising of the various equipment and units may be simultaneous or staged, depending on the flare systems capacity and time involved. The EDP system is to be kept separate from the normal process control system.

4. Fire Protection System

Refer to the guidelines entitled "Guidelines for Offshore Fire Protection Systems".

5. Testing and Maintenance

The continued presence of hydrocarbons and or toxic products on oil and gas facilities requires that a degree of reliability is maintained for all safety systems. Guidelines are as follows:

- The ESD System, as described in 3 above, should be designed to be fail-safe, that is, loss of signal or power results in the safety device(s) assuming the designed safe position.
- A test program for safety systems should be developed and followed throughout the operating life of the facility. Testing should be sufficiently frequent to verify that the system is functioning as designed. Therefore, the safety system should be designed to accommodate testing.
- Equipment should be designed and maintained to ensure reliability.

6. Training

Personnel on board the installation should be adequately trained in the operation of the emergency shutdown and related safety systems, in accordance with the COSOP Guidelines on Emergency Safety Training on Offshore Installations.

GUIDELINES FOR THE ADEQUACY OF ESCAPE ROUTES

A principal requirement of safety on offshore petroleum installations shall be the adequacy of evacuation routes from accomodation and muster stations to survival craft.

2. The following basic principles which are based upon the draft Norwegian Det Norske Veritas (DnV) recommended practice (RP C 103) should be considered in the design and operation of escape routes:

(a) Escape routes are to be provided to facilitate personnel evacuation in emergency situations. Escape routes should be as direct and straight as possible and lead to abandonment (muster) stations, sheltered areas, areas at sea level or on an adjacent installation or other safe areas.

(b) At least two escape routes from any work station should be provided (Clause 312 of the Directions - i.e. Specific Requirements as to Offshore Petroleum Exploration and Production).

(c) Every escape route and abandonment station should be well marked, readily accessible and unobstructed. All escape routes should be provided with adequate and reliable emergency lighting and with photoluminescent direction signs.

(d) There should be adequate space for assembling personnel around lifeboat stations before embarkation. As a guide, a minimum 0.5 square metres per person (or an area as otherwise agreed with the Designated Authority) should be provided.

(e) Escape routes should normally be part of the daily used passageways.

(f) The escape routes should allow easy transit of a stretcher carrying an adult person. All means of egress, including ladders, should be constructed to allow a person wearing self-contained breathing apparatus, to pass through without hindrance.

(g) Escape routes should be provided with non-slip surfaces. Where mud, oil spoilage etc. might occur, self-drained grating should be provided.

(h) All escape doors should be constructed so that they can be easily opened from both sides by one person. The doors should normally open outwards in the direction of the escape, and be provided with panic bars. A key-lock system should not be used. However, in the case of a floating production facility, the use of panic bars on water-tight seal doors would not be appropriate.

(i) Escape routes and abandonment procedures should be clearly detailed in a public display area aboard the installation and in each sleeping room.

(j) Each person should be trained and retrained in escape drill exercises as detailed in Clause 208 in the Directions on a random basis. The interval between training should preferably be seven days but should not exceed 14 days. The training should include contingency plans for various escape scenarios. This training should ensure an automatic response to an emergency situation.

GUIDELINES FOR FIRE PROTECTION SYSTEMS

These guidelines describe the general requirements for the design, installation, and testing of Fire Protection Systems on offshore oil and gas production facilities. They are intended to provide the essential elements of good industry practice. These guidelines complement other applicable local or international standards and do not replace them.

1. General

The best protection against the occurrence of fire will be realised through the provision of well designed, and maintained facilities, and regular surveillance by operating personnel.

A fire protection system should be provided on each manned facility. The requirement for fire protection systems on normally unmanned facilities should be determined by qualitative or quantitative risk assessment.

2. Fire Protection Systems

The fire protection system comprises an integrated arrangement of passive and active elements which are designed to achieve the following objectives:

- Initiate alarms and emergency shutdown (Refer to COSOP guidelines on Emergency Shutdown Systems).
- Minimise fuel source inventory.
- Contain the fire and prevent escalation.
- Protect critical facilities and enable safe evacuation of personnel from the facilities.
- Reduce the emission and the effects of smoke and toxic gases.
- Extinguish the fire.

3. Passive and Active Fire Protection Systems

Passive fire protection includes items such as firewalls, blast protection, equipment layout and design (especially with respect to locating hazardous equipment remote from quarters and emergency assembly areas), material selection, escape routes, bunding and drainage.

Active fire protection includes detection systems, emergency shutdown (ESD) systems, and fire protection systems such as deluge systems, fixed flooding systems, sprinkler systems, hydrants, hose reels and hand held extinguishers.

4. Fire Risk Assessment

Passive and active fire protection systems should be assessed on a scenario based fire risk analysis. The risk analysis should include the assessment of the ability of the fire water deluge system, (including the fire water pumps) to survive accidental events. This analysis should consider the function, configuration, capacity, redundancy, availability and protection of the fire protection system.

The methodology to be used in the fire risk analysis and the acceptance criteria shall be agreed by consultation between the regulatory authority and the operator. The methodology may be qualitative or quantitative or a combination of both.

5. Testing and Maintenance

It is essential that the fire protection system be maintained to ensure reliability. Guidelines to maintain reliability are as follows:

- Materials and equipment should be selected to minimise maintenance requirements.
- The system should be designed to facilitate maintenance should it be required.
- A test program for protection systems should be developed and followed throughout the operating life of the facility. Testing should be sufficiently frequent to maintain reliability. Therefore the system should be designed to accommodate testing.

6. Training

Personnel on board the installation should be adequately trained in the operation of the emergency shutdown and related safety systems, in accordance with the COSOP Guidelines on Emergency Safety Training on Offshore Installations.

GUIDELINES FOR EMERGENCY SAFETY TRAINING ON OFFSHORE INSTALLATIONS

These Guidelines concerning emergency safety training on installations aim to provide operators with a flexible framework within which their individual training needs can be assessed, developed and implemented. They are based on existing practices carried out by Australian operators and on a publication by the UK Offshore Operators Association Limited titled "Guidelines for Offshore Emergency Safety Training on Installations".

The overall responsibility to develop and implement training is the operator's, however, planning should be done in consultation with employees. All employees have the responsibility to co-operate and participate in training programs to their best ability.

The aims of safety training programs are to ensure the safety of persons, the integrity of the installation and protection of the environment. Personnel must be made aware of the inherent hazards of their work and environment against which precautions must be taken and knowledge obtained as to how to take those precautions. They must also receive training and information on the procedures of work and equipment provided to allow the proper discharge of their duties.

These Guidelines are designed to provide guidance on one aspect only, albeit an extremely important one, of overall safety training; emergency safety training. The isolated nature of an offshore installation in a hazardous environment gives emphasis to survival and safety needs to a degree in excess of that applying onshore. A minimum requirement for those working offshore is to receive awareness training so that they are able to understand these increased risks and have the skills required to do so.

An emergency training program should take into account the varying levels of responsibility of the trainees. The effectiveness of the training provided and its retention by trainees should be validated and recorded on a Training Register. Accordingly, an emergency safety training programme should aim to:

a) provide for effective responses by personnel in the event of an emergency (it is recommended that this would ideally include training in techniques to overcome the panic mode);

b) instil confidence in the equipment supplied and the procedures laid down, and in the trainee's own abilities to react to emergency situations effectively;

c) ensure that these skills and knowledge, once attained, are maintained at an effective level;

e) insofar as they apply to emergency situations, take account of new techniques and equipment.

Thus, in details, the training program may vary between operating companies and even installations, however, the aims are common It would be desirable that a standard approach be adopted across industry to ensure some level of consistency between platforms and operators.

It is essential that skills acquired through the training recommended in these Guidelines are maintained. Therefore allowance should be made for the retraining of those already in the industry as well as for training new employees.

The maintenance and retention of such skills can be assured by:

1. Continuous regular performance of the task trained for; or
2. Frequent regular experience and practice of the skills involved; or
3. Formal refresher training.

In assessing the retraining required, the following criteria should be addressed and considered for each case, since needs will vary between individual categories:

- Has the subject matter changed?
- Is the person regularly involved in performing the task?
- Is the task part of his/her professional knowledge?
- Level of in-house training provided by the company.

Where formal refresher training is appropriate, the interval between initial and refresher courses should in no circumstances exceed four years and a two year period is considered to be the optimum.

In order to set out recommended training, offshore personnel has been categorised as follows:

- Casual Visitors (Eg Government Inspectors, Press, VIP's and others).
- Contractors/Vendor Personnel who work offshore occasionally.
- Company Personnel who work occasionally offshore.
- Non Supervisory Contractor Personnel who work offshore regularly.
- Supervisory Contractor Personnel who work offshore regularly.
- Permanent Offshore Company Personnel.

The philosophy for offshore safety training is based upon the premise that supervisors (both from the company and designated contractor) are expected to give a lead when dealing with offshore safety and in response to an emergency.

1. **Schedule 1.**
Casual Visitors

Those visiting offshore installations on a casual basis should be briefed by installation staff when or before they board the installation so that they are able to conform to fire and other emergency procedures on the installation. Such visitors would normally be accompanied by a responsible person but should, in order to ensure their personal safety, be able to:

1.1 Be advised of the need to report hazards to a responsible person.

1.2 Recognise "No Smoking"/"Smoking" areas and escape routes.

1.3 Understand the need for protective clothing and life-jacket.

1.4 Recognise and take appropriate action on hearing emergency signals.

1.5 Respond to the system for accounting for the whereabouts of all personnel who are on the installation.

1.6 Know and recognise their station and duties in event of an emergency.

1.7 Recognise the organisational structure for the safety of personnel and the installation under the authority of the Person in Charge of the Platform /Offshore Installation (Clause 210 of the Directions to the P(SL)A).

2. **Schedule 2**

Contractors/Vendor Personnel who work offshore occasionally

In addition to the training described under Schedule 1, such personnel should have sufficient knowledge of the following to enable them to act in a safe and responsible manner, in an installation emergency. In accordance with Clause 205 of the Directions, the Safety and Emergency Response Manuals should be drawn to the attention of such personnel who should be able to:

2.1 Ensure their own personal safety and not imperil the safety of others.

2.2 React effectively as required by the company's emergency procedures within the context of its safety policy.

2.3 Apply simple fire prevention procedures based on a knowledge of:

a) How fires start (common causes of fire and explosions).

b) The nature of fire.

c) The explosive and flammable risks peculiar to offshore petroleum installations.

2.4 Ensure their personal protection against fire and other hazards.

2.5 Be able to identify and operate the fire fighting equipment in the areas in which they are working.

2.6 Be familiar with all life-saving appliances, and be able to follow escape routes to muster and escape craft stations.

2.7 If required wear breathing apparatus, and be suitably trained for its use.

2.8 Understand actions to be taken prior to, during, and after abandonment from an offshore installation, using totally enclosed life-saving systems and other life-saving appliances.

2.9 Understand basic helicopter discipline and escape procedure and use of helicopter survival equipment.

3. Schedule 3

Company Personnel who work offshore occasionally

In addition to the training described under Schedules 1 & 2, such personnel should be sufficiently familiar with company procedures to assist permanent installation staff if called upon to do so in an emergency.

4. Schedule 4

Non Supervisory/Contractor Personnel who work offshore regularly

In addition to the training described under Schedules 1-3, such personnel should be able to:

4.1 Recognise fire hazards.

4.2 Guide their own actions and co-operate with others by applying the theory and practice of fire prevention, control and extinction.

4.3 Be acquainted with the following in connection with helicopter operations:

a) Helicopter escape procedures.

b) Location and use of survival equipment on helicopters.

c) Use of personal survival equipment.

4.4 Be acquainted with the following sea survival techniques:

a) Methods of manning and launching of escape craft and life-rafts.

b) Procedures aboard such craft.

c) Survival and safety equipment provided on such craft.

5. Schedule 5

Supervisory Contractor Personnel who work offshore regularly

Personnel who regularly work offshore and who may be required to perform specialist duties in an emergency on operational structures should receive more substantial training than that covered above. Its purpose should be to ensure that such personnel make a contribution to the safety of the installation.

The main objective here is to instil a high level of confidence as a firm foundation for effective and determined action whatever the situation. In addition to the training described under Schedules 1 to 4, such personnel should also be trained to:

5.1 React positively to the company's fire and emergency procedures and understand their responsibilities.

5.2 Identify the fire extinguishers, and other forms of equipment and systems available on the structure, and be able to operate them competently as appropriate to various types of fire situations, Eg electrical, domestic, cascade, etc.

5.3 Operate water equipment including hoses, hydrants, branch pipes and monitors.

5.4 Assist in dealing with the various types of fire which might be experienced offshore:

a) Class A - Combustible Material (wood, furnishings etc)

b) Class B - Flammable Liquids (oil, methanol etc)

c) Class C - Flammable Gases

6. Schedule 6

Permanent Offshore Company/Contractor Personnel

In addition to the training described under Schedules 1 to 5 such personnel should be able to advise non permanent personnel during emergencies on practices and procedures.

TRAINING OF PERSONNEL WITH SPECIALIST DUTIES

In addition to the training described under Schedules 1 to 6 inclusive, there will be a need to provide persons occupying certain positions (extra) specialised training in helicopter landing, fire fighting, lifecraft coxswains (or equivalent) and first aid procedures.

7. Schedule 7

Helicopter Landing Officers

Helicopter Landing Officers (or equivalent) should be trained and competent to carry out all of the duties defined in Clause 215 of the Directions.

8. Schedule 8

Emergency Response Team (ERT)

Members of ERTs should be trained to:

8.1 Act as a co-ordinated ERT and be able to understand and respond to the directions of the ERT Leader/s.

8.2 Recognise the various types and makes of breathing apparatus available on the installation.

8.3 Wear breathing apparatus equipment with confidence and, to this end, operate all necessary controls and valves.

8.4 Play a part in search and rescue operations and, to this end, effect entries as required in difficult fire and smoke conditions.

8.5 Carry out first aid resuscitation procedures using appropriate equipment.

8.6 Respond/assist with the abandonment of the installation.

The skills described should be the subject of refresher training. The interval between initial and refresher courses should in no circumstances exceed four years and a two year period is considered to be the optimum.

9. Schedule 9

Emergency Response Team Leaders

Personnel appointed to lead an ERT should be able to carry out all duties defined under Schedule 8 and should also be able to:

9.1 Assess a fire situation and the best method of handling it.

9.2 Lead an ERT in action against all types of fires and emergencies and take charge at the scene of the fire/emergency.

9.3 Communicate effectively with those in overall control of the fire fighting operation.

The skills described in this Schedule should be the subject of refresher training. The interval between initial and refresher courses should in no circumstances exceed four years and a two year period is considered to be the optimum.

10. Schedule 10

Helideck Fire Crews

Helideck Fire Crews (or equivalent) should be able to:

10.1 Recognise the special hazards associated with helicopters and act accordingly in emergencies.

10.2 Recognise the most appropriate equipment for dealing with helicopter fires and be able to use it.

10.3 Apply fire fighting techniques appropriate to helicopter or helideck emergencies.

10.4 Effect rescue operations in helicopter emergencies.

The skills described in this Schedule should be the subject of refresher training. The interval between initial and refresher courses should in no circumstances exceed four years and a two year period is considered to be the optimum.

11. Schedule 11

Lifeboat Coxswains

Lifeboat Coxswains (or equivalent) should be able to:

11.1 Take charge of all aspects of launching, handling and recovering survival craft.

11.2 Take command of a survival craft at sea in all weather conditions.

11.3 Operate all equipment in the craft.

11.4 Take charge of all operations in connection with sea survival and the recovery of man overboard.

11.5 Assist in drills and exercises for the training of personnel on board the installation and take charge of an assigned lifeboat station under the overall charge of the Person in Command of the Platform/Offshore Installation.

The skills described in this Schedule should be the subject of refresher training. The interval between initial and refresher courses should in no circumstances exceed four years and a two year period is considered to be the optimum.

12. Schedule 12

First Aid Training

Requirements for first aid coverage should comply with Clause 232 of the Directions to the P(SL) Act. First aid training should be given to a certain minimum number of personnel on the installation, so as to provide assistance in the event of an emergency and to act as first aid personnel in survival craft. This minimum number should be at least equal to the number of survival craft required for evacuation during emergencies.

13. Schedule 13

Supervisory Persons

Supervisors, i.e. offshore managers and supervisors having executive responsibilities, and those designated to assume executive responsibilities for emergencies should:

13.1 Be able to assess and control developing situations with the objective of safeguarding personnel and equipment.

13.2 Be trained and given practice in decision making in emergency situations.

13.3 Be able to ensure the application of the installation's emergency procedures.

13.4 Have an in depth understanding of the installation's, and any others connected to it, emergency response systems.

The command ability of certain supervisory persons in emergencies is crucial to the safety of all personnel offshore. Such persons should receive appropriate and on-going training.

GUIDELINE FOR THE SAFETY CASE

Scope

This guideline specifies requirements for a Safety Case for fixed and floating offshore petroleum production platforms, satellite platforms and pipelines, and mobile drilling rigs, construction and production facilities.

Objectives of the Safety Case

The objectives of a Safety Case, as applied in the Australian offshore context, should be:

- to demonstrate that the operator (company) has identified the major hazards of the installation and risks to personnel, and has provided appropriate controls;

- to demonstrate that the safety management system (SMS) of the operator and that of the installation are adequate to ensure that the design, construction and operation of the installation and its associated services, are safe; and

- to demonstrate that adequate provisions for ensuring safe evacuation, escape and rescue have been made to cover the event of a major emergency and that an adequate Temporary Safe Refuge (TSR) has been provided to ensure the safety of personnel until they can be evacuated from the installation. The requirements for a TSR are set out in Attachment 1.

Safety Cases will need to be kept up to date so that they incorporate modifications to installations, changes to work practices and take technological advances into account.

The submission of a Safety Case does not in any way reduce the responsibility of the operator to ensure that, as far as reasonably practicable, precautions have been taken to protect people or the environment from major accident hazards.

The content of a *Safety* Case

There are three broad categories of information required in the Safety Case:

- information about the installation, its activities, operation and

interaction with its surroundings;

- the system by which safety is to be achieved and maintained in design, construction and operation of the installation, ie the Safety Management System (SMS); and

- reasoned arguments and judgements about the nature, likelihood and impact of potential major hazards which may occur at the installation and the means to prevent realisation of these hazards, or minimise their consequences should they occur. This latter category is the Formal Safety Assessment (FSA).

The Safety Case need not contain the detailed documentary evidence which supports the conclusions reached in the Safety Case, but it will contain sufficient information to allow the regulating authority to judge whether the conclusions are sound. It should contain precise references to the location of the supporting documentation for consultation if necessary.

Specific elements of a Safety Case

Information contained in the Safety Case would be expected to include (in a quantitative manner where possible) more detailed information in the following categories.

The information is grouped into the three broad headings referred to above.

A. General Information

1. Description of the installation and its operation.

2. Description of interaction between the installation and its surroundings.

3. Description of inter-relation between the installation and other facilities/installations and industries.

B. Safety Management System

This is the system by which safety is to be achieved and maintained in design, construction and operation of the installation. The Safety Management System should set out the safety objectives, the system by which these objectives are to be achieved, the performance standards which are to be met and the means by which adherence to these standards are to be monitored.

It would be expected to cover as a minimum:

1. Organisation reporting structures.

2. Management personnel standards.

3. Training for operations and emergencies (reference should be made to the Emergency Safety Training Guidelines).

4. Design procedures.

5. Construction procedures.

6. Procedures for operations, maintenance and modifications (ie in Safety and Operating Manuals).

7. Emergency procedures (ie Emergency Response Plan).

8. Management of safety by contractors in respect of their work.

9. The involvement of the workforce (operators' and contractors') in safety.

10. An accident reporting, investigation and follow-up system.

11. Provision of medical services.

12. Monitoring and auditing of the operation of the system.

13. Systematic re-appraisal of the system in the light of the experience of the operator and the industry.

14. Consideration of safety management systems of support groups including supply boats/standby vessels (including training of seamen in rescue operations), divers, and integration of those systems into the Safety Case.

The Safety Management System should draw on principles of Quality Management similar to those contained in approved Standards.

C. Formal Safety Assessment

A Formal Safety Assessment (FSA) is an essential element in a modern safety regime for major hazard installations. FSA is the identification and evaluation of hazards over the life of a project from the initial feasibility study through the concept design study and detail design, to construction and commissioning, then to operation, decommissioning and abandonment. It is a demonstration that so far as is reasonably practicable the risks to personnel have been minimised.

The potential hazards will vary from installation to installation, so that there can be no precise specification of what will be contained in the FSA.

The amount of evidence required on each aspect of the FSA will vary according to the importance of that aspect and, in particular, the

consequences of the particular hazard being considered. Quantitative analysis of such risks will permit a more objective presentation of the Safety Case. The operator should aim to provide a Safety Case which stands on its own as a demonstration that major hazards are controlled.

The Formal Safety Assessment will include:

1. A demonstration that, as far as is reasonably practical, the exposure to personnel on the installation to major hazards and their consequences has been minimised.

2. A demonstration that the acceptance standards have been met in respect of the integrity of the TSR, escape routes, embarkation points and lifeboats from design accidental events (refer to Attachment 2) and that all reasonably practicable steps have been taken to ensure the safety of persons in the TSR and using the escape routes and embarkation points.

3. A demonstration that within the TSR there are facilities as specified by the operator which are adequate for the purpose of control of an emergency, as required to facilitate safe evacuation and escape of personnel on board the installation.

4. A fire risk analysis, in accordance with the requirements of Attachment 3.

5. An evacuation, escape and rescue analysis in accordance with Attachment 4.

The preparation of a Safety Case

The Safety Case should be prepared by the operator. The operator may use external sources if necessary. Operators should introduce mechanisms which will ensure the participation of employees in the preparation of the Safety Case. In the absence of a workforce, consultation could occur between the operators and the relevant employee organisations where practicable.

Companies should not rely entirely on external resources to prepare the Safety Case, as many of the benefits which come with an operator's review of his own activities could be lost as a consequence.

The role of the regulatory regime in the Safety Case

The role of the regulatory authority in examining a Safety Case is to ensure that the operator is fulfilling its duties to identify and eliminate or control major hazards.

The Safety Case should therefore contain sufficient information about the major hazard potential of the operator's activities to enable the

regulatory authority to determine whether the significant risks have been identified and are being properly managed. The support for the arguments put forward in the Safety Case should be detailed enough to enable them to be challenged if it emerges that they are critical to the conclusions of the Safety Case.

The acceptance criteria should be set by the regulatory authority in consultation with the operator, following the "as low as reasonably practical" principle. The operator should define the conditions which constitute loss of integrity of the TSR, and the standards of protection for the TSR, and escape routes to the TSR, and from the TSR to the embarkation points. The operator should also specify the minimum complement of embarkation points and lifeboats.

In the event that a TSR is not provided, the operator should demonstrate that adequate alternate provision has been made for ensuring the safe evacuation, escape and rescue of personnel from the facility during the specified endurance period.

After examining the Safety Case, the authority will most likely discuss the identified hazards and risks associated with the project with the operator. This dialogue may be by correspondence or informally and may lead to a request for additional information to be provided by the operator.

Safety Cases should be updated as necessary, both in respect of plant modifications (when they occur) and periodically taking into account new technology. Examples would include plant modifications introducing a new hydrocarbon source to a platform, which could increase the size of a potential hazard, and a significant change in the management of the installation.

Operators should be required to review their Safety Cases at between three and five year intervals, taking into consideration changes in technology, developments in hazard assessment, and any series of accidents which may be connected with the operations of the installation that would materially effect the details of the previously submitted Safety Case. Operators should also review their Safety Case three months before planned major changes on operational activity. In addition to the five year maximum review period the authority should consult with the operators on a continuing basis.

The role of the workforce in the Safety Case

The operator should introduce mechanisms which will ensure that the preparation, implementation and monitoring of the Safety Case will be in consultation with representatives of its own and the contractors' workforce. In the absence of a workforce, then consultation could take place with representatives from relevant employee organizations.

Training for Operations and Emergencies

The Safety Case should provide a detailed outline of the operator's overall training program and strategy. The strategy should provide a general framework which thoroughly addresses the issues of both prevention and control. It should also incorporate details of contractors' training programs.

Topics/areas which should be addressed include:

1. Management safety policies
   - responsibility of parties
   - duty to comply

2. Safe work practices and procedures, including:

   (a) Permit to Work System (refer to guideline)
   (b) Skills training to carry out potentially hazardous tasks effectively, efficiently and safely

3. Awareness training:
   . recognition of hazards
   . preferred order of hazard control
   . precautions

4. Training for new equipment/technology/process

5. Emergency Safety Training (refer to guidelines)

6. Maintenance and retention of skills refresher training.

The Safety Case should also include details outlining time frames, evaluation procedures, details of verification systems for training, etc.

The overall responsibility to develop and implement training is the operator's. However, planning should be done in consultation with employees. All employees have the responsibility to cooperate and participate in training programs to their best ability.

ATTACHMENT 1

REQUIREMENTS FOR A TEMPORARY SAFE REFUGE (TSR)

The TSR would normally be the accommodation. However, there may be additional or more appropriate locations elsewhere on the installation. The location/s chosen must be demonstrated as providing a safe haven for personnel until they can safely evacuate and escape from the installation. Within the TSR there should be a Control Room with facilities as specified by the operator which are adequate for the purpose of monitoring and control of an emergency.

The Safety Case should specify the function of the TSR, the conditions which constitute its integrity, the conditions for integrity of its supporting structure and the events in which and the period for which it is to maintain its integrity.

It should be constructed so that external fire protection is provided both to prevent breach of the TSR and to maintain breathable air within it. In addition there should be an integrated set of active and passive measures provided to prevent the ingress of smoke and other contaminates into the accommodation and to maintain breathable air within it.

For the purpose of maintaining breathable air within the TSR, ventilation air intakes should be provided with smoke and gas detectors and in the event of a smoke or gas detection the ventilation and dampers should shut down.

In respect of escape routes to the TSR and from the TSR to the embarkation points, the Safety Case should specify the conditions which constitute their passability, the conditions for integrity of their supporting structure and the events in which and the periods for which they are to maintain their passability.

In the case of existing installations, any requirement for the upgrading of the TSR, escape routes and embarkation points should be determined on the basis of the Safety Case. Where the Control Room is not in the TSR, facilities to monitor and control an emergency should be installed in the TSR. Where the Radio Room is not in the TSR, facilities for external communications should be located in the TSR.

ATTACHMENT 2

DESIGN ACCIDENTAL EVENT

A design accidental event is any event which has been assessed by the operator as likely to occur over the life of the facility.

A design accidental event shall not cause the loss of any of the following within the endurance period specified:

- the integrity of the TSR
- the passability of at least one escape route from each location on the installation
- the integrity of a minimum complement of embarkation points and lifeboats specified for personnel in the TSR
- the passability of at least one escape route to each of these embarkation points

ATTACHMENT 3

FIRE RISK ANALYSIS

The regulations and guidance notes should promote an approach to fire and explosion protection which is integrated between

. active and passive fire protection

. different forms of passive fire protection, such as fire proofing and installation layout, and

. fire protection and explosion protection.

The need for, and location and resistance of, fire and blast walls is to be determined by safety assessment rather than by regulations.

Similarly the function, configuration, capacity, availability and protection of the fire water deluge system is to be determined by safety assessment.

A scenario based design method for fire protection is preferred.

The fire and explosion protection system should provide a high degree of ability of the water deluge system including the fire pump system, to survive severe accident conditions.

Reference should be made to the Guidelines for Fire Protection Systems prepared by COSOP.

ATTACHMENT 4

SPECIFICATIONS FOR EVACUATION, ESCAPE AND RESCUE ANALYSIS

The purpose of the analysis is to determine what facilities are required to ensure safe evacuation, escape and rescue of personnel on board the installation. Listing of these suggested alternatives does not imply that these facilities are required.

The analysis should specify the facilities and other arrangements which would be available for the evacuation, escape and rescue of personnel in the event of an emergency which makes it necessary for personnel to leave the installation. Reference should be made to the Guidelines for the Adequacy of Escape Routes prepared by COSOP.

The analysis should specify

- the formal command structure for the control of an emergency affecting the installation
- arrangements for the activation of emergency shutdown valves, and sub sea isolation valves, if fitted, including hazards from risers and pipelines.
- the likely availability and capacity of helicopters, whether in the field or otherwise, for the evacuation of personnel,
- the types, numbers, location and accessibility of totally enclosed motor propelled survival craft (TEMPSC) available for the evacuation of personnel from the TSR and other parts of the installation from which access to the TSR is not readily available
- the types numbers and locations of life rafts and other facilities provided as alternative means of escape to the sea
- the specification (including speed, sea capability and accommodation), locations and functions of the standby vessel and/or other vessels available for the rescue of personnel
- the types, numbers, locations and availability of fast rescue craft, whether stationed on the installation or on the standby or other vessels
- the types, numbers and locations of personal survival and escape equipment.

UK Offshore Installations (Emergency Pipe-line Valve) Regulations 1989

COSOP agreed that the UK Regulations be adopted, but with amendments to Regulation 8(1) such that :

- there is a requirement for a testing to include an inspection of the valve and of its mechanism for actuating it for the purpose of identifying any external leak, external damage or external corrosion every three months

- there is a requirement for a testing to include the partial closing of the valve, and its re-opening, by a person positioned by it, every six months

- there is a requirement for a full closing and opening of the valve by the activation of the associated installation's emergency shutdown system every twelve months.

1989 No. 1029

OFFSHORE INSTALLATIONS

The Offshore Installations (Emergency Pipe-line Valve) Regulations 1989

Made - - - -	*20th June 1989*
Laid before Parliament	*20th June 1989*
Coming into force	*12th July 1989*

ARRANGEMENT OF REGULATIONS

Whereas the Secretary of State has consulted pursuant to section 7(1) of the Mineral Workings (Offshore Installations) Act 1971(a) (hereinafter referred to as "the 1971 Act") and section 32(1) of the Petroleum and Submarine Pipe-lines Act 1975(b) (hereinafter referred to as "the 1975 Act") with organisations in the United Kingdom appearing to him to be representative of those persons who will be affected by the following Regulations:

Now, therefore, the Secretary of State in exercise of his powers under sections 6, 7 and 11 of, and paragraphs 1(1), 3 and 7 of the Schedule to, the 1971 Act and section 26 of the 1975 Act, and of all other powers enabling him in that behalf, hereby makes the following Regulations:–

(a) 1971 c.61; section 6 was amended by section 37 of, and Schedule 3 to, the Oil and Gas (Enterprise) Act 1982 (c.23).
(b) 1975 c.74; section 26 was amended by section 25(5) of the Oil and Gas (Enterprise) Act 1982 (c.23); section 33(1) was extended by section 25(1) of that Act.

Citation and commencement

1. These Regulations may be cited as the Offshore installations (Emergency Pipe-line Valve) Regulations 1989 and shall come into force on 12th July 1989.

Interpretation

2. In these Regulations–

"associated installation" means, in relation to a riser or valve, the offshore installation served by it;

"controlled waters" means controlled waters within the meaning of section 1(4) of the 1971 Act;

"emergency shut-down system" means the system comprising mechanical, electrical, electronic, pneumatic, hydraulic or other arrangements by which the plant and equipment on an offshore installation are automatically shut down in the event of an emergency;

"emergency shut-down valve" means a valve fitted for the purposes of regulation 5 below;

"fixed installation" means an offshore installation which is not a floating installation;

"floating installation" means an offshore installation which is supported by its buoyancy in the water;

"installation manager" means the manager of an associated installation;

"manager" includes, where no manager of an associated installation is appointed pursuant to section 4 of the 1971 Act, any person made responsible by the owner for safety, health and welfare on the installation;

"offshore installation" means any offshore installation for the purposes of the 1971 Act which is maintained in controlled waters for the carrying on of any activity to which the 1971 Act applies other than an offshore installation which is–

(a) entirely below sea-level at all states of the tide;

(b) used exclusively for flaring; or

(c) not normally manned and used exclusively for the loading of substances into vessels or for their reception and storage prior to such loading;

"owner", in relation to a pipe-line in respect of which no person has been designated as its owner in pursuance of section 33(3) of the 1975 Act, means the person in whom the pipe-line is vested;

"pipe-line" means a pipe or system of pipes which is connected by means of a riser to an offshore installation and which is used for the purpose of conveying any substance which is flammable or toxic not being a pipe-line with a nominal internal diameter of less than 40 millimetres;

"quick-disconnect fittings" means fittings on a riser serving a floating installation which are designed to allow the flexible part of the riser to be disconnected quickly from the installation;

"riser" means that section of a pipe-line which connects an offshore installation to a section of the pipe-line which lies in, or in close proximity to, the sea-bed and extends outwards from the installation.

Application

3. These Regulations shall apply–

(a) in respect of pipe-lines constructed in pursuance of a works authorisation granted for the purposes of section 20 of the 1975 Act after the coming into force of these Regulations, from the construction of the pipe-line; and

(b) in respect of other pipe-lines, on and after 31st December 1990.

Prohibition on use of pipe-lines

4. No pipe-line shall be used unless it complies with the provisions of regulations 5, 6 and 8 below.

Incorporation of emergency shut-down valves

5.—(1) There shall be incorporated in every riser, and thereafter maintained in good working condition, a valve which shall be capable of blocking the flow of substances within the pipe-line at the point at which it is incorporated.

(2) The valve shall be held open by an electrical, hydraulic or other signal to the mechanism for actuating the valve on the failure of which signal the valve shall automatically close.

(3) The valve shall also be capable of being closed–

(a) by a person positioned by it; and

(b) automatically by the operation of the associated installation's emergency shut-down system.

(4) If the pipe-line of which the riser forms part is designed to allow for the passage of equipment for testing, inspecting or maintaining the pipe-line, the valve shall also be designed to allow for such passage.

(5) The valve and its actuating mechanism shall so far as reasonably practicable be protected from damage arising from fire, explosion or impact.

Location of emergency shut-down valves

6.—(1) Every emergency shut-down valve shall be located in a position in which it can be safely and fully inspected, maintained and tested.

(2) In the case of a riser which serves a fixed installation, the emergency shut-down valve shall, so far as this is consistent with paragraph (1) above, be located–

(a) if part of the riser is located within a water-filled encasement, above the highest possible level of the water in the encasement;

(b) if part of the riser is located within an air-filled encasement, in that part; and

(c) in any other case, above the level on the riser of the highest wave crest which may reasonably be anticipated.

(3) In the case of a riser which serves a floating installation, the emergency shut-down valve shall, so far as this is consistent with paragraph (1) above, be located–

(a) if part of the riser is held under tension from the associated installation, as near as practicable to the flexible pipe which links that part with the part of the riser which is on the installation; and

(b) in any other case, above both the level on the riser of the highest wave crest which may reasonably be anticipated and any quick-disconnect fittings.

(4) Subject to paragraphs (1) to (3) above, every emergency shut-down valve shall be located so that the distance along the riser between the valve and the base of the riser is as short as reasonably practicable.

Operation and use of emergency shut-down valves

7.—(1) After an emergency shut-down valve has operated so as to block the flow of substances within the pipe-line–

(a) the installation manager shall ensure that the manager of every other offshore installation to which the pipe-line is connected and the person for the time being entitled to operate the pipe-line are notified; and

(b) the valve shall not be re-opened so as to permit the flow of such substances unless the reason for the operation of the valve has been established to the satisfaction of the installation manager and he has authorised the re-opening of the valve.

(2) Before giving his authority for the purpose of paragraph (1)(b) above, the installation manager shall ensure that the manager of every other offshore installation to which the pipe-line in question is connected and the person for the time being entitled to operate the pipe-line have been consulted.

(3) An emergency shut-down valve shall be used only to block the flow of substances through the pipe-line into which it is fitted and shall not be used to adjust that flow.

Inspection and testing

8.—(1) There shall be carried out in respect of every emergency shut-down valve–

(a) at intervals not exceeding 3 months, an inspection of the valve and of the mechanism for actuating it for the purpose of identifying any external leak, external damage or external corrosion;

(b) at intervals not exceeding 6 months, a testing which shall include the partial closing of the valve, and its re-opening, by a person positioned by it; and

(c) not less than 2 months or more than 4 months after every testing for the purposes of sub-paragraph (b) above, a testing which shall include the full closing and re-opening of the valve by the activation of the associated installation's emergency shut-down system.

(2) The period within which the first inspection and testing for the purposes of sub-paragraphs (a) and (b) of paragraph (1) above is to be carried out in respect of an emergency shut-down valve shall commence with the date on which these Regulations first apply to the pipe-line in question.

(3) A record of each inspection or testing carried out for the purposes of paragraph (1) above shall be made and this shall state in relation to the inspection or testing–

(a) the identity of the emergency shut-down valve and the pipe-line;

(b) the names of the owner of the pipe-line, the owner of the associated installation and the manager of that installation;

(c) the date on which it was carried out;

(d) the name, qualifications and employer (if any) of every person engaged in carrying it out;

(e) particulars of the procedures and any equipment used to carry it out; and

(f) any damage or defect revealed and the action taken or proposed to be taken to remedy it.

(4) Every record made in accordance with paragraph (3) above shall be preserved together with any document produced in the course of the inspection or testing in question and a copy of the record and documents shall be kept–

(a) for a period of 2 years from the inspection or testing, on the associated installation; and

(b) for a period of 5 years from the inspection or testing, at a principal place of business in the United Kingdom of the owner of the pipe-line in question.

(5) For the purposes of paragraph (4) above "document" has the same meaning as in Part I of the Civil Evidence Act 1968(a).

Duties of persons

9.—(1) It shall be the duty of the owner of an associated installation and the installation manager to afford, or cause to be afforded, to the owner of the pipe-line in question and the person for the time being entitled to operate it such facilities and assistance as they may reasonably require for the purpose of securing that regulations 4 to 6, 7(3) and 8 above are complied with.

(2) It shall be the duty of–

(a) the owner of the pipe-line to ensure that regulation 4 above is complied with;

(b) the owner of the pipe-line, the owner of the associated installation and the concession owner to ensure that regulations 5, 6 and 7(3) above are complied with;

(c) the installation manager to ensure that regulation 7(1) and (2) above is complied with; and

(d) the owner of the pipe-line, the owner of the associated installation, the concession owner and the installation manager to ensure that regulation 8 above is complied with.

(3) It shall be the duty of every person while on or near an associated installation–

(a) not to contravene the provisions of regulation 7(1)(b) above; and

(a) 1968 c.64.

(b) to co-operate with any other person on whom a duty is imposed by these Regulations so far as is necessary to enable that duty to be performed.

Amendment of the Submarine Pipe-lines Safety Regulations 1982

10. Regulation 6 of the Submarine Pipe-lines Safety Regulations 1982(a) shall be amended by the addition at the end of paragraph (2)(a) of the words–

"or, if different, any emergency shut-down valve incorporated in the pipe-line for the purposes of regulation 5 of the Offshore Installations (Emergency Pipe-line Valve) Regulations 1989.".

Civil liability

11. The provisions of section 11 of the 1971 Act (which makes provision for civil liability for breach of statutory duty) shall apply to the duties imposed on any person by these Regulations.

Offences

12.—(1) In the event of a contravention of regulation 9 above, the person contravening the regulation shall be guilty of an offence.

(2) In any proceedings for an offence under this regulation it shall be a defence for the person charged to prove:–

(a) that he exercised all due diligence to prevent the commission of the offence; and

(b) that the relevant contravention was committed without his consent, connivance or wilful default.

Cecil Parkinson
Secretary of State
for Energy

20th June 1989

(a) S.I. 1982/1513, to which there are amendments not relevant to these Regulations.

EXPLANATORY NOTE

(This note is not part of the Regulations)

These Regulations provide for the protection of offshore installations which are connected to a pipe-line conveying flammable or toxic substances from dangers arising from the pipe-line.

The Regulations come into force on 12th July 1989. They will apply to pipe-lines constructed under an authorisation granted after that date from the time of construction and to all other pipe-lines from 31st December 1990 (regulation 3).

The Regulations require an emergency shut-down valve to be incorporated in the risers which connect pipe-lines to offshore installations at a position on the risers prescribed by the Regulations (regulations 5 and 6). Provisions are made which regulate the re-opening of the valves and impose requirements concerning their periodic inspection and testing (regulations 7 and 8). A prohibition is imposed on the use of pipe-lines which do not comply with the Regulations (regulation 4).

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CULLEN RECOMMENDATIONS APPENDIX E

Note: Where action is marked "Endorsed by COSOP" the Committee has agreed that the recommendation should be implemented. Where action is marked "Supported by COSOP" the Committee has agreed in principle with the recommendation however, there may be impediments to its implementation.

RECOMMENDATION	ACTION
Safely Case	
1. The operator should be required by regulation to submit to the regulatory body a Safety Case in respect of each of its installations. The regulation should be analogous to Reg 7 of the CIMAH Regulations subject to recommendations 2-13 (paras 17.3343).	COSOP has prepared guidelines on the application of the Safety Case in accordance with the recommendations
2. The Safety Case should demonstrate that certain objectives have been met, including the following:-	The guidelines cover those aspects of recommendations 1- 12 specific to Australian offshore operations.
(i) that the safety management system of the company (SMS) and that of the installation are adequate to ensure that (a) the design and (b) the operation of the installation and its equipment are safe (paras 17.36 and 21.56-57); (ii) that the potential major hazards of the installation and the risks to personnel thereon have been identified and appropriate controls provided (para 17.37); and (iii) that adequate provision is made for ensuring, in the event of a major emergency affecting the installation (a) a Temporary Safe Refuge (TSR) for personnel on the installation and (b) their safe and full evacuation, escape and rescue (paras 17.37-38, 19.109, 19.157 and 20.8).	
3. The SMS should be in respect of (a) the design (both conceptual and detailed) of the operator's installations; and (b) the procedures (both operational and emergency) of those installations. In the case of existing installations the SMS in respect of design should be directed to its review and upgrading so far as that is reasonably practicable (para 21.56).	
The SMS should set out the safety objectives, the system by which these objectives are to be achieved, the performance standards which are to be met and the means by which adherence to these standards is to be monitored (para 21.56).	
It should draw on quality assurance principles similar to those stated in BS 5750 and ISO 9000 (para 21.58).	
4. In furtherance of the objectives set out in para 2 above, the operator should be required to set out the following in the Safety Case:-	
(i) A demonstration that so far as is reasonably practicable hazards arising from the inventory of hydrocarbons	

(a) on the installation, and
(b) in risers and pipelines connected to the installation both in themselves and as components of the total system of which they form part have been minimised (paras 19.17 and 19.20).

(ii) A demonstration that so far as is reasonably practicable the exposure of personnel on the platform to accidental events and their consequences has been minimised (para 17.37).

(iii) A demonstration by quantified risk assessment of major hazards that the acceptance standards have been met in respect of risk to the integrity of the TSR, escape routes, embarkation points and lifeboats from design accidental events and that all reasonably practicable steps have been taken to ensure the safety of persons in the TSR and using escape routes and embarkation points (paras 17.38 and 19.157).

(iv) A demonstration that within the TSR there are facilities as specified by the operator which are adequate for the purpose of control of an emergency (para 19. 182).

(v) A fire risk analysis, in accordance with recommendation 49 below (para 19.90).

(vi) An evacuation, escape and rescue analysis, in accordance with recommendations 73-75 below (para 20.9).

5. For the purposes of the demonstration referred to in para (iii) of recommendation 4, the accidental events are to be identified by the operator. A design accidental event is an event which will not cause the loss of any of the following:-

—the integrity of the TSR,
—the passability of at least one escape route from each location on the platform,
—the integrity of a minimum complement of embarkation points and lifeboats specified for personnel in the TSR, and
—the passability of at least one escape route to each of these embarkation points,

within the endurance period specified. Events more severe than this are referred to as residual accidental events (para 19.160).

The acceptance standards for risk and endurance time should be set before the submission of the Safety Case. Standards should be set by reference to the ALARP principle. For the time being it should be the regulatory body which sets these standards. The operator should define the conditions which constitute loss of integrity of, and the standards of protection for, the TSR and escape routes to the TSR and from the TSR to the embarkation points; and should specify the minimum complement of embarkation points and lifeboats for the TSR (paras 19.158-159).

6. The TSR should normally be the accommodation (paras 19.156 and 19.161).

In the case of existing installations any requirement for the upgrading of the accommodation, escape routes and embarkation points should be determined on the basis of the Safety Case (para 19.165).

7. In connection with the above the Safety Case should specify the following:-

In respect of the TSR-

— its function
—the conditions which constitute its integrity
—the conditions for integrity of its supporting structure
—the events in which and the period for which it is to maintain its integrity (paras 19.157-158).

In respect of escape routes to the TSR and from the TSR to the embarkation points-

—the conditions which constitute their passability
—the conditions for integrity of their supporting structure
—the events in which and the periods for which they are to maintain their passability (*provided* that for each location on the platform there should be a minimum of two escape routes to the TSR, at least one of which should remain passable for the period) (para 19.164).

In respect of embarkation points and lifeboats-

—the number and location
—the conditions for their integrity and that of their supporting structure
—the events in which and the periods for which they are to maintain their integrity —the minimum complement for the TSR (para 19.164).

8. No fixed installation should be established or maintained in controlled waters; and no mobile installation should be brought into those waters with a view to its being stationed there or maintained in those waters unless a Safety Case in respect of that installation has been submitted to and accepted by the regulatory body (para 17.41).

9. As regards existing installations the date for submission of the Safety Case should be laid down by regulation. There is an urgent need for the submission of Safety Cases, but the date should be selected by the regulatory body. The regulatory body should have the power, in the event of the failure of an operator to submit an acceptable Safety Case, to require the operator to take whatever remedial action it considered necessary, including requiring the installation to be shut down (paras 17.44-45).

10. A Safety Case should be updated:-

(i) After a period of years from its last assessment (not less than 3, not more than 5, years).

(ii) At the discretion of the regulatory body on the ground of a material change of circumstances, such as a change of operator, the occurrence of a major emergency (including one in which there is a precautionary evacuation), a major technological innovation or the discovery or better understanding of a major hazard.

However, provision should be made in order to avoid the need for more than one Safety Case to be updated by an operator at the same time; and to enable the regulatory body to postpone the automatic updating where it has recently required a discretionary updating (para 17.46).

11. As regards modifications to installations or their equipment or procedures, the operator should, before putting the modification into effect, ascertain what effect, if any, it has on the relevant components of the Safety Case. An operator should be required to report to the regulatory body all intended modifications which meet criteria set by the regulatory body, with a view to discussing with the regulatory body whether and to what extent a review of the Safety Case is required (para 17.47).

Covered under 601(2) of the Schedule of Specific Requirements as to Offshore Petroleum Exploration and Production - 1990 (the Directions) under the Petroleum (Submerged Lands) Act 1967.

12. For the time being the acceptance by the regulatory body of Safety Cases should not be regarded as justifying the revocation of regulations or the withdrawal of guidance notes (para 17.67).

Where an operator proposes to meet the objectives of a Safety Case by means which are not in accordance with regulations or guidance notes the justification for such a course should be set out in the Safety Case. For the assistance of operators the regulatory body should publish as soon as possible, and thereafter update in the light of experience, a list of the individual regulations relating to an installation and its equipment in respect of which it is prepared to grant exemption in the light of a satisfactory demonstration in a Safety Case; and to do likewise in regard to guidance notes (para 17.67).

In due course the existing regulations of a detailed prescriptive nature should be reviewed with a view to their revocation or replacement by regulations which set objectives. However, it is anticipated that there will continue to be even in the long term a case for some detailed prescriptive regulations (paras 17.63, 17.67 and 21.67).	
13. The regulatory body should discuss with the industry whether it is desirable and practicable that at the stage of the application for Annex B consent (or its equivalent) there should be a procedure for submission by operators of a preliminary assessment of matters relevant to a Safety Case and for the acceptance of this assessment being a prerequisite for the granting of Annex B consent (para 17.43).	A Development Plan Guideline is being developed by DPIE which may include such a requirement
Auditing of the operator's management of safety 14. The operator should be required to satisfy itself by means of regular audits that its SMS is being adhered to (para 21.60).	COSOP endorses this recommendation with audits subject to the satisfaction of the Designated Authority
15. The regulatory body should be required regularly to review the operator's audit on a selective basis; and itself to carry out such further audit as it thinks fit; and by regular inspection verify that the output of the SMS is satisfactory (para 21.60).	Endorsed by COSOP
Independent assessment and surveys of installations	
16. The regulatory body should consider (i) after the introduction of requirements for the demonstration of SMS and auditing of compliance with it; and (ii) after experience in the operation and effectiveness of such requirements whether and to what extent it will be appropriate to retain the present system of certification (para 2 1 .64) .	Endorsed by COSOP
Legislation- General	
17. (i) The principal regulations in regard to offshore safety should take the form of requiring that stated objectives are to be met (referred to as "goal-setting regulations") rather than prescribing that detailed measures are to be taken (para 21.67).	Endorsed by COSOP

(ii) In relation to goal-setting regulations, guidance notes should give non mandatory advice on one or more methods of achieving such objectives without prescribing any particular method as a minimum or as the measure to be taken in default of an acceptable alternative (para 21.67).

(iii)However, there will be a continuing need for some regulations which prescribe detailed measures (para 21.67).

18. The provisions of the Mineral Workings (Offshore Installations) Act 1971 and the Petroleum and Submarine Pipe-lines Act 1975 which have the same general purposes as those of Part 1 of the Health and Safety at Work etc Act 1974 (HSWA), and the regulations made under such provisions, should be made relevant statutory provisions for the purposes of the HSWA (para 21.68).

Not relevant to Australia.

19. The Construction and Survey Regulations, the Fire Fighting Equipment Regulations, the Life-Saving Appliances Regulations and the Emergency Procedures Regulations should be revoked and replaced by-

Not relevant to Australia.

(i) Construction Regulations, covering *inter alia* the structure and layout of the installation and its accommodation.

(ii) Plant and Equipment Regulations, covering *inter alia* plant and equipment on the installation and in particular those handling hydrocarbons.

(iii) Fire and Explosion Protection Regulations, covering *inter alia* both active and passive fire protection and explosion protection, and

(iv) Evacuation, Escape and Rescue Regulations, covering *inter alia* emergency procedures, life-saving appliances, evacuation, escape and rescue.

Each of the above sets of regulations should include goal-setting regulations as their main or primary provisions and should be supported by guidance notes giving advice which is non-mandatory in the sense set out in paragraph (ii) of recommendation 17 (para 21.69).

20. Operators should be encouraged to specify the standards which they will use to comply with goal-setting regulations. For a given installation compliance may be demonstrated by reference to such standards, the terms of guidance notes and what is shown by a safety assessment or a combination of one or more of such methods (paras 17.66 and 21.70).	Endorsed by COSOP with "encouraged" replaced by "required"
21. As regards existing guidance notes the regulatory body should consider whether and to what extent they should be treated without replacement or modification as giving non-mandatory advice in the sense set out in paragraph (ii) of recommendation 17; and should inform the industry accordingly (para 21.71).	Endorsed by COSOP
22. In connection with the preparation of guidance notes the regulatory body should review the procedures for consultation so as to ensure that the views of the representatives of employers and employees involved in work offshore are adequately taken into account (para 21.72).	Endorsed by COSOP
The regulatory body	
23. There should be a single regulatory body for offshore safety (para 21.62).	Endorsed in principle for each State
24. The single regulatory body should discharge the safety functions in relation to fire-fighting equipment and life-saving appliances. As regards standby vessels it should discharge all functions, whether directly or through the agency of the Department of Transport (DoT), save those which relate to the statutory responsibility of the DoT under the Merchant Shipping Acts (paras 21.65-66).	Endorsed in principle by COSOP
25. The functions of the Petroleum Engineering Division of the Department of Energy (DEn) which are concerned with the regulation of offshore safety should in future be discharged by a discrete division of the Health and Safety Executive (HSE) which is exclusively devoted to offshore safety (paras 22.34 and 22.37).	Not directly applicable
26. This division should employ a specialist inspectorate and have a clear identity and strong influence in the HSE. It should be headed by a chief executive who should be responsible directly to the Director General of the HSE and should be a member of its senior management board. His function would include the development of the offshore safety regime, and in particular the implementation of its provisions for Safety Cases and SMS (para 22.37).	Not applicable

Safety committees and safety representatives	
27. The regulatory body, operators and contractors should support and encourage the involvement of the offshore workforce in safety. In particular, first line supervisors should involve their workforce teams in everyday safety (para 18.48).	Endorsed by COSOP.
28. The operator's procedures included in line management of operations which are aimed at involving the workforce in safety should form part of its SMS (para 21.56).	Endorsed by COSOP.
29. The DEn's intention to review the Offshore Installations (Safety Representatives and Safety Committees) Regulations 1989 after 2 years' experience of their working is endorsed (para 21.85).	Not applicable to Australia.
30. Safety representatives should be protected against victimisation by a provision similar to Sec 58(i)(b) of the Employment Protection (Consolidation) Act 1978 (para 21 .86).	Should be examined in the context of Australia
31. The Offshore Installations (Safety Representatives and Safety Committees) Regulations 1989 should be modified to the effect that the training of safety representatives should be determined and paid for by the operator (para 21.87).	Not applicable to Australia.
Permits to work	
32. The operator's permit to work system should form part of its SMS (para 21.56).	Endorsed by COSOP.
33. Operators and the regulatory body should pay particular attention to the training and competence of contractors' supervisors who are required to operate the permit to work system (paras 18.17 and 18.29).	Endorsed by COSOP.
34. Standardisation of the permit to work system throughout the industry is neither necessary nor practicable. However, in view of the fact that there is much in common between the systems of different operators, the industry should seek to increase harmonisation, for example in the colours used for different types of permits to work and in the rules as to the period for which a permit to work remains valid (para 18.28).	Endorsed by COSOP.
35. While it is not inappropriate for contractors' supervisors to act as Performing Authorities, operators should be made responsible for ensuring that such supervisors are trained in the permit to work system for the installation where they are to act as Performing Authorities and that they carry documentary proof of having completed such training (para 18.29).	Endorsed by COSOP for inclusion in the guidelines on Work Permit Systems

36. All permit to work systems should incorporate a mechanical isolation procedure which involves the physical locking off and tagging of isolation valves (para 18.29).	Endorsed by COSOP for inclusion in the guidelines on Work Permit Systems
37. A permit to work and its consequent isolations, both mechanical and electrical, should remain in force until the work is sufficiently complete for the permit to be signed off and the equipment returned to operation (para 18.8).	Endorsed by COSOP for inclusion in the guidelines on Work Permit Systems
38. Copies of all issued permits to work should be displayed at a convenient location and in a systematic arrangement such that process operating staff can readily see and check which equipment is under maintenance and not available for operation (para 18.8).	Endorsed by COSOP for inclusion in the guidelines on Work Permit Systems
Incident reporting	
39. The regulatory body should be responsible for maintaining a database with regard to hydrocarbon leaks, spills and ignitions in the industry and for the benefit of the industry. The regulatory body should:-	State/NT Designated Authorities maintain such records for their jurisdictions
(i) discuss and agree with the industry the method of collection and use of the data,	
(ii) regularly assess the data to determine the existence of any trends and report them to the industry, and	
(iii) provide operators with a means of obtaining access to the data, particularly for the purpose of carrying out quantified risk assessment (para 18.43).	
Control of the process	
40. Key process variables, as determined by the Safety Case, should be monitored and controllable from the Control Room (para 18.36).	Endorsed by COSOP
41. The Control Room should at all times be in the charge of a person trained and qualified to undertake the work of Control Room operator. The Control Room should be manned at all times (para 18.35).	Endorsed by COSOP
42. The training of Control Room operators should include instruction in an onshore course in the handling of emergencies (para 18.35).	Refer to Emergency Training Guideline

Hydrocarbon inventory, risers and pipelines

43. The Emergency Pipe-line Valve Regulations should continue in force until they are subsumed in the Plant and Equipment Regulations. The provision in these regulations for there to be on each riser a valve with full emergency shutdown capability and located as close to sea level as practicable is endorsed (paras 19.34-35).	1st sentence does not apply to Australia. Refer to COSOP guideline.
44. There should be no immediate requirement that a subsea isolation valve (SSIV) be fitted on a pipeline connected to an installation. The operator should demonstrate in the Safety Case that adequate provision has been made, including if necessary the use of SSIVs, against hazards from risers and pipelines (para 19.36).	Part of the Safety Case
45. Studies should be carried out with the following objectives:-	Endorsed by COSOP
(i) To explore the feasibility of dumping in an emergency large oil inventories, such as those in the separators, in a safe and environmentally acceptable manner, so as to minimise the inventory of fuel available to feed a fire (para 19.19).	
(ii) To minimise the pipeline connections to platforms (para 19.21).	
46. Studies should be carried out with the following objectives:-	Objective supported by COSOP
(i) To achieve effective passive fire protection of risers without aggravating corrosion (para 19.22).	
(ii) To improve the reliability and reduce the cost of SSIVs so that it is more often reasonably practicable to install them (para 19.37).	

Fire and gas detection and emergency shutdown

47. The arrangements for the activation of the emergency shutdown valves (ESVs), and of SSIVs if fitted, on pipelines should be a feature of the Safety Case (para 19.42).	Endorsed by COSOP
48. Studies should be done to determine the vulnerability of ESVs to severe accident conditions and to enhance their ability to survive such conditions (para 19.43).	Supported by COSOP

Fire and explosion protection

49. Operators should be required by regulation to submit a fire risk analysis to the regulatory body for its acceptance (para 19.90).	Endorsed by COSOP
50. The regulations and related guidance notes should promote an approach to fire and explosion protection:- (i) which is integrated as between - —active and passive fire protection —different forms of passive fire protection, such as fire insulation and platform layout, and —fire protection and explosion protection (paras 19.87-95); (ii) in which the need for, and the location and resistance of, fire and blast walls is determined by safety assessment rather than by regulations (para 19.96); (iii) in which the function, configuration, capacity, availability and protection of the fire water deluge system is determined by safety assessment rather than by regulations (paras 19.97 and 19.99); (iv) which facilitates the use of a scenario-based design method for fire protection as an alternative to the reference area method (paras 19.91 and 19.98); and (v) which provides to a high degree the ability of the fire water deluge system, including the fire pump system, to survive severe accident conditions (para 19.100).	COSOP's draft guidelines on automatic fire fighting systems refer
51. The ability of the fire water deluge system, including the fire pump system, to survive severe accident conditions should be a feature of the Safety Case (para 19.100).	Endorsed by COSOP
52. The regulatory body should work with the industry to obtain agreement on the interpretation for design purposes of its interim hydrocarbon fire test and other similar tests. If in the view of the regulatory body there exists a need for an improved test, such as a heat flux test, it should work with the industry in order to develop one (para 19.101).	COSOP awaits the results of further work in the UK in this area.
53. The DEn discussion document on Fire and Explosion Protection should be withdrawn (para 19 .102) .	Not applicable to Australia.

54. The regulatory body should ask operators which have not already done so to undertake forthwith a fire risk analysis, without waiting for legislation (para 19.103).	This action has already been undertaken.

Accommodation, TSR, escape routes and embarkation points

55. Provisions should continue to be made by regulations supported by guidance notes as to the construction of the accommodation; and as to escape routes and embarkation points (para 19.166).	COSOP's escape route guidelines refer
56. The regulations and the related guidance notes should promote an approach to protection of the accommodation:-	COSOP guidelines refer.
(i) in which external fire protection is provided both to prevent breach of the accommodation and to maintain breathable air within it (para 19.170); and	
(ii) in which an integrated set of active and passive measures is provided to prevent ingress of smoke and other contaminants into the accommodation and to maintain breathable air within it (paras 19 .170-171) .	
57. For the purpose of maintaining breathable air within the accommodation, it should be required by regulation that the ventilation air intakes should be provided with smoke and gas detectors and that on smoke or gas alarm the ventilation and dampers should shut down (para 19.172).	COSOP guidelines refer.
58. The regulations and related guidance notes on escape routes should recognise that it may not be practicable to protect escape routes against all physical conditions; and accordingly should be based on the objective that they should remain passable (para 19 .174) .	COSOP guidelines refer.
59. It should be required by regulation that escape routes are provided with adequate and reliable emergency lighting and with photoluminescent direction signs (para 19.175).	Endorsed by COSOP
60. The regulatory body should ask operators which have not already done so to carry out forthwith an assessment of the risk of ingress of smoke or gas into the accommodation; and to fit smoke and gas detectors and implement ventilation shutdown arrangements as in recommendation 57, without waiting for legislation (para 19.173).	Endorsed by COSOP

61. Studies should be carried out with the objective of assisting designers in predicting the breathability of air in a TSR where its external fire wall is subjected to a severe hydrocarbon fire (para 19.163). — Supported by COSOP

Emergency centres and systems

62. It should be required by regulation that there should be available within the TSR certain minimum specified facilities for the monitoring and control of an emergency under hostile outside conditions (paras 19.178 and 19.182). — Endorsed by COSOP

These facilities should be in the Control Room, which should be located in the TSR (para 19. 179).

On existing installations where the Control Room is not in the TSR, these facilities should be in an Emergency Control Centre located in the TSR. In such a case the Control Room should be protected against fire and explosion as determined by safety assessment (paras 19.180-181).

63. It should be required by regulation that a Radio Room with facilities for external communications should be located in the TSR (para 19.179). — Endorsed by COSOP

On existing installations where the Radio Room is not in the TSR, these facilities should be in an Emergency Radio Room located in the TSR (para 19.180).

64. The regulations and related guidance notes should promote an approach to emergency systems:- — Endorsed by COSOP

(i) which provides to a high degree the ability of these systems to survive severe accident conditions (paras 19.188-189); and

(ii) which applies to communications systems the fail-safe principle (para 19.193).

The emergency systems include the emergency power supplies and systems, the emergency shutdown system and the emergency communications systems. Severe accident conditions include fire, explosion and strong vibration (para 19.188).

65. The ability of emergency systems to survive severe accident conditions should be a feature of the Safety Case (para 19.189). — Endorsed by COSOP

66. The regulatory body should work with the industry to promote the use of status light systems (para 19.192). — Endorsed by COSOP

67. The regulatory body should work with the industry to achieve standardisation of status lights and of alarm systems for emergencies (para 19.194).	Endorsed by COSOP
68. Studies should be done to determine the vulnerability of emergency systems to severe accident conditions and to enhance their ability to survive such conditions (para 19.190).	Endorsed by COSOP
69. The regulatory body should ask operators which have not already done so to review forthwith the ability of emergency systems to withstand severe accident conditions (para 19.191)	Endorsed by COSOP
70. Where a regulation imposes a requirement for a major emergency or protective system, such as a fire deluge system, it should be required that the operator should set acceptance standards for its availability (para 19.199).	Endorsed by COSOP

Pipeline emergency procedures

71. Operators should be required by regulation regularly to review pipeline emergency procedures and manuals. The review should ensure that the information contained in manuals is correct, that the procedures contained are agreed with those who are responsible for executing them and are consistent with the procedures of installations connected by hydrocarbon pipelines (para 19.196).	Endorsed by COSOP
72. Operators should be required by regulation to institute and review regularly a procedure for shutting down production on an installation in the event of an emergency on another installation which is connected to the first by a hydrocarbon pipeline where the emergency is liable to be exacerbated by continuation of such production (para 19.197).	Endorsed by COSOP

Evacuation, escape and rescue - General

73. Operators should be required by regulation to submit to the regulatory body for its acceptance an evacuation, escape and rescue analysis in respect of each of its installations (para 20.9).	Endorsed by COSOP
74. The analysis should specify the facilities and other arrangements which would be available for the evacuation, escape and rescue of personnel in the event of an emergency which makes it necessary or advisable in the interests of safety for personnel to leave the installation (para 20.9).	Endorsed by COSOP
75. In particular the analysis should specify:-	Endorsed by COSOP

(i) The formal command structure for the control of an emergency affecting the installation;

(ii) The likely availability and capacity of helicopters, whether in-field or otherwise, for the evacuation of personnel;

(iii) The types, numbers, locations and accessibility of totally enclosed motor propelled survival craft (TEMPSC) available for the evacuation of personnel from (a) the TSR and (b) other parts of the installation from which access to the TSR is not readily available;

(iv) The types, numbers and locations of life rafts and other facilities provided as means of escape to the sea;

(v) The specification (including speed, sea capability and accommodation), location and functions of the standby vessel and other vessels available for the rescue of personnel;

(vi) The types, numbers, locations and availability of fast rescue craft, whether stationed on the installation or on the standby or other vessels; and

(vii) The types, numbers and locations of personal survival and escape equipment.

(All in para 20.9).

76. The regulatory body should ask operators which have not already done so to undertake an evacuation, escape and rescue analysis forthwith, without waiting for legislation. The timetable for completion of this analysis should be agreed between the regulatory body and the industry but should not exceed a total of 12 months, and that only for operators of a large number of installations (para 20.9).

Endorsed by COSOP

Helicopters

77. Operators should adopt a flight following system for determining at short notice the availability and capacity of helicopters in the event of an emergency. This system could be either a system operated by the individual operator or a North Sea-wide system (para 20.11).

Supported by COSOP. Operators should be encouraged to consider other mutual support systems.

TEMPSC

78. The requirement by regulation that each installation should be provided with TEMPSC having in the aggregate sufficient capacity to accommodate safely on board 150°./o of the number of persons on the installation should be maintained (para 20.16). Such provision should include TEMPSC which are readily accessible from the TSR and which have in the aggregate sufficient capacity to accommodate safely on board the number of persons on the installation (para 20.16).	Survival craft requirements for Australian conditions are covered under clause 319 of the Directions to the Petroleum (Submerged Lands) Act 1967. COSOP endorses the Safety Case approach, which requires operators to evaluate survival craft requirements as part of a formal evacuation, escape and rescue analysis.
79. On new installations where the provision of davit-launched TEMPSC is acceptable to the regulatory body they should be oriented so as to point away from the installation (para 20.24).	Endorsed by COSOP
80. The regulatory body should work with the industry to develop equipment and methods to enable TEMPSC to be launched clear of the installation including where, as on existing installations, they are oriented so as to point along the side of the installation (para 20.18).	Endorsed by COSOP
81. Reg 5 of the Life-Saving Appliances Regulations should be amended or replaced so as to enable free-fall TEMPSC to be installed on new and existing installations. It should remain for the operator to justify its choice of TEMPSC as being appropriate in the particular conditions of its installation (para 20.24).	First sentence not applicable to Australia. Second sentence endorsed by COSOP
Means of escape to the sea	
82. It should be required by regulation that each installation should be provided with life rafts having in the aggregate sufficient capacity to accommodate safely on board at least the number of persons on board the installation; along with suitable ropes to enable those persons to obtain access to the life rafts after they have been launched and deployed (para 20.26).	Endorsed by COSOP
83. A variety of means of descent to the sea should be provided on all installations. In accordance with recommendation 75 the types, numbers and locations of facilities for this purpose should be specified in the evacuation, escape and rescue analysis; but such facilities should include:- —fixed ladders or stairways —personal devices for controlled descent by rope (paras 20.28-29).	Endorsed by COSOP

84 The regulatory body should work with the industry to determine the practicability and safety of escape chutes and collapsible stairways (para 20.30).	Supported by COSOP
Personal survival and escape equipment	
85. Each individual on board an installation should be provided with:- (i) a personal survival (or immersion) suit; (ii) a life-jacket; (iii) a smoke hood of a simple filter type to exclude smoke and provide protection for at least 10 minutes during escape to or from the TSR; (iv) a torch; and (v) fireproof gloves. These articles should be kept in the accommodation (para 20.36). Other survival suits, life-jackets and smoke hoods for at least one half of the number of persons on the installation should be stored in containers placed at suitable locations on the installation (para 20.36).	Exclusions as per the Directions to the P(SL) Act
86. The use of small transmitters or detectors on life-jackets in order to assist in the finding of personnel in the dark should be considered. Luminescent strips should be of a colour other than orange (paras 20.33-34).	Endorsed by COSOP
87. Work should be carried out with the objective of combining the functions of a survival suit and a life-jacket in one garment (para 20.32).	Endorsed by COSOP where applicable
Standby vessels	
88. Changes in the regulations and the code for the assessment of standby vessels should be aimed at an improvement in the quality of standby vessels, introducing basic standards for existing vessels and higher specifications for new vessels (para 20.41).	Need and performance specifications for standby vessels should be evaluated as part of the Safety Case. International standards should be recognised where appropriate.
89. It should be required by regulations that each standby vessel should comply with the following standards:- (i) It should be highly manoeuvrable and able to maintain its position; (ii) It should provide full visibility of the water-line in all directions from the bridge;	See 88

(iii) It should have at least two 360° searchlights capable of being remotely controlled;

(iv) It should have two fast rescue craft. One of the 2 fast rescue craft should be able to travel at 25 knots in normal sea states. The smaller fast rescue craft (9 person capacity) should be crewed by 2 persons; the larger by 3 persons. Fast rescue craft should be equipped with adequate means of communicating with the standby vessel by VHF radio; and carry an adequate portable searchlight;

(v) It should have the means of rapid launching of its fast rescue craft;

(vi) It should have adequate means of communication by radio with its fast rescue craft, the installation, nearby vessels and the shore; and

(vii) It should have at least two methods of retrieving survivors from the sea.

(All in para 20.42).

90. Reg 10 of the Emergency Procedures Regulations should be revoked (para 20.39).	Not applicable in Australia
91. Sec 3 of the code for the assessment of standby vessels (areas of operation) should be withdrawn (para 20.39).	Not applicable in Australia
92. The owners of standby vessels should be required to notify the regulatory body weekly as to the locations and functions of their vessels in the ensuing week. A copy of such notification should also be given to the DoT (para 20.54).	Supported by COSOP if Safety Case establishes need.
93. As regards the appropriate numbers for the crew of standby vessels, the DoT should take into account the evidence given in the Inquiry when reviewing the code in this respect (para 20.50).	Supported by COSOP
94. The proposals in the amended code as to age limit, medical examination and certification of fitness of members of the crew of standby vessels; and as to their periods of duty are endorsed (paras 20.51-52).	Endorsed by COSOP
95. The regulatory body should work with the industry to obtain agreement as to adequate training packages for the crew of standby vessels. Such training should be administered, and records of training kept by the Offshore Petroleum Industry Training Board (OPITB) (para 20.55).	Supported by COSOP
96. The coxswain and crew of fast rescue craft should receive special training for their duties, along with regular refreshers (para 20.55).	Endorsed by COSOP

Command in emergencies

97. The operator's formal command organisation which is to function in the event of an emergency should form part of its SMS (para 20.59).	Endorsed by COSOP
98. The operator's criteria for selection of OIMs, and in particular their command ability, should form part of its SMS (para 20.59).	Endorsed by COSOP
99. There should be a system of emergency exercises which provides OIMs with practice in decision-making in emergency situations, including decisions on evacuation. All OIMs and their deputies should participate regularly in such exercises (para 20.61).	Endorsed by COSOP

Drills, exercises and precautionary musters and evacuations

100. The operator's system for emergency drills and exercises should form part of its SMS (paras 20.61 and 20.64).	Endorsed by COSOP
101. Offshore emergency drills and exercises should be carried out in accordance with the UKOOA guidelines for offshore emergency drills and exercises on installations (paras 20.61 and 20.64).	Endorsed by COSOP
102. All offshore staff should attend one muster per tour of duty (para 20.62).	Endorsed by COSOP
103. The circumstances of all precautionary musters and evacuations should be reported by operators to the regulatory body (para 20.62).	Endorsed by COSOP
104. Operators should maintain lists of personnel on board by alphabetical order and also by reference to the names of contractors whose personnel are represented on board. These lists should be updated for every movement of personnel and copied immediately to the shore (para 20.62).	Endorsed by COSOP

Training for emergencies

105. The UKOOA guidelines for offshore emergency safety training on installations should be a minimum requirement for survival, fire-fighting and other forms of training detailed therein for the relevant personnel employed offshore. Personnel who have not met the requirements of these guidelines should not be permitted to work offshore (para 20.64).	COSOP Emergency Safety Training Guidelines are based on these guidelines

In order to ensure that these guidelines are complied with operators should be required to devise and maintain a system for the purpose, pending the date when the central training register instituted by OPITB for recording the personal details and safety training courses attended by all personnel seeking employment offshore is fully operational (para 20.64).

106. The operator's system for emergency training and its enforcement should form part of its SMS (para 20.64).

Endorsed by COSOP

APPENDIX F

DISCUSSION PAPER

AUSTRALIAN RESPONSE TO THE CULLEN REPORT

FEBRUARY 1991

DEPARTMENT OF PRIMARY INDUSTRIES AND ENERGY

In this paper the recommendations of the report of the public inquiry by Lord Cullen into the Piper Alpha disaster are summarised, and actions already taken by COSOP in response to an earlier technical investigation are considered against the Cullen recommendations. Additional recommendations by Cullen and issues for alternative approaches to the Australian offshore safety regulatory regime are identified for consideration by COSOP.

1 BACKGROUND

1.1 The public inquiry into the Piper Alpha Disaster by Lord Cullen was established in July 1988 with hearings commencing in January 1989. The report of the inquiry (the Cullen Report) was presented to the UK Government in November 1990. During the inquiry a technical investigation was conducted by the UK Department of Energy and reports of that investigation (the Petrie Reports) were released in September and December 1988.

1.2 The Consultative Committee on Safety in the Offshore Petroleum Industry (COSOP) used the findings of the Petrie Report to form the basis of the initial examination of the implications of the Piper Alpha accident in regard to the safety of Australian offshore operations.

2 RECOMMENDATIONS OF THE CULLEN REPORT

2.1 The Cullen report has been endorsed by the UK Government which has accepted all 106 recommendations on 24 subjects. As a result of this endorsement, the UK offshore safety system is undergoing an extensive restructuring modelled on the onshore system, with the primary onus of responsibility for offshore safety being shifted towards the operating companies and away from the regulatory authorities.

2.2 This fundamental change in the UK offshore regulatory system has implications for COSOP in regard to the action already taken in response to several subjects identified by Petrie, and on responses to the additional recommendations made by Cullen.

2.3 The Cullen recommendations can be grouped roughly into three main areas:

- Safety assessment and the regulatory system (Recommendations 1-31)
- Prevention and mitigation measures (Recommendations 32-54)
- Evacuation, escape and rescue (Recommendations 55-106)

Safety assessment and the regulatory regime

2.4 The recommendations relating to safety assessment and the regulatory system stem from Cullen's view that existing detailed and prescriptive regulations were inflexible. The responsibility for offshore safety should be put more clearly on the companies rather than the regulator. By requiring a formal safety assessment (FSA) from the operator of any offshore installation, mobile or fixed, a more objective framework for regulation can be established.

2.5 The FSA encompasses the whole life cycle of a project, from feasibility study through design, construction, operation, and abandonment. Its need arises because the combinations of mechanical and human failures are so numerous that a major accident hardly ever repeats itself. The techniques used include hazard and operability (HAZOP) studies, quantitative risk assessment (QRA), fault tree analysis, human factors analyses, and safety audits. The output of a FSA is essentially equivalent to a Safety Case as described later in the paper.

Prevention and mitigation measures

2.6 Prevention measures addressed in recommendations 32-40 are aimed at improving aspects of the permit to work (PTW) system. Other prevention measures include a requirement that the regulatory body maintains a database on incidents involving hydrocarbons for the benefit of industry. Mitigation measures include Control Room capabilities and operations, hydrocarbon inventory control, provision against hazards from risers and pipelines, fire and gas detection, emergency shutdown valves, and fire and explosion protection.

Evacuation, escape and rescue

2.7 Recommendations in the third group cover a wide range of subjects including accommodation, provision of a temporary safe refuge (TSR), escape routes and embarkation points, emergency centres and systems, pipeline emergency procedures, evacuation, escape and rescue, helicopters, totally enclosed motor propelled survival craft (TEMPSC), means of escape to the sea, personal survival and rescue equipment, standby vessels, command in emergencies, drills, exercises and precautionary musters and evacuations, and training for emergencies.

3 ISSUES PREVIOUSLY CONSIDERED BY COSOP

3.1 Cullen has confirmed the results of the technical investigation by Petrie and the work undertaken to date by COSOP corresponds with several of the subjects on which Cullen has made recommendations. In a number of those areas, where there are additional aspects raised by Cullen, Cullen's recommendations are included for consideration by COSOP.

Permit to work systems (PTW)

3.2 Cullen reported that the general standard of PTW systems needed improving and particular attention be paid to the training and competence of contractor's supervisors who are required to operate the PTW system. He considers that operators should be made responsible for ensuring that such supervisors are trained in the PTW system for the installation on which they are working, and carry documentary proof of having completed such training.

3.3 Cullen has recommended (32-38) that the operator's PTW system should form part of its safety management system (SMS), and not be a standardised system (although it should have common principles). A standardised system is undesirable because the PTW system must marry with each operator's safety philosophy, organisation and work methods.

3.4 The industry should seek to increase harmonisation of the PTW system, giving examples as the colours used for different types of work permits and validity period of a permit.

3.5 All PTW systems should include a mechanical isolation procedure to physically lock off and tag isolation valves. A PTW and its consequent isolations should remain in force until the work is sufficiently complete for the permit to be signed off and the equipment returned to operation.

3.6 Copies of PTWs are to be displayed at a convenient location and in a systematic arrangement so that process operating staff can see and check what equipment is not available for operation.

3.7 In response to the Petrie findings, COSOP has prepared draft guidelines on the PTW system for possible inclusion in the Administrative Guidelines to the Directions (Schedule of Specific Requirements as to Offshore Petroleum Exploration and Production). These guidelines make reference to the aspects of training, isolation of the work site, and effective period of the PTW, but do not address the training of contractor's, the display/location issue or harmonisation of PTW systems across the industry.

Fire fighting systems

3.8 These are considered by Cullen under recommendations 47-54 covering the topics "Fire and gas detection and emergency shutdown", and "Fire and explosion protection".

3.9 Cullen recommends that the arrangements for the activation of emergency shutdown valves (ESVs) and of subsea isolation valves (SSIVs) on pipelines, and fire and explosion protection on installations, should be a feature of the Safety Case.

3.10 The vulnerability of ESVs to severe accident conditions should be a subject of research into the enhancement of their ability to survive such

conditions.

3.11 Regulations and related guidance notes should promote an approach to fire and explosion protection that is integrated between active and passive fire protection, eg additional firewalls may effect leak dispersal, platform layout and fire insulation.

3.13 The need for, location of, and resistance of, fire and blast walls should be determined by a FSA rather than regulations.

3.14 The approach to the design of fire protection systems, ie the fire water deluge system, the fire pump system and the fire pump start up and changeover controls, should ensure that as far as is reasonably practicable systems should be able to survive severe accident conditions, including fire, explosion and strong vibration.

3.15 The Department of Energy document on Fire and Explosion Protection is to be withdrawn because its prescriptive approach runs counter to the objective setting approach favoured by Cullen.

3.16 COSOP responded to the Petrie findings by reviewing the adequacy of existing fire fighting systems, concluding that these meet international industry specifications for such equipment. As a result of these reviews improvements to the strength and capacity of some fire walls have been identified and a program of firewall sealing is underway in Bass Strait. Work is planned on some Australian platforms to fully isolate firewater pumps from other platform service systems.

3.17 A draft guidelines document on the Design and Operation of Automatic Fire Fighting Systems has been prepared providing advice to industry on the design and automatic operation of fire fighting equipment. The guidelines state that producing operations should not take place unless fire fighting equipment is operational and call for special attention to be paid to clauses in the Directions referring to the maintenance of fire fighting equipment. The guidelines also give directions in regard to the location and protection of fire fighting system components.

Life raft operability

3.18 COSOP's initial response to the reported failure of life rafts to inflate led to servicability tests of all survival craft and a review of the adequacy of inspection procedures and frequency of inspections.

3.19 Recommendations 78-81 cover the provision of totally enclosed motor propelled survival craft (TEMPSC) on each installation. Cullen's concern was that the non availability of TEMPSC at the time of the disaster was not related to their number but to their location and distribution. TEMPSC should be accessible from the temporary safe refuge and be able to accommodate on board the number of persons on the installation. The regulation requiring each installation to provide TEMPSC with aggregate capacity of 150% of the number of persons on

the installation is maintained. (The Department of Energy had proposed 200%).

3.20 The difficulty of launching davit mounted TEMPSC leads to the need to develop methods of launching clear of the installation. Cullen recommends that there should be no statutory barrier to the use of free fall TEMPSCs on new and existing installations.

3.21 On new installations where the provision of davit launched TEMPSC is acceptable to the regulatory body, they should be oriented to point away from the installation.

3.22 Cullen recommends that industry and the regulatory body develop equipment and methods to enable TEMPSC to be launched clear of existing installations where they are oriented to point along the side of the installation.

3.23 Australian operators have inspected and tested all survival craft to ensure that they are serviceable and have reviewed the location of equipment. Alternative automatic release devices are under consideration. A free fall lifeboat was selected for the Challis Venturer and Esso has examined the use of survival capsules and made recommendations to the Victorian Department of Manufacturing and Industry Development. In addition, COSOP has identified the need for an audit system to cover the of maintenance of the craft.

3.24 The possibilities for launching survival craft well clear of the installation and the aggregate capacity of TEMPSC should be the subject of further evaluation by COSOP.

Evacuation

3.25 In recommendations 73/76 Cullen requires regulatory bodies to ask operators to submit within 12 months, without waiting for legislation, an evacuation, escape and rescue analysis in respect of each of its installations. Recommendations 74-76 specify the facilities and other arrangements to be included in the analysis. Details of air and sea rescue craft capability and availability, platform escape craft and personal survival equipment, are required.

3.26 Recommendations 82-84 require the provision of life rafts of adequate capacity, along with suitable ropes to enable access after the rafts have been launched and deployed. A variety of means of descent to the sea, including fixed ladders, stairways and personal devices for controlled descent by rope, should be provided. The industry should determine the practicability of escape chutes and collapsible stairways.

3.27 COSOP has re-examined the adequacy, location and protection of evacuation routes on offshore platform facilities. Modifications to escape routes and evacuation procedures to improve the safety of personnel have been implemented on three WA offshore platforms, Marlin Fortescue and Cobia in Bass Strait, and Challis in the Timor sea. Woodside is evaluating the effect of smoke in enclosed areas on

evacuation on North Rankin.

3.28 A draft guidelines document, based on the draft Norwegian Det Norske Veritas recommended practice (RP C 103), suggests principles for consideration in the design and operation of escape routes.

Emergency systems

3.29 Cullen observed that emergency systems, including the emergency power supplies, the emergency shutdown (ESD) system and the communications systems need to possess a high degree of ability to survive severe accident conditions of fire, explosion and strong vibration.

3.30 He recommended (62-70) that facilities to monitor and control an emergency should be located in the Control Room which should be located in the temporary safe refuge (TSR). (The concept of the TSR is considered later). On existing installations where the Control Room is not in the TSR, these facilities should be in an emergency control centre located in the TSR. The Control Room should be protected against fire and explosion as determined by safety assessment.

3.31 The recommendations also make provision for external communications, the use of status light systems, and a review of the ability of emergency systems to withstand severe accident conditions. Where a regulation imposes a requirement for a major emergency or protective system, such as a fire deluge system, it should be required that the operator should set acceptance standards or its availability.

3.32 COSOP has reviewed emergency control systems and the fail safe systems which are fitted to Australian installations. Some upgrading has taken place on Nth Rankin A and Esso has reviewed the control logic associated with its Bass Strait ESD systems. A draft paper setting out guidelines on the philosophy for ensuring the integrity of ESD systems was in the process of being revised before the release of the Cullen report.

Venting of explosions

3.33 Cullen considers that regulations relating to fire and explosion protection should be subject to separate treatment as well as in the Safety Case. The regulations should be framed to allow the subject to be treated as an integrated whole, giving freedom to the designer to utilise all available measures, including installation layout, reduction of over-pressures by equipment layout, venting, localisation of explosion effects by blast walls, floors and ceilings, and minimisation of missiles.

3.34 He has recommended (49-54) that operators be required by regulation to submit a fire risk analysis for acceptance by the regulatory body, and has framed the principles for the regulations and guidance notes.

3.35 Australian operators have been undertaking reviews of blast and fire wall protection for existing platforms and for future design

specifications. Improvements to natural ventilation to minimise the potential for, and the impact of, explosions have been, and are being, carried out on a number of installations. These features are also being incorporated in the design of new facilities. COSOP recognises that the layout, design etc., of Australian installations differs significantly from those in the North Sea.

Emergency shutdown systems-pipelines

3.36 Cullen identified as a problem area the emergency response by platforms connected by pipeline to the platform affected by an accident .

3.37 Recommendations (71-72) require operators by regulation to regularly review pipeline emergency procedures and manuals, and to institute and review regularly a procedure to shut down production on an installation in the event of an emergency on another installation connected to the first by pipeline, where continuation of production could exacerbate the emergency.

3.38 Australian operators have undertaken reviews of the adequacy of ESVs in the event of a platform based incident. Installation and relocation of ESD valves has been undertaken by Woodside and Esso.

3.39 COSOP agreed that the UK Offshore Installations (Emergency Pipeline Valve) Regulations 1989 be adopted in Australia. These regulations require ESVs on pipeline risers. COSOP has also been considering the provision of passive protection for existing pipeline isolation valves and assessing the desirability of installing SSIVs. It has also agreed to examine the question of the location of these risers in the context of any recommendations from the Cullen inquiry on this issue.

4 ACTION FOR COSOP

4.1 As well as re-assessing its action on those areas of the Petrie report to which it has already responded, COSOP should also consider its position in relation to Cullen's major recommendations. These recommendations raise three main issues for the safety of Australia's offshore installations.

4.2 These issues are:

- The suitability of the Safety Case concept for Australian offshore operations.
- The concept of regulation by objective rather than by prescriptive legislation.
- The structure and location of the Inspectorate.

4.3 The immediate need is for COSOP to decide on the first two issues. If it is agreed that these concepts are applicable to Australian offshore safety, then in each of the seven areas already addressed by COSOP the question that should be asked is whether the actions taken as a result of

reviews following the Petrie Report are consistent with the Cullen recommendations.

4.4 If it is agreed that Cullen's recommendations regarding regulations and guidance notes (ie that they state required objectives rather than being prescriptive), are appropriate, then COSOP should re-examine its draft guidelines to determine if modifications are needed. (This is in addition to any modifications arising out of specific aspects raised by Cullen).

4.5 Before reviewing these issues, the Safety Case and other recommendations not already addressed by COSOP, need to be considered.

Safety Case

4.6 The concept of a Safety Case is one of the most important recommendations made by Cullen.

4.7 In his report Cullen has adopted an approach to offshore safety which draws on the findings of the UK Burgoyne Committee (1980), the operation of the UK onshore safety regime (which incorporates the concept of Safety Cases under the Control of Major Industrial Hazards CIMAH regulations), and the principles of the Norwegian offshore safety regime. He recommends that offshore operators should be required by regulation to submit a Safety Case in respect of each of their operations, analogous to the CIMAH Regulations.

4.8 The philosophy behind the Safety Case is that the SMS of an installation is the responsibility of the operator, who must demonstrate to the regulatory authority that the design and operation of the installation and its equipment are safe, and that potential major hazards have been identified and appropriate controls provided. One advantage of the objective setting approach is more flexible regulations which can accommodate changing technology without the need to change the regulations themselves. Another is the aim of keeping Safety Cases under regular review, with on going discussion between the operator and the regulator.

4.9 A Safety Case should demonstrate that the SMS of the company and that of the installation are adequate to ensure that its design and operation are safe, and that potential major hazards and risks to personnel have been identified and appropriate controls provided.

4.10 The SMS sets out the operator's safety objectives, the method of achieving those objectives, the performance standards to be met, and the means by which adherence to those standards will be achieved. The SMS would cover the achievement of safety through

- organisational structure
- management personnel standards
- training for operations and emergencies
- safety assessment

- design procedures
- operational, maintenance, modification and emergency procedures
- management of safety by contractors in respect of their work
- involvement of the workforce (operators' and contractors') in safety
- accident and incident reporting investigation and follow up
- monitoring and auditing of the operation of the system
- systematic re-appraisal of the system in the light of the experience of the operator and industry.

4.11 A major objective of a Safety Case is to ensure that adequate provision has been made, in the event of an emergency, for a temporary safe refuge (TSR) for people on the installation, and safe evacuation, escape and rescue. Recommendations 5 - 8 provide the requirements to be considered in a Safety Case for the TSR and its evacuation in an emergency.

4.22 In a Safety Case the operator is required to demonstrate that as far as is reasonably practicable, hazards arising from the inventory of hydrocarbons on the installation and in risers and pipelines associated with the installation, have been minimised. The operator also has to demonstrate that exposure of personnel to accidents is minimised. The integrity of the TSR and evacuation methods and fire risk, is to be determined by quantitative risk assessment.

4.23 A Safety Case is to be submitted by an operator in respect of each installation, and that the regulation requirements are to be analogous to the CIMAH Regulations and subject to Cullen's recommendations 2-13.

4.24 For existing installations the date for submission of a Safety Case is to be laid down by regulation. Cullen states that there is an urgent need for the submission of a Safety Case but the date should be selected by the regulatory body, which should have the power, in the failure of an operator to submit an acceptable Safety Case, to require the operator to take whatever remedial action it considered necessary, including requiring the installation to be shut down.

4.25 Cullen has recognised the need for a review of a Safety Case periodically, and for the regulatory body to cause a review in the event of the change of operator, technology, or a major emergency. All intended modifications to an installation are to be reported to the regulatory body and discussion take place to see if a review of the Safety Case is warranted.

4.26 During the transition period to the new regime Cullen proposes that there should be a regulation requiring a Safety Case which would be complemented by a limited number of further, defined regulations, but beyond this it is the regulatory body's responsibility to develop the regime. Wholesale revocation of the existing regulations and guidance is not envisaged, and Cullen suggests that the regulatory body advise industry of those regulations to which it is prepared to grant exemption

if a satisfactory alternative in the Safety Case is demonstrated.

Cullen also makes recommendations on a number of other matters, many of which relate to the Safety Case and to the legislative and regulatory body. On some subjects, Cullen has made quite specific recommendations.

Auditing of the operator's management of safety

4.27 The responsibility for regular audit of the SMS is given to the operator, with the requirement that the regulatory body regularly review the operator's audit on a selective basis, carrying out further audits as thought fit.

Safety committees and safety representatives

4.28 The importance of involvement of the offshore workforce in safety is recognised in recommendations 27-31, which call for the regulatory body, operators and contractors to support and encourage workforce teams to participate in everyday safety. This group of recommendations requires involvement of the workforce in safety as part of the SMS and protection of safety representatives from victimisation. The training of safety representatives is to be determined and paid for by the operator.

Incident reporting

4.29 Recommendation 39 requires the regulatory body to develop a data base with regard to leaks, spills and ignitions in the industry for the benefit of the industry.

Control of the process

4.30 The Control Room is to be manned at all times by a qualified person and key process variables, as determined in the Safety Case, should be monitored and controllable from the Control Room. The training of Control Room operators should include instruction in an onshore course in the handling of emergencies.

Hydrocarbon inventory, risers and pipelines

4.44 Recommendation 43 calls for a valve on each riser, located as close as is practicable to sea level, with full emergency shutdown capability, as is currently required in the existing regulations.

4.45 Recommendation 44 requires operators to make provision, in the Safety Case, for the use of subsea isolation valves (SSIVs) where necessary to cover hazards from risers and pipelines.

4.46 Cullen also recommends that studies be undertaken to explore the feasibility of dumping large oil inventories in an emergency (in an environmentally acceptable manner) and the minimisation of pipeline connections to a platform. Studies should also consider the achievement of passive fire protection of risers and the improvement of reliability and

reduction of the cost of SSIVs.

Fire and gas detection and emergency shut down

4.47 Cullen recommends (47) that the Safety Case should feature arrangements for the activation of ESVs and of SSIVs where fitted,on pipelines.

4.48 There is a need for further study to enhance the ability of ESVs to survive severe accident conditions.

Accommodation, Temporary Safe Refuge(TSR) escape routes and embarkation points

4.49 Recommendation 55-61 require regulations and related guidance notes to continue to promote fire protection of the accommodation while providing breathable air within it. Cullen recommends that ventilation air intakes should be provided with smoke and gas detectors and that on activation of an alarm the ventilation and dampers should shut down.

4.50 The objective in relation the protection of escape routes and embarkation points is that they should be passable, even though it may not be practicable to protect them in all physical conditions.

4.51 Escape routes should be provided with adequate and reliable emergency lighting and with photoluminescent direction signs.

4.52 Recommendation 60 requires an immediate assessment of the risk of ingress of smoke into the accommodation, and the fitting of smoke and gas detectors and ventilation shutdown.

4.53 Studies are recommended into the breathability of air in a TSR where its external fire wall is subjected to fire.

Helicopters

4.54 Recommendation 77 requires operators to adopt a flight following system so that the availability and capacity of helicopters is known quickly in an emergency.

Personal survival and escape equipment

4.55 Recommendations 85-87 require each individual on board an installation to be provided with:

- a personal survival (or immersion) suit
- a life-jacket
- a smoke hood of a simple filter type to exclude smoke and provide protection for at least 10 minutes during escape to or from the TSR
- a torch and fireproof gloves.

These articles are to be kept in the accommodation.

4.56 Other survival suits, smoke hoods and life-jackets for at least half

the number of people on the installation should be stored in containers at suitable locations on the installation.

4.57 The use of small transmitters or detectors on life-jackets should be considered, luminescent strips should not be orange.

Standby vessels

4.58 Cullen has recommended (88-96) that changes in the regulations on standby vessels should be aimed at the improvement of the quality of the vessels which should:

be highly manoeuverable
have full visibility of the waterline in all directions from the bridge
have 2 remotely controlled 360 degree searchlights
have 2 fast rescue craft, capable of 25 knots and equipped with radio and a searchlight
be able to rapid launch fast rescue craft
have adequate communication with its craft, the installation, nearby vessels and the shore and
have 2 methods of retrieving survivors from the sea.

4.59 Recommendations 90-96 relate to crew numbers, their fitness, periods of duty and training.

Command in emergencies

4.60 In recommendations 97-99 Cullen allows for the assessment and upgrading, as necessary, of the performance of the command structure. Emergency exercises are recognised as essential in ensuring that written procedures, which are to be part of the SMS, work in practice.

Drills, exercises and precautionary musters and evacuations

4.61 Cullen recommends (100-104) that emergency drills and exercises should form part of the SMS and should be carried out in accordance with UK Offshore Operators Association guidelines. All staff should attend 1 muster per tour of duty and the circumstances of any precautionary musters and evacuations must be reported by the operators to the regulatory body.

4.62 Operators are to maintain lists of personnel on board in alphabetical order and also by reference to the names of contractors with personnel on board. These lists are to be updated for every movement of personnel and copied immediately to the shore.

Training for emergencies.

4.63 Recommendations 105-106. The UK Offshore Operators Association guidelines for offshore emergency safety training should be a minimum requirement. Persons who have not met the requirements of those guidelines should not be allowed to work offshore.

5 ISSUES FOR FUTURE OFFSHORE LEGISLATION

5.1 A regulatory scheme based on the Cullen model has the advantage that the onus of responsibility for designing and operating a safe installation is transferred to the operator from the regulator, leaving the latter with the power to ensure the effectiveness of the operator's SMS.

5.2 Cullen recommends (17) that principal regulations in regard to offshore safety should require stated objectives to be met instead of prescribing detailed measures to be taken. While guidance notes on goal setting regulations should give non-mandatory advice on methods of achieving such objectives without prescribing any particular method, there will be a continuing need in some instances for regulations which require detailed measures.

5.3 Recommendations 18,19 specify the UK Health and Safety at Work legislation to be adopted, and recommend revocation of existing regulations and their replacement with 4 groups of goal setting regulations supported by guidance notes. Operators are to be encouraged to specify the standards they will use to comply with the regulations.

5.4 Not all commentators support this goal setting approach, arguing that while it may be effective for onshore safety there is a possibility that the degree of self regulation advocated by Cullen might lead to a reduction in offshore safety standards. Statistical comparisons of UK offshore safety records, UK onshore safety records and of the Norwegian offshore safety record (which has applied Safety Case principles for some time), by the Heriot-Watt University in Edinburgh, has revealed no evidence that the Norwegian offshore industry had a significantly better safety record than the UK offshore industry, although the UK offshore industry had a higher accident rate than UK onshore industry between 1975 and 1988.

5.5 Cullen questions the existing UK procedure whereby offshore safety regulations are prescribed by a government agency and the discharge of functions of the regulations are inspected by the same agency. He recommends that a single regulatory body (the Health and Safety Executive), competent to evaluate the operator's safety management system, take over from the Department of Energy, whose policies have had the effect of distancing offshore regulations from the main stream of practise in modern regulations on health and safety.

5.6 Cullen recommends a single regulatory body for offshore safety to discharge safety functions in relation to fire-fighting equipment and life-saving appliances. It should discharge all functions in regard to standby vessels, either directly or through the agency of the Department of Transport, except where covered by the Merchant Shipping Acts.

5.7 The functions of the Petroleum Engineering Division of the Department of Energy concerned with offshore safety are to be

transferred to a discrete division of the Health and Safety Executive which is exclusively devoted to offshore safety. The staffing, and functions of the Division are identified in recommendation 26.

5.8 Australian offshore safety regulations are the joint responsibility of the Commonwealth and the States/Northern Territory, as applied through the Schedule of Specific Requirements as to Offshore Petroleum Exploration and Production-1990 (the Directions) under the Petroleum (Submerged Lands) Act 1967 (PSL Act).

5.9 Specific safety regulations are also enforced by the majority of States and the Northern Territory through occupational health and safety legislation.

5.10 The PSL Act requires operators to conduct their operations in a proper and workmanlike manner, in accordance with good oil field practise, securing the safety, health and welfare of those at work. "Good oil field practise" is defined as all those things that are generally accepted as good and safe in the carrying on of exploration for petroleum or in operations for the recovery of petroleum.

5.11 While the Directions establish broad principles and procedures for safety and emergency response manuals to be approved by the Designated Authority, they do not address safety management aspects required of the operator. They also in some respects prescribe detailed requirements on many specific and limited operational aspects. As such they do not apply the principle of being objective setting through an integrated safety management system as recommended by Cullen.

5.12 The current Australian offshore safety regime could be seen to have several disadvantages:

- it is administered by different bodies in different States
- occupational health and safety regulations are not uniform, and are separate from the Directions
- the prescriptive nature of the Directions in some aspects mean that there is potential for failure to keep up with technological change and the complexity of offshore operations means that there may be inadequate rules for some procedures
- the onus of responsibility for making and enforcing the rules is essentially that of the regulator
- operators could have a primary desire to comply with the regulations rather than exert maximum effort towards total safety.
- compliance with the regulations by an operator could take preference over wider safety considerations.

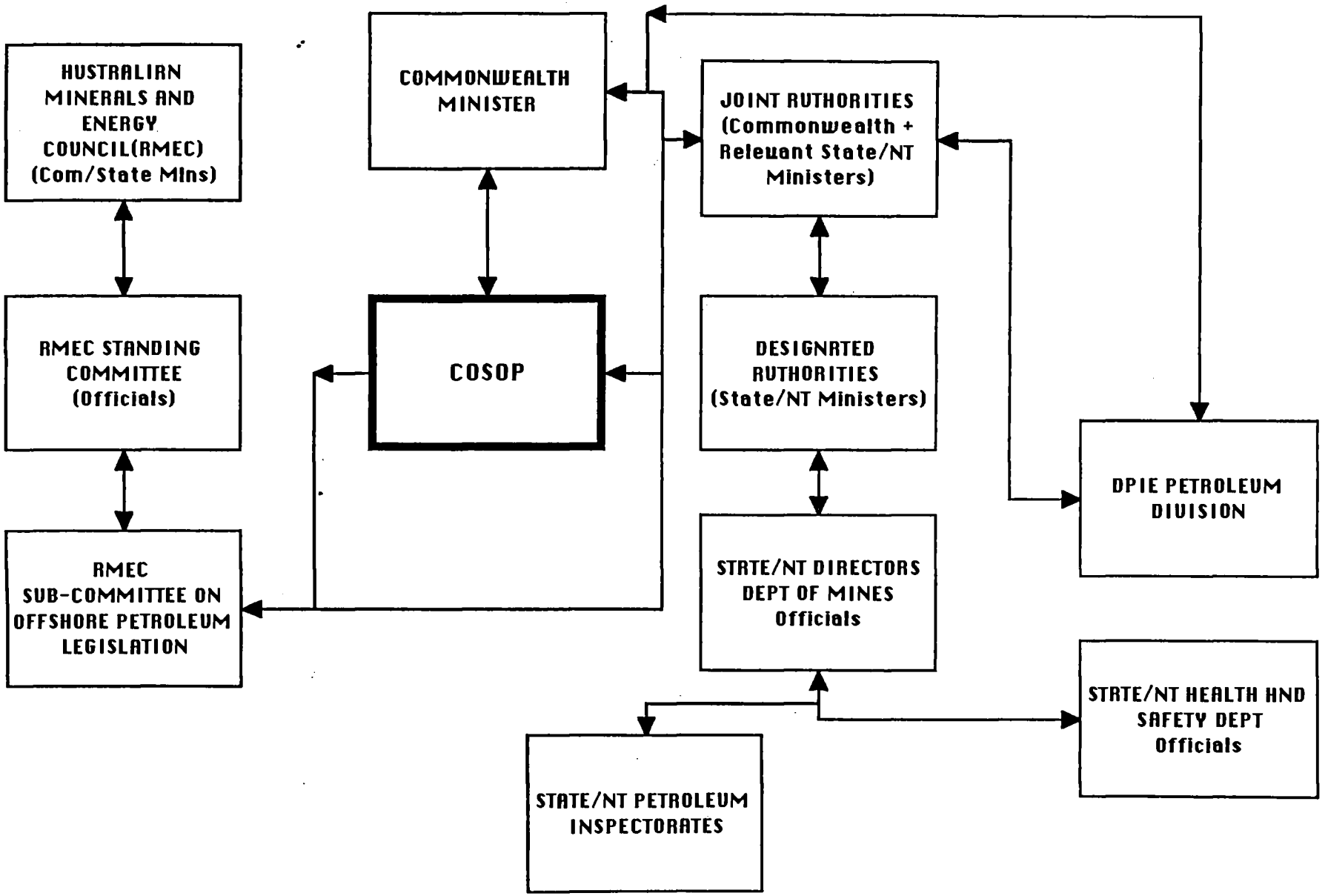
5.13 While many of the recommendations made by Cullen can be addressed through review of the existing Directions prescribed by the PSL Act, the adoption of the safety management system incorporating the Safety Case could require fundamental changes to the Australian offshore regulatory system. This may not, however, require wholesale changes to the regulatory institutional structure. It should be noted that one consequence of the replacement of the current Australian offshore

safety regulatory institutional structure with a centralised Health and Safety Executive may be the substantial re-negotiation of the existing Commonwealth/State joint administrative system.

5.14 Irrespective of whether COSOP believes the existing regulatory institutional structure is appropriate, or whether responsibility should rest with a single authority, it is doubtful that the implementation of a new regulatory system could be accomplished in the short term. Any substantial change to the existing system will place added strain on the resources of the Mines Departments and the Occupational Health and Safety authorities.

Petroleum Division
February 1991

AMEC/COSOP RELATIONSHIPS



APPENDIX G