

11 OPERATIONS AND MAINTENANCE

11.1 Organization

Husky Oil will manage the production and maintenance operations of the White Rose oilfield on behalf of itself and its co-venturer Petro-Canada from the Husky Oil office in St. John's, where the Operations Manager will be located. The day to day management and control of all offshore operations will be the responsibility of the OIM, who will be located on the FPSO. The OIM will report to the Operations Manager. Each MODU operating in the field will be managed and controlled by an Installation Manager, who will also report to the Operations Manager. The OIM on the FPSO will, however, take responsibility for routine coordination of all concurrent offshore operations.

11.1.1 On-shore Organization

The on-shore organization will be structured to provide total support for all normal offshore operations, during both the development phase and the production phase. The on-shore organization will include personnel with all the requisite skills, knowledge, and experience for ensuring thoroughly competent support to the offshore operation, including emergency situations. It will be focused on flexibility, efficiency and cost effectiveness.

The preliminary intended on-shore organization is shown in Figure 11.1-1.

The permanent core of the on-shore organization is expected to comprise some 45 to 50 people, with breakdown as indicated in Table 11.1-1.

In addition, there will be further personnel onshore in the following categories:

- helicopter air and ground staff;
- dockworkers and crane operators for supply vessel operations at the shorebase; and
- crews for the supply and standby vessels.

Offshore operations will be serviced by two helicopters. It is expected that this part of the operation will require some 20 to 25 staff, including flight crews, maintenance crews, and administrative support.

Each marine support vessel is forecast to have a crew of 10 to 12 people. Up to four vessels will be needed to service routine FPSO operation plus one drilling unit. Ice season requirements will call for deployment of further support vessel strength, as will the addition of further drilling units.

Figure 11.1-1 On-shore Organization

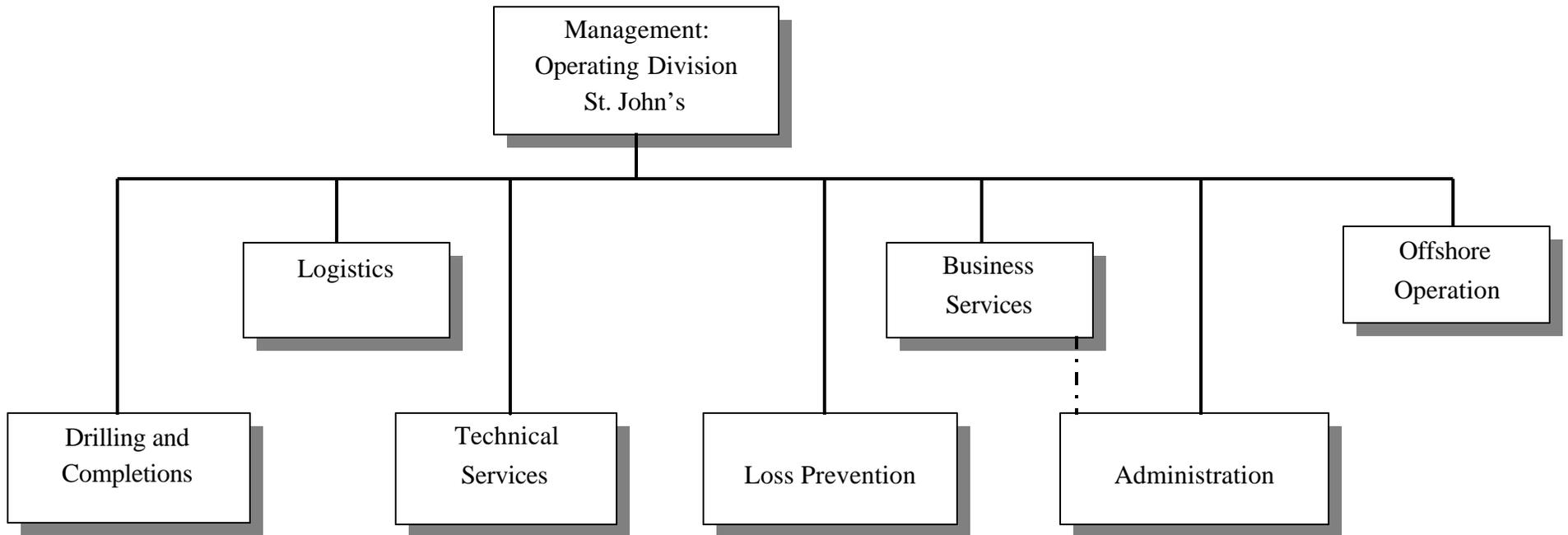


Table 11.1-1 Distribution of On-shore Personnel

Responsibility	Number of Persons	Function
Management	1	Operations Management
Drilling and Completions	3-4	Drilling Supervision Drilling Engineering Completions Engineering
Technical Services	15-16	Facilities Engineering Reservoir Engineering Geology Geophysics Petroleum Engineering Petrophysics Telecommunications Computer Services Maintenance Engineering Subsea Engineering Instrumentation and Controls
Logistics	11-12	Procurement Materials Transportation Crane Operation Radio Operation Yard Labour
Business Services	7-8	General Accounting Invoice Processing Production Accounting
Administration	5-6	Office Management Human Resources Public Relations Secretarial Services Reception Telephone
Loss Prevention	3-5	Loss Management Quality Assurance Quality Control Security
Total	45-50	

At dockside, the requirement for dock workers and crane operators is forecast at some six to eight people to handle servicing and turnaround for one supply vessel. Actual numbers will be dependent on the number of concurrent vessel servicing operations ongoing at dockside at any one time.

Husky Oil intends to examine the possibility, merits and feasibility of sharing some onshore servicing and support facilities with other operators, such as Hibernia and Terra Nova.

Husky Oil will hire additional temporary staff, either directly or via subcontractors, to cope with non-routine peak activity periods, such as shutdowns or special tasks.

The following describes the on-shore functional groups and their support activities.

11.1.1.1 Operations Management

The Operations Manager, who will be responsible for the entire operation, both technically and commercially, will lead this group. The Operations Manager will be responsible for issuing and implementing all Husky Oil policies.

11.1.1.2 Drilling and Completions

The drilling and completions department will plan and implement drilling and workover programs, and provide support during offshore drilling, workover, and well completion activities. It will be responsible for well and completion designs, and for obtaining Husky Oil, Petro-Canada and regulatory approvals. It will work with the drilling contractor to coordinate activities and scheduling.

11.1.1.3 Technical Services

This group will be responsible for supplying technical support for operations. It will provide engineering, geoscientific and maintenance services, together with document control, for:

- reservoir development planning, monitoring and management;
- engineering design;
- computer system support and development;
- telecommunication systems support; and
- technical support for production and operations.

Close liaison will be maintained with the drilling and completions group and the offshore group.

11.1.1.4 Logistics

This group will be responsible for the coordination of all logistical support to the project. This will include land and marine transportation, aviation services, and ice and weather surveillance. The warehouse, marine base, pipeyard, and 24-hour radio and communications links will be operated by this group. It will also provide coordination services to the loss management group in support of ice management operations.

The group will also be responsible for procurement activities, including expediting and inspection, as required.

11.1.1.5 Business Services and Administration

This group will be responsible for the administration of all contracts and agreements, accounting and financial reporting. Its responsibilities will include co-venture accounting, coordination of departmental budgets, financial management, hydrocarbon accounting, reporting on Canada-Newfoundland benefits, and audit management. It will also supply provide support related to employee relations, industrial relations and organizational effectiveness of internal and external committees. It is also expected that responsibility for crude movements and transportation, tanker scheduling, and administration of royalty obligations will be assigned to this group.

11.1.1.6 Loss Management

The scope of this group covers all matters related to health and safety, environment, process hazard management, risk assessment and loss prevention. The group will implement HS&E policies to encourage achievement of the optimum operating conditions with respect to health, safety and environment.

The group will establish and maintain channels of communication with appropriate external organizations required to support safe and environmentally responsible operations. These organizations will include the police, Canadian Coast Guard, and environmental protection agencies.

The group will also be responsible for ensuring that adequate and rigorous quality assurance and quality control policies and procedures are in place. The group will monitor and audit adherence to these policies and procedures.

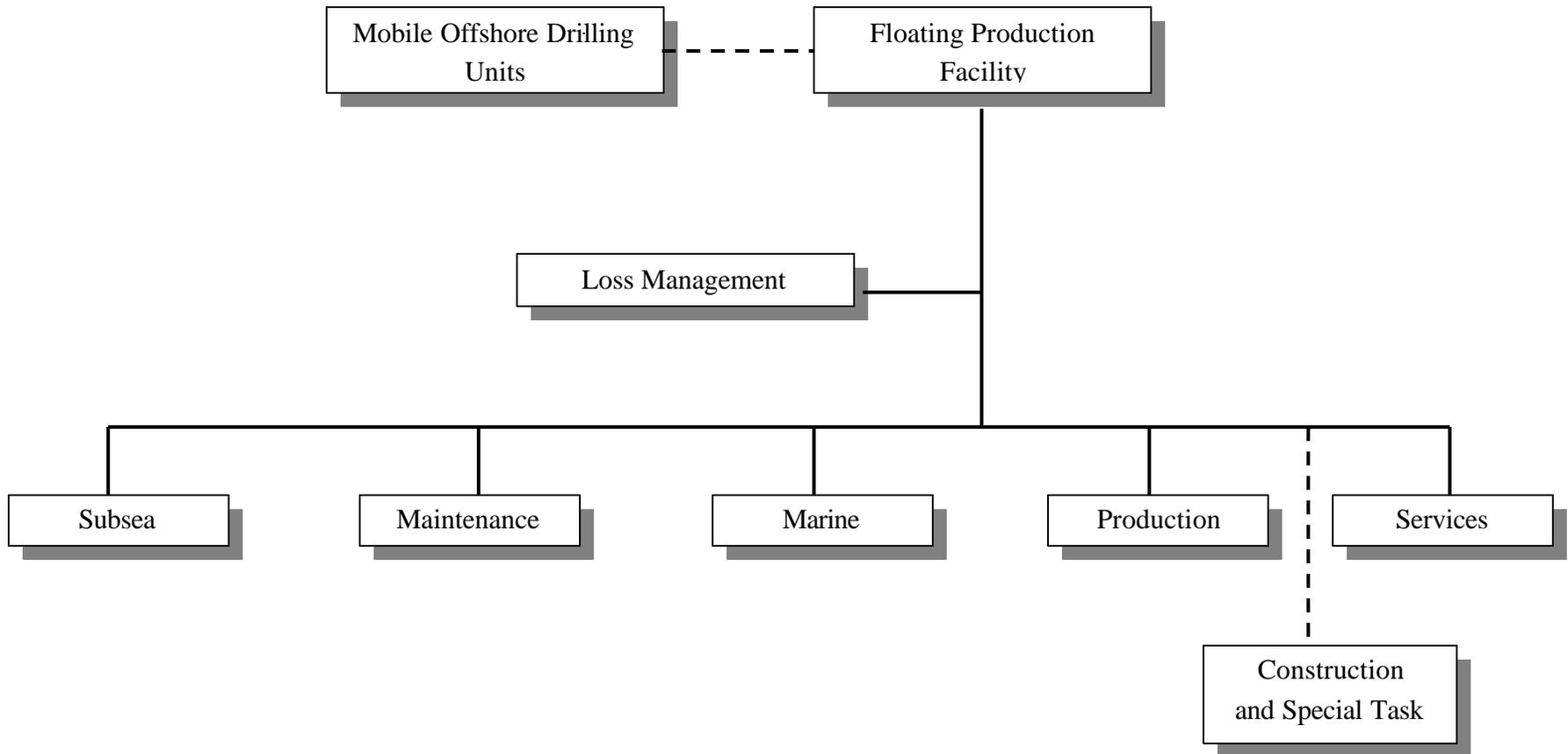
Security will also be the responsibility of this group. This will entail preparation and implementation of appropriate security procedures aimed at protection of personnel and equipment at all locations, both offshore and onshore. The group will liaise closely with the police in the implementation of this task.

11.1.2 Offshore Organization

The offshore organization will consist of skilled personnel in all disciplines required for safe, efficient, and environmentally responsible operation of all offshore facilities. The preliminary proposed organization is shown in Figure 11.1-2.

The OIM will be responsible for management of the FPSO. This will include the routine operation of the production facility and all related activities.

Figure 11.1–2 Offshore Organization



All drilling will be carried out by semi-submersible drilling units, each of which will be the responsibility of a dedicated Installation Manager onboard. The FPSO OIM will, however, have responsibility for coordination of all offshore activities. These include drilling workover, diving and ice management, in addition to the FPSO-related activities of production, storage, offloading and shipping.

The drilling semi-submersible Installation Manager will be responsible for the safe and efficient operation of that unit in accordance with the Drilling Program Authorization (DPA), Approval to Drill Well (ADW), Well Operations Authorization (WOA), or Approval for Well Operations (AWO) applicable to that well program. The semi-submersible Installation Manager will report to the Operations Manager, located on-shore in St. John's.

To ensure that all responsibilities concerning simultaneous offshore production and drilling are clearly understood, Husky Oil will prepare a manual specifically for this purpose. It will address the interfaces, particularly communications, between the FPSO and the various other units operating simultaneously offshore in both routine and emergency conditions.

A primary aim in the formulation of the offshore teams will be to foster teamwork and efficiency. This will be achieved by selection of personnel with appropriate production or marine skills and experience, coupled with cooperative positive attitudes and demonstrated competence. Multi-tasking of personnel will also be an aim, both to increase flexibility and effectiveness and to provide personnel with an enriched work environment. This cross-functional strength will be accomplished by providing regular training.

11.1.2.1 Floating Production, Storage and Offloading Facility

The crew complement for the FPSO is expected to be approximately 45 to 50 at any one time. Provision for rotation requires that this number be doubled, giving an FPSO staff strength of some 90 to 100 personnel. The likely breakdown of categories and numbers of personnel who will make up the FPSO team is shown in Table 11.1-2.

Table 11.1-2 Distribution of FPSO Offshore Personnel

Responsibility	Number of Persons	Function
Management	1	Offshore Installation Manager
Loss Management	2	Loss Prevention Advice Environment Advice Medical Services
Production	6-7	Supervision Control Room Operators Production Operations
Marine	6-7	Marine Supervisors Marine Operations
Maintenance	14-15	Supervision Instrument Maintenance Mechanical Maintenance Electrical Maintenance Telecommunication Maintenance Maintenance Scheduling
Services	16-18	Supervision Helideck Loading Deck Crew Supervision Deck Crew Operations Crane Operations Radio Operations Ice and Weather Surveillance Catering and Accommodations Services
Total	45-50	

There will be an occasional requirement for construction or other specialized personnel offshore to perform upgrades, repairs, or modifications to equipment or systems. The work to be performed by such personnel will normally be planned and scheduled for minimal impact on production. Where necessary, due to unforeseen circumstances arising offshore, they will be mobilized on an ad hoc basis. The numbers of such personnel will depend upon the scope of work to be performed. As far as possible, personnel already onboard as part of the maintenance group will be used in support of the such activities.

The offshore operation will be provided with engineering support by the technical services group. This support will be for specific tasks, or investigation and solution of process problems, and will be on an ad hoc basis.

The following describes the offshore functional groups.

Offshore Installation Management

The FPSO will be managed by the OIM. The OIM will be responsible for coordinating all activities on the FPSO, as well as other activities such as drilling, diving, workovers, and shipping, ongoing in the field. The OIM will be in command in all emergency conditions, and will be the primary communications conduit to the Operations Manager in St. John's.

The OIM will retain control and responsibility for the FPSO as long as the production system remains connected and the vessel is on station. When it becomes necessary to disconnect, the OIM will prepare the production system for disconnection and then hand over control to the senior marine officer for control of the disconnection. The senior marine officer will remain in control until the vessel has been reconnected. Control will then revert to the OIM.

Loss Management

Loss management personnel will be available for providing support to line management in the implementation of all safety and environmental policies and procedures, and development and implementation of emergency exercises and drills.

Loss management personnel will also coordinate implementation of the ice management plan in association with the services group and will also assist in conducting offshore safety and environmental inspections and audits, and performing accident and incident investigations.

First aid services will be provided by an onboard medic, who will be qualified and trained to regulatory requirements. Other operations personnel will be trained in advanced first aid and will support the medic, as required. First aid drills and medical escort training will be coordinated by the medic, who will also be responsible for implementing the company's health awareness programs.

Production

The FPSO will be a highly automated facility, controlled by an integrated control system from a Central Control Room. There will be minimal routine manual operation, and production staff will be trained for other tasks besides production, such as in marine or maintenance functions.

Production will be on a round-the-clock basis and staffing will be on a shift basis to accommodate this.

Marine

This group will be responsible for all activities related to vessel operation, including propulsion, thruster and ballasting operations, maintenance of vessel stability, monitoring of mooring loads, deck loading, and station

keeping. This group will possess within its members all necessary marine qualifications and experience to meet Canadian Coast Guard and Transport Canada requirements. Such members will also liaise with, and lend assistance to, the Maintenance group to ensure optimum performance and reliability of the marine equipment and systems.

Maintenance

This group will be comprised of personnel trained in mechanical, electrical, instrumentation and communications maintenance. The majority will be trained to operate on a cross-discipline basis. They will work closely with the marine group, as indicated above, to ensure safe, reliable operation of vessel systems.

Routine maintenance operations and major shutdowns will be planned and scheduled by the group.

The group will also liaise, and participate to the highest degree possible, with construction and specialist personnel to ensure efficient use of manpower during upgrading, repair or modification tasks.

Services

This group will be responsible for all other activities necessary for an efficient offshore operation. This will include personnel dedicated to logistical, material, personnel movements, and catering. The group will coordinate other vessel movements, including those of supply and standby vessels, helicopter services, deck and crane operations, radio and communications operations, diving operations, catering, housekeeping, and accommodation management.

It will also be responsible for environmental monitoring and ice surveillance and coordination of the ice management plan under direction of the OIM.

11.1.2.2 Mobile Offshore Drilling Unit

Each drilling vessel will require some 70 to 100 drilling and support staff during drilling operations. To provide for rotation, this means a requirement of some 140 to 200 personnel per drilling unit.

11.2 Operations and Maintenance Procedures

Operations and maintenance procedures and manuals will be implemented specifically for the White Rose development. They will make provision for compliance with all regulatory requirements, and personnel will be trained to operate in accordance with the manuals and procedures.

The procedures will be finalized as requisite information becomes available (for example, systems and equipment operations and maintenance manuals after vendor selection and receipt of equipment/system documentation) and will cover the following topics:

- systems;
- equipment;
- reporting relationships and procedures;
- maintenance procedures;
- production and marine procedures;
- ice management procedures;
- health and safety procedures;
- emergency procedures;
- alert and contingency procedures; and
- environmental monitoring procedures.

Documents will be developed on a hierarchical basis to facilitate ease of use by personnel. The basic documents will be developed in the detailed design phase. They will then be augmented by the various user groups to customize them to their particular needs, all the while maintaining strict compliance with regulatory requirements.

11.2.1 Systems

Systems manuals will provide descriptions and drawings of the primary process, ancillary systems, and associated equipment and subsystems. The rationale behind the design will be presented. Operating parameters will be set out. Operator training manuals will be based upon these documents.

11.2.2 Equipment

Detailed information on each individual piece of equipment and each system and subsystem will be assembled and incorporated into data books. Such information will be drawn from vendor sources, design specifications and operational record. It will include drawings, specifications, descriptions, materials, installation guidelines, operation and maintenance guidelines, and recommendations on spare parts inventory.

11.2.3 Reporting Relationships and Procedures

Roles, limits of authority, lines of reporting and accountabilities in production operations will be set out in reporting procedures and where applicable bridging manuals. These will clearly identify reporting relationships throughout the organization as well as with external agencies.

The procedures for record-keeping will be set out in the manuals, together with requirements for report generation and distribution and data acquisition.

Operating and maintenance records will be documented as required by Husky Oil and governing regulations. Requisite reports will be produced routinely.

11.2.4 Maintenance Procedures

Maintenance procedures manuals will be prepared for all equipment. These procedures will be based on design data, recommendations by vendors, operating conditions, and the importance of the equipment to operation of the facility. This latter aspect will be based on the effect of failure of the item of equipment on personnel safety, environmental consequences, operational efficiency, and revenues.

The maintenance program will be extensively supported by computerized systems, providing detailed information on each item of equipment, including its criticality, maintenance history, and spares to be kept in inventory. The system will also be linked to an inventory control system.

The basic significant features of monitoring, inspection, and maintenance and repair, will be recognized in the program.

11.2.4.1 Monitoring

All structures and equipment will be monitored routinely as a planned part of the maintenance program. Sensors and monitoring devices will be used as part of the program. Also as part of the overall monitoring program, the integrity of the following aspects of the FPSO will be monitored, using on line monitoring systems:

- structural components;
- sub-structural components;
- equipment condition;
- corrosion rates; and
- vessel stability.

11.2.4.2 Inspection

All structural elements, piping and equipment will be inspected regularly and comprehensively to ensure their integrity. The degree of inspection will be predicated upon the item's criticality to the operation, its vulnerability and service, operating conditions, vendor recommendations, and feedback from the monitoring systems.

Inspection will be accomplished by one or more of the recognized techniques of visual inspection, non-destructive testing, operational parameter monitoring, vibration monitoring, and field and laboratory tests.

The main areas of attention will be:

- structural;
- pressure containing systems;
- rotating equipment;
- subsea systems;
- lifting equipment; and
- life saving equipment.

11.2.4.3 Maintenance and Repair

The focus of this activity is to maintain the facility in optimum condition to ensure safe and continuous production operations. Three categories of maintenance and repair are recognized:

- preventative maintenance;
- predictive maintenance; and
- breakdown maintenance.

How a particular piece of equipment is categorized depends on its criticality to safety and operations (for example, safety equipment and systems will be in the top category), and every effort will be made to avoid incurring situations where these have to receive maintenance on a breakdown basis.

The procedures will also cover the monitoring and control of ice build-up on the various structural components of the FPSO.

The maintenance and repair program will be supported by a computerized support system which will record maintenance history, maintenance costs, item availability, and breakdown frequency.

11.2.5 Production and Marine Procedures

This procedures manual will deal with the safe and efficient operation of the FPSO for all facets of production and marine-related activities. It will describe in detail how the following will be carried out or managed:

- process start-up and shutdown;
- routine production;
- operations limits;

- adverse weather conditions;
- crude storage and shipment; and
- marine activities.

11.2.6 Ice Management Procedures

Husky Oil already has an Ice Management Plan in place for its exploration operations on the Grand Banks. Husky Oil will review and update, or modify, this plan as appropriate for application to the production phase of the White Rose development.

Ice management procedures will set out clearly the steps and responsibilities for ice surveillance, monitoring and reporting. The procedures will be structured to include cooperation with other operators and government agencies in their concurrent ice surveillance and management operations on the Grand Banks. All available ice intelligence information sources will be used to ensure the well-being of the facilities offshore.

The steps necessary for avoidance of iceberg collision or excessive sea ice pressure will be detailed in the procedures. This will include how the following will be accomplished:

- disconnection of production risers;
- disconnection and flushing of loading lines; and
- repositioning of the FPSO.

Further discussion of the ice management plan will be found in Section 11.3.

11.2.7 Health and Safety Policies and Procedures

As outlined in the Preliminary Safety Plan (Volume 5, Part One) Husky Oil will implement health and safety policies and procedures for the White Rose development that will meet or exceed all statutory requirements, and ensure continued health and fitness of all employees. Operational characteristics and conditions will be monitored, and modified if required, to minimize the risk to employees of occupational injuries or illnesses and to minimize exposure to excessive noise, heat, radiation or vibration. Particular attention will be paid to providing proper adequate ventilation and to ergonomics. Programs will be developed to promote occupational hygiene, enhance the well-being of personnel, and prevent accidents.

The procedures will provide for the safe handling of hazardous materials according to the requirements of Workplace Hazardous Materials Information Systems (WHMIS). All employees will be trained to ensure complete awareness and understanding of this aspect of the procedures. The environmental management system will include a section on chemical management.

Safety will be designed into the facility via active and passive protection systems. Hazard and operability studies (HAZOPS) will be an essential work item at key stage of design. Their purpose will be to identify hazards, forecast the consequences, eliminate or ameliorate the causes, and devise options for mitigation to the maximum practical extent.

Particular emphasis will be placed on the procedures developed with respect to the fire and gas monitoring system. This system will be the main means of process hazard detection, and will have a direct interface with the emergency shutdown system and active protection systems.

Safety procedures training will be provided to every employee, and records will be maintained on the training courses provided to each employee, together with the dates on which they were provided.

11.2.8 Emergency Procedures

Procedures will be implemented to address every kind and scale of emergency that might reasonably be expected to arise on the FPSO or other offshore facilities. The procedures will detail the steps to be followed for each type of emergency, from a minor emergency situation to complete evacuation of the FPSO. Personnel both on-shore and offshore will be assigned membership in an emergency team and will be trained to perform their specified function in that team. Regular drills will be held onboard to maintain the currency of the individual and team response capability. Teams will include, but not necessarily be limited to:

- fire;
- first aid;
- lifeboat and coxswain;
- helideck;
- person overboard;
- emergency command centre control; and
- marine emergency.

11.2.9 Alert and Contingency Procedures

Standard operator's procedures will be implemented to respond to alerts and potential emergency situations. The procedures will describe how contingency measures will be initiated in the event of an imminent or possible problem condition.

The procedures will have the aim of assembling all available information concerning the problem so that it can be analyzed by the OIM, and used by the OIM to make informed decisions concerning appropriate courses of action.

The procedures will be so structured that they produce a sufficient amount of information to enable the OIM to avoid proceeding unnecessarily from an alert situation to an emergency situation. The following are examples of the kind of conditions that could trigger an alert situation:

- loss of monitoring capability on critical systems;
- severe wind forecast;
- severe sea forecast;
- heavy sea ice;
- possible iceberg impact;
- possible vessel impact;
- potential loss of well control;
- icing on superstructure; and
- system impairment conditions (loss of mooring chain).

The OIM will be responsible for determining which contingency procedures are to be implemented in response to each specific alert. The OIM's decision will be based on the information to hand and the potential risks arising.

The OIM will retain control and responsibility for the FPSO as long as the production system remains connected and the vessel is on station. When it becomes necessary to disconnect, the OIM will prepare the production system at the time of disconnection and then hand over control to the senior marine officer for control of the disconnection. The senior marine officer will remain in control until the vessel has been reconnected. Control will then revert to the OIM.

11.2.9.1 Environmental Monitoring Procedures

The environmental monitoring procedures will be developed to ensure compliance with the environmental monitoring program and are discussed further in Chapter 7 of the EIS (Comprehensive Study Part One).

The prime purpose of these procedures will be to minimize exposure of personnel to risk, protect the environment, protect the asset, and facilitate safe operation. The following are the key environmental factors that will be addressed in the procedures:

- pollution prevention;
- oceanography;
- meteorology; and
- waste management.

11.3 Ice Management Plan

As indicated earlier in Section 11.2.6, Husky Oil has an Ice Management Plan in place for its offshore exploration program. This plan will be reviewed and updated, or modified, as appropriate, for application to the production phase of the White Rose development. Such an update will draw upon the experience of other operators on the Grand Banks, together with the latest techniques and developing technologies, to produce the optimum plan for ice management for the White Rose development. It will cover both sea ice and icebergs, and will be flexible in recognition of the fact that the sea ice and iceberg conditions at the White Rose area vary considerably from year to year.

Husky Oil participates in the Regional Grand Banks Ice Management Plan. This is a joint plan of all the operators on the Grand Banks, and provides for:

- coordination of ice and iceberg detection, monitoring and trajectory projection; and
- coordinated management of response actions to icebergs transiting the areas.

The iceberg season for the Grand Banks averages 3.5 months, covering the period from March to June. Icing and iceberg frequencies and criteria are outlined in Chapter 8, as well as in the EIS (Comprehensive Study Part One).

Sea ice may be encountered from the beginning of February until the end of April. Mean sea ice concentrations have large regional variations, with the greatest concentrations being through the Avalon Channel and the Flemish Pass. Although March is the most critical month for the Grand Banks area, the ice only encroaches on this area in the most severe ice coverage years.

Icing of a structure and substructures, and above the water line on support vessels may occur from November to April if the air temperature drops below -3°C and the winds exceed 17 knots. Normally, icing is generated from sea spray although it can also be caused by freezing precipitation. Based on operational experience to date, icing does not present any restriction to operations, but it may impact helicopter and support vessel activities.

11.4 Operational Limits

The limiting conditions imposed by environmental factors on the structure and associated systems will be largely predicated upon the final design criteria adopted for the FPSO and equipment specification.

The criteria selected for equipment and system redundancy and availability, scheduled maintenance, and unscheduled shutdowns and breakdowns will also directly impact upon operational efficiency.

11.4.1 Limiting Conditions on the Structure and Facilities

Environmental factors could impose limitations on the following operations:

- station-keeping ability;
- deck loading;
- bulk storage;
- crane operation;
- helicopter movement;
- ice management; and
- crude storage and tanker loading.

11.4.2 System and Equipment Efficiency Limits

The White Rose facility is expected to have a system efficiency in the range of 90 to 94 percent. This is consistent with experience on similar operating facilities in the North Sea and elsewhere.

The efficiency may be impacted by factors such as:

- equipment failures;
- environmental factors;
- reservoir performance; and
- well performance.

11.5 Logistics

Husky Oil intends to investigate all possibilities of cooperation with other operators in the prospective use of shared services and facilities to support offshore operations. Where synergies exist, it is highly probable that cost savings on this aspect can accrue to all parties.

11.5.1 Marine Base, Warehousing, and Storage Yard

The marine base will be located in or near St. John's. The wharfage should be capable of servicing two to three supply vessels concurrently. Synergies with other East Coast operators will be investigated.

The base will require sufficient handling equipment in cranes, forklifts and winches to support the three-vessel loading/offloading operation. It must similarly also be capable of handling the bulk materials, mud, cement, fuel, and water for up to three vessels concurrently.

The warehouse and pipeyard will preferably be located at, or close to, the marine base. Non-availability of suitable land may preclude this, in which case it will be necessary to have these at a remote location, and trucking between that location and the marine base will be necessary.

11.5.2 Support Vessels

The number and range of support vessels required will be determined after the complete design of the offshore facilities. Vessels will be required for two primary purposes:

- support services on location; and
- transportation between the marine base and offshore facilities.

The support services on location will cover:

- anchor and mooring-chain handling;
- iceberg surveillance, towing and deflection;
- shuttle tanker mooring assistance;
- environmental monitoring;
- oil spill response;
- diving support;
- subsea inspection and maintenance; and
- standby service:
 - person-overboard,
 - on-scene command,
 - search and rescue, and
 - emergency evacuation.

Transportation services between the marine base and offshore facilities will require:

- cargo and bulk re-supply; and
- personnel transportation (marine).

Fleet configuration will be finalized after completion of the field depletion plan and design engineering for the FPSO. Vessels will be continuously available in the field for standby duty in accordance with regulatory requirements. Supply vessels will convey materials, consumables and equipment to and from the offshore facilities.

All personnel staffing the support vessels will be fully trained in emergency duties. There will be routinely scheduled emergency drills and exercises.

11.5.3 Material Procurement and Movement

Husky Oil will adopt a philosophy whereby a minimum spares inventory is maintained consistent with the avoidance of adverse impact on production. To this end, all equipment components will be critically assessed to ascertain maximum and minimum spares requirements. This assessment will determine where the spares should be located. This will be in accordance with the priorities assigned to them. Safety equipment and equipment critical to production will be assigned high priority and will be stored where they are easily accessed and readily available.

11.5.4 Personnel Movements

Personnel movements between St. John's and the field will normally be carried out by helicopter. It is expected that a fleet of two helicopters will be sufficient to meet the needs of conveying the 500 (250 offshore at any one time) production, drilling, and support personnel to and from St. John's and the respective offshore facilities. This is based on a scenario which includes ongoing production in conjunction with two drilling units operating concurrently.

Husky Oil intends to investigate the potential benefits of cooperation with other operators in this regard.

11.5.5 Diving Requirements

Husky Oil intends that diver intervention will only be used infrequently for certain specific underwater operations that cannot be achieved by ROVs.

Husky Oil intends to contract diving services out to a company which will have extensive demonstrated experience and competent performance in subsea production operations. That company will be required to assign a fully qualified and competent superintendent to direct and control the operation. Husky Oil will also place a diving representative onboard to monitor the diving program.

Husky Oil and the diving company will jointly implement the diving procedures manual. The manual will be structured to be compliant with all statutory diving and safety regulations.

11.6 Communications

Communications means all systems, both internal and external, that transmit voice, data, video or image information. Husky Oil will require such communications linkages between all of its facilities both on-shore and offshore on the White Rose project.

System reliability will be paramount for the safety of all offshore operation. Primary and back-up systems will be used to ensure continuous communications capability amongst all facilities in all environmental conditions.

The system components will be state-of-the-art, multi channel and will have adequate redundancy for their purpose. The actual configuration will be finalized at a later date, but is expected to be based on the system currently in use by Husky Oil. In such case, the system will comprise elements as described in the following:

- FPSO and MODU/Shore Link

Communication will be operated from a satellite earthstation in St. John's. The offshore ends of the system include a stabilized base satcom earthstation installed onboard the FPSO and MODUs, with space segment supplied by Telesat Canada's Anik E-2 satellite. The stabilized C-Band earthstation on the FPSO and the MODUs provides wide band digital services including 256 kbps of aggregate bandwidth that is subdivided into discrete voice and data channels.

The C-Band service includes multiple platform-to-shore trunks, Group 3 digital fax service and local area network (LAN) service connectivity to the Husky Oil Operations LAN/PABX in St. John's.

Husky Oil Operations satcom communications are down-linked through a St. John's CUF C-Band teleport. This will provide local St. John's dial-tone extended to the FPSO and the MODUs.

- Telephone System

Telephone service on board the FPSO and MODUs, and at the Husky Oil St. John's office, will use standard services. Centrex lines from the FPSO and MODUs, and the St. John's office, will terminate in a Centrex Group at the switching centre in St. John's.

Centrex lines will terminate on a Key Telephone System on the FPSO and MODUs. This will allow the offshore telephone lines to appear on multiple telephone sets on the FPSO and MODUs, and will allow for extension to extension calling on the FPSO or MODUs. The back-up line will terminate on the Centrex group at the Husky Oil Operations St. John's office, but will bypass the Key Telephone System on the FPSO or MODUs to provide "hot-line" protection in the event of a key system failure.

There will be a number of direct lines which bypass the switchboard. These will be used for emergency only. They will be located throughout the office and will be activated when required.

- Local Area Network (LAN)

The satellite communications system will include an Ethernet LAN for the Husky Oil Operations Offices in St. John's, extended to the FPSO and MODUs using a gateway over the C-Band satellite link. The LAN hubs at the St. John's office and on the FPSO and MODUs will communicate by routers at each location. The routers will address and route data between the FPSO, MODUs and shore-side devices over the link.

- Ship Radio System

The communications system will meet the current Global Marine Distress Signalling System (GMDSS) standard and also will supply required air/ ground/air VHF radio equipment.

The GMDSS radio station will be a complete system, including two HF/MF radios, VHF marine radios with digital selective calling, emergency position indicating beacon, and search and rescue transponder equipment for service in Ocean Area A3.

- Air/Ground/Air VHF Base Station

One air/ground/air VHF AM base station transceiver will be installed in the radio rooms of the FPSO and MODUs. This system is used by the radio operators on the FPSO and MODUs for short-range voice communications with helicopters on arrival at, and on departure from, the FPSO or MODUs.

- Air/Ground/Air VHF Hand-held.

Two air/ground/air VHF AM hand-held radios will be supplied for the helicopter crews on the FPSO and MODUs.

- Non-directional Beacon

A non-directional beacon will be installed on the FPSO and MODUs. These beacons will be used by helicopter aircrews to home in on the FPSO or MODU, using radio detection finder equipment installed in the helicopters.

- VHF Radio System

A VHF radio base station will be installed on the FPSO and the MODUs. This will also include a fleet of hand-held VHF radios. This network will be used for loading/offloading supply boats and for other local voice communications in the immediate area of the FPSO or MODU.

- Shore Base Radio Station Services

The FPSO and MODUs will use a St. John's operations centre for marine and aeronautical coast station services. Services provided via this facility include marine vessel tracking, helicopter flight following, emergency response call-out services, and 24-hour per day monitoring of the Operator standby HF radio channel for routine and emergency response communications.

- Recording Equipment

Offshore voice communications during an emergency will be recorded by the St. John's operations centre to assist in incident investigation following an emergency.

11.7 Contingency Plans

11.7.1 Emergency Response Plan

Husky Oil has a comprehensive detailed East Coast Operations Alert and Emergency Response Plan (AERP). Existing facilities and locations operated by Husky Oil and its contractors are currently covered by this plan. As changes are made to facilities, locations, and contractors, the plan will be continuously updated.

An emergency is defined as an unexpected occurrence either resulting in, or having the likely potential to result in, death, serious injury or illness requiring hospitalization, environmental impact posing a serious threat to on-scene personnel or wildlife, or major and significant damage to property. The following are examples of possible emergency situations which will be covered by contingency planning:

- an accident which results, or could result, in loss of life or serious injury (for example, diving accidents, person overboard);
- explosions or major fires;
- loss of well control;
- hydrocarbon or chemical spills,
- loss of, or damage to, helicopters or fixed wing aircraft;
- loss of, or damage to, support or standby vessels;
- loss or disablement of FPSO or MODU;
- loss of FPSO or MODU ballast control or stability;
- hazards posing an imminent threat to the operating area, such as heavy weather, sea ice, icebergs, or potential collision with an ocean-going vessel;
- major damage to equipment not caused by any of the above (for example, materials handling equipment failure); and
- security related incidents involving issues such as extortion, bomb threat, or acts of terrorism.

11.7.1.1 Emergency Response Organization

The organization used by Husky Oil for its 1999 and 2000 drilling programs is shown in Figure 11.7-1. A similar organization will be implemented during the drilling/FPSO operations for the development and production operations phases.

The responsibilities of the Emergency Response Team will include:

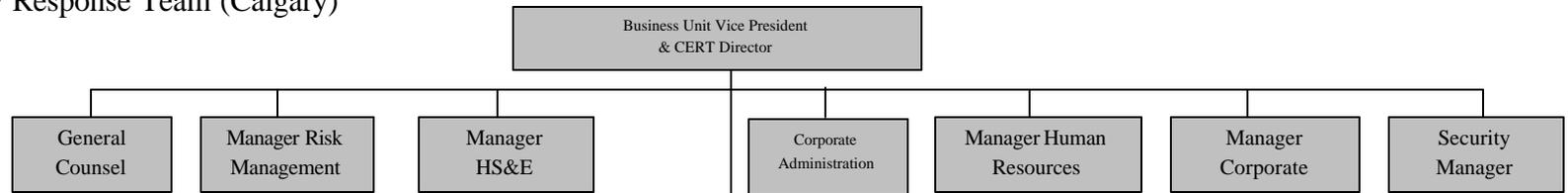
- assisting the on-scene emergency action teams by obtaining personnel and equipment resources as required;
- addressing family, public and employee communications issues;
- liaising with government and regulatory authorities;
- addressing engineering and other technical issues related to the emergency;
- addressing accounting;
- addressing insurance issues;
- addressing logistics and procurement issues; and
- addressing loss control (HS&E) issues.

Offshore emergency response teams will include:

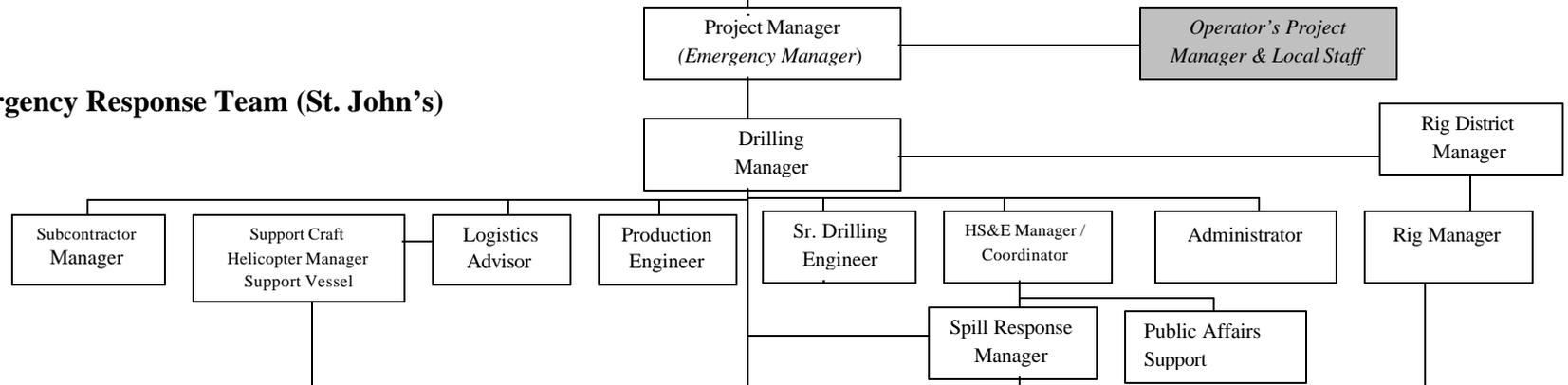
- technical operations team;
- medical team;
- fire team;
- helideck team;
- lifeboat team;
- FPSO rescue craft team;
- MODU rescue craft team(s);
- fast rescue craft team; and
- spill response team.

Figure 11.7–1 Emergency Response Organization Chart

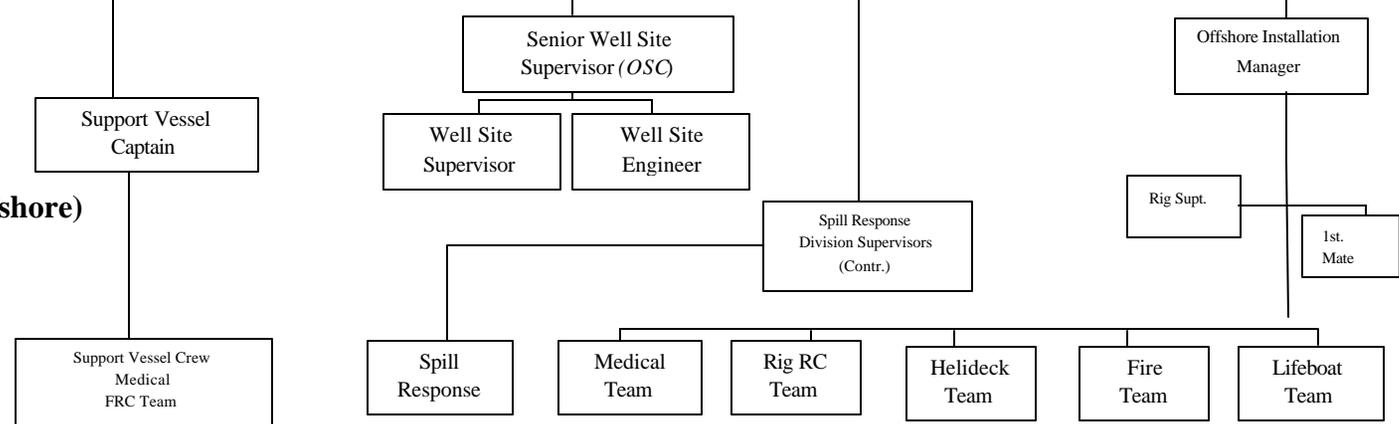
Corporate Emergency Response Team (Calgary)



East Coast Emergency Response Team (St. John's)



Emergency Response Team (Offshore)



11.7.1.2 Training and Exercises

All personnel will receive general response plan orientation and refresher training.

Specialized emergency response training will be provided for medical teams, offshore fire teams, evacuation/lifeboat teams, rescue craft teams, support vessel fast rescue craft teams, helideck teams, and spill response teams.

Scheduled regular emergency drills will be carried out, including FPSO or MODU abandonment, fire, person overboard, loss of well control, loss of ballast control, and use of rescue and breathing apparatus.

External groups or agencies will be familiarized with the overall AERP and their specific responsibilities under the plan.

A specific AERP training matrix will identify the main training topics, personnel roles, and type of training required.

Scheduled and planned AERP exercises will be conducted regularly, including communications exercises, tabletop exercises and logistics exercises.

11.7.1.3 Response Time

Husky Oil will plan emergency response in such a way that the actual response time to any emergency will be as expeditious as it can possibly be made. Personnel in all emergency response teams will be on call 24 hours per day. Key onshore personnel will be located in the St. John's area. Specialist personnel with skills pertinent to specific emergencies will be involved, as required.

11.7.1.4 Response Capability Improvement Initiatives

Husky Oil will cooperate with other operators and agencies in all emergency situations through resource sharing and mutual aid. Husky Oil currently has established mutual aid agreements with other operators, including the Hibernia Management and Development Company Ltd. (HMDC) and Petro-Canada, operator of the Terra Nova field.

Husky Oil will also participate in joint training exercises with other operators.

11.7.1.5 Environmental Emergencies

Contingency planning for the specific case of environmental emergencies is described in Chapter 6 of the EIS (Comprehensive Study Part One).

11.7.1.6 Response Considerations

Response to all incidents will be carried out in a consolidated integrated fashion. Each person involved in emergency response will know their emergency response role thoroughly, and will be fully conversant with the roles of others with whom they will interact.

Specific considerations will apply to specific situations. Examples include:

- **Personal Injury or Fatality**

Notwithstanding that every effort will be made to avoid accident or injury to personnel, such events may occur in the offshore environment. These can range from injuries of a minor nature that can be treated offshore, through serious injuries that necessitate transfer to an on-shore facility, and in the worst case, personnel fatality.

An offshore medic trained in trauma response will be provided on the FPSO and on the MODUs. This person will have the support, when required, of other personnel trained in advanced first aid and medical escort service. The emergency medical team will complement the medic, to the extent appropriate, with the following additional personnel:

- Level 1 first aid attendants on the FPSO and MODUs and support vessels, trained to provide first response and basic first aid,
- Level 2 first aid attendants on the FPSO and MODUs and support vessels, trained to provide more advanced first aid to the more seriously injured as needed,
- A shorebased designated on-call physician trained in offshore oil and gas related emergencies available for medical consultation on a 24-hour basis.

The onboard sick bay will be supplied with all equipment and medical supplies necessary to provide immediate first aid.

- **Fire or Explosion**

Passive and active protection systems will be designed into the FPSO to mitigate as much as possible the potential effects of fire or explosion.

The fire detection system, whether automatically or manually activated, will initiate response to the fire or explosion, activating water deluge, foam, or carbon dioxide protective systems.

Trained fire teams will supplement the protective systems. All personnel will receive comprehensive training in fire team duties. The teams' state of readiness will be kept at top level by regular drills. Exercises simulating major emergencies will be carried out on a regular basis. To ensure optimum ability to respond to major offshore emergencies, support vessel crews and onshore personnel will also be trained in offshore emergency response.

- Vessel Collision and Structural Impairment

If, notwithstanding all vessel avoidance procedures, there is a collision between the FPSO and another vessel, structural impairment to some degree will be likely. Production will, in such instance, be immediately suspended pending an assessment of the damage sustained to the FPSO.

The OIM will decide what action should be taken after the degree of damage is assessed. Depending on the extent of damage, this may vary from a decision to resume production, through various intermediate choices, up to a decision to evacuate the FPSO.

All FPSO personnel will carry out weekly muster and lifeboat drills, and it will be a prerequisite for all offshore personnel to be trained in basic sea survival before going offshore. A selected number of offshore personnel will be trained as lifeboat coxswains.

- Heavy Weather

Heavy weather is deemed to apply when topside facilities have to be shut down due to vessel motion.

The OIM will take appropriate precautions in advance of the arrival of heavy weather. Producing systems will also be shut down in a controlled fashion. Wells will be shut in, tankers disconnected, cranes secured, and compressors shut down. If production is expected to be shut down for an extended period of time, the flowlines may be flushed to mitigate hydrate and/or pour point problems.

The OIM will be responsible for all decisions concerning courses of action during heavy weather.

- Oil Spills

The possibility of a serious oil spill is the major environmental concern in offshore operations. The risk will be reduced to as low as reasonably practicable level through the extensive monitoring procedures on the installation.

In the unlikely event that a spill should nevertheless occur, the spill response team will take the following actions, as appropriate:

- isolate or stop the leak by closing the line, tank valves, etc.;
- place absorbent pads on deck to prevent further contamination of the water body;
- boom spill and contain, if possible;
- recover product using skimmers;
- notify as soon as possible anyone working on or using the water body, in proximity to the release;
- if necessary, the local Oil Spill Response Contractor may be contacted for advice and/or assistance;
- collect samples, if safe to do so; and
- if the spill is significant, Oil Spill Response Procedures will be initiated.

- Loss of Well Control

Loss of well control, while unlikely, is more likely to occur during work being carried out from a drilling unit. This would include such activities as drilling, well completion or well workover. Therefore, in the event of loss of well control, remedial action will be implemented by the affected drilling unit in accordance with drilling and well control procedures. If circumstances so dictate, oil spill response action will also be implemented.

- Loss of Vessels or Helicopters

All vessels and helicopters will be required to advise the on-shore flight-tracking centre and offshore facilities of their position and status on a regular basis. In the case of aircraft, reporting will be required every 15 minutes. In the event that any vessel or helicopter becomes distressed, these reports will help identify its location, and hence, improve the speed with which aid can be brought to the scene.

In the event that such aid is required, all available resources will be immediately assigned to proceed to the last estimated location of the distressed unit.

All search and rescue organizations will be immediately contacted and appropriate communication channels established. A command centre will be set up at to assist the search and rescue operation.

- Subsea Flowline or Manifold Leaks

Monitoring of subsea flowlines and manifolds will be carried out by pressure instrumentation and by visual monitoring (for example, using a ROV).

In the event that a leak is detected, action will be taken immediately to shut in the flowline or manifold affected. If necessary, oil spill contingency response will be implemented.

- Diving Emergencies

Diving activities in the field require close coordination with all operations currently occurring on the FPSO. Ongoing diving activities will require the suspension of all over-the-side work, restriction of offloading of supply vessels, and strict monitoring of suction inlets and discharge outlets.

In the event of a diving emergency, the field diving superintendent will coordinate the emergency response. The FPSO OIM will provide coordinated support assistance from FPSO resources on request from the diving superintendent. As well, other field resources, such as vessels and helicopters, will be assigned as appropriate to assist on the request of the diving superintendent.

11.8 Vessel Surveillance and Collision Avoidance

Husky Oil already has vessel surveillance and collision avoidance procedures in place to protect personnel and facilities in its offshore drilling operations. These are part of its AERP and will be updated as appropriate to reflect the full production operation of the field.

Ocean-going vessels transiting the area of offshore operations may pose a threat to the moored FPSO or anchored MODUs. The crews of the FPSO, each MODU and each standby vessel will be required to maintain radar watch at all times to monitor vessel traffic in proximity to the FPSO and MODUs, and to react should the possibility of collision develop. The success of any anti-collision system is dependent on early warning and fast, efficient reaction.

These will be a designated vessel exclusion zone around all project facilities (radius 500 m), a designated safety zone (radius 5 nautical miles), and cautionary zone (radius – additional 5 nautical miles) established for the operation. These zones will be communicated to mariners using established networks and are intended to facilitate communication between project vessels and ocean-going vessels.

The primary objective of the collision avoidance procedures will be to ensure that every possible effort is made to avert a collision between the approaching vessel and the FPSO or MODU, and that the approaching vessel is alerted as early as possible to take avoidance action. The FPSO, MODU, or standby vessel may attempt to attract the attention of the approaching vessel in any one or more of the following ways:

- establishing radio communication;
- shining searchlights in the direction of the approaching vessel and then towards the FPSO or MODU, whichever is threatened;
- firing suitable pyrotechnics;
- signal light of the threatened vessel, FPSO or MODU, flashing “U” (“urgency”);
- foghorn or whistle of the threatened vessel, FPSO or MODU, sounding “U”;

- using onboard equipment, such as sirens, klaxons or concussive noisemakers;
- making use of international GMDSS procedures and frequencies; and
- other means at the discretion of the OIM.

Zones will be established, centred on the FPSO or MODUs, as follows:

- **Collision Zone** is bounded by a circle of radius 500 m (0.27 nautical mile). Any approaching vessel which has a closest point of approach (CPA) within, or at the perimeter of, this zone will trigger a collision alert for the threatened FPSO or MODU; and
- **Near Miss Zone** is a circular zone having its inner boundary at the perimeter of the Collision Zone (500 m) and its outer boundary at 2.0 nautical miles from the subject FPSO or MODU. The procedures will reflect that a near miss situation has the potential to develop rapidly into a collision situation.

The degree of action initiated, when the trajectory of an approaching vessel is projected to intrude into one of the zones, will be determined by the proximity of the CPA to the threatened facility and the time for the approaching vessel to reach CPA. The actions are determined according to the following target monitoring zones:

- **First Alert Zone.** In this zone, a vessel detected approaching the threatened facility is expected to reach a CPA within the Collision or Near Miss Zone if its present course is maintained;
- **Second Alert Zone.** In this zone, an approaching vessel is expected to reach a CPA within the Collision or Near Miss Zone within 30 minutes if its present course and speed are maintained; and
- **Emergency Zone.** In this zone, an approaching vessel is expected to reach a CPA within the Collision or Near Miss Zone within 15 minutes.

The following summarizes the actions that will be taken for each of the above alert zones:

- Actions in First Alert:
 - attempt to establish radio communications with the approaching vessel;
 - inform all standby vessels, shore base and other platforms;
 - maintain constant radio and radar watch;
 - dispatch standby vessel to a position at least 2 nautical miles from the threatened FPSO or MODU on bearing of the approaching vessel;
 - suspend operations;
 - prepare lifeboats; and
 - exercise options to attract the attention of the approaching vessel.

- Actions in Second Alert:
 - advise Rescue Coordination Centre/Canadian Coast Guard and put on standby;
 - maintain contact with Canadian Coast Guard, shorebase and other platforms;
 - confirm that no personnel are below main deck and that all ballast control valves and water tight doors are closed;
 - complete suspension of operations in preparation for disconnecting;
 - continue to exercise options to attract the attention of the approaching vessel;
 - use GMDSS to issue standard marine alert with “urgency” priority;
 - sound alarm and muster non-essential personnel in lifeboats in preparation for evacuation;
 - standby vessel moves to intercept approaching vessel; and
 - standby vessel prepares fast rescue craft, rescue and medical equipment for use in evacuation of the FPSO or MODU.

- Actions in Emergency:
 - recall standby vessel to threatened facility to prepare for evacuation;
 - disconnect in sufficient time to avoid collision;
 - remaining personnel to enter lifeboats;
 - maintain contact with standby vessel;
 - remain in lifeboats while monitoring situation;
 - if the FPSO or MODU is disabled, command of the situation is passed to the standby vessel master;
 - use GMDSS to issue standard marine alert with “distress” priority;
 - maintain communications with shorebase and CCG for as long as possible; and
 - the standby vessel will continue to exercise options to attract the approaching vessel.

The marine watch or environmental observer onboard the FPSO or MODU will monitor and plot all vessels which are expected to enter a region within a 5-nautical mile (9.3 km) radius of the facility. The observer will inform the OIM of all vessels expected to enter the region within the 5-nautical mile radius.

11.9 Operations Safety

Husky Oil promotes safe operations for personnel and protection for the environment. Safe operations are paramount and will not be downgraded for reasons of expediency.

A loss management program will be implemented specific to the White Rose development. It will become an integral part of Husky Oil's corporate loss control management philosophy. This philosophy is based on elimination or reduction of risks to personnel, assets, production, and environment through continuous and systematic approach. It covers all aspects related to health and safety, environment, reliability, management of process hazards, risk assessment, and loss control.

The White Rose HS&E loss control management system will focus on preventing and minimizing accidental losses, and will be accompanied by the Health, Safety and Environmental Loss Control Management Performance Standards, addressing the following:

- leadership and administration;
- leadership training;
- planned inspections and maintenance;
- accident and incident investigation;
- emergency preparedness;
- organizational rules, policies and procedures;
- employee knowledge and skill training;
- personal protective equipment;
- health and hygiene controls and services;
- group meetings;
- environmental program; and
- other loss control issues:
 - critical operations,
 - engineering and change management,
 - personal communications,
 - personnel recruitment, and
 - purchasing and contract management.

An exclusion zone will be established around the FPSO. It will consist of two circular zones centred on the FPSO. The inner zone, the Safety Zone, will have a radius of 5 nautical miles from the FPSO. The outer zone, the Cautionary Zone, will circumscribe the Safety Zone and have a radius of 10 nautical miles (18.5 km) from the FPSO. Advice on this will be published through notices to mariners.

The FPSO and each MODU will incorporate a temporary safe refuge (TSR) to serve as a “safe haven” where personnel can muster during emergency. The TSR will serve as a resource base for emergency actions and communications. Access routes to the TSR will provide a safe path from any area of the installation during the initial stages of an incident. The TSR will be provided with the means of getting to, and using, the evacuation systems. The TSR will incorporate the following features:

- protection against smoke and gas ingress;
- protection against loss of breathable atmosphere;
- protection against heat/temperature build-up;
- reliable power supplies;
- lighting and visibility systems;
- communication systems;

- command structure; and
- facilities to handle medical and rescue emergencies.

Two safe escape routes to the TSR will be provided from all work areas to increase the likelihood that at least one route will remain accessible during any given condition.

Evacuation systems will be provided in sufficient quantity, and at strategic locations, to cater for 200 percent of the normal personnel on board. Secondary and tertiary escape systems will also be provided.

An adequate supply of lifebuoys will be provided, and distributed in such a way that at least one lifebuoy will be visible from any point of the outside walkways on the installation.

Lifejackets will be provided to accommodate as a minimum:

- 100 percent of maximum personnel on board located within the TSR; and
- a minimum of 50 percent of the maximum personnel on board located outside the TSR.

Every person on board will be issued with an emergency survival pack containing a survival suit, heat resistant gloves, and a flashlight. These will be kept in the individual's cabin. Additional survival suits to accommodate 100 percent of the personnel on board will be located in storage cabinets outside the TSR adjacent to the evacuation systems.

A standby vessel will be in place at the FPSO and at each MODU at all times. It will be equipped with hospital space, emergency food provisions, and a fast rescue craft for use in retrieving personnel.