1. **Course Framework**

Advanced training for oil tanker Cargo Operations

**1. Aims**

This course provides training for masters, chief engineers, officers and any person with immediate responsibility for the loading, discharging and care in transit or handling of cargo. It comprises a specialized training programme appropriate to their duties, including oil tanker safety, fire safety measures and systems, pollution, operational practice and obligations under applicable law and regulations. The course takes full account of section A-V/1 of the STCW code adopted by the international convention on standards of training, certification and watchkeeping for seafarers, 1978 as amended 2010.

Any of this training may be given on board or ashore. It should be supplemented by practical instruction on board and, where appropriate, in a suitable shore-based installation.

**2. Objective**

Provided they hold an appropriate certificate and are otherwise qualified in accordance with regulation V/1-2.2 of the international convention on standards of training, certification and watchkeeping for seafarers, 1978, as amended in 2010, those successfully completing the course should therefore be able to take immediate responsibility for loading, discharging and care in transit or handling of cargo on oil tankers. They will make a safer and more effective contribution to the operation and control of the cargo on a tanker, which will improve the ship safety and provide greater protection to the environment. In particular, during the course, there will be:

- Familiarization with the equipment, instrumentation and controls used for cargo handling on a tanker
- A greater awareness of the need of proper planning, the use of checklists and the time scales involved in the various cargo handling operations
- An enhanced awareness to apply proper and safe procedures at all times when carrying out the various operations on board an oil tanker
- An acquisition of experience on identifying operational problems and solving them
- An improvement in the ability to make decisions which promote safety and protect the marine environment
- An increased ability to make decisions which promote safety and protect the marine environment
- An increased ability to plan and co-ordinate actions during emergencies

**3. Entry standards**

The course is open to seafarers who have completed a shore-based fire-fighting training course approved by the administration, and who have relevant experience appropriate to their duties on oil tankers, as stipulated in STCW regulation V/1 paragraph 2.1, and subparagraphs 1.1 or 1.2. The following then is the minimum entry requirement:

- Relevant experience on board a tanker as stipulated by STCW (regulation V/1, paragraph 2.1)

**4. Course certificate**

The specialized oil tanker training programme must be approved by the administration. Masters and officers who are qualified in accordance with regulation V/1 paragraphs 1 or 2, as appropriate (that, they have experience appropriate to their duties on tankers, and complete this training programme), shall be issued with an appropriate certificate.

**5. Course intake limitations**

The number of trainees will not exceed 20 and practical training should be taken in small groups not exceeding four per group.
6. **Staff requirements**

The instructor shall have appropriate training in instructional techniques and training methods (STCW Code section A-1/6, paragraph 7). It is recommended that qualified personnel who are experienced in the handling and characteristics of oil tanker cargoes give all training and instruction and the safety procedures involved. Staff be recruited from deck and the engine departments who have served on board a tanker in a senior capacity and have the necessary practical experience.

7. **Training facilities and equipment**

Proper classroom facilities with an overhead projector (OHP) are sufficient for most of the course. However, dedicated computer based training (CBT) modules to be run on an ordinary PC, as well as exercises on an operational, hands-on liquid-cargo-handling simulator will greatly enhance the quality and result of the course. If this is the case, then sufficient PCs required. In addition, a video cassette player will be required in case videos are used in the teaching programme.

The following equipment should be available:

- Resuscitator
- Breathing apparatus
- Portable oxygen meter
- Portable combustible-gas detector
- Portable interferometer
- Portable toxic-gas detector
- Chemical absorption tubes for toxic-gas detector (for benzene, carbon monoxide, hydrogen sulphide)
- Tank evacuation equipment

8. **Use of Simulator**

The revised STCW convention sets standards regarding the performance and the use of simulators for mandatory training, assessment or demonstration of competence.

The general performance standards for simulators used in training and for simulators used in assessment of competence are given in section A-1/12. Section B-1/12 provides guidance on the use of simulators in these activities.

Simulator-based training and assessment is not a mandatory requirement for this oil tanker training programme. However, it is widely recognized that well-designed lessons and exercises can improve the effectiveness of training and shorten training times compared to traditional methods.

If used a simulator-based training, instructors should ensure that the aims and objectives of these lessons are defined within the overall training programme and that tasks are selected so as to relate as closely as possible to shipboard tasks and shorten training times compared to traditional methods.

If using a simulator-based training, instructors should ensure that the aims and objectives of these lessons are defined within the overall training programme and that tasks are selected so as to relate as closely as possible to shipboard tasks and practices. Instructors should refer to reference R8, section A-1/12, part 2.
Advanced training for oil tanker Cargo Operations

Minimum requirements for the training of Masters and officers on oil tankers
(STCW chapter V, regulation V/1 paragraph 2)

Note:
It is suggested that a relevant liquid cargo-handling simulator (oil) can serve as an efficient teaching tool. Should such a system be available, then the class/lecture hours should be adapted to incorporate such without raising the overall duration of the course. Areas that may be suitable for such a training are indicated with an *

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<tr>
<th>Course Outline</th>
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<td>2 Basic properties of petroleum and its hazards (STCW Code, section A-V/1 paragraph11)</td>
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<td>3.4 Gas indicators</td>
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<td>3.5 Fire-fighting principles – revision</td>
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<td>4 Pollution prevention (STCW Code, section A-V/1 paragraph 9,14)</td>
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<td>4.1 Ship and equipment</td>
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<td>4.3 Oil Record Book</td>
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<td>4.4 Action in case of oil spills</td>
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<td>5 Oil tanker design and equipment (STCW Code, section A-V/1 paragraph 10)</td>
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<td>5.1 Constriction</td>
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<td>5.2 Pumping, piping and discharge arrangements</td>
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<td>5.3 Cargo heating system</td>
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<td>5.4 Venting arrangements</td>
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<td>5.5 Level gauges</td>
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<td>5.6 Environmental protection equipment</td>
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<td>6 Oil tanker operation</td>
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### Inert Gas Systems (IGS) (STCW Code, section A-V/1 paragraphs 10,12)

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<tr>
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<td>1. Inert Gas Systems (IGS) (STCW Code, section A-V/1 paragraphs 10,12)</td>
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<td>1.1 General</td>
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<tr>
<td>1.2 The inert gas system</td>
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<td>1.3 Inert gas plant</td>
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<tr>
<td>1.4 Scrubber</td>
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<tr>
<td>1.5 Inert gas blowers</td>
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<td>1.6 Inert gas pressure-regulating valve</td>
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<td>1.7 Non-return devices</td>
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<tr>
<td>1.8 Inert-gas distribution and venting</td>
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<tr>
<td>1.9 Gas-analyzing and indicating equipment</td>
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<tr>
<td>1.10 Operation</td>
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<tr>
<td>1.11 Meters, indicators and alarms</td>
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<tr>
<td>1.12 Emergency procedures</td>
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<tr>
<td>1.13 Maintenance and testing</td>
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### Crude oil Washing Systems

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<td>Knowledge, understanding and proficiency</td>
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<tr>
<td>1. Crude Oil Washing (COW) (STCW Code, section A-V/1 paragraphs 10,12)</td>
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<tr>
<td>2.1 Introduction</td>
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<tr>
<td>2.2 Design of COW systems</td>
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<tr>
<td>2.3 COW piping</td>
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<tr>
<td>2.5 Pumps</td>
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<td>2.6 Stripping systems</td>
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<td>2.7 Operations</td>
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**Advanced training for oil tanker Cargo Operations**

**Model Course – 1.02**

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<th>13.2 Examination</th>
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<td><strong>TOTAL</strong></td>
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Detailed Teaching Syllabus

Advanced training for oil tanker Cargo Operations

The detailed teaching syllabus is presented as a series of knowledge, understanding and proficiency to be acquired. The objective, therefore, describes what the trainee must do to demonstrate that specified knowledge or skill has been transferred and competence achieved.

Thus each training objective is supported by a number of related performance elements in which the trainee is expected to be proficient. The teaching syllabus shows the required performance expected of the trainee in the tables that follow.

In order to assist the instructor, references are shown to indicate IMO references and publications, textbooks and teaching aids that instructors may wish to use preparing and presenting their lessons.

Knowledge, understanding and proficiency

1. Introduction (1.5 hours)

1.1 Oil tankers (1 hour)

.1 defines:
- Oil tanker
- Crude oil tanker
- Product carrier
- Combination carrier

.2 describes combination carriers as oil/bulk/ore (OBO) or oil/ore (O/O) carriers

.3 identifies and describes an OBO and an O/O carrier from cross-sectional diagrams

.4 explains the purpose of and differences between OBO and O/O carriers

.5 describes the LOT procedures

.6 describes the features of a double-hull tanker

.7 describes the features of a mid-deck design tanker

.8 explains the principle of hydrostatic balance loading

1.2 International and national regulations concerning oil tankers (1 hour)

.1 states the shipping activities are of international nature and that the international forum for maritime and therefore for shipping matters is IMO

.2 states that the IMO has drawn up conventions which affect ships

.3 states that the conventions directly affecting ship and shipping activities are the conventions SOLAS 1974 as amended, MARPOL 73/78 as amended and STCW 78 as amended in 1995; and states their full title

.4 states that the countries that are party to the above conventions have the provisions of those conventions incorporated into their national laws

.5 states that oil tankers are affected by the above conventions either through the laws of the Flag State or the Port State

.6 states that compliance with the structural requirements of SOLAS is certified by means of Cargo Ship Safety Construction Certificate with the oil tanker Supplement

.7 states that compliance with the equipment requirements of SOLAS is certified by means of Cargo Ship Safety Equipment Certificate with the oil tanker Supplement

.8 states that a safety Management System in compliance with the ISM Code must be in place on board all tankers of 500 GT and upwards

.9 states that construction and requirement requirements under MARPOL 73/78 is certified by means of international oil pollution prevention certificate with supplements B

.10 states that Flag States are responsible for the issuance of the certificates but may appoint another agency on their behalf

.11 states that, in many ports, Oil tanker operations are governed by local regulations

.12 states that the port State authorities may verify compliance with the aforementioned conventions, including ILO conventions (ILO 147)

.13 states that oil tankers have the potential to cause marine and/or coastal pollution

.14 states that the owner of the ship is liable for clean-up costs and other damages
.15 states that a number of maritime countries, party to the CLC and fund conventions (69/92; 71/92) require a ship owner to be insured against such damages.

.16 states that the proof of insurance is the certificate of insurance or other financial security in respect of civil liability or other financial security in respect of civil liability for oil pollution damage, which is issued by flag state under the provisions of the convention.

.17 states that the Convention limits the ship owners liability for oil pollution damage in accordance with the tonnage of the ship.

.18 states that an owner cannot limit his/her liability if an oil pollution incident occurred as a result of his/her fault.

2. Basic properties of petroleum and its hazards (5.5 hours)

2.1 Basic physics (0.5 hour)
- .1 describes the three states of matter.
- .2 defines melting, sublimation, evaporation, melting point and boiling point.
- .3 describes surface tension, adhesion, cohesion, hydrostatic pressure, miscibility, solubility and diffusion as these terms apply to liquids.
- .4 defines the viscosity and saturated vapour pressure of liquids.
- .5 describes diffusion, pressure and miscibility as applied to gases/vapour.
- .6 defines the critical pressure and temperature of gases.
- .7 describes the structure of atoms and molecules.
- .8 states that a negatively charged body has an excess of electrons.
- .9 states that a positively charged body has a shortage of electrons.
- .10 states that similarly charged bodies repel each other and oppositely charged bodies attract each other.
- .11 describes induction and how the induction of an electrode may cause it to become charged.
- .12 describes how a charged electrode may be discharged.
- .13 states that a discharge releases energy which may cause a spark.

2.2 Properties of petroleum (0.5 hour)
- .1 states that crude petroleum as discharged at the well head is a mixture of a large number of different hydrocarbon molecules.
- .2 states that the molecules are termed 'light' or 'heavy' according to the number of carbon atoms in the molecule.
- .3 states that the boiling point of the constituent compounds range from -162°C (methane) to a value in excess of 140°C.
- .4 states that the composition of petroleum depends on the source.
- .5 states that crude oil is a mixture of hydrocarbons ranging from those which are partly gaseous under normal atmospheric conditions to those which are liquid and solid.
- .6 states that crude oil is split into fractions in an oil refinery process termed as 'distillation'.
- .7 states that heavy fractions (containing a large number of carbon atoms) can be split into lighter fractions (containing a smaller number of carbon atoms) by means of an oil refinery process termed as 'cracking'.
- .8 states that each petroleum fraction has a range of physical properties specific to itself.
- .9 defines the volatility of petroleum as the tendency of crude oil or an oil product to produce gas.
- .10 states that volatility is characterised by the vapour pressure.
- .11 states that the true vapour pressure (TVP) of a petroleum mixture is difficult to measure, but that a correlation exists between TVP and Reid vapour pressure (RVP), which is relatively easy to measure.
- .12 states that the carriage of petroleum and petroleum products in bulk poses health and environmental hazards.

2.3 Hazards associated with the handling and carriage of petroleum (5 hours)

Toxicity in general (0.5 hour)
- .1 states that poisoning may occur orally, through inhalation or by skin contact.
- .2 states that poisoning may be acute or chronic.
.3 states that the toxicity of a substance is difficult to measure and that it is therefore rated on the basis of studies performed on animals and extrapolated from the human body.

.4 lists and describes the criteria by which toxicity is measured and expressed.

**Toxicity of petroleum** (0.5 hour)

.5 describes the effects of ingesting petroleum.

.6 describes the effects of petroleum on the skin and in the eyes.

.7 states that the main effects of petroleum gas on persons and the complications it may cause.

.8 describes the symptoms of narcosis.

.9 states that the toxicity of petroleum gas varies widely, depending on its main hydrocarbon constituents.

.10 lists typical toxic constituents of petroleum gas.

.11 describes the threshold limit value (TLV) that is generally accepted for petroleum gas.

.12 states that this TLV must NOT be taken as applicable to gas mixtures containing benzene or hydrogen sulphide.

.13 states that the human body can tolerate a concentration above TLV for short periods.

.14 explains why:
- the absence of a smell of gas is insufficient guarantee of its absence.
- a combustible gas indicator cannot be expected to measure TLV accurately.

.15 states that leaded gasoline is considerably more toxic than unleaded gasoline if ingested or absorbed through the skin, but there is little difference between toxicity of vapours of leaded and unleaded petroleum.

**Toxicity of inert gas** (0.5 hour)

.16 states that the main hazard associated with inert gas is its low oxygen content, but that it may also contain toxic gases.

.17 states that the main hazard associated with inert gas is its low oxygen content, but that it may also contain toxic gases.

.18 describes the fate of the nitrogen oxides in fresh flue gas.

.19 states that nitrogen dioxide is more toxic than nitric oxide.

.20 states that:
- the sulphur dioxide content depends on the sulphur content of the fuel oil and on the efficiency of the scrubber.
- the carbon monoxide content depends on combustion conditions.

.21 states that NOx and SOx are now regulated by Annex VI of MARPOL 73/78.

**Oxygen deficiency** (0.5 hour)

.22 states that oxygen content of air is 21% by volume but may be lower in enclosed spaces.

.23 explains the reasons for a lower oxygen content.

.24 explains why reliance should not be placed on symptoms for indicating an oxygen-deficient atmosphere.

.25 states that persons have varying susceptibility to oxygen deficiency but that all will suffer if the oxygen content drops below 16% by volume.

.26 states that if oxygen is less than 21% atmosphere may be extremely dangerous unless it is known which gas has replaced the oxygen.

.27 describes the symptoms that appear when the oxygen content decreases.

**Flammability and explosiveness** (1 hour)

.28 states that liquids cannot burn unless flammable vapours are emitted.

.29 defines flashpoint.

.30 describes the combustion process for hydrocarbons.

.31 describes flammable range, lower flammable limit (LFL) and upper flammable limit (UFL).

.32 explains the fire tetrahedron.

.33 states that hydrocarbon gas may not be evenly distributed within a space.

.34 describes the determination of flashpoint.

.35 explains why the flashpoint determined by the open-cup (o.c.) test is somewhat higher than that determined by the closed-cup (c.c.) test.
Advanced training for oil tanker Cargo Operations
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.36 states that for many safety related rules, a division has been made between hydrocarbon liquids with a flashpoint of 60°C and above and those with a flashpoint below that temperature.

.37 identifies a flammability composition diagram and with the aid of the diagram describes the effects of:

- gas-freeing
- purging
- purging and gas-freeing of cargo tanks

.38 lists as source of ignition:

- open fires
- naked lights
- sparks from accidents, work or tools
- electrostatic discharges

.39 describes the process of gas evolution in a tank.

.40 lists causes for this gas to be expelled from a tank.

.41 explains the dangers of gas dispersion for the ship’s accommodation and terminal jetties.

.42 states that the dispersion of air/vapour mixtures to be below LFL is speeded up by strong winds.

**Electrostatic hazards (1 hour)**

.43 explains what charge separation is and when it occurs.

.44 explains that no hazard exists if the different materials remain in contact and immobile relative to one another.

.45 states that a large voltage differential develops after charge separation.

.46 explains the creation of an electric field.

.47 describes the charge separation within a conductor in an electrostatic field.

.48 describes the process of charge relaxation and factors relevant to relaxation.

.49 states that highly conductive materials can retain their charge if insulated by a poor conductor.

.50 states that an electrical breakdown between two points, giving rise to a discharge, depends on the strength of the electrostatic field between the points.

.51 states that a field strength of 3000 KV per meter is sufficient to cause the breakdown of air or petroleum gases.

.52 states that field strength near protrusions is greater than the overall field strength, and that a discharge may occur between a protrusion and the space around it or between a protrusion and another object nearby.

.53 states that single-electrode discharges are unlikely to lead to explosions on tankers.

.54 gives examples of two-electrode discharges and describes when these discharges may cause ignition.

.55 describes the instantaneous release of energy with respect to:

- conductors
- liquid non-conductors
- solid non-conductors
- intermediate liquid & solid non-conductors

.56 explains when liquids are considered to be non-conductors.

.57 defines and lists static accumulator oils.

.58 explains the function of anti-static additives.

.59 explains why all distillates must be treated as static accumulator oils unless they contain anti-static additives.

.60 lists the processes giving rise to charges within distillates.

.61 explains the electrostatic hazards of equipment permanently mounted in the upper part of a tank, and the measures to minimize the hazards.

.62 explains how operations can cause a charged mist to develop within a tank.

.63 explains the dangers of introducing steam, inert gas or carbon dioxide into a charged atmosphere.

**Hazards to the marine environment (1 hour)**

.64 explains the damage the oil causes to the marine environment as a result of blanketing, ingestion by sea organisms and the deterioration of amenities.
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.65 explains the meaning of toxic load
.66 explains that it is when the toxic load, of an area, is exceeded after an incident that causes harm to the marine environment
.67 explains that oil can interfere with other legitimate uses of the sea (water inlets, fish farming, fishing industry and coastal tourism)
.68 explains that oil tankers can introduce oil into the sea:
- in port, as a result of:
  - leaking hoses or loading arms
  - overflow from tanks
  - equipment failure
  - improperly set sea valves
  - at sea, as a result of:
  - stranding or collision
  - lightering operations
  - tank washing and line flushing
  - de-ballasting
  - thermal expansion of oil in tanks or piping
.69 states that pollution as a result of stranding and collision constitutes a minor part, and operational pollution the major part, of marine pollution by oil
.70 describes the causes of air pollution
.71 states that air pollution is now covered under Annex VI of MARPOL 73/78
.72 states that the Baltic Sea Area is now a special area under Annex VI

3. Safety (6 hours)

3.1 General precautions (0.5 hour)
.1 explains the desirability of eliminating both flammable atmospheres and sources of ignition, but that this is not always possible
.2 lists pump-room and tank deck as possibly having flammable atmospheres and the accommodation as possibly having ignition sources
.3 explains that the accommodation should therefore be kept free of flammable gases
.4 explains that the pump-room, cargo deck, deck stores, forecastle, centre castle, dry cargo holds etc. should be kept free of ignition sources
.5 states that inert gas increases the safety from fire and explosion but does not obviate the need for precautions
.6 describes the danger of mixing bunkers with volatile cargo
.7 states that smoking may only be permitted at times and in places specified by the Master and that additional restrictions may apply in port
.8 states that matches and lighters may only be used in designated smoking areas and may not be carried in places where hydrocarbon vapours may be encountered
.9 states that naked lights and open flame are prohibited in places where hydrocarbon vapours may be encountered
.10 explains that care should be taken to ensure the integrity of pump-room lighting, and describes the precautions to be taken if additional lighting is required
.11 states that portable and permanent notices prohibiting smoking and naked lights should be conspicuously exhibited
.12 describes the special precautions for galleys and galley personnel
.13 lists electrical and electronic equipment which should not be permitted on tank decks or other areas where flammable gas may be encountered
.14 explains precautions to be taken before hammering, sandblasting or using power tools
.15 explains the dangers of non-inerted tanks
.16 lists the precautions to be taken when hot work is to be undertaken in a cargo tank
.17 states that periodic gas tests should be carried out during the work
.18 lists the precautions for hot work on pipes
.19 describes the permits required for work alongside a jetty involving hot work or electrical equipment
.20 states that no maintenance, dismantling or modification should take place at a tanker berth without written permission from the terminal manager
3.2 Entry into enclosed spaces (1.5 hours)

Pump-rooms
.1 explains that the ship’s SMS requires special procedures to be followed if entering an enclosed space
.2 explains why pump-room constitutes a special hazard
.3 lists the sources of leakage of hydrocarbon vapour as pump-seals, valve glands, drain cocks and mud boxes
.4 explains measures to minimize pump-room hazards
.5 explains why outlet ducts should permit the removal of hydrocarbon vapours from the bottom of the pump-room
.6 lists the precautions for entering pump-rooms
.7 states that the pump-room lifeline and harness should be rigged ready for immediate use, and that approved breathing apparatus and resuscitation equipment should be available in an accessible location

Cargo tanks
.8 states that no one should enter a cargo tank unless their entry is sanctioned by a responsible officer
.9 lists the precautions to be taken for entering a cargo tank

Cofferdam, double bottom or other enclosed space
.10 states that the same precautions apply as for entering cargo tanks
.11 states that toxic gas must be suspected to be present in spaces into which volatile petroleum may have leaked

3.3 Precautions against electrostatic hazard (0.5 hour)

.1 lists precautions for using equipment in a flammable atmosphere where electrostatic hazard exists
.2 states that non-conductive equipment may be used, provided natural fibre ropes are used
.3 states that no special precautions are necessary within metal pipes
.4 states that no special precautions are necessary in an inert atmosphere
.5 states that high electrostatic potentials are present in an inert atmosphere because of particulates in suspension
.6 states that if there is reason to doubt that the atmosphere is inert the above precautions also apply
.7 states that metal floats do not present a hazard, provided they are earthed by means of conductive guide wires
.8 lists the precautions to be taken when loading and discharging static accumulator oils in non-inerted tank atmospheres

a. Gas indicators (1.5 hours)

.1 describes the operating principle of:
- a catalytic-filament combustible-gas indicator
- a non-catalytic heated-filament gas indicator
- a refractive index meter
- chemical indicator tubes
- an oxygen meter with paramagnetic sensors
- an oxygen analyser with electrolytic sensor
- an oxygen analyser with selective chemical absorption liquid
.2 correctly carries out instrument-check procedures and gas measurements, using the above gas indicators
.3 explains why a catalytic-filament combustible-gas indicator is unsuitable for measuring hydrocarbon vapours in an inert atmosphere

3.5 Fire-fighting principles - revision (1 hour)

.1 lists the methods of controlling a fire as:
- removal of oxygen (smothering)
- cooling
- inhibition of burning process
.2 states that:
- removal of oxygen can be achieved by foam or inert gas
- cooling is best effected by water (spray or fog)
- inhibition of the burning process is effected by chemical dry powder
.3 describes water as fire-extinguishing agent and states that:
- it is readily available
- it has an effective cooling action
- it should not be used on oil fires as a jet, but as a spray or fog
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- it should not be directed towards electrical equipment

4 describes foam as a fire-fighting agent and states that:
- there are high-, medium- and low-expansion foams
- it has a limited cooling effect
- it should not come into contact with electrical equipment
- various foam concentrates are incompatible with each other
- foam concentrates deteriorate with time

5 describes carbon dioxide as a fire-fighting agent and states that:
- it is an excellent smothering agent
- it must be used in conditions where it is not diffused, i.e. in enclosed spaces
- it may generate static electricity and should not be injected into explosive atmospheres
- personnel should have left the space into which carbon dioxide is to be injected

6 states that when HALON was used as a fire extinguishing agent, there were two types:
- Halon 1211 - used in portable extinguishers
- Halon 1301 - used in fixed extinguishers

7 states that HALON as a fire-fighting agent has been decommissioned under the Montreal Protocol

8 states that under IMO guidelines, as of 01.1.1994 HALON has been prohibited on new ships built after this date

9 states that for existing installations IMO has not set a deadline as all Halon use on board will eventually be decommissioned based on the de-commissioning of Halon ashore

10 states that there are regulations for the protection of cargo tanks, the cargo tank deck area and pump-rooms

11 states that:
- the protection of cargo tank deck area shall be achieved by a fixed deck foam system
- the protection of cargo tanks shall be achieved by a fixed inert gas system

12 states that protection of the pump-room shall be achieved by:
- a CO₂ system,
- a high-expansion foam system, or
- a fixed pressure water-spraying system

13 states that pump-room protection systems must be operated from a position outside the pump-room

14 states that some tankers may be exempted from the inert gas requirements owing to the size or age

15 states that an inert gas system is required on all new tankers and most existing tankers of 20,000 dwt and above

3.6 Protective equipment (1 hour)

1 acts as a member of a team and takes charge of team exercises with:
- tank evacuation equipment
- resuscitation equipment
- SCBA

2. Pollution prevention (4 hours)

a. ship and equipments (0.5 hour)

1 states that an oil tanker must comply with constructional requirements with respect to:
- segregated ballast capacity
- slop-tank capacity
- limitation of tank size
- survival capability in case of damage
- overboard piping arrangements
- emergency towing arrangements

2 states that an oil tanker must have approved equipment for:
- monitoring and controlling discharges of oil and oil/water mixtures into the sea
- establishing the oil/water interface in slop-tanks

3 states that the ship and its equipment shall be maintained in satisfactory condition

4 states that different requirements may apply to certain oil tankers such as:
- oil tankers engaged in specific trades
- oil tankers having special ballast arrangements
- oil tankers carrying asphalt or similar cargoes
- oil tankers trading within special areas or within 50 miles of the nearest land
- vessels engaged in alternate crude oil/product transport

.5 states that such different requirements are reflected in the IOPP Certificate

4.2 Operational pollution (1 hour)

At sea

.1 states that load-on-top (LOT) procedures are normally allowed on oil tankers
.2 states that the discharge provisions applicable to oil must be complied with
.3 states that, when discharge into the sea in compliance with the discharge provisions is not possible, oil and oily mixtures should be discharged to shore reception facilities
.4 states that reception facilities require notice, including information on produce and quantity
.5 states that the Masters must send a report to the Flag State in case of any inadequacies observed regarding reception facilities
.6 states that sea surface and discharge outlets must be observed when discharging ballast or decanting slop-tanks
.7 states that the surface of clean or segregated ballast must be observed prior to discharge
.8 states that the pumps must be running before opening sea inlets to prevent pipeline contents polluting the sea

In port

.9 states that:
- moorings must be kept adjusted when a ship is alongside to prevent the ship from ranging
- oil/water levels must be watched in cargo and slop-tanks when handling ballast or cargo
- over side discharge scuppers must be plugged when handling cargo or ballast, or when bunkering
- sea valves must be closed and secured during cargo work
- a watch must be kept both at the manifold and when patrolling the deck
- hoses and loading arms must be drained before disconnecting

4.3 Oil Record Book (ORB) (1 hour)

.1 states that the ship is provided with an ORB
.2 states that the format of ORB is uniform and that all operations involving oil and oily mixtures should be recorded, where possible in coded entries
.3 states that, where the use of coded entries is not possible, entries should be recorded in English or French in addition to the national language (Flag State)
.4 explains that coded entries and the use of English or French are to facilitate inspection by foreign authorities
.5 states that foreign authorities may ask to inspect the book and have copies of entries certified as true entries by the master, and that the ship is required to co-operate in these matters
.6 states that ORB must be kept on board in a readily available location and must be preserved for a period of three years following the date of last entry

4.4 Action in case of oil spills (1 hour) At sea

.1 states that all oil spills must be reported
.2 states that the initial report must be sent to the nearest coastal State as soon as possible and by the fastest telecommunication means available
.3 lists the contents of initial report as:
- name of ship
- frequency or radio channel guarded
- name, address and contact details of owner and representative
- type of ship
- date and time (UTC) of the incident
- description of the incident, including damage sustained
- ship's position, course, speed, as appropriate at time of incident
- type of oil involved
- other cargo carried
.4 states that a follow-up report should be sent as further details become available in port.

.5 lists the following actions to be taken:
- duty officer to shut down pumping and close valves from which oil is escaping
- duty officer to call master and chief officer
- duty officer to alert engine room and if necessary have them pressurise the fire main
- chief officer to prepare fire-fighting gear if necessary
- Master to inform terminal
- if the spill is on deck, chief officer to organize treatment with absorbent material

4.5 Air pollution (0.5 hour)
.1 explains that air pollution may be caused by inert gas or hydrocarbon gas finding their way into the atmosphere because of:
- breathing or venting of loaded tanks
- purging or gas-freeing operations
- loading or ballasting cargo tanks

.2 states that now air pollution is covered under Annex VI of MARPOL 73/78
.3 states that Baltic Sea Area is a special area under Annex VI of MARPOL 73/78
.4 states that some ports have specific regulations (other than stated above) prohibiting or limiting air pollution
.5 states that air pollution prevention measures may take the form of:
- on board ship procedures to contain vapour and inert gas
- the use of vapour return lines

.6 describes containment procedures as being the displacement of vapour and gas from tanks being filled (i.e. ballasted) to tanks being emptied (i.e. discharged), using common vent piping as the gas-transfer line
.7 explains that the tank atmosphere pressure must be watched since the rate of ballasting is unlikely to equal the rate of discharging
.8 recognizes special procedures apply when loading or discharging using vapour emission control systems

5.1 Construction (0.5 hour)

Safety considerations
.1 states that an oil tanker can be divided into fore part, tank area and after part, and the tank area is separated, from fore and after parts, by means of cofferdams
.2 states that accommodation spaces, main cargo control stations and service spaces must be positioned aft of the tank area, but that some exceptions to this rule are possible
.3 states that the navigation bridge may be fitted above the tank area where necessary, but that there must be an open space between the navigation bridge and the cargo tank deck
states that means must be provided to keep deck spills away from the accommodation
states that entrances, air inlets and openings to accommodation, service spaces and control stations shall not face the cargo area
states that windows and side scuttles facing the cargo area and for some distance away from the cargo area on each side must be of non-opening type
states that special requirements have been laid down for the fire integrity of bulkheads and decks of oil tankers
states that oil tanker design will change in future as double- hull phasing in has commenced
states that double-hull phase in is being effected under IMO regulations as well as OPA 90
.10 states that double-hull phase in is dependent on the year of build of the ship and that by 2015 all tankers will be double- hulled
.11 states that under IMO rules the alternative mid-deck design is also acceptable
.12 explains the merits and demerits of double hull and mid deck tanker designs
.13 draws the cross section of:
- double hull tanker
- mid-deck tanker
.14 states that as per revised Annex I of MARPOL 73/78, from 2007 the pump-room will have a double bottom protection

Environmental considerations
.15 defines segregated ballast tank (SBT)
.16 describes which oil tankers must be provided with SBT
.17 describes that the capacity and distribution of SBT must be such that:
- ballast is sufficient for all but severe weather conditions
- at all stages of the voyage, the ship is trimmed by stern with the propeller submerged
.18 states that product tankers of 40,000 tonnes DWT and above built before 1980 may, in lieu of SBT, operate with
dedicated clean ballast tanks (CBT)
.19 states that crude oil tankers of 40,000 tonnes DWT and above built before 1980 may, in lieu of SBT, be equipped and
operated with a crude oil washing (COW) system
.20 defines CBT
.21 states that capacity requirements of CBT are similar to those of SBT
.22 explains how SBT and CBT contribute towards the protection of the marine environment
.23 lists the advantages of SBT over CBT
.24 explains how COW contributes towards the protection of the marine environment
.25 states that crude oil tankers of 20,000 tonnes DWT and above built after 1979 must be provided with and operate a
COW system in addition to SBT
.26 states that oil tankers may have been provided with SBT even if not required to do so, but the capacity need not
necessarily comply with the international requirements
.27 states that, on tankers built after 1979, the location of SBT offers protection to some extent against oil spills caused
by stranding or collision
.28 states that subdivision and stability requirements for oil tankers are intended to provide survival capability in case of
stranding or collision damage
.29 states that there are requirements with respect to the number and minimum capacity of slop-tanks
.30 states that the applicability of some IMO requirements depends on the age or size of the oil tanker
.31 states that all of the above requirements apply equally to combination carriers
.32 states that there are additional requirements for combination carriers concerning slop-tanks and cargo lines in wing
tanks
.33 states that tankers aged 5 years and over are subject to an enhanced survey programme

5.2 Pumping, piping and discharge arrangements (1.5 hpr)
.1 describes an oil tanker’s cargo system
.2 explains the difference between a free-flow tanker and a pipeline tanker
.3 explains the advantages and limitations of the free-flow system
.4 states that:
- pipeline systems on board tankers differ in their degree of sophistication, depending on employment of the
tanker
- ULCC and VLCC have relatively simple pipeline system
- some product (parcel) tankers may have very sophisticated pumping and piping system
.5 states that all oil tankers require a high overboard line, enabling discharge above the waterline
.6 describes the ‘stripping system’
.7 states that stripping is essential to reduce cargo residues in tanks and pipelines
.8 states that stripping system is important to handle tank draining when tank washing
.9 states that not all tankers have separate stripping systems
.10 states that large crude oil tankers need to have a means of emptying pump lines and discharging the residues via a
special small-diameter pipeline
.11 describes:
- a gate or sluice valve
- a butterfly valve
- a non-return valve
- an angle stop valve
.12 explains that a pressure-relief valve is needed only for positive displacement pumps and in the discharge of
the pump
.13 explains that the pressure-relief valve re-circulates the oil into the suction side of the pump
.14 explains that a non-return valve is fitted on the discharge side of the pump to prevent oil flowing back when the pump
stops
.15 explains why many deep-well pumps do not have non-return valves
.16 describes an eductor with the aid of a drawing
.17 explains that an eductor is frequently used for discharging ballast and stripping tank-washing slops

5.3 Cargo heating systems (0.5 hpr)
.1 lists oils which may require heating as:
  - bitumen
  - heavy lubricating oils
  - high pour-point gas oils
  - heavy fuel oils
  - some crude oils

.2 states that steam heating coils are generally used for heating cargo tanks

.3 states that steel heating coils suffer serious corrosion attack from crude oil cargoes but may be used for cargoes of lubricating oil

.4 explains why wing tanks generally require more steam than cargo tanks

.5 states that bitumen requires far more heat than other oils and may therefore only be carried in special ships

.6 states that slop-tanks are heated to facilitate the separation of water and oil

5.4 Venting arrangements (1 hour)

.1 states that petroleum gas is expelled from cargo tank vents during many cargo handling and associated operations

.2 states the importance of such gases being sufficiently dispersed to prevent the creation of flammable gas mixtures

.3 states that there can be flammable gas concentrations external to cargo tanks in the case of volatile cargoes with a high vapour pressure

.4 lists a few examples of such cargoes and situations which lead to gas evolution

.5 explains gas evolution and venting during loading

.6 lists other operations leading to venting of gas

.7 explains gas dispersion and variables affecting gas dispersion

.8 states that wind can assist in gas dispersion

.9 states that the venting system of cargo tanks is entirely distinct from such systems in other compartments of the ship

.10 states that venting arrangements may be independent for each cargo tank or combined with those for other tanks

.11 states that, in the latter case, means are provided to isolate each cargo tank

.12 states that venting system must be provided with devices to prevent the passage of flame into the cargo tanks

.13 states that provisions must be made to guard against liquid rising in the venting system to a height which would exceed the design head of the cargo tanks

.14 states that such provision shall include high-level alarms or overflow control systems, together with gauging devices and tank-filling control procedures

.15 states that the height of vent openings must be not less than 2 meters above the deck

.16 states that distances above deck and away from openings are dependent on the fitting of high-velocity vents

.17 states that PV valves must be fitted

.18 explains the reason for, and the functioning of PV valves

.19 explains, with the aid of a drawing, the functioning of purge pipes

.20 states that as per SOLAS amendments, tankers carrying petroleum products require secondary means of venting

.21 states that the above amendment is applicable to tankers that carry petroleum products with a flashpoint less than 60°C or crude oil

.22 explains the secondary means of venting

.23 explains vapour recovery line construction arrangements as per MARPOL Annex VI

5.5 Level gauges (0.5 hour)

.1 describes, with aid of drawing, the operating principle of:
  - mechanically operated float gauges
  - electrically powered servo-operated gauges
  - electrical capacitance gauges
  - bubbler gauges
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- pneumatic or hydraulic level gauges using a closed cell
- other differential-pressure-type gauges
- ultrasonic and sonic gauges
- radioactive gauges
- surface-sensing-type-gauges

.2 describes the terms ‘accuracy’ and ‘repeatability’ and the factors influencing both

5.6 Environmental protection equipment (4 hours)
In case a simulator is provided, training for Sec. 5.6 can be done on a simulator (suggested Ex.6, 7)

.1 states that compliance with discharge provisions is further ensured by an oil discharge monitoring and control system
.2 describes what the system must be able to do
.3 describes the meaning of starting interlock
.4 describes the effects of malfunctioning of the system
.5 states that the malfunctioning equipment should be repaired before the next ballast voyage
.6 states how long records must be maintained
.7 states that any failure or malfunctioning of the equipment must be recorded in the oil record book
.8 lists the different principles involved in measuring oil content as ultraviolet fluorescence, turbidity measurement, light absorption, gas measurement and infra-red absorption
.9 lists the advantages and disadvantages of the principles involved
.10 states that effective LOT procedures depend on determination of the oil/water interface in slop-tanks and other factors
.11 explains, with the aid of a drawing, the operating principle of a portable oil/water interface detector

6 Oil tanker operations (9 hours)
   a. General precautions (1 hour)

Superstructure
.1 lists operations during which openings in the superstructure should be closed
.2 describes measures to prevent flammable gas entering the ventilation system
.3 describes measures taken to adjust the air-conditioning system
.4 explains that precautions are also necessary when tankers conduct cargo- and ballast-handling, purging, gas-freeing or tank-cleaning operations in adjacent berths
.5 states that the number of crafts coming alongside should be kept to a minimum
.6 states that all cargo tank lids should be closed and secured during the operations referred to under objective 6.1.1
.7 describes what must be done with respect to sighting and ullage ports, cargo vent outlets and high-velocity vents
.8 states that covers of tank-washing openings should only be removed from those tanks in which tank-cleaning or gas-freeing operations are taking place
.9 states that the lids of SBT should be kept closed when cargo or ballast is handled, to prevent the drawing in of flammable gas
Pump-rooms
.10 states that tanks or lines containing petroleum should not be drained into the pump-room bilges
.11 states that the pump-room ventilation system must be in operation throughout cargo handling

Cargo hoses
.12 states that:
   - the provision of hoses is the responsibility of the terminal, but the master may reject a hose that appears to be defective
   - lifting bridles and saddles should be provided to support all hoses, and excessive weight on the ship's manifold is to be avoided
.13 states that an insulating flange (or an insulating length of hose) should be fitted
.14 explains that:
   - metal on the seaward side of the insulation should be electrically continuous to the ship
   - metal on the landward side of the insulation should be electrically continuous to the shore

6.2 Loading and discharging operations (3 hours)
In case a simulator is provided, training for Sec. 6.2 can be done on a simulator (suggested Ex.3)

.1 explains how volume of oil on board can be determined by means of soundings or ullage measurements and calibration tables

.2 explains that, in order to calculate the cargo lifted, the oil volume must be converted to weight by multiplication by its specific gravity (density at 15°C in vacuum)

.3 defines specific gravity (density at 15°C in vacuum)

.4 explains that relative density depends on temperature

.5 states that information on relative density used by the terminal is based on the standard temperature of 60°F

.6 states that an alternative scale of the weight/volume ratio that is used in the oil industry is the API scale

.7 defines the API scale

.8 lists units commonly used in the oil industry:
  - for volume as:
    - cubic feet
    - cubic meters
    - barrels (of 42 US gallons)
  - for weight as:
    - tonnes of 1000 Kg
    - tonnes of 2000 lbs
    - tonnes of 2240 lbs

.9 states that tables are available for converting the different units in order to calculate weights

.10 calculates:
  - the mass of full cargo to be lifted, given deadweight scales, loading and discharge port, length of voyage, ballast fuel, stores and consumption
  - the volume of cargo that can be lifted, given the relative density or API at 60°F and the cargo temperature
  - whether bending, hogging, and sheering stresses are within acceptable limits, given the load distribution and appropriate graphs

.11 states that the loading and discharging plan must take into account the ship’s stability

.12 states that an emergency shutdown procedure must be agreed upon between ship and terminal

.13 explains that loading should initially be by gravity

.14 explains the checks to be carried out after pumps have been started

.15 states that, when discharging is about to begin, the shore valves to receiving tanks must be opened before the tanker’s manifold valves are opened

.16 explains that special measures are necessary when pressure might exist in the shore line and no check valves are fitted

.17 explains the danger of line blowing and the precautions to be taken

.18 states that special procedures apply for ship-to-ship transfers

### 6.3 Ballasting and de-ballasting (1 hour)

In case a simulator is provided, training for Sec. 6.3 can be done on a simulator (suggested Ex.3)

.1 states that ballast quantity is at the discretion of the master

.2 describes considerations affecting ballast quantity and the tanks to be used

.3 states that due account should be taken of stress forces when choosing ballast tanks and while ballasting or de-ballasting is in progress

.4 lists additional considerations influencing ballast quantity as lightening operations, passing under bridges, berth constraints and draught requirements for fairway/channels

.5 states that ballasting and de-ballasting often take place in stages, such as:
  - at the discharge terminal
  - during sea passage
  - when heavy weather is expected
  - prior to arrival in loading port
  - at the loading terminal

.6 explains that ballasting operations whilst alongside should be discussed with the terminal prior to commencement

.7 states that, in earlier times, ballast was always taken into cargo tanks

.8 states that, at a later period, tankers were provided with segregated ballast capacity for coming alongside and leaving
9.9 explains that, on oil tanker provided with SBT or operating with CBT, there may be reasons for taking additional ballast in cargo tanks.
9.10 describes CBT operations during a normal tanker voyage in general terms.
9.11 states that CBT operations appropriate to a ship are contained in an approved Dedicated Clean Ballast Tank Operation Manual.
9.12 states that, if no SBT or CBT capacity has been provided, or if additional ballast is required, ballast must be taken into dirty cargo tanks.
9.13 states that this will constitute dirty ballast.
9.14 states that the discharge of dirty ballast is subject to discharge provisions.
9.15 lists the discharge provisions for oil and oily mixtures from the cargo-tank area of all oil tankers.
9.16 states that the discharge provisions do not apply to clean ballast or to segregated ballast.
9.17 defines clean ballast.
9.18 describes the change of ballast at sea in compliance with the discharge requirements.
9.19 states that the ballast change is necessary to arrive in the loading port with clean ballast.
9.20 states that LOT procedures result in oily water collecting in the slop-tanks.
9.21 states that more stringent discharge provisions apply in certain sea areas, called special areas.
9.22 lists the special areas under Annex I of MARPOL 73/78 as:
   - Antarctic Area
   - Baltic Sea Area
   - Mediterranean Sea
   - Black Sea
   - Gulf Area
   - Gulf of Aden Area
   - Red Sea
   - North-West European Waters
9.23 states that under the revised Annex I of MARPOL 73/78, likely to be in force from 1st January 2007, Oman Sea Area will also be declared as a special area.
9.24 states that more areas can be declared as special areas in the future.
9.25 states that only clean and segregated ballast may be discharged within special areas.
9.26 states that, on ships equipped with COW system, ballast should not be put into cargo tanks unless these have been crude oil washed.
9.27 describes COW operations.
9.28 states that, in view of explosion hazards, COW must take place in an inerted tank atmosphere.
9.29 lists as explosion hazards:
   - the use of high capacity washing machines
   - the uncontrolled evolution of gas
9.30 states that some crude oils are unsuitable for COW.
9.31 states that tanks which have been crude oil washed require additional water washing before taking in clean ballast.
9.32 states that a description of the COW system on board and of the correct operation of the system are contained in an approved COW Operations and Equipment Manual.
9.33 states that all ballast - segregated, clean and dirty - should be discharged above the waterline.
9.34 lists the conditions in which discharge is permitted below the waterline.
9.35 states that particular care must be taken when ballasting some double hull tankers due to possible loss of stability.

6.4 Tank cleaning (1 hour)
6.1 lists the reason for tank washing as cleaning cargo tanks for the next cargo, cleaning cargo tanks for clean ballast, sludge control, tank entry for repairs, or dry-docking.
6.2 describes tank cleaning with:
   - cold water
   - hot water
   - chemicals
6.3 states that tank cleaning produces large quantities of oil-contaminated water.
6.4 states that the volume of water may be reduced if tanks have first been crude oil washed.
6.5 describes tank washing with portable and fixed machines.
.6 describes movements of single- and multiple-nozzle machines states that tank washing stirs up oily residues within a tank,
.7 thereby generating hydrocarbon gas
.8 states that tank washing also causes electrostatic hazards as a result of water mist, water slugs and introduction into the tanks of portable tank-washing machines
.9 states that, because of the factors described in objectives 6.4.7 and 6.4.8, the tank atmosphere should be made safe against explosions and that:
- this could be done by washing tanks in a too-lean, a too-rich or an inert atmosphere
- it is difficult to maintain a too-rich atmosphere
- if the ship is so equipped, tank washing should be done in an inert atmosphere
- an inert atmosphere is imperative if using high-capacity washing machines, crude oil washing, or washing in the re-circulation mode
.10 states that tank washing water should be transferred to the slop-tank
.11 describes tank washing with the open-cycle and closed-cycle (re-circulation) modes
.12 lists the precautions to be taken when tanks must be washed in an uncontrolled atmosphere

6.5 Slop-tank operations
.1 describes why slop-tanks are essential for effective LOT procedures
.2 states that oil tankers require one or two slop-tanks, depending on the size of the vessel
.3 states that, during changing of ballast, the slop-tanks receive the oily part of the dirty ballast
.4 with the aid of a drawing, explains slop-tank operations with one or two slop-tanks during tank washing and decanting
.5 states that slop-tank fills rapidly during open-cycle tank washing, but that during closed-cycle tank washing the level of the slop-tank also rises
.6 explains this rise in level
.7 states that slop-tanks can be heated for better separation of oil and water
.8 states that decanting operations come under the discharge requirements
.9 explains why, if LOT procedures have been properly executed, the slop-tank should contain oil, emulsion and water upon arrival in the loading port
.10 states that a cargo of crude oil may be loaded on top of the contents of the slop-tank
.11 describes what is decanting

6.5 Purging and gas-freeing (1 hour)
In case a simulator is provided, training for Sec. 6.6 can be done on a simulator (suggested Ex.4)
.1 lists the reasons for gas-freeing as tank washing, tank entry or repairs
.2 defines gas-freeing as the replacement of hydrocarbon vapour or inert gas by air
.3 explains that accommodation openings should be closed when purging or gas-freeing
.4 explains that hydrocarbon gas remains inside a tank after cargo discharge
.5 explains that such vapours may be mixed with inert gas in IGS-fitted ships or with air in ships not fitted with an IGS
.6 states that there is no explosive atmosphere in an inerted tank
.7 explains why atmosphere should never be allowed to come within the flammable range when gas-freeing an inerted tank
.8 defines purging with inert gas as replacing the hydrocarbon vapours with inert gas
.9 explains, with the aid of a flammability composition diagram, how purging will prevent a flammable atmosphere developing within a tank
.10 explains how gas-freeing a non-inerted tank will result in the tank atmosphere being in the explosive range for some time
.11 states that gas-freeing is done by portable fans or fixed ventilating systems
.12 states that the IGS is used for purging and may also be used for gas-freeing
.13 states that gas-freeing may take place through displacement or mixing
.14 describes both methods in general terms
.15 defines a gas-free tank
.16 explains why a tank atmosphere may become dangerous again if ventilation is discontinued
.17 states that the inert gas supply must be blanked off or the valve closed in the branch piping to a gas-free tank
.18 lists the general safety precautions applicable when gas-freeing

6.6 Ship/shore liaison (1 hour)
.1 lists the information to be provided by the terminal for loading and for discharging
.2 lists the information to be provided by the tanker for loading and for discharging
.3 states that an operational agreement should be made in writing before loading or discharging
.4 lists and explains the subjects to be covered by the loading and discharging plan
.5 describes pre-loading tank inspection, and the limitations when surveyors cannot enter a tank
.6 states that:
- reliable ship/shore communications are essential
both parties should therefore establish, agree in writing and maintain reliable primary and stand-by communications system
.7 states that, when different grades of oil are handled, their names and description should be clearly understood by both parties
.8 states that ship/shore safety checklist should be completed jointly by ship and shore staff
.9 generally describes the checklist and explains the reason and relevance of the check items

7. **Cargo and ballast pumps (2 hours)**

7.1 **Pump theory and characteristics (1 hour)**
.1 states that the suction action of a pump is really atmospheric pressure pushing the liquid into the inlet side of the pump
.2 explains that for that reason a pump could in theory draw up liquid to a height which equals atmospheric pressure, i.e. approximately 10 meters
.3 states that, in practice, the situation is less favourable and that the height of 10 meters is decreased by the combined effects of:
- net positive suction head (NPSH) of the pump
- line resistance
- true vapour pressure
- vertical distance between pump and suction
.4 states that these combined effects may nullify atmospheric pressure
.5 explains that, if the combined effects exceed 10 meters, the liquid being pumped will boil
.6 explains how low vapour pressure of the liquid being pumped will improve suction
.7 explains how positive trim of the ship will improve suction
.8 explains how a full tank increases suction
.9 states that decreasing the pumping rate will decrease NPSH and the line resistance, thereby increasing suction
.10 explains that the discharge pressure will fluctuate when the liquid boils
.11 states that the phenomenon causes cavitation within the pump
.12 states that starting a centrifugal could cause a rush of liquid through the discharge piping, leading to excessive line resistance
.13 explains that for that reason a centrifugal pump must be started against a closed discharge valve, and for electrically-driven pumps the starting current will be too high resulting in an automatic shut down
.14 identifies a graph showing the characteristics of a centrifugal pump
.15 explains the meaning of head
.16 explains the different curves on the graph and their mutual relationship
.17 explains the meaning of NPSH
.18 explains the meaning of ‘design point’
.19 explains that the actual discharge rate also depends on static and dynamic backpressure of the shore installation
.20 draws a typical Q-H curve and a shore installation curve
.21 explains that long shore piping of small dimensions would mean a steep shore installation curve
.22 shows how a Q-H curve can be drawn for two pumps running in parallel
.23 shows how the discharge rate of such pumps is affected by steep and near-horizontal shore installation curves
.24 explains that with steep shore installation curves there may be little if any advantage in letting more than one pump discharge into the shore system
.25 explains the danger of running two or more pumps in parallel if their characteristics are not exactly the same or if the pumps are running at different speeds
.26 derives the discharge rate of the pump, using a Q-H curve and a shore installation curve

Practical aspects
.27 explains why a stripping pump must be self-priming
.28 lists the main types of cargo pumps and explains the advantages of deep-well pumps
.29 describes the working of a centrifugal pump
.30 describes the difference between a simplex pump and a duplex pump
.31 states that reciprocating pumps are fitted with three gauges, and describes the function of each gauge
.32 states that reciprocating pumps are self-priming
.33 explains why such pumps are not of high capacity
.34 describes the working of centrifugal pump
.35 states that centrifugal pumps:
- are generally used as cargo pumps
- are not self-priming
- may be driven by steam turbine, by electricity or by direct drive diesel motor
.36 states that:
- the speed of turbine driven pumps can be varied by adjusting the steam supply to the turbine
- a turbine driven pump has a tachometer in addition to the three gauges
- electrically driven pumps may be designed to run at constant speed
- an electrically driven pump has a volt and ampere meter to indicate power and load in addition to the three gauges
.37 states that centrifugal pumps are capable of being driven at high speed, that the cargo cools the pump and that loss of suction entails the danger of overheating and fire
.38 describes the working of a rotary positive displacement pump, explaining that such pumps are self priming
.39 explains why such pumps are not in general use on board oil tankers
.40 describes the working of a screw pump, explaining that such pumps are self-priming
.41 states that screw pumps are capable of being driven at high speed
.42 explains why few oil tankers are equipped with screw pumps. 43 explains the products for which screw pumps are suitable

7.2 Pressure surge (1 hour)
.1 explains how a pressure surge occurs
.2 describes what may be the result of a pressure surge leading to excessive pressure stresses
.3 lists the three pressure components in liquid being pumped
.4 explains how the rapid closure of a valve can superimpose an additional pressure on the liquid
.5 describes the effects closing the valve will have:
- downstream
- upstream
- at the pump
.6 describes the pressures to which the pump is subjected
.7 states that \(2L/a\) is known as the pipeline period
.8 defines \(L\) as the length of piping and \(a\) as the speed of sound in the liquid
.9 states that the system is liable to serious pressure surges if valve closure time is equal to or less than the pipeline period
.10 explains why long pipelines are more liable to pressure surges and that valve closure times must be adjusted accordingly
.11 states that offshore moorings are liable to have long pipelines
.12 lists measures to prevent pressure surges as:
- a reduction in the linear flow rate
- an increase in the effective valve closure time

8. Emergency procedures (2 hours)
.1 Emergency plan (0.5 hour)
.1 states that every oil tanker greater than 150 tonnes must have an oil pollution emergency plan
.2 states that planning and preparation are essential for dealing successfully with emergencies arising from oil spillages, fires, explosions, personnel affected by petroleum and other calamities, and lists the information which should be readily available as:
- type of cargo and its disposition
- location of other hazardous substances
- general arrangement plan of the ship
- stability information
- location of fire-fighting equipment
.3 explains how towing hawsers must be rigged when the ship is alongside

8.2 Emergency alarms (0.5 hour)
.1 describes the different alarms used in cases of emergencies such as:
- general emergency
- fire alarm
- CO₂ alarm
.2 states that other important alarms are:
- inert gas alarm
- high-level alarm
- engine room alarms
- bridge alarms
- accommodation alarms
- galley alarms

8.3 Emergency organization (0.5 hour)
.1 states the need for an emergency organization and lists the main components of the organization as:
- a command centre located in a normally safe position on the vessel, with communication equipment readily available
- an alternative emergency position to be identified if the normal command centre cannot be occupied
- a senior officer identified as being in control during the emergency, with another senior officer being identified as his/her deputy
- an emergency team formed under the control of crew members to take action as directed from the command centre
- a second emergency team formed to assist the emergency team as necessary
- an engineering team formed under the control of a senior engineer
.2 states the need for realistic drills to be undertaken periodically

8.4 Action on discovering an emergency (0.5 hour)
.1 states that if an emergency occurs the immediate action must be to:
- raise the alarm
- provide information to the command centre as to the location and nature of the emergency
- shut down all cargo operations and close valves
- remove all craft from alongside

9. Inert Gas Systems (IGS) (8 hour)

1.1 General (0.5 hour)
.1 describes which oil tankers must be provided with an IGS
.2 lists exceptions to this requirement
.3 states that oil tankers with COW must always be provided with an IGS
.4 defines inert gas
.5 describes the effect of inert gas with the aid of a flammability composition diagram
.6 states that cargo tanks of oil tankers fitted with an IGS should be in a non-flammable condition at all times
.7 states that, in order to maintain the cargo tanks in a nonflammable condition, the system is required to:
inert empty cargo tanks
- be operative during cargo and ballast handling
- purge tanks prior to gas-freeing
- top up pressure in cargo tanks when necessary
.8 states that some refined products, such as certain aviation fuels, release oxygen into ullage space of an inerted tank

9.2 The inert gas system (0.5 hour)
.1 describes the inert gas system as consisting of three distinct parts, which:
- produce the inert gas
- cool and clean the gas
- distribute the gas
.2 describes good quality inert gas from the generating plant as containing:
- nitrogen (77% by volume)
- carbon dioxide (13% by volume)
- oxygen (4% by volume)
- water (5% by volume)

and small quantities of undesirable by-products such as nitrogen oxides, sulphur dioxide, carbon monoxide and soot particles.

.3 states that the gas is cooled and cleaned in the scrubber, where:
- undesirable by-products and water are removed from it
- its temperature is reduced to approximately 30°C

.4 states that the inert gas must be kept under positive pressure to prevent the ingress of air

.5 states that the distribution system takes the inert gas to the cargo tanks

.6 explains why precautions must be taken to prevent a backflow of gas from the cargo tanks to the generating plant

.7 lists the main dangers of malfunctioning as:
- a rise in the oxygen content of the gas
- a drop in the supply pressure
- insufficient cooling and cleaning in the scrubber

**9.3 Inert gas plant** (0.5 hour)

.1 lists the main sources of inert gas in an oil tanker as:
- the main and auxiliary boilers (flue gas)
- an independent inert gas generator
- a gas turbine plant with an afterburner

.2 states that the main purpose of the plant is to produce a good quality, inert gas with low oxygen content (i.e. 5% by volume or less)

.3 states that:
- in the case of flue gas, the quality of the inert gas depends on the boiler load
- in port, the boiler load depends mainly on the number of cargo pumps in service
- if the discharge rate has to be reduced, a way to increase the boiler load may have to be found
- this may be achieved by circulating seawater through appropriate piping by means of the ballast pump
- boiler load may in many ships also be increased by dumping steam directly to the condenser

.4 states that inert gas is let into the system by means of the inert gas uptake valve or valves

.5 explains considerations for selecting the location of the flue-gas uptake point

.6 explains considerations with respect to material and arrangements of the uptake valves

.7 explains considerations with respect to material and arrangements of the piping

9.4 Scrubber, IG blowers, OG pressure regulating valves (1 hour)

.1 describes the working of the scrubber with the aid of a drawing

.2 states that the construction of the scrubber should allow for hot corrosive gases

.3 explains the corrosive properties of the scrubber equivalent

.4 states that the drainage of the effluent should not be impaired when the ship is fully loaded

.5 lists scrubber instrumentation and alarms

.6 states that at least two blowers are required to deliver the scrubbed inert gas to the cargo tanks

.7 states that in generator systems one blower may be permitted provided sufficient spares are carried

.8 states that each blower has an inlet valve and a discharge valve

.9 states blower capacity

.10 explains that blowers may also have an air inlet and may therefore also be used to gas-free cargo tanks

.11 explains that corrosion-resistant materials or coatings must be used in the construction of blowers and casings

.12 explains that fan casings should be fitted with drains

.13 states that sufficient openings should be provided to permit inspection
.14 states that failure of the blowers should be indicated by an alarm
.15 states that a means should be fitted for continuously indicating the temperature and pressure of the inert gas at the discharge side of the blowers
.16 states that the inert gas blowers should shut down automatically in the event of:
- low water pressure or low flow rate in the scrubber
- high water level in the scrubber
- high gas temperature
.17 states that a minimum inert gas pressure of 200 mm water gauge should be maintained in any one cargo tank or combination of cargo tanks in the event of discharge at maximum discharge rate
.18 lists possible causes of loss of inert gas pressure between blower and cargo tanks
.19 describes the two functions of the gas pressure regulating valve
.20 states that the valve is automatically controlled by means of a pressure transmitter and pressure controller
.21 by means of sketches, shows different arrangements for controlling the inert gas pressure in the inert gas main, i.e.:
- throttling the regulating valve
- re-circulating the inert gas to the scrubber
- leading the inert gas into the atmosphere
.22 states that the pressure in the inert gas main must be monitored and that an alarm must be given when the pressure exceeds a set limit
23 states that an audible alarm should be given when the pressure of inert gas falls below 50 mm water gauge, or, alternatively, the main cargo pumps should shut down automatically
.24 describes when automatic shut down of the gas regulating valve is required

9.5 Non-return devices (0.5 hour)
.1 explains the reasons for fitting non-return devices
.2 states that non-return devices consist of a deck water seal and a deck mechanical non-return valve
.3 describes the deck water seal as the principal barrier
.4 describes, with the aid of a sketch, the functioning of:
- a wet-type seal
- a semi-dry-type seal
- a dry-type seal
.5 states that an alarm must be activated when the water level falls by a predetermined amount, but the seal should not be rendered ineffective when the alarm is given
.6 states that heating arrangements should be provided to prevent freezing of the seal
.7 states that sight glasses and inspection openings should be provided to allow inspection
.8 explains the two functions of the deck mechanical nonreturn valves
.9 states that the deck mechanical non-return valve should be located forward of the deck water seal and be fitted with a positive means of closure
.10 states that, alternatively, a separate deck isolating valve must be fitted
.11 explains the advantages of having a separate deck isolating valve

9.6 Inert gas distribution and venting (1 hour)
.1 states that the inert gas distribution system consists of:
- the inert gas main, which runs from the deck isolating valve forward along the cargo tanks area
- branch lines, which run from the inert gas main to the individual tanks
.2 states that tanks may be isolated from the inert gas main by means of valves or blanks in the branch lines
.3 states that the inert gas piping may also serve as vent piping
states that, in such cases, the inert gas main ends in the riser
5 states that other venting arrangements are possible
.6 states that the inert gas and venting system must allow for:
- gas-freeing
- purging
- inerting
- cargo and ballast handling
- tank entry
.7 states that for those purposes the following provisions must be made:
- blanks or valves to isolate tanks
- vent stacks or vent risers
- p/v valves
- liquid-filled p/v breakers
.8 sketches a typical inert gas and vent piping arrangement, illustrating the location of the above provisions and describing the above operations
.9 describes mixing and displacement methods for changing the atmosphere in tanks
.10 describes, with the aid of sketches, the functioning of a liquid-filled p/v breaker
.11 explains why the liquid level in the breaker and the specific gravity of the liquid are important.

9.7 Gas-analysing, recording and indicating equipment (0.5 hour)
.1 lists the requirements for a fixed oxygen analyser
.2 describes where a sampling point should be provided for use with portable instruments
.3 states that portable instruments must be provided for measuring concentrations of oxygen and flammable vapour
.4 explains the limitations of meters working on the catalytic-filament principle
.5 states that all metal parts of portable instruments and sampling tubes introduced into a tank should be earthed against the ship's structure

9.8 Operations (2 hours)
In case a simulator is provided, training for Sec. 9.8 can be done on a simulator (suggested Ex.2)
.1 lists the procedures for starting the inert gas plant
.2 lists shut-down procedures for the inert gas plant
.3 lists safety checks to be carried out when the inert gas plant has been shut down
.4 states that cleaned and gas-freed tanks should be inerted prior to loading, ensuring that:
- purge pipes and vents are opened to the atmosphere
- those openings are closed when the oxygen content has fallen below 8% by volume
- tanks are pressurised in excess of 100 mm water gauge and kept in common with the inert gas main
- states that re-inerting after a breakdown follows the same procedure
.5 states that no sounding, ullaging or sampling equipment should be lowered into the tank while inerting
.6 lists the conditions which must be checked before discharging ballast from cargo tanks
.7 lists the measures to be taken when loading cargo
.8 states that a positive inert gas pressure of at least 100 mm water gauge should be maintained during the loaded voyage
.9 states that good quality inert gas (0% content < 5% by volume) must be used for topping up
.10 explains why the inert gas pressure may have to be decreased initially before discharge commences
.11 states that:
- tanks should then be pressurised before discharge
- discharge should not commence before all of the conditions are in order
- oxygen content of the inert gas in the main should be continuously recorded
.12 explains how inert gas containment can be practised by transferring inert gas from cargo tanks being loaded to those being de-ballasted
.13 states that the measures to be taken before ballasting cargo tanks are the same as those before loading
.14 states that simultaneous cargo and ballast handling requires careful monitoring of the quality and pressure of inert gas
.15 states that, during the ballast voyage, all tanks other than those to be gas-freed should be kept inerted
.16 states that, before inert gas is introduced into a cargo tank, it should be established that the oxygen content of the gas is
not more than 5% by volume
.17 states that cargo tanks should be washed in the inert condition and under positive pressure

.18 lists the conditions for tank entry
.19 explains why certain oils with high flashpoints need not be carried in inerted tanks
.20 explains the conditions in which tanks containing such oils may have to be inerted
.21 describes inerting procedures when product contamination may occur
.22 explains the considerations which apply to combination carriers with an inert gas system

9.9 Meters, indicators and alarms (0.5 hour)
.1 lists the following meters and indicators in the inert gas system:
- means for continuously indicating the pressure and temperature of inert gas at the discharge side
- means for continuously indicating and recording pressure of the inert gas forward of the non-return devices
- means for continuously indicating the recording of the oxygen content at the discharge side of the gas blowers
.2 lists meters/indicators/alarms required in the cargo control room or at a position accessible to the officer in charge of cargo operations
.3 lists meters required on the navigating bridge
.4 states that a meter is required in the machinery control room or in the machinery space to indicate the oxygen content of the inert gas being supplied
.5 lists alarms required for the inert gas system
.6 states that, on combination carriers, the alarm arrangements are such as to ensure that the gas pressure in the slop-tanks can be monitored at all times
.7 states that an independent audible alarm shall be provided to operate on predetermined limits of low pressure in the inert gas mains
.8 states that the alarms required in accordance with objectives shall be fitted in the machinery space and the cargo control room
.9 describes when automatic shutdowns are required on inert gas blowers and a gas regulating valve
.10 lists the additional alarms required if gas is provided by an inert gas generator

9.10 Emergency procedures (0.5 hour)
.1 lists measures to prevent air being drawn into a tank should the inert gas system fail to deliver inert gas of good quality and adequate pressure
.2 describes measures to maintain the inerted condition on crude oil and product tankers if the inert gas system cannot be repaired
.3 describes alternative measures on product tankers when discharging or de-ballasting with the inert gas plant out of action
.4 lists measures on product tankers when tank washing is necessary in a non-inerted condition

9.11 Maintenance and testing (0.5 hour)
.1 lists and describes inspections and checks to be made on:
- inert gas scrubber
- inert gas blowers
- deck water seal
- non-return valve
- scrubber effluent line
- alarms

10 Crude oil washing (COW) (5 hours) STCW Code Sec. A-V/1 pa. 10. 12 In case a simulator is provided, training for Sec. 10 can be done on a simulator (suggested Ex.5)

10.1 Introduction (0.5 hour)
.1 defines crude oil washing (COW)
.2 lists advantages and disadvantages of COW over water washing of cargo tanks
.3 states that COW is mandatory for many crude oil tankers under international pollution regulations
.4 states that the International Oil Pollution Prevention (IOPP) Certificate of the ship indicates if COW is mandatory
.5 explains that not effecting COW operations when so required is a contravention of international rules which may lead to fines and detention of the ship

10.2 **Design of COW systems** (1 hour)

.1 states that the design of COW systems must comply with international specifications
.2 lists the following items as part of a COW system:
  - Pump
  - Piping
  - fixed washing machines
  - stripping system
.3 states that a ship effecting COW operations must have an operational inert gas system
.4 lists the factors influencing the effectiveness of COW
.5 states that the number and location of washing machines is governed by the international specifications (IMO Guidelines on COW - 1983 edition)
.6 states that the washing pressure and nozzle diameter govern jet length
.7 states that there is a relationship between the diameter of the COW piping, the number of washing machines served by the piping and the fluid velocity in the piping
.8 explains how too many washing machines operating on a given pipeline may lead to low pressure at the washing machine, thereby decreasing its effectiveness
.9 states that the effectiveness of the COW system is verified under a given set of conditions and that COW operations should therefore be carried out under the same conditions as during the test procedures
10.3 COW piping (0.5 hour)
.1 states that the COW system consists of permanent pipe work
.2 explains that exceptions are allowed in the case of combination carriers where tank washing machines are located in the hatch covers
.3 states that provisions have been made to prevent over pressure
.4 states that the COW and water washing piping may be combined, but that hydrants in such combined systems must be blanked off during COW
.5 explains the need to anchor the COW piping to the ship structure
.6 states that to anchor the end of branch pipes tank cleaning machines can be used, but that special arrangements are necessary when removing such washing machines
.7 explains that, if common piping is used for COW, and water washing, such piping may pass through a heater, which should be effectively blanked off from the COW supply during COW
.8 states that the oil should be drained from the line before such piping is used for water washing

10.4 Tank-washing machines (0.5 hour)
.1 states that only fixed washing machines may be used
.2 states that these machines may be deck mounted, or mounted inside a tank (in which case they are known as submerged machines)
.3 describes washing machines as either single- or multi- nozzle machines
.4 describes the operation and washing pattern of:
  - single-nozzle tank washing machine
  - multi-nozzle tank washing machine explains that single-nozzle machines may be programmable
explains that single-nozzle machines are subject to reaction forces
explains methods of driving washing machines
 describes how the movement of deck-mounted and submerged machines may be verified
states that each machine can be isolated from its supply line by means of a stop valve
.10 states that, if a washing machine is removed:
- the supply line must be blanked off
- the tank washing opening must be closed

10.5 Pumps (0.5 hour)
.1 states that the pumps used for COW may be cargo pumps or dedicated pumps
.2 states that, if cargo pumps are used, the COW supply may be either bled off the discharge piping or delivered by one pump
.3 describes how, in former case, to ensure sufficient pressure in the COW piping if the terminal presents too little back-pressure

10.6 Stripping systems (0.5 hour)
.1 states that effective stripping is essential for good COW results
.2 states that a positive trim is important for good COW results
.3 states that the stripping system must be able to remove oil at a rate 1.25 times the total throughput of all washing machines
.4 states that remote readout facilities must be provided in the cargo control room for monitoring the efficiency of the stripping system
.5 states that means such as level gauges, hand dipping and stripping performance gauges are provided for checking that the tank bottoms are dry after COW
.6 states that stripping system can drain cargo lines and pumps after discharge and that a special small diameter line is provided to discharge those stripping ashore

10.7 Operations (1.5 hours)
.1 states that a ship under obligation to use COW is provided with a COW Operations and Equipment Manual, which is of standard format
2 lists sections which must be included in the manual

3 states that tanks to be washed depend on whether cargo tanks are used for ballast or not

4 states that ballast should only be taken in cargo tanks which have been crude oil washed

5 lists the following cargo tanks to be crude oil washed:
   - cargo tanks required for ballast after departure
   - cargo tanks required for ballast prior to arrival
   - cargo tanks required for ballast during heavy weather (if anticipated)

6 states that, for sludge-control purposes, no tank need be washed more than once every four months

7 states that, before arrival in the discharging port, the COW system should be examined whilst under pressure with the parameters set out in the COW Operations and Equipment Manual for:
   - number of washing machines
   - pressure of washing fluid
   - duration of washing
   - program of washing machine
   - trim of ship
   - stripping requirements

9 states that washing fluid may be obtained from the discharge line or from the slop-tank

10 states that only dry crude may be used

11 defines dry crude

12 describes this use of dry crude as being a precaution against electrostatic generation

13 explains that, in order to ensure that dry crude is used for COW, discharge should start with de-bottoming the cargo tanks which supply the crude for COW

14 defines de-bottoming as drawing off at least 1 meter of liquid from the cargo tank

15 states that COW, using oil from the slop-tanks, may be effected by the re-circulating method

16 explains why the level in the slop-tank must be watched

17 states that COW and cargo operations must be halted if the oxygen content in the tanks rises above 8% by volume

18 states that, before crude oil washing a tank, the oxygen content in the tank should be measured:
   - 1 meter below deck
   - in the middle of the ullage space

20 given a COW Operations and Equipment Manual and a stowage plan, draws up a discharging and COW programme

21 demonstrates ability to programme and monitor tank washing machines

22 demonstrates ability to calibrate the oxygen meter and to measure the oxygen content of a cargo tank

23 using a pumping, piping and COW piping plan, lines up the valves for discharging and COW operations

24 explains the items of the:
   - pre-arrival checklist
   - checklist before crude
   - checklist during COW
   - checklist after COW

25 explains how the effectiveness of COW can be checked by measuring the amount of oil floating on top of the departure ballast

26 explains the measures taken to prevent marine pollution during ballasting and tank-washing operations

27 explains that all crude oil washing should be completed before the ship leaves its final port of discharge

28 explains why crude oil washing may have to be carried out at sea

29 explains that the tanks must be available for inspection at the next port

30 states that crude oil washing operations should be recorded in the Oil Record Book in accordance with the coded list of items

31 explains the importance of maintenance of the COW and inert gas systems:
   - states that failure of equipment may lead to COW not being effected
   - states that COW not being effected may lead to delays of the ship
   - states that the inert gas supply not functioning properly results in cargo operations being suspended

32 explains the meaning of crude oils not suitable for COW

33 explains where the information on unsuitable crude oils may be found
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.34 states that unsuitable crude oils may not be carried in a tanker under obligation to use COW, unless that tanker is provided with SBT of sufficient capacity
.35 states that COW operations may come under Port State inspection

11. Management of risk on oil tanker (4 hours)

11.1 Background (0.5 hour)
.1 states that no oil, whether naturally occurring or refined, is absolutely free from potential harmful effects
.2 states that all people involved in the carriage should consider the available information on their potential hazards before making any decisions
Please note: The potential hazard is intrinsic to the oil and independent of how it is handled
.3 states that managerial decisions on board an oil tanker should aim to minimize risk associated with oil carriage (probability of spill) by handling appropriate to the hazardous properties

11.2 Definitions (0.5 hour)
.1 states that risk is a measure of the probability that a harmful event (death, injury or loss) arising from a spill may occur under specific conditions of carriage or handling
.2 explains that, in general terms, acceptability of risk may differ for different people
.3 states that for the carriage of oil by sea, the risk involved should be considered in absolute terms
.4 defines risk assessment on board an oil tanker as identification and quantification of risk resulting from a specific operation during its handling and transit
.5 states that risk assessment is concerned with determining those factors which are especially dangerous and determining the likelihood of occurrence
.6 states that risk should be assessed against defined limits of carriage and established on the basis of existing management system on board
.7 defines risk management as a decision-making process to select the optimal steps for reducing a risk to an acceptable level
.8 states that risk management involves considerations of type of vessel, competence, communication, safety awareness, training and engineering factors
.9 states that in the context of carriage of oil in bulk by sea, risk management consists of 3 steps: risk assessment (evaluation), spill control, and risk monitoring
.10 states that risk perception is the way in which we see risk and determine its importance
.11 risk perception by society for carriage of oil by sea and therefore, by the regulatory authorities (IMO) reflects the culture of the society and changes with time as more information becomes available

11.3 Risk on oil tankers (1 hour)
.1 explains that at the loading level, consideration must be given to the siting of tanks, loading pressure, ensuring proper loading practices in order to reduce the exposure of crew to the hazards and the surrounding area to acceptable levels (this may involve taking into account local weather and prevailing winds, etc.)
.2 understands that at the shipboard personnel level, the person often does not understand the potential risk of mishandling of oil
.3 clear instructions for stowage and carriage must be designed and conveyed so that precautions to be taken by the ship staff are well understood
.4 explains that handling of oil cargo must ensure safe practices and must take into account potential mishandling that the product may receive in the hands of uninformed people
.5 states that ultimately, risk management is the responsibility of each individual on board an oil tanker and reflects their relevant training or lack of it

11.4 Risk assessment process (1 hour)
* IMO
Reference

.1 states that the incidences where potentially toxic vapours (the hazard) may be present must be identified
.2 states that:
- exposure to potentially toxic vapours usually involves mixed exposures
- there may be more than one vapour in the process and there may be more than one adverse effect

Dose and effect

.3 states that the dose which will have a critical effect must be identified
.4 states that:
- the relationship between dose and effect is very different from one oil cargo to another
- the frequency of dosing may alter the effect
- in some cases a frequent, low dose exposure may provide a more severe effect than a less frequent but higher dose

Exposure assessment

.5 explains that an exposure assessment must be made from the identification of the potentially toxic vapours and knowledge of their properties
.6 states that exposure falls into two main types - anticipatable and accidental
.7 states the main difference between anticipatable and accidental exposure as that the first may be calculated and the other may only be estimated approximately at best
.8 states that anticipatable exposure is that which is likely to occur because of the improper procedures being followed by the person while handling an oil cargo
.9 states that anticipatable exposure should be obvious in that it must be an identifiable consequence of a defined method of mishandling
.10 states the importance of proper handling with view to 8.4.8 and 8.4.9

Accidental exposure

.11 states that accidental exposure is that exposure:
- which results from an accident during transport, or during cargo handling
- when more commonly a spillage occurs due to a damaged pipe or other equipment, or a tanker running aground

11.5 Risk management in practice (1 hour)

.1 states that if the result of risk assessment indicates that the risk is too high, risk management must be undertaken with the aim of risk reduction
.2 states that risk management is a complex issue taking into account many factors such as a wide range of scientific, technical and legal considerations
.3 states that scientific considerations relate to the chemical and physical properties of the oil/petrochemical product that are carried
.4 states that the technical aspects relate to the process of carriage, ship type and its equipment
.5 states that the other inter-related factor includes the legal considerations as:

2.2 national (the Flag State)
2.3 local (the Port State) Risk management and law

.6 states that risk management is often controlled by legislation which lays down allowable limits of spill (e.g. within or without a special area) and puts specific duties on management and workers such as MOU being undertaken with respect to PSC
.7 states that on a global basis, the mantle rests with IMO
.8 states that the oil industry plays a vital role in assisting the development of legislation at the international level, which is later incorporated into the legislation at the national level
.9 states that law covers risk interactions that include workplace, product and the environment

Acceptability of risk

.10 explains that risk management team on board has to determine that in case of an incident what level of exposure is acceptable to people exposed
.11 states that the acceptable and unacceptable levels are easy to ascertain
.12 states that the ease/difficulty of risk management decision making is dependent as follows:
- ! risk - t safety = easy decision
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- t risk - J, safety = easy decision
- in between = difficult decision

.13 states that it is usually a level of tolerable exposure lying between these that is difficult to decide.

.14 states that, for example, four risk zones can be:
- death or permanent incapacity
- Disability
- Discomfort
- detectability

.15 further states that risk management on board should, at worst, ensure that exposure to a potentially harmful incident lies in the area between disability and discomfort (Risk Zones 3 and 4)

.16 defines death or permanent incapacity as the most severe category with death or permanent incapacity occurring immediately or shortly after exposure. This includes severe effects such as, permanent (unless surgically corrected) blindness

.17 defines disability as a condition where individuals who are markedly helped by external assistance; treatment results in full recovery

.18 defines discomfort as the category that includes those for whom a full recovery is probable without external assistance, although systematic relief may be possible and reassurance desirable

12 Contingency Planning (2 hours)

2.4 General (0.5 hour)

.1 states that an oil spill can be a great risk to human health, the vessel, coastal communities and industry and the marine environment

.2 states that an oil spill can also seriously damage the industry's and the owner/operator's reputation

.3 states that an oil can enter the marine environment as a result of accidental or deliberate releases

.4 states that accidental releases can occur as a result of natural disasters, human error or due to technical and mechanical faults in oil transfer

.5 states that intentional releases could include dumping slop wastes, acts of war, terrorism or sabotage

.6 further states that incidents involving vessel groundings, collisions, fire, explosion, cargo reaction etc. could also cause oil spills from vessels involved

2.5 Management (0.5 hour)

.1 states that there are three fundamental elements that make up effective management of a chemical spill

.2 states the three elements as:
- a response team
- clear roles and responsibilities
- effective communication

.3 explains the response team as typically with functional responsibilities (headed by the Master) to address command, planning, operations and logistics arrangements

.4 explains that the key aim of the response organization is to rapidly move from reactive to proactive management

.5 further explains that the above may also be conceived as turning the oil spill emergency into a managed project

.6 explains that clear roles and responsibilities amount to a 'job description' for each of the identified personnel on board the ship

.7 explains that effective communications means information flow within the ship and to the outside world

.8 states that effective communication is a serious challenge and requires both modern technology and disciplined personnel

.9 states that staff with an identified role in a response plan are given effective training on a regular basis
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.10 states that the training on board will include the appropriate level of tuition in oil spill equipment deployment, depending on their role.
.11 states that familiarization with relevant contingency plans and procedures will also form part of the regular training package on board.
.12 states that spill drills are an excellent way to exercise and train personnel in their emergency roles and to test contingency plans and procedures.
.13 states that the planning process is not a one-off event and contingency plans require periodic review and maintenance.

12.3 Preparation of the Contingency Plan (1 hour)
.1 states that an oil contingency plan should comprise three parts:
  - strategy section
  - action section
  - data section
.2 explains that the strategy section describes the scope of the plan and the proposed response strategy.
.3 explains that the action section sets out the emergency procedures that will allow rapid assessment of the spill and the mobilization of response (personnel and equipment).
.4 explains that the data contains all data sheets, of the cargo being carried, required to support an oil spill response effort and conduct the response according to an agreed strategy.
.5 states that data section also includes the details of prevailing condition - post spill.

Strategy section
.6 states that strategy section is sub-divided into 6 subsections. Introductory sub-section 1 contains the following elements:
  a) introduction and scope
  b) authorities and responsibilities
  c) statutory requirements, relevant agreements .7 states that sub-section 2, oil spill risks, includes:
    a) identification of activities and risks
    b) types of oils likely to be spilled
    c) probable fate of spilled oil
    d) development of oil spill scenarios
    e) special local considerations
.8 states that sub-section 3, spill response strategy, includes:
  1. response objectives
  2. limiting and adverse conditions
  3. strategy for open sea
  4. strategy for coastal zones
  5. strategy for waste storage and disposal
.9 states that sub-section 4, equipment, supplies and services, includes:
  a) on board oil spill equipment
  b) inspection, maintenance and testing
.10 states that sub-section 5, management, manpower and training, includes:
  a) emergency/safety officer
  b) incident organization chart
  c) manpower availability
  d) training/safety schedules and drill/exercise programme
.11 states that sub-section 6, communication and control, includes:
  a) command centre on board
  b) communications equipment
  c) reports, manuals, and incident logs

Actions
.12 states that actions section is sub-divided into 3 sub sections as:
- initial procedures
- control of operations
- termination of operations

1.13 states that sub-section 1, initial procedures, includes:
- raising alarm
- assembling full response team
- identifying immediate response priorities
- mobilizing immediate response
- establishing command centre
- identifying resources immediately at risk, informing parties
- deciding to escalate response by informing port/shore authorities

1.14 states that sub-section 2, control of operations includes:
- updating information (sea/wind/weather forecasts)
- reviewing and planning operations
- obtaining additional equipment and supplies
- preparing incident log and management of reports
- briefing port officials, operators and local P & I

1.15 states that sub-section 3, termination of operations, includes:
- deciding final and optimal levels of emergency operation
- standing-down equipment, cleaning, maintaining, replacing
- preparing formal detailed report
- reviewing plans and procedures from lessons learnt

1.16 states that the data section contains:
- coastal charts, currents, tidal information (ranges and streams), prevailing winds
  - risk locations and probable fate of oil
  - sea zones and response strategies
  - coastal zones and response strategies
  - clean-up waste on board, storage and subsequent disposal ports

13 Assessment and discussion (2 hours)