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E

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VALIDATION OF MODEL TRAINING COURSES

Model Course – Basic Training for Oil and Chemical Tanker Cargo Operations

Note by the Secretariat

SUMMARY

Executive summary:	This document provides the draft of a revised model course on Basic Training for Oil and Chemical Tanker Cargo Operations
Strategic direction:	5.2
High-level action:	5.2.2
Planned output:	5.2.2.5
Action to be taken:	Paragraph 3
Related document:	STW 40/14

1 Attached in the annex is a revised draft model course on Basic Training for Oil and Chemical Tanker Cargo Operations.

2 The preliminary draft of this revised model course was forwarded to members of the validation panel for their comments. Due to time constraints, any comments received on the draft course from the validation panel will be provided directly to the Sub-Committee.

Action requested of the Sub-Committee

3 The Sub-Committee is invited to consider the above information and take action, as appropriate.

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ANNEX

DRAFT MODEL COURSE ON BASIC TRAINING FOR OIL AND CHEMICAL TANKER CARGO OPERATIONS

MODEL COURSE 1.01

BASIC TRAINING FOR OIL AND CHEMICAL TANKER CARGO OPERATIONS

ACKNOWLEDGEMENTS

This course for Basic Training for Oil and Chemical Tanker Cargo Operations is based on material developed by Anglo Eastern Maritime Training Centre, Mumbai for IMO.

IMO wishes to express its sincere appreciation to the Government of India for its provision of expert assistance, valuable cooperation in support of this work.

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Introduction

■ Purpose of the model courses

Purpose of the IMO model courses is to assist maritime training institutes and their teaching staff in organizing and introducing new training courses, or in enhancing, updating or supplementing existing training material where the quality and effectiveness of the training courses may thereby be improved. The purpose is also to enhance the capabilities of shipboard personnel who sail on specialized carriers such as tankers. It is not the intention of the course to compartmentalize the trainee's way of thinking in terms of tanker operation. The idea is to make him/her aware of the specialization of operations specific to an oil and chemical tanker and sensitize him/her towards the responsibilities that s/he will face on such a vessel.

It is not the intention of the model course programme to present instructors with a rigid "teaching package" which they are expected to "follow blindly". Nor is it the intention to substitute audio-visual or "programmed" material for the instructor's presence. As in all training endeavors, the knowledge, skills and dedication of the instructors are the key components in the transfer of knowledge and skills to those being trained through IMO model course material.

Because educational systems and the cultural backgrounds of trainees in maritime subjects vary considerably from country to country, the model course material has been designed to identify the basic entry requirements and trainee target group for each course in universally applicable terms and to specify clearly the technical content and levels of knowledge and skills necessary to meet the technical intent of IMO conventions and related recommendations.

This course is meant for officers and ratings assigned basic duties and responsibilities related to cargo or cargo equipment on board oil and chemical tankers. By successfully doing this course, the aforementioned shipboard personnel will fulfill the mandatory minimum requirements of Regulation V/1-1 of STCW 1978, as amended. The coverage of the model course is wide in scope and includes oil and chemical tanker safety, fire safety measures and systems, prevention and control of pollution, operational practice and obligations under applicable laws and regulations. In addition, the course covers the “support and operational” aspects on board including a section on risk assessment, as well as safety in line with the ISM Code and the SMS procedures on board.

In order to keep the training programme up to date in future, it is essential that users provide feedback. New information will provide better training in safety at sea and protection of the marine environment. Information, comments and suggestions should be sent to the Head of the STCW and Human Element Section at IMO, London.

■ Use of the model course

Use of the model course: the instructor should review the course plan and detailed syllabus, taking into account the information provided under the entry standards specified in the course framework. The actual level of knowledge and skills and the prior education of the trainees should be kept in mind during the review, and any areas within the detailed syllabus which may cause difficulties because of differences between the actual trainee entry level and that assumed by the course designers should be identified. To compensate for such differences, the instructor is expected to delete from the course, or to reduce the emphasis on items dealing

with knowledge or skills already attained by the trainees. S/he should also identify any academic knowledge, skills or technical training which they may not have acquired.

The instructor, using his/her professional judgment, can analyze the detailed syllabus and the academic knowledge required to allow training in the technical area to proceed. The instructor can then design the appropriate pre-entry course or alternatively insert the elements of academic knowledge required to support the technical training elements concerned at appropriate points within the course.

Adjustment of the course objective, scope and content may also be necessary if in a country's maritime industry the trainees completing the course are to undertake duties which differ from the course objective specified in the model course.

Within the course plan the course designers have indicated assessment of the time which should be allotted to each area of learning. However, it must be appreciated that these allocations are arbitrary and assume that the trainees have fully met all entry requirements of the course. The instructor should therefore review these assessments and may need to reallocate the time required to achieve each specific learning objective or training outcome.

■ Aims

This course provides training to candidates to be duly qualified under Section A – V/1-1 of the STCW code with specific duties for loading, unloading and care in transit or handling of oil and chemical cargoes. It comprises a basic training programme appropriate to their duties, including basic training for oil and chemical tanker safety, fire safety measures, pollution prevention, operational practice and obligations under applicable law and regulations. The course covers the competence requirements as given in the table under Section A-V/1-1-1 of the STCW Code adopted by the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978 as amended in 2010.

Any of this training may be given on board or ashore. It could be by practical training on board or in a suitable shore-based installation.

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 or chemical tanker
- An acquisition of experience in identifying operational problems and assist in solving them.
- An improvement in the ability to promote safety and protect the marine environment
- An increased ability to assist and co-ordinate actions during emergencies

■ Lesson plans

After adjusting the course content, if so required, to suit the trainee intake and any revision of the course objectives, the instructor can then draw up lesson plans based on the detailed syllabus. The detailed syllabus contains specific references to the textbooks or teaching material proposed to be used in the course. Where no adjustment has been found necessary in the acquisition of knowledge and proficiency of the detailed syllabus, the lesson plans may

simply consist of the detailed syllabus with keywords or other reminders added to assist the instructor in making his/her presentation of the material.

■ Presentation

The presentation of concepts and methodologies must be repeated in various ways until testing and evaluating the trainee's performance and achievements satisfy the instructor, that the trainee has attained the required proficiency under each specific learning objective or training objective. The syllabus is laid out in the form of acquiring knowledge, understanding and proficiency format and each objective specifies what the trainee must be able to do as the learning or training outcome. Taken as a whole, these objectives aim to meet the knowledge, understanding and proficiency specified in the appropriate tables of the STCW Code.

■ Implementation

For the course, to run smoothly and to be effective, considerable attention must be paid to the availability and use of:

- Properly qualified instructors
- Support staff
- Rooms and other spaces
- Equipment
- Textbooks, technical papers, and
- Other reference material

Thorough preparation on part of the instructor is the key to successful implementation of the course. IMO has produced a booklet entitled "Guidance on the Implementation of IMO Model Courses", which deals with this aspect in greater detail and which is appended to this model course.

In certain cases, the requirements for some or all of the training in a subject are covered by another IMO model course. In these cases, the specific part of the STCW Code which applies is given and the user is referred to the other model course.

■ Guidance to course developers and instructors

This course comprises of two main parts.

The first, tanker safety section, covers the hazards involved in cargo operations and the systems, equipment and constructional features of tankers that exist to control the hazards.

Cargo operations cover loading, unloading and ballasting, including the use of the inert gas system.

Instructors should emphasize in their teaching the hazards involved in the operations on oil and Chemical tankers. They should explain, in as much detail as is necessary to ensure these operations are undertaken safely, the systems, equipment and constructional features that exist to control those hazards.

Instructors should keep in mind that some of the topics in this model course are also included in the model course for the Officer in Charge of a Watch in the function controlling the Operation of the Ship and Care for the Persons on Board. These topics may therefore be treated as a revision of earlier learning.

Physical properties of vapours are covered in the basic physics of the Officer in Charge of a Watch model course (for both navigation and marine engineering functions); therefore the basic physics in Section 2.1 of this model course is a revision and extension of that training. Similarly, entrants should have completed an approved shore-based fire-fighting course (STCW CHAPTER VI, Section A-VI/1 para 2.1.1.2), and hence fire-fighting principles in Section 6.0 are a revision of this topic.

Basic knowledge of Tankers (Section 1) are also covered in the model course for the Officer in Charge of a Watch in the function controlling the Operation of the Ship and Care for the Persons on Board. These topics may similarly be treated as a revision of earlier learning.

A new section 5.7 on Tanker Safety Culture with the use of Code of safe working practices and ISM has been included. This Section will include the following:

- Safety management on Tanker
- Background
- Entry Permits
- Risk Management in Practice

The idea is to help the trainees develop a proactive attitude on how to develop a safety culture and act accordingly.

■ Training and the STCW 2010 Convention

The standards of competence that have to be met by seafarers are defined in Part A of the STCW Code in the standards of Training, Certification and Watchkeeping for Seafarers Convention, as amended in 2010. This IMO model course has been revised and updated to cover the competences in STCW 2010. It sets out the education and training to achieve those standards.

Mandatory minimum requirements for the training and qualification of masters, officers, and ratings on oil and chemical tankers are detailed in section A-V/1-1 of the STCW Code. This model course aims to provide a basic training for oil and chemical tanker cargo operations referred to in Regulation V/1-1 para 1.2.2.2, appropriate to these duties.

For ease of reference, the course is divided into separate sections.

Part A provides the framework for the course with its aims and objectives and notes on the suggested teaching facilities and equipment. A list of useful teaching aids, IMO references and textbooks is also included. A mapping of the IMO model course 1.01 topics is shown collated with the STCW code chapter V Table A 1-1-1

Part B provides an outline of lectures, demonstrations and exercises for the course, together with a suggested sequence and timetable. From the teaching and learning point of view, it is more important that the trainee achieves the minimum standard of competence defined in the STCW Code than that a strict timetable for each topic is followed. Depending on their experience and ability, some students will naturally take longer to become proficient in some topics than in others.

Part C gives the Detailed Teaching Syllabus. This is based on the theoretical and practical knowledge specified in the STCW Code. It is presented in a sequence, starting with basic knowledge and information on chemistry and physics of hazards safety, and concluding with Emergencies and pollution prevention. Each subject area is covered by a series of required

performances, in other words what the trainee is expected to be able to do as a result of the teaching and training. In this way the overall required performance of knowledge, understanding and proficiency as stated in the STCW code column 2 of Table A V/1-1-1 is met.

The verbs used in each learning objective caters to the level of competence necessary to be achieved, e.g. verbs such as States, Lists, Defines will attribute the cognitive level of knowledge and the trainee needs to only reproduce the learning objective, on the other hand when verbs such as Describes, explains etc. are written detailed understanding of the topics are required. IMO references, textbook references and suggested teaching aids are included to assist the teacher in those area and design lessons.

Part D contains an Instructor Manual. Against each heading in the detailed teaching syllabus the teaching guidelines have been divided into:

- Understanding of concepts by description or explanations
- Case study for discussions
- Simulator exercises

It is envisaged that such micro level division of each heading in the teaching syllabus will give the instructor, with varied backgrounds around the world, ample guidelines on developing His/her work plan, as well as the flexibility to adapt keeping in mind the level of the trainees furthermore, additional notes, as well as simulator exercises for instructors who may have access to a liquid-cargo-handling simulator, have also been provided. In case in places where such level of sophistication such as simulators is not available, Diagrams have been provided to carry out table top exercises for loading unloading and other skill and performance based learning objectives.
Part E Covers Evaluation and Assessment. It is a way of finding out if learning has taken place. It enables the assessor (Instructor), to ascertain if the learner has gained the required skills and knowledge needed at a given point towards a course or qualification. An evaluation paper is included but the author recommends that assessment should be carried out on a continuous basis and a practical demonstration of simulator based assessment would be more realistic in addition to the test paper.

The Convention defines the minimum standards to be maintained in Part A of the STCW Code. Mandatory provisions concerning Training and Assessment are given in section A-1/6 of the STCW Code. These provisions cover: qualification of instructors; supervisors as assessors; in-service training; assessment of competence; and training and assessment within an institution. A corresponding Part B of the STCW Code contains non-mandatory guidance on training and assessment.

A Separate IMO model course addresses Examination and Assessment of Competence. This course explains the use of various methods of demonstrating competence and criteria for evaluating competence as tabulated in the STCW Code and may be helpful in developing any necessary assessments that can include a form of a written examination. As a further aid to the instructor therefore, suggestions have been made on how to set a very specific objective type question paper for this course. In case a simulator is being used for training pertaining to this model course, then it is suggested that this form of assessment be independent of the assessment done on the simulator.

■ Responsibilities of Administrations

Administrations should make sure that training courses delivered by colleges and academies are such as to ensure officers completing training do meet the standards of competence required by STCW Regulation V/1-1 paragraph 2.2.

■ Validation

The Sub-Committee on Standards of Training and Watchkeeping has validated the information contained in this document for use by technical advisors, consultants and experts for the training and certification of seafarers so that the minimum standards implemented may be as uniform as possible, "Validation", in the context of this document, means that the Sub - Committee has found no grounds to object its content. The Sub-Committee has not granted its approval to the document, as it considers that this work must not be regarded as an official interpretation of the Convention.

In reaching a decision in this regard, the Sub-Committee was guided by the advice of a validation group comprised of representatives designated by IMO.

Part A: Course Framework

■ Scope

This course provides training for officers and ratings. It comprises a basic training programme appropriate to their duties, including oil and chemical tanker safety, fire safety measures and systems, pollution prevention, operational practice and obligations under applicable laws and regulations. The course takes full account of Section A-V/1-1 of the STCW Code adopted by the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers 1978, as amended, including the Manila amendments 2010.

This training may be given on board or ashore. It can be supplemented by practical training on board or wherever possible on simulators in training institutions or in a suitable shore-based installation.

■ Objective

Provided they hold an appropriate certificate and are otherwise qualified in accordance with regulation Section A-VI/1 of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers 1978, as amended, those successfully completing the course may be eligible to serve on board Oil and Chemical tankers.

■ Entry standards

This course is open to seafarers who have qualified in accordance with regulation Section A-VI/1 of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers 1978, as amended including the Manila amendments 2010 approved by the Administration.

■ Course certificate

All who are qualified in Basic training for oil and chemical tanker cargo operations programme in accordance with regulation V/1-1 paragraphs 1 or 2 shall be issued with an appropriate certificate.

■ Course intake limitations

The number of trainees should not exceed 20 and practical training should be undertaken in small groups of not more than eight.

■ Staff requirements

The instructor shall have appropriate training in instructional techniques and training methods (STCW Code A-I/6, para 7). It is recommended that all training and instruction is given by qualified personnel experienced in the handling and characteristics of Oil and Chemicals cargoes and the safety procedures involved. Staff may be recruited among deck and engineer officers of Oil and Chemical tankers, and / or fleet superintendents as appropriate.

■ Teaching facilities and equipment

Ordinary classroom facilities and an overhead projector are sufficient for most of the Course. However, dedicated 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. In such cases sufficient number of PCs for use by trainees will be required. In addition, a video player will be required if using videos in the teaching program.

The following equipment should be available:

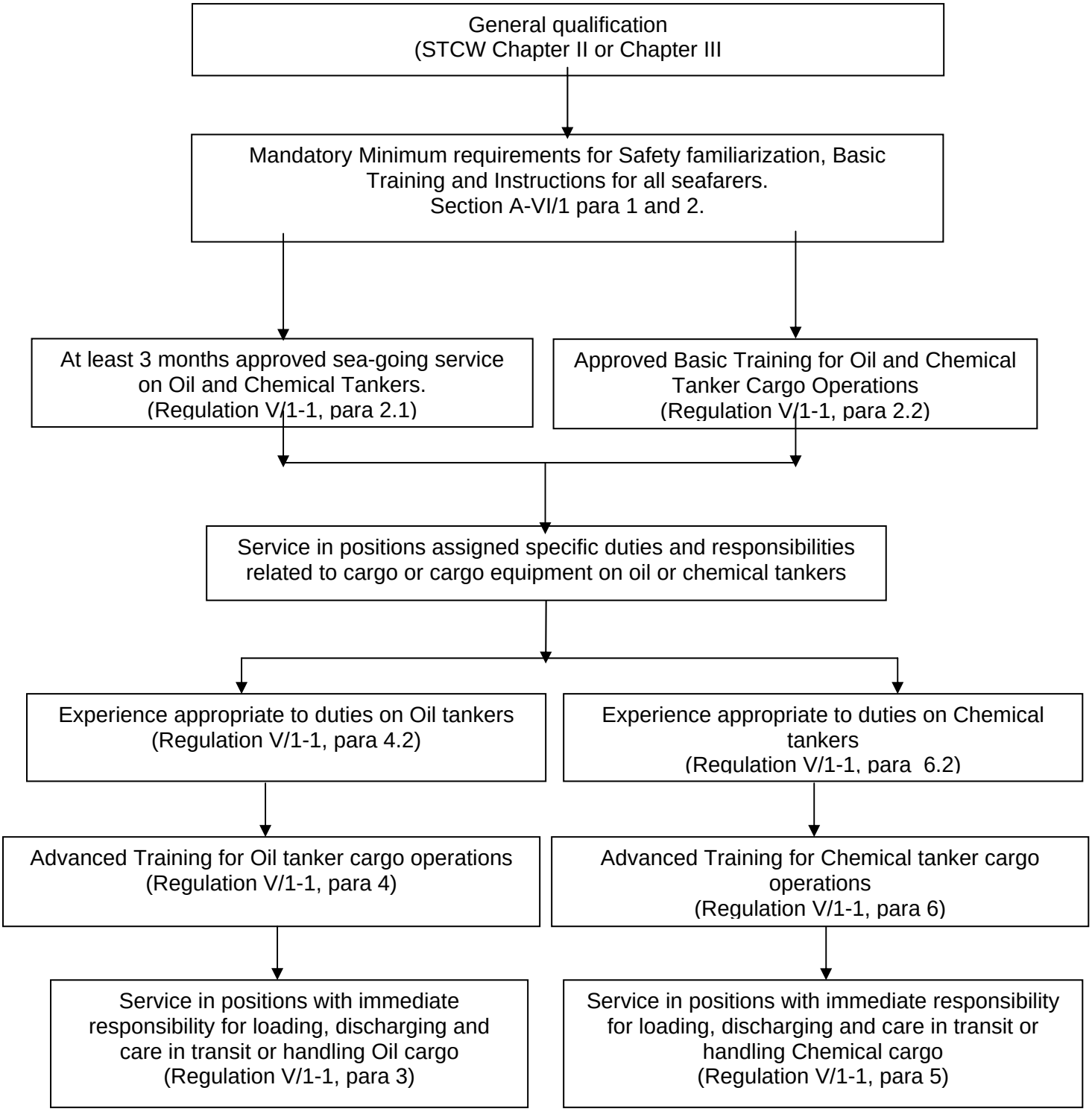
1. Resuscitator
2. Breathing apparatus
3. Portable oxygen meter
4. Portable combustible-gas detector
5. Portable tankscope / Multi point flammable gas (infra- red gas analyzer)
6. Portable toxic-gas detector & chemical absorption tubes
7. Portable multigas – detector
8. Personal multigas – detector
9. Tank evacuation equipment.

■ Use of Simulators

The revised STCW Convention sets standards regarding the performance and 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-I/12. Simulator -based training and assessment is not a mandatory requirement for this Basic training for Oil and Chemical tanker course. However, it is widely recognized that well-designed lessons and exercises can improve the effectiveness of training.

If using simulator-based training, instructors should ensure that the aims and objective of these sessions are defined within the overall training program and that tasks are selected so as to relate as closely as possible to shipboard tasks and practices. Instructors should refer to STCW, Section A-I/12, Part 2.

■ STCW 1978, as amended, including 2010 Manila amendments



Note: Administrations may require additional training at sea or ashore to meet national regulations.

■ Design

The core technical and academic knowledge, understanding and proficiency are set out in Table A-V/1-1-1 of the STCW as amended in 2010, adopted by IMO as part of the 2010 STCW Convention as shown below:

> ***Standard of competence***
> *1 Every candidate for certification in basic training for oil and chemical tanker cargo operations shall be required to:*
>
> *.1 demonstrate the competence to undertake the tasks, duties and responsibilities listed in column 1 of table A-V/1-1-1; and*
>
> *.2 provide evidence of having achieved:*
> *.2.1 the minimum knowledge, understanding and proficiency listed in column 2 of table A-V/1-1-1, and*
>
> *.2.2 the required standard of competence in accordance with the methods for demonstrating competence and the criteria for evaluating competence tabulated in columns 3 and 4 of table A-V/1-1-1.*

The content of the Model course is designed to suit the trainers teaching this course for optimum delivery, ensuring high degree of consistency and adherence to STCW 2010 standards leading to certification in basic training for oil and chemical tanker cargo operations.

The flow of topics mentioned in Part C, is thus reflecting, how the trainer should design their course and delivery and is for guidance only.

To show consistency and adherence to STCW 2010, as given in table A-V/1-1-1, a mapping is provided below for easy reference from STCW's competences and training outcomes to the topics covered in the IMO Model course 1.01.

The STCW 2010 Table A-V/1-1-1 Mapping of IMO Model course 1.01 topics

STCW 2010 Table A-V/1-1-1 Mapping of IMO Model course 1.01 topics

STCW 2010 Table A-V/1-1-1				IMO Model course 1.01		
S.No	**Competence**	**Knowledge, Understanding and Proficiency**		**S.No**	**Topic**	**Knowledge, Understanding and Proficiency**
1	**Contribute to the safe cargo operation of oil and Chemical Tankers**	1.0 Basic knowledge of tankers: .1 types of oil and chemical tankers .2 general arrangement and Construction		**1**	**Basic knowledge of tankers**	1.1 Types of oil tankers 1.2 Types of Chemical tankers 1.3 Basic knowledge of ship arrangements of an oil tanker 1.4 Basic knowledge of ship arrangements of a chemical tanker
		2.0 Basic knowledge of cargo operations: .1 piping systems and valves .2 cargo pumps .3 loading and unloading .4 tank cleaning, purging, gas freeing and inerting		**7**	**Cargo operations**	7.1 For oil tankers 7.1.1 Cargo information 7.1.2 Loading 7.1.3 Unloading 7.1.3.1 Pump characteristics 7.1.4 Tank cleaning 7.1.5 Purging and gas freeing 7.2 For chemical tankers 7.2.1 Cargo information 7.2.2 Loading 7.2.3 Unloading 7.2.4 Tank cleaning and gas-freeing
		3.0 Basic knowledge of the physical properties of oil and Chemicals: .1 pressure and temperature; Including vapour Pressure		**2**	**Physical and Chemical properties of oil and chemicals**	2.1 Basic physics. 2.2 Basic chemistry, chemical elements and groups 2.3 Physical properties of oil and chemicals carried in

STCW 2010 Table A-V/1-1-1				IMO Model course 1.01		
S.No	**Competence**	**Knowledge, Understanding and Proficiency**		**S.No**	**Topic**	**Knowledge, Understanding and Proficiency**
		/ temperature Relationship .2 types of electrostatic charge generation .3 chemical symbols				bulk
		4.0 Knowledge and Understanding of tanker safety culture and safety management		**3**	**Knowledge and understanding of tanker safety culture and safety management**	
2	**Take precautions to prevent hazards**	5.0 Basic knowledge of the hazards associated with tanker operations, including: .1 health hazards .2 environmental hazards .3 reactivity hazards .4 corrosion hazards .5 explosion and flammability hazards .6 sources of ignition, including electrostatic hazards .7 toxicity hazards .8 vapour leaks and clouds		**4.1**	**Hazards**	4.1.1 Health hazards 4.1.2 environmental hazards 4.1.3 reactivity hazards 4.1.4 corrosion hazards 4.1.5 explosion and Flammability hazards 4.1.6 sources of ignition, Including electrostatic Hazards 4.1.7 toxicity hazards 4.1.8 vapour leaks and clouds
		6.0 Basic knowledge of hazard controls: .1 inerting, water padding, drying agents and monitoring techniques .2 anti-static measures		**4.2**	**Basic knowledge of hazard controls**	4.2.1 inerting, water padding, drying agents and monitoring techniques 4.2.2 anti-static measures 4.2.3 ventilation 4.2.4 cargo segregation

STCW 2010 Table A-V/1-1-1				IMO Model course 1.01		
S.No	**Competence**	**Knowledge, Understanding and Proficiency**	**S.No**	**Topic**	**Knowledge, Understanding and Proficiency**
		.3 ventilation .4 segregation .5 cargo inhibition .6 importance of cargo Compatibility .7 atmospheric control .8 gas testing			4.2.5 cargo inhibition 4.2.6 importance of cargo Compatibility 4.2.7 atmospheric control 4.2.8 Gas Testing 4.2.9 Understanding of information on a Material Safety Data Sheet (MSDS)
		7.0 Understanding of information on a Material Safety Data Sheet (MSDS)			
3	**Apply occupational health and safety precautions and measures**	8.0 Function and proper use of gas-measuring instruments and similar equipment	**5**	**SAFETY**	5.1 Function and proper use of gas-measuring instruments and similar equipment
		9.0 Proper use of safety equipment and protective devices including: .1 breathing apparatus and tank-evacuating equipment			5.2 Proper use of safety equipment and protective devices including: 5.2.1 breathing apparatus and tank-evacuating equipment
		.2 protective clothing and Equipment			5.2.2 protective clothing and equipment
		.3 resuscitators			5.2.3 resuscitators
		.4 rescue and escape equipment			5.2.4 rescue and escape equipment
		9.0 Basic knowledge of safe working practices and procedures in accordance with legislation and			5.3 Basic knowledge of safe working practices and procedures in accordance with legislation and

STCW 2010 Table A-V/1-1-1				IMO Model course 1.01		
S.No	**Competence**	**Knowledge, Understanding and Proficiency**	**S.No**	**Topic**	**Knowledge, Understanding and Proficiency**
		industry guidelines and personal shipboard safety relevant to oil and chemical tankers including: .1 precautions to be taken when entering enclosed spaces			industry guidelines relevant to oil and chemical tankers. 5.3.1 Precautions to be taken when entering enclosed spaces
		.2 precautions to be taken before and during repair and maintenance work			5.3.2 Precautions to be taken before and during repair and maintenance work
		.3 safety measures for hot and cold work			5.3.3 Safety measures for hot and cold work
		.4 electrical safety			5.3.4 Electrical safety
		.5 ship/shore safety checklist			5.3.5 Ship/shore safety checklist
		10.0 Basic knowledge of first aid with reference to a Material Safety Data Sheet (MSDS)			5.4 Basic knowledge of first aid with reference to a Material Safety Data Sheet (MSDS)
4	**Carry out fire-fighting operations**	11.0 Tanker fire response organization and action to be taken	**6**	**Fire Safety and Fire fighting operations**	6.1 Oil and Chemical Tanker fire response organization and action to be taken
		12.0 Fire hazards associated with cargo handling and transportation of hazardous and noxious liquids in bulk			6.2 Fire hazards associated with cargo handling and transportation of hazardous and noxious liquids in bulk

STCW 2010 Table A-V/1-1-1				IMO Model course 1.01		
S.No	**Competence**	**Knowledge, Understanding and Proficiency**		**S.No**	**Topic**	**Knowledge, Understanding and Proficiency**
		13.0 Fire-fighting agents used to extinguish oil and chemical fires				6.3 Fire-fighting agents used to extinguish oil and chemical fires
		14.0 Fixed fire-fighting foam system operations				6.4 Fixed fire-fighting foam system operations
		15.0 Portable fire-fighting foam Operations				6.5 Portable fire-fighting foam operations
		16.0 Fixed dry chemical system Operations				6.6 Fixed dry chemical system operations
		17.0 Spill containment in relation to fire-fighting operations				6.7 Spill containment in relation to fire-fighting operations
5	**Respond to emergencies**	18.0 Basic knowledge of emergency procedures including emergency Shutdown		**8**	**Emergencies**	8.1 Basic knowledge of emergency procedures, including emergency shutdown
						8.2 Organizational structure 8.3 Alarms 8.4 Emergency procedures 8.5 First-aid treatment
6	**Take precautions to Prevent pollution of the environment from the release of oil or chemicals**	19.0 Basic knowledge of the effects of oil and chemical pollution on human and marine life		**9**	**Pollution Prevention**	9.1 Basic knowledge of the effects of oil and chemical pollution on human and marine life
		20.0 Basic knowledge of shipboard procedures to prevent pollution				9.2 Basic knowledge of shipboard procedures to prevent pollution
		21.0 Basic knowledge of measures to be taken in the event of spillage, including				9.3 SOPEP and SMPEP Measures to be taken in the event of spillage,

STCW 2010 Table A-V/1-1-1				IMO Model course 1.01		
S.No	**Competence**	**Knowledge, Understanding and Proficiency**		**S.No**	**Topic**	**Knowledge, Understanding and Proficiency**
		the need to: .1 report relevant information to the responsible persons .2 assist in implementing shipboard spill-containment procedures				including the need to: .1 report relevant information to the responsible persons .2 assist in implementing shipboard spill-containment procedures
				10	**Case Studies discussion on oil and NLS ship emergencies**	**10.1** Fire and Explosion during unloading operations on an oil tanker **10.2** Collapsing of seamen during squeegeeing operations

■ Teaching Aids (A)

Note: - Other equivalent teaching aids may be used as deemed fit by the instructor.

A1 Instructor's Manual (Part D of this course)
A2 Resuscitator
A3 Breathing apparatus
A4 Portable oxygen meter
A5 Portable combustible-gas detector
A6 Portable tankscope / Multi point flammable gas (infra- red gas analyzer)
A7 Portable toxic-gas detector & chemical absorption tubes
A8 Portable multigas – detector
A9 Personal multigas – detector
A10 Tank evacuation equipment.
A11 Overhead projector for power point presentations
A12 Oil Tanker Cargo & Ballast Water Handling Simulator
A13 Chemical Tanker Cargo & Ballast Water Handling Simulator
A14 White board
A15 Videos

■ IMO references (R)

R1 SOLAS 1974, International Convention for the Safety of Life at Sea, 1974 (SOLAS 1974) Consolidated Edition 2009, (IMO-IIOE)
R2 STCW 78 as amended, including 2010 Manila amendments, International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, Manila Amendments 2010
R3 MARPOL 73/78, International Convention for the Prevention of Pollution from Ships, 1973/1978 (MARPOL 73/78) Consolidated Edition 2011
R4 IG Systems, Inert Gas Systems (IMO-860E)
R5 COW Systems, Crude Oil Washing Systems (IMO-617E)
R6 MFAG with Chemical supplement, Medical First Aid Guide for Use in Accidents Involving Dangerous Goods (iMO251 E)
R7 BCH Code, International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (IBC Code), as amended (IMO-IOOE)
R8 IBC Code, International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (IBC Code), as amended (IMO-IOOE)
R9 SOPEP Guidelines, Guidelines for the Development of Shipboard Pollution Emergency Plans (SOPEP) (IMO-586E)
R10 ISM Code, International Safety Management Code (ISM Code) (IMO-117E)
R11 IMO Model Course 2.06 Oil Tanker Cargo & Ballast Handling Simulator
R12 IMO Model Course 1.37 Chemical Tanker Cargo & Ballast Handling Simulator

■ Textbooks (T)

Note: - Other textbooks may be used as deemed fit by the instructor.

T1 Safety in Oil Tankers, International Chamber of Shipping, Safety in Oil Tankers. (International Chamber of Shipping, Carthusian Court, 12 Carthusian Street, London, ECIM 6EZ, U.K.)

T2 Safety in Chemical Tankers, International Chamber of Shipping, Safety in Chemical Tankers (International Chamber of Shipping, Carthusian Court, 12 Carthusian Street, London, EC1M 6EZ, U.K.)

■ Bibliography (B)

B1 International Safety Guide for Oil Tankers and Terminals. 5th ed. [London, Witherby and Co. Ltd. (32/36 Aylesbury Street, London, EC1 R OET, U.K),1996] (ISBN 1-85609-081-7)

B2 Tanker Safety Guide (Chemicals), International Chamber of Shipping, Tanker Safety Guide (Chemicals), 3rd ed. (London, Witherby and Co. Ltd., 2002) (ISBN 0-948691-50-6)

B3 Safe Oil Tanker operations, Safe Oil Tanker operations 2011 edition- Capt. KSD Mistree & Mr. B. K. Sharma. - MARINEX Publications. A-3, Silver Queen, Soonawala Agyari marg,Mumbai 445470, India. e-mail: marinez1@hotmail.com Tel: 91 22 24465470

B4 Basic Safe Tanker Handbook for Oil, Chemicals, LPG and LNG, Basic Safe Tanker Handbook for Oil, Chemicals, LPG and LNG, 2011, Capt. KSD Mistree, MAREX Publication, C - 209, Morya House, New Link Road, Andheri (w), Mumbai - 400 053. India. Tel.: 91 22 6734 9292 Fax: 91 22 6734 9222

B5 Ship to Ship Transfer Guide (Petroleum), International Chamber of Shipping/Oil Companies International Marine Forum, Ship to Ship Transfer Guide (Petroleum), 4th ed. (London, Witherby & Co. Ltd., 2005) (ISBN 1-85609-097-3)

B6 CHRIS manual II, U.S. Coast Guard, CHRIS, Manual II, Hazardous Chemical Data, (Washington, D.C., Government Printing Office, 1988)

B7 Condensed Chemical Dictionary, N. I. Sax, and R. J. Lewis, Sr., Hawley's Condensed Chemical Dictionary, 13th ed. (New York, Van Nostrand Reinhold, 1977) (ISBN 0-442-011318)

B8 Tank Cleaning Guide, Tank Cleaning Guide, 6th ed. (Rotterdam, B.V. Chemical Laboratory "Dr. A. Verwey", 1998)

B9 Drager-Tube Handbook, Drager-Tube Handbook 11th ed. (Drager Sicherheitstechnik GmbH, Revalstrasse 1, D-23560 Lubeck, Germany, 1998) (ISBN 3-926762-06-3)

B10 Measures to Prevent Accidental Pollution, INTERTANKO, Measures to Prevent Accidental Pollution, 1990

B11 Code of Safe Working Practises, PO Box 29, Norwich, NR3 1GNTelephone orders/General enquiries:0870 600 5522 Fax orders: 0870 600 5533E-mail: customer.services@tso.co.uk Textphone 0870 240 3701

B12 Tanker Management Self Assessment, Witherby Publications , 32/36 Aylesbury Street London. www.witherbys.com ISBN 10: 1905331231 ISBN 13: 9781905331239

■ Videos - DVDs, CD ROMs, CBT's (V)

Note: - Other equivalent videos, CD-ROMs, CBT's may be used as deemed fit by the instructor.

For Oil Tankers VO(x)

VO1 Portable gas detection equipment calibration procedures
Available from: KARCO Website:http://www.karco.in
e-mail ID:karco@karcoservices.com
Contact Person:Capt Pravesh Diwan
Telephone:91-22-67101229

VO2 Tanker safety depends on you
Available from: NATIONAL AUDIO VISUAL CENTER
National Technical Information Service
5301 Shawnee Rd, Alexandria
VA 22312
e-mail: orders@ntis.gov

VO3 Operation and maintenance of inert gas systems

VO4 The ship/shore interface – petroleum tankers

VO5 Tanker practices series
- cargo - part 4 Code No: 504

VO6 Permit to work Code No: 621

VO7 Entry into enclosed spaces (edition 2) Code No: 682

VO8 Personal safety on tankers (edition 2), Code No: 970
Available from: Videotel Marine International
84 Newman Street, London W1T 3EU, UK
Tel: +44(0) 20 72991800
Fax: +44(0) 207299 1818
e-mail: mail@videotelmail.com
URL: www.videotel.co.uk

For Chemical Tankers VC(x)

VC1 FRAMO cargo pumping system - instruction

VC2 Operation of FRAMO cargo pumping system
Available from: Head Office- Frank Mohn Services AS,
PO Box 98,Slatthaug, 5851 Bergen, Norway.
Phone: +4755999000.
URL: www.framo.no

VC3 Static electricity on board tankers - DVD

VC4 Nitrogen on board chemical tankers - DVD

VC5 Explosion on board a laden chemical tanker – DVD
Available from: KARCO Website:http://www.karco.in
e-mail ID:karco@karcoservices.com
Contact Person:Capt Pravesh Diwan
Telephone:91-22-67101229

VC6 Chemical tank cleaning & inspection (edition 2) Code No: 950

VC7 Vapour emission control Code No: 1118

VC8 Don't gamble with safety on chemical tankers Code No: 595

Consider adding CBT's from seagull, namely:-
- Liquid cargo properties (CBT # 0032)
- COW (CBT # 0054)
- ODME (CBT # 0055)

Part B: Course Outline

■ Lectures

As far as possible, lectures should be presented within a familiar context and should make use of practical examples. They should be well illustrated with diagrams, photographs and charts where appropriate, and be related to matter learned during seagoing time.

An effective manner of presentation is to develop a technique of giving information and then reinforcing it. For example, first tell the trainees briefly what you are going to present to them; then cover the topic in detail; and, finally, summarize what you have told them. The use of an overhead projector and the distribution of copies of the transparencies as trainees handouts contribute to the learning process. The areas where the Instructors can use various instructional methods while delivering the course are broadly recognised as:

- ### Classroom (Lecturing and explaining)

  Explanation of any topics encompassed writing Part C- Detailed teaching syllabus of this model course is the most used instructional method. This type of method is often referred to as “the lecture method”, “presentation” or “chalk and talk”, although nowadays the blackboards are mostly replaced by whiteboards and the chalks by whiteboard markers, n some institutions who have embraced technology, “interactive whiteboards” have replaced traditional whiteboards take a full advantage of what these boards offers As the software supplied with the interactive whiteboard usually allows the Instructors to keep notes and annotations as an electronic file for later distribution either on paper or through a number of electronic formats. Although the chalks gets replaced by using a pen, finger, stylus or other device, the expression “chalk and talk” remains the same.

- ### Laboratory / Classroom / Simulator (Demonstration / Exercises)

  The topics identified to be taken up as practical in the course outline that follows, can be taught by demonstration method. Like explanation method mentioned above, this method is always linked in some way to other instructional strategies. The Instructor would need to identify very clearly what is the activity, and then would need to perhaps break it down in various steps. In case the trainees are allowed to practice, then proper supervision for assessment would be required, which will require the whole class to be divided into various groups, with every group being supervised by Instructors, qualified to conduct this course.

  Traditional methods of instruction have been largely adopted for maritime training courses, however with the advancement of technology and reducing costs, the industry is witnessing the increasing introduction of technology into the classrooms, including the use of simulation technology.

  The use of simulators provides a learning platform where all three elements of learning; knowledge, skill and attitude can be integrated into a valuable learning experience.

The Manila Amendments to the STCW Convention have also embraced the use of simulators for training and evaluation and assessment of competence. It is therefore important that the potential for utilizing this valuable training tool is realized to the maximum.

It is suggested that relevant topics of cargo operation which are marked with an Asterisk (*) in the course outline that follows, should be taught on a simulator. When the simulator sessions are used to cover the topics mentioned in this course, then the method of assessment that can be used is also provided in the Part E of this Model course and is for guidance only.

When simulators are used for training and assessing competence, the Instructors are guided to the STCW 2010 requirements with relation to simulators and to the training and assessment. The Simulator should conform to the requirements of STCW 2010 Regulation I/12 (use of simulators), section A-I/12, parts 1 and 2, Performance Standards for the simulator and simulator training objectives and sections B I/12, (guidance regarding the use of simulators). The training and assessment should conform to the requirements of STCW 2010 Regulation I/6 (training and assessment), section A-I/6, training and assessment 4.3.1, 4.3.2 and 6.5 and section B-I/6 (guidance regarding training and assessment).

In case simulators cannot be used owing to unavailability of such facility within the training institute / centre, screenshots of some topics have been appended in Part D - Instructor's Manual for assisting the training. These screen shots can be incorporated in power point presentations, projected, or given in a handout for interactive table top exercise to elucidate understanding and thus assist effective teaching and learning to take place.

- ## Classroom (Case-studies)

Case-studies which form supporting instructional methods can be incorporated within the core methods mentioned above or used as the major method for developing certain types of learning in a session covering certain topic. Group work, questioning, discussion and role-play are also some of the examples of supporting instructional methods, which the Instructors can incorporate and use in a lesson.

Case- studies, an example for each (oil and chemical), appended in Part D of this model course is a capture of a real life situation. Instructors are requested to carefully select the case-studies that will form a part of training of this model course. Cases should typically provide information outlining a problem based scenario, where decisions involving value judgments are involved. Although the information actually provided within cases can vary considerably with some containing very detailed and comprehensive information, whereas others simply documenting the key elements of a situation, the latter is preferred.

The Instructors should ensure that whichever case studies they incorporate within their lesson plan, it should be interesting and appropriate for the level of trainees attending the course.

- ## Course Outline

The tables that follow list the competencies and areas of knowledge, understanding and proficiency, together with the estimated total hours required for lectures and practical exercises. Teaching staff should note that timings are suggestions only and should be adapted to suit individual groups of trainees depending on their experience, ability, equipment and staff available for training.

COURSE OUTLINE

	Knowledge, understanding and proficiency	Total hours for lectures	Total hours for practicals
1	**Basic knowledge of tankers**		
1.1	Types of oil tankers	0.25	
1.2	Types of Chemical tankers	0.25	
1.3	Basic knowledge of ship arrangements of an oil tanker (*)	0.50	
1.4	Basic knowledge of ship arrangements of a chemical tanker (*)	0.50	
2	**Physical and chemical properties of oil and chemicals**		
2.1	Basic physics	1.5	
2.2	Basic chemistry, chemical elements and groups	1.5	
2.3	Physical properties of oil and chemicals carried in bulk	1.5	
3	**Knowledge and understanding of tanker safety culture and safety management**	**1.5**	
4.1	**Hazards**		
4.1.1	Health hazards	0.50	
4.1.2	Environmental hazards	0.50	
4.1.3	Reactivity hazards	0.25	
4.1.4	Corrosion hazards	0.25	
4.1.5	Explosion and Flammability hazards	0.50	
4.1.6	Sources of ignition, Including electrostatic Hazards	0.50	
4.1.7	Toxicity hazards	0.25	
4.1.8	Vapour leaks and clouds	0.25	
4.2	**Basic knowledge of hazard controls**		
4.2.1	Inerting, water padding, drying agents and monitoring techniques	0.50	

	Knowledge, understanding and proficiency	Total hours for lectures	Total hours for practicals
4.2.2	Anti-static measures	0.50	
4.2.3	Ventilation	0.25	
4.2.4	Cargo segregation	0.25	
4.2.5	Cargo inhibition	0.25	
4.2.6	Importance of cargo Compatibility(#)	0.50	
4.2.7	Atmospheric control	0.50	
4.2.8	Gas Testing	0.25	
4.2.9	Understanding of Information on a Material Safety Data Sheet (MSDS) (#)		0.50
5	**SAFETY**		
5.1	Function and proper use of gas-measuring instruments (**)/(#)		1.0
5.2	Proper use of safety equipment and protective devices including:		
5.2.1	breathing apparatus and tank-evacuating equipment(**)/(#)	0.50	
5.2.2	protective clothing and equipment(**)/(#)	0.50	
5.2.3	resuscitators(**)/(#)	0.25	
5.2.4	rescue and escape equipment(**)/(#)	0.25	
5.3	Basic knowledge of safe working practices and procedures in accordance with legislation and industry guidelines relevant to oil and chemical tankers	0.5	
5.3.1	Precautions to be taken when entering enclosed spaces	0.25	
5.3.2	Precautions to be taken before and during "repair and maintenance" work in a gas dangerous area	0.25	
5.3.3	Safety measures for hot and cold work	0.25	
5.3.4	Electrical safety precautions	0.25	
5.3.5	Ship/shore safety checklist (#)	1.5	
5.4	Basic knowledge of first aid with reference to a Material Safety Data Sheet (MSDS) (#)		1.5
6	**Fire Safety and Fire fighting operations**		
6.1	Oil and Chemical Tanker fire response organization and action to be taken (**)	1.5	
6.2	Fire hazards associated with cargo handling and transportation of hazardous and noxious liquids in bulk	1.5	
6.3	Fire-fighting agents used to extinguish oil and chemical fires (**)	0.50	
6.4	Fixed fire-fighting foam operations	0.25	
6.5	Portable fire-fighting foam operations	0.25	
6.6	Fixed dry chemical system operations	0.25	

	Knowledge, understanding and proficiency	Total hours for lectures	Total hours for practicals
6.7	Spill containment in relation to fire-fighting operations	0.25	
7	**Cargo operations**		
7.1	For oil tankers	1.0	
7.1.1	Cargo information	0.5	
7.1.2	Loading (*)	0.25	
7.1.3	Unloading (*)	0.25	
7.1.3.1	Pump characteristics	0.25	
7.1.4	Tank cleaning (*)	0.25	
7.1.5	Purging and gas freeing (*)	0.50	
7.2	For Chemical Tankers	1.0	
7.2.1	Cargo information	0.50	
7.2.2	Loading (*)	1.0	
7.2.3	Unloading (*)	0.5	
7.2.4	Tank cleaning and gas-freeing (*)	1.5	
8	**Emergencies**		
8.1	Basic knowledge of emergency procedures, including emergency shutdown	0.5	
8.2	Organizational structure	0.25	
8.3	Alarms	0.25	
8.4	Emergency procedures	0.25	
8.5	First-aid treatment	0.25	
9	**Pollution Prevention**		
9.1	Basic knowledge of the effects of oil and chemical pollution on human and marine life	0.5	
9.2	Basic knowledge of shipboard procedures to prevent pollution	0.25	
9.3	SOPEP and SMPEP Measures to be taken in the event of spillage, including the need to: .1 report relevant information to the responsible persons .2 assist in implementing shipboard spill-containment procedures	0.25	
10	**Case Studies on oil and NLS ship Emergencies**		
10.1	Explosion during slop discharge of an oil tanker	0.25	
10.2	Overflow from a chemical tankers tank after partial unloading	0.25	

	Knowledge, understanding and proficiency	Total hours for lectures	Total hours for practicals
11	**Assessment**		0.5
	Subtotals	**33**	**3.5**
	Total for the course		**36.5**

Notes

It is suggested that relevant topics which are marked with an Asterisk (*) may be taught on a simulator.

It is suggested that relevant topics which are marked with a Hash (#) may be conducted separately in any facility which can conduct practical exercises and instruction under approved and truly realistic training conditions (e.g., simulated shipboard conditions).

It is suggested that relevant topics which are marked with a double Asterisk (**) may be demonstrated practically or relevant videos to be shown for same.

Teaching staff should note that the hours for lectures and exercises are suggestions only as regards sequence and length of time allocated to each objective. These factors may be adapted by lecturers to suit individual groups of trainees depending on their experience, ability, equipment and staff available for teaching.

Part B: Course Timetable

Teaching staff should note that timetables are suggestions only as regards to sequence and length of time allocated to each objective. Lecturers to adapt these factors to suit the needs of individual group of trainees depending upon their experience, ability and on the equipment and staff available for training: Below is a suggested time table so arranged to let the topics flow in the correct sequence of learning

	1st Period (1.5 Hours) **(0900 - 1030 hrs)**	**2nd Period** (1.5 Hours) **(1100 - 1230 hrs)**		**3rd Period** (1.5 Hours) **(1330 - 1500 hrs)**	**4th Period** (1.5 Hours) **(1530 - 1700 hrs)**
Day 1	1.1 Types of oil tankers (0.25 hrs) 1.2 Types of chemical tankers (0.25 hrs) 1.3 Basic knowledge of ship arrangements of an oil tanker (0.5 hrs)(*) 1.4 Basic knowledge of ship arrangements of a chemical tanker (0.5 hrs)*	2.1 Basic physics (1.5 hrs)	**Lunch Break (1230 – 1300 hrs)**	2.2 Basic chemistry, chemical elements and groups (1.5 hrs)	2.3 Physical properties of oil and chemicals carried in bulk (1.5 hrs)
Day 2	3 Knowledge and understanding of tanker safety culture and safety management (1.5 hrs)	4.1.1 Health hazards (0.5 hrs) 4.1.2 Environmental hazards (0.5 hrs) 4.1.3 Reactivity hazards (0.25 hrs) 4.1.4 Corrosion hazards (0.25 hrs)		4.1.5 Explosion and flammability hazards (0.5 hrs) 4.1.6 Sources of ignition, including electrostatic hazards (0.5 hrs) 4.1.7 Toxicity hazards (0.25 hrs) 4.1.8 Vapour leaks and clouds (0.25 hrs)	4.2.1 Inerting, water padding drying agents and monitoring techniques (0.5 hrs) 4.2.2 Anti- static measures (0.5 hrs) 4.2.3 Ventilation system on oil and chemical tankers (0.25 hrs) 4.2.4 Cargo Segregation (0.25 hrs)
Day 3	4.2.5 Cargo Inhibition (0.25 hrs) 4.2.6 Importance of cargo compatibility (0.5 hrs)(#)	4.2.9 Understanding of Information on a Material Safety Data Sheet (MSDS) (0.5 hrs) (#)		5.2.1 Use of breathing apparatus and tank evacuating equipment (0.5 hrs)(#)/(**) 5.2.2 Use of protective	5.3 Safe working practices relevant to oil and chemical tankers (0.5 hrs) 5.3.1 Enclosed space entry

	1st Period (1.5 Hours) **(0900 - 1030 hrs)**	**2nd Period** (1.5 Hours) **(1100 - 1230 hrs)**		**3rd Period** (1.5 Hours) **(1330 - 1500 hrs)**	**4th Period** (1.5 Hours) **(1530 - 1700 hrs)**
	4.2.7 Atmospheric control (0.5 hrs) 4.2.8 Gas testing (0.25 hrs)	5.1 Function and proper use of gas measuring instruments (1 hr)(#)/(**)		clothing and equipment (0.5 hrs) (#)/(**) 5.2.3 Proper use of resuscitators (0.25hrs) (#)/(**) 5.2.4 Use of rescue and escape equipment (0.25 hrs) (#)/(**)	(0.25 hrs) 5.3.2 Precautions to be taken before and during repair and maintenance work in a gas dangerous area (0.25 hrs) 5.3.3 Safety measures for hot and cold work (0.25 hrs) 5.3.4 Electrical safety precautions (0.25 hrs)
Day 4	5.3.5 Ship Shore Safety Checklist (1.5 hrs) (#)	5.4 Basic Knowledge of first aid with reference to a Material Safety Data Sheet (1.5 hrs)(#)		6.1 Oil and chemical tanker fire response organization (1.5 hrs(**)	6.2 Fire hazards associated with cargo handling and transportation of hazardous and noxious liquids in bulk (1.5 hrs)
Day 5	6.3 Fire fighting agents used to extinguish oil and chemical fires (0.5 hrs) (**) 6.4 Fixed fire-fighting foam operations (0.25 hrs) 6.5 Portable fire-fighting foam operations (0.25 hrs) 6.6 Fixed dry chemical system operations (0.25 hrs) 6.7 Spill containment in relation to fire-fighting operations (0.25)	7.1 For oil tankers (1.0 hrs) 7.1.1 Cargo Information (0.5 hrs)	**Lunch Break (1230 – 1300 hrs)**	7.1.2 Loading (0.25 hrs) (*) 7.1.3 Unloading (0.25 hrs) (*) 7.1.3.1 Pump characteristics (0.25 hrs) 7.1.4 Tank Cleaning (0.25 hrs) (*) 7.1.5 Purging and gas freeing (0.5 hrs) (*)	7.2 For Chemical Tankers (1.0 hrs) 7.2.1 Cargo information (0.5 hrs)
Day 6	7.2.2 Loading (1.0 hrs) (*) 7.2.3 Unloading (0.5 hrs) (*)	7.2.4 Tank cleaning and gas-freeing (1.5 hrs) (*)		8.1 Basic knowledge of emergency procedures,	9.1 Basic knowledge of the effects of oil and

	1st Period (1.5 Hours) **(0900 - 1030 hrs)**	**2nd Period** (1.5 Hours) **(1100 - 1230 hrs)**		**3rd Period** (1.5 Hours) **(1330 - 1500 hrs)**	**4th Period** (1.5 Hours) **(1530 - 1700 hrs)**
				including emergency shutdown (0.5 hrs) 8.2 Organizational structure (0.25 hrs) 8.3 Alarms (0.25 hrs) 8.4 Emergency procedures (0.25 hrs) 8.5 First-aid treatment (0.25 hrs)	chemical pollution on human and marine life (0.5 hrs) 9.2 Basic knowledge of shipboard procedures to prevent pollution (0.25 hrs) 9.3 SOPEP and SMPEP (0.25 hrs) 10.1 Explosion during slop discharge of an oil tanker (0.25 hrs) 10.2 Overflow from a chemical tankers tank after partial unloading (0.25 hrs)

Tea Breaks: 1030-1100 / 1500-1530

Notes
It is suggested that relevant topics which are marked with an Asterisk (*) may be taught on a simulator.

It is suggested that relevant topics which are marked with a Hash ($^{\#}$) may be conducted separately in any facility which can conduct practical exercises and instruction under approved and truly realistic training conditions (e.g., simulated shipboard conditions).

It is suggested that relevant topics which are marked with a double Asterisk (**) may be demonstrated practically or relevant videos to be shown for same.

Part C1: Detailed Teaching Syllabus

TOPIC 1	**BASIC KNOWLEDGE OF TANKERS**
COMPETENCE 1	**Contribute to the safe cargo operation of Oil and Chemical Tankers**

TRAINING OUTCOMES:

Demonstrates a knowledge and understanding of:

Tankers:

.1 types of oil and chemical tankers
.2 general arrangement and construction

TOPIC 1	BASIC KNOWLEDGE OF TANKERS			
Knowledge, Understanding and Proficiency		**IMO Reference**	**Text books Bibliography**	**Teaching aid**
1.1	**Types of oil tankers**	**R1,R2**	**B1, B3, B4**	**A1, A11, A14**
1.1.1	Lists important stages in the development of oil tankers			
1.1.2	States oil tankers built after 6th July 1996 subsequent to the grounding of Exxon Valdez requires to have double hull			
1.1.3	Describes Crude oil Carriers, Product Tankers, Combination carriers - O/O & OBOs			
1.2	**Types of Chemical tankers**	**R1,R2, R7, R8**	**B2, B4**	**A1, A11, A14**
1.2.1	Lists important stages in the development of chemical tankers			
1.2.2	States Type 1 and Type 2 Chemical tankers were built with double hulls from 1973			
1.2.3	States Type 3 Chemical tankers were like single hull tankers but with increased subdivisions but from 1st January 2007 they require to have double hulls.			
1.2.4	describes Type 1, Type 2 and Type 3 Chemical Tankers			
1.2.4.1	States that the Bulk Chemical Codes divide chemical tankers into three ship types, Type 1, Type .2 and Type 3, which reflect the hazard rating of the cargoes to be carried			
1.2.4.2	States that a Type 1 ship is a chemical tanker intended for the transportation of products considered to present the greatest overall hazards and that Type 2 and Type 3 are for products of progressively lesser hazards			
1.2.4.3	States that a Type 1 ship is required for highly hazardous cargoes such as dodecylphenol and phosphorus			
1.2.4.4	States that the most common chemical tanker cargoes require Type 2 or Type 3 ships			
1.2.4.5	States that the background for the IMO grouping of ship types is the ship's capability to survive damage caused by collision or stranding, in combination			

TOPIC 1	BASIC KNOWLEDGE OF TANKERS			
Knowledge, Understanding and Proficiency		**IMO Reference**	**Text books Bibliography**	**Teaching aid**
	with the location of the cargo tank in relation to such damage			
1.2.4.6	States that the term "overall hazard" includes both safety hazard and pollution hazard			
1.2.5	Explains difference between Parcel Tankers, Bulk Solvent Carriers and Dedicated small Chemical Tankers Survival capability and tank location			
1.3	**Basic knowledge of Ship arrangements of an Oil tanker**	**R1,R2,R3,R4**	**B1, B3, B4**	**A1, A11, A12,A14**
1.3.1	Identifies with the aid of a sketch the general tank arrangements, including: - cargo tanks - pump-rooms - segregated ballast tanks - slop tanks - cofferdams - peak tanks - deep tanks			
1.3.2	Describes the piping arrangements of an oil tanker, including: - internal piping in tanks and pump-rooms - external piping (deck lines) - crossovers - by-passes - ring-main systems - direct piping systems - valves			
1.4	**Basic knowledge of Ships arrangements of a chemical tanker**	**R1,R2, R7, R8,R12**	**B2,B4**	**A1,A11, A13,A14**
1.4.1	Lists tanks in the cargo area, such as: - cargo tanks - slop tanks - segregated ballast tanks			
1.4.2	Explains, with the aid of a simple drawing, how the tanks mentioned above may be located in a chemical tanker			
1.4.2.1	States that some chemical tankers have small additional cargo tanks located on deck			
1.4.2.2	States that slop tanks are tanks			

TOPIC 1	BASIC KNOWLEDGE OF TANKERS			
Knowledge, Understanding and Proficiency		**IMO Reference**	**Text books Bibliography**	**Teaching aid**
	designated or used for tank washings and cargo residues			
1.4.2.3	States that cargo tanks may also be used as slop tanks and vice versa			
1.4.2.4	States that segregated ballast tanks are tanks designated for ballast only			
1.4.2.5	States that segregated ballast tanks are equipped with a pumping system that is independent of the cargo system, in order to avoid contamination by cargoes			
1.4.2.6	States that cargo tanks may also be used for ballast			
1.4.2.7	States that some commonly fixed piping arrangements in a cargo tank are: - discharge line - cargo ventilation line - drop line			
1.4.2.8	States that the main purpose of the discharge line is to lead the cargo from the cargo tank to the manifold by means of a cargo pump			
1.4.2.9	States that the drop line is mainly used to fill the cargo tank			
1.4.2.10	States that the main purpose of the ventilation line is to lead vapour from the cargo tank to the cargo ventilation riser			
1.4.2.11	States that the vapour pressure may be regulated by a pressure/vacuum relief valve in the ventilation line			
1.4.2.12	States that the vent outlets are arranged to prevent the entry of water into the cargo tanks and, at the same time, to direct the vapour discharge upwards			
1.4.2.13	States that the vent outlets are provided with flame screens and high-velocity devices			
1.4.2.14	States that there are several types of valves used in cargo-handling systems on chemical tankers			
1.4.2.15	States that chemical tankers are provided with chemical cargo hoses			
1.4.2.16	States that the chemical cargo hose constitutes a weak part of the cargo-handling system and that incorrect handling of the hose will increase the danger of fire, health hazard and pollution			

TOPIC 1	BASIC KNOWLEDGE OF TANKERS			
Knowledge, Understanding and Proficiency		**IMO Reference**	**Text books Bibliography**	**Teaching aid**
1.4.3	Describes, with the aid of a simple drawing, a cargo-loading arrangement			
1.4.4	Describes, with the aid of a drawing, a simple cargo-un-loading arrangement			
1.4.5	Describes correct handling, storage and inspection of the ship's cargo hoses			
1.4.6	States that all materials used for construction of tanks and the associated piping, valves and pumps must be resistant to the cargoes carried and dictated by the service temperature			
1.4.7	States that mild steel is the normal material for the construction of a chemical tanker			
1.4.8	States that mild steel is resistant to most chemicals, but that its propensity to rust makes it unsuitable for chemical cargoes			
1.4.9	States that rust makes tank cleaning more difficult and may also contaminate the cargo			
1.4.10	States that in order to avoid cargo contamination and to obtain a smooth surface on tank structures, mild-steel cargo tanks on chemical tankers are always coated internally with paint that is resistant to groups of chemicals			
1.4.11	States that no coating today is suitable for all cargoes shipped in chemical tankers, and that a "coating resistance list" must be strictly followed when cargo is to be loaded in a coated tank			
1.4.12	States that most chemical tankers have their cargo-tank section divided into some coated tanks and some stainless-steel tanks			
1.4.13	States that stainless steel may be "clad" or solid			
1.4.14	States that clad steel consists of a mild steel plate with a veneer of stainless steel of about 2 mm thickness			
1.4.15	States that stainless steel is resistant to almost all chemicals			
1.4.16	States that stainless steel is not "stainless" or corrosion-resistant unless it is handled properly			

TOPIC 1	BASIC KNOWLEDGE OF TANKERS			
Knowledge, Understanding and Proficiency		**IMO Reference**	**Text books Bibliography**	**Teaching aid**
1.4.17	States that the steel manufacturer's or the owner's instructions for maintenance of stainless-steel tanks and piping must be strictly followed by ship's personnel			
	Pumps and eductors			
1.4.18	States that the main cargo pumps fitted on chemical tankers are mainly of the centrifugal type			
1.4.19	States that these pumps may be of the deep well type in the cargo tanks or placed in a pump-room			
1.4.20	States that screw pumps and piston pumps are used also in some unloading systems			
1.4.21	States that the cargo-pumping systems on chemical tankers are designed to minimize cargo residues after unloading			
1.4.22	States that in addition to the main unloading pumps, there are arrangements for alternative unloading			
1.4.23	States that alternative unloading may be done by means of portable cargo pumps or eductors			
1.4.24	Describes generally an unloading system consisting of submerged cargo pumps			
1.4.25	Describes generally an unloading system consisting of pumps placed in pump rooms			
1.4.26	Describes generally the safe handling of a centrifugal pump			
	Cargo heating systems			
1.4.27	States that some cargoes have to be heated by the ship's cargo heating system			
1.4.28	States that the main reason for heating a cargo is to: - prevent it from solidifying - keep the viscosity below a certain level during unloading			
1.4.29	States that the heating medium maybe steam, or thermal oils			

TOPIC 1	BASIC KNOWLEDGE OF TANKERS			
Knowledge, Understanding and Proficiency		**IMO Reference**	**Text books Bibliography**	**Teaching aid**
1.4.30	States that means are provided to ensure that cargo does not enter boilers or the engine-room through leakages in cargo heating coils			
1.4.31	describes, with the aid of a drawing, a cargo heating system: - using heating coils filled inside the cargo tank - using a heat exchanger placed outside the cargo tank			
1.4.32	States that mixtures of water and cargo from tank-washing operations are called “slops”			
1.4.33	States that tanks which contain this sort of mixture are called “slop tanks”			
1.4.34	States that slop tanks should be placed inside the cargo area			
1.4.35	States that slops may be stored in slop tanks or in cargo tanks			
1.4.36	States that slops from different cargoes may be incompatible			
1.4.37	Describes, with the aid of a drawing, a tank-washing and slop retaining system			
1.4.38	States that “inert gas” is a gas or vapour containing insufficient oxygen to support combustion.			
1.4.39	States that strict cargo quality controls are needed by shippers and thus require inert gas of extreme purity			
1.4.40	States that “Nitrogen” is used as inert gas on board chemical tankers			
1.4.41	States that inert gas other than nitrogen has constituents like carbon oxides, sulphur oxides, moisture etc. which may result into cargo contamination			
1.4.42	States that these vessels may have nitrogen generators on board and in absence of such generators, arrangements are there to receive nitrogen from a shore reception facility			
1.4.43	States that depending upon the requirements of a cargo different gauging system are needed in accordance with IBC/BCH code			
1.4.44	States that gauging could be “open”, "restricted" or "closed".			

TOPIC 2	**PHYSICAL AND CHEMICAL PROPERTIES OF OIL AND CHEMICALS**
COMPETENCE 1	**Contribute to the safe cargo operation of oil and Chemical Tankers**

TRAINING OUTCOMES:

Demonstrates a knowledge and understanding of:

Physical properties of Oil and Chemicals:

.1 pressure and temperature; vapour Pressure / temperature Relationship
.2 electrostatic charge generation
.3 chemical symbols

TOPIC 2	PHYSICAL AND CHEMICAL PROPERTIES OF OIL AND CHEMICALS			
Knowledge, Understanding and Proficiency		**IMO Reference**	**Text books Bibliography**	**Teaching aid**
2.1	**Basic physics**	**R2**	**B1, B2, B3,B4**	**A1, A11, A14**
2.1.1	Defines the following in simple terms - states of aggregation - liquid density - vapour density - vapour pressure - viscosity - pour-point			
2.1.2	Describes briefly the structure of atoms and molecules			
2.1.3	States that a negatively charged body has an excess of electrons			
2.1.4	States that a positively charged body has a shortage of electrons			
2.1.5	States that similarly charged bodies repel each other and oppositely charged bodies attract each other			
2.1.6	Describes induction and how the induction of an electrode may cause it to become charged			
2.1.7	Describes how a charged electrode may be discharged			
2.1.8	States that a discharge releases energy which may cause a spark			
2.2	**Basic chemistry, chemical elements and groups**	**R2,R7,R8**	**B1,B2,B3,B4,B7**	**A1,A11,A14**
2.2.1	Explains in simple terms: - chemical symbols and structures - “atomic number” and ‘atomic weight” - the Periodic System and Periodic Table - a hydrocarbon molecule - chemical elements of acids and bases - chemical reactions			
2.2.2	Gives examples of chemical reactions			
2.2.3	States the use of the Codes in relation to reactivity of cargoes			
2.2.4	Explains the details of the chemical data for a common cargo (as given in the ICS or other cargo Data Sheets)			
2.2.5	The hydrocarbon structure			

TOPIC 2	PHYSICAL AND CHEMICAL PROPERTIES OF OIL AND CHEMICALS			
	Knowledge, Understanding and Proficiency	**IMO Reference**	**Text books Bibliography**	**Teaching aid**
2.2.5.1	States that crude petroleum as discharged at the well head is a mixture of a large number of different hydrocarbon molecules			
2.2.5.2	States that the molecules are termed “light” or “heavy” according to the number of carbon atoms forming the molecule			
2.2.5.3	States that very heavy molecules such as asphalt and bitumen tend to be solid under normal atmospheric conditions			
2.2.5.4	States that intermediate molecules such as petrol (motor spirit) and diesel oil tend to be liquid under normal atmospheric conditions			
2.2.5.5	States that very light gaseous molecules such as methane are extracted at the well head			
2.2.5.6	States that the petroleum remaining after the removal of products such as methane is termed “crude oil”			
2.2.5.7	States that crude oil is a mixture of hydrocarbons which under normal atmospheric conditions are gaseous, liquid and solid			
2.2.5.8	States that in an oil refining process, “distillation” refers to splitting of crude oil i into a number of fractions			
2.2.5.9	States that each petroleum fraction has a range of physical properties specific to itself			
2.3	**Physical properties of oil and chemicals carried in bulk**	**R2**	**B1,B2,B3,B4**	**A1,A11,A14**
2.3.1	Defines the following in simple terms and explains their practical significance in the tanker trade: - flashpoint - volatility - upper flammable/explosive limit - lower flammable/explosive limit - auto-ignition temperature - spontaneous combustion - reactivity - toxicity - corrosivity			

TOPIC 2	PHYSICAL AND CHEMICAL PROPERTIES OF OIL AND CHEMICALS			
	Knowledge, Understanding and Proficiency	**IMO Reference**	**Text books Bibliography**	**Teaching aid**
2.3.2	States that there is need for taking cargo samples and for the chemical and physical analysis of cargoes			
2.3.3	Explains/Demonstrates the properties of oil and chemicals carried in bulk, including: - the determination of cargo temperature - the determination of cargo density - determination of colour of cargoes and use of a colour scale - determination of flashpoint - test for contamination by hydrocarbons - test for contamination by chloride - test for contamination by water			

TOPIC 3	**KNOWLEDGE AND UNDERSTANDING OF TANKER SAFETY CULTURE AND SAFETY MANAGEMENT**
COMPETENCE 1	**Contribute to the safe cargo operation of oil and Chemical Tankers**

TRAINING OUTCOMES:

Demonstrates a knowledge and understanding of:

.1 tanker safety culture and safety Management

TOPIC 3	KNOWLEDGE AND UNDERSTANDING OF TANKER SAFETY CULTURE AND SAFETY MANAGEMENT			
	Knowledge, Understanding and Proficiency	**IMO Reference**	**Text books Bibliography**	**Teaching aid**
3.0	**Knowledge and understanding of tanker safety culture and safety management**	**R2,R10**	**B1,B2,B3, B4,B11,B12**	**A1,A11, A14**
3.1	States that studies show that 80% or more of accidents are caused by operator or human error (including collective management failure)			
3.2	States that poor safety culture is caused by poor management not ensuring that work morale and commitment, communication, crew qualifications, training, procedures, equipment and other resources are sufficient and efficient to meet aims.			
3.3	States that the Tanker Management and Self Assessment (TMSA) guide provides a standard framework to assess a ship operators management systems			
3.4	Lists 12 self assessment elements as: - leadership and accountability - recruitment and management of shore-based personnel - recruitment and management of ships personnel - reliability and maintenance standards - navigational safety - cargo ballasting and mooring operations - management of change - incident investigation and analysis - safety management - environmental management - emergency preparedness and contingency planning - measurement, analysis and improvement			

TOPIC 4.1	**HAZARDS**
COMPETENCE 2	**Take precautions to prevent hazards**

TRAINING OUTCOMES:

Demonstrates a knowledge and understanding of:

Hazards:

.1 health hazards
.2 environmental hazards
.3 reactivity hazards
.4 corrosion hazards
.5 explosion and flammability hazards
.6 electrostatic hazards
.7 toxicity hazards

TOPIC 4.1 HAZARDS				
Knowledge, Understanding and Proficiency		**IMO Reference**	**Text books Bibliography**	**Teaching aid**
4.1	**Hazards** - Lists the hazards associated with tanker operations as: .1 health hazards .2 environmental hazards .3 reactivity hazards .4 corrosion hazards .5 explosion and flammability hazards .6 sources of ignition, including electrostatic hazards .7 toxicity hazards .8 vapour leaks and clouds	**R2, R6, R7, R8**	**B1, B2, B3, B4, B6, B11**	**A1, A11, A14**
4.1.1	**Health hazards** *Toxic effects*			
4.1.1.1	lists the hazards to health of: - skin contact with liquid petroleum - ingestion (swallowing) of liquid petroleum - inhalation of petroleum vapour - compounds of lead contained in the cargo			
4.1.1.2	Describes the toxic effect on personnel of skin contact with and ingestion (swallowing) of petroleum liquid and inhalation (breathing) of petroleum vapour			
4.1.1.3	States that skin contact with liquid petroleum causes irritation and dermatitis because of the removal of essential natural skin oils			
4.1.1.4	States that ingestion of liquid petroleum into the stomach causes acute discomfort and nausea			
4.1.1.5	States that if the liquid is inhaled into the lungs there is a serious risk of suffocation through interference with the normal oxygen/carbon dioxide transfer taking place during breathing			
4.1.1.6	states that the liquid ingested will tend to vaporize and the vapour could be inhaled into the lungs			
4.1.1.7	States that inhalation of petroleum			

TOPIC 4.1 HAZARDS			
Knowledge, Understanding and Proficiency	**IMO Reference**	**Text books Bibliography**	**Teaching aid**
vapour will produce narcosis, the main symptoms being headache/eye irritation and dizziness, with very high concentrations leading to paralysis, insensibility and very possibly death			
4.1.1.8 States that the vapours from some chemicals are toxic by inhalation			
4.1.1.9 States that some chemicals or their vapours are toxic by absorption through the skin			
4.1.1.10 States that effects of exposure involving dangerous chemicals are given in the ICS or other Cargo Data Sheets			
4.1.1.11 States that the action to be taken in an emergency is indicated in the Data Sheets, in the form of “If this happens do this”			
4.1.1.12 States that when providing first aid, personnel should also be aware of the list of “don’ts”, including: - Do not attend to victim unless it is safe to do so - Do not attempt to do more than necessary - Do not delay in summoning for help and informing the master - Do not enter the enclosed spaces unless you are a trained member of a rescue team acting upon instruction			
4.1.1.13 States that all personnel should be familiar with the health data set out in the Data Sheets for the cargoes carried			
4.1.1.14 States that cargo vapours in sufficient concentration will exclude oxygen and, even if not toxic, may cause asphyxiation			
Oxygen deficiency			
4.1.1.15 States that the oxygen content of air is 21% by volume			

TOPIC 4.1 HAZARDS			
Knowledge, Understanding and Proficiency	**IMO Reference**	**Text books Bibliography**	**Teaching aid**
4.1.1.16 States that the oxygen content in enclosed spaces may become lower			
4.1.1.17 Describes the reasons of oxygen deficiency in an enclosed space could be: - An inert atmosphere - Displaced oxygen due to presence of cargo vapour - Combustion - Chemical reactions - Rusting - Drying paint			
4.1.1.18 States that in certain wind conditions vented gases may descend down, making the atmosphere on open deck harmful due to: - - Presence of gases in harmful concentration - Oxygen deficiency			
4.1.1.19 States that if harmful conditions on deck exist, all non-essential work on deck should cease and only essential personnel should remain on deck, taking all appropriate precautions			
4.1.1.20 Describes the symptoms of the effect of oxygen deficiency as asphyxia			
4.1.1.21 States that reliance should not be placed on symptoms for indicating an oxygen-deficient atmosphere			
4.1.1.22 States that persons have varying susceptibility to oxygen deficiency but that all will suffer if the oxygen content drops below 16% by volume			
4.1.1.23 States that if oxygen is less than 21% an atmosphere may be extremely dangerous unless it is known which gas has replaced the oxygen			
4.1.1.24 States that the main hazard associated with inert gas is its low oxygen content, but that it may also contain toxic gases			
4.1.1.25 Lists the main toxic constituents of inert gas			

TOPIC 4.1 HAZARDS			
Knowledge, Understanding and Proficiency	**IMO Reference**	**Text books Bibliography**	**Teaching aid**
4.1.2 Environmental hazards			
4.1.2.1 Defines "pollution" as inconvenience or damage, caused by human activities, to human and animals, plants and to our environment as a whole, by spreading of hydrocarbons and chemical compounds to air ,Water or land			
4.1.2.2 States that a major oil pollution can harm other industries like fishery, tourism, etc			
4.1.2.3 States that crude oil tankers, product tankers and chemical tankers are chiefly responsible for marine pollution			
4.1.2.4 States that cargoes in tankers may be harmful to the environment			
4.1.2.5 States that most chemicals carried represent a pollution risk			
4.1.2.6 Explains hazards caused to the environment, covering the effect on human and marine life from the release of oil, or chemicals			
4.1.2.7 Explains the effect that the specific gravity and solubility of the cargo have on the hazards to the environment in the event of a spillage			
4.1.2.8 Explains the effect of the cargo vapour pressure and atmospheric conditions on the hazards to the environment			
4.1.2.9 Explains the dangers arising from a vapour cloud drift as potential fire and health hazards			
4.1.3 Reactivity hazards			
4.1.3.1 States that chemical cargo may react in a number of ways, such as: - With itself (self reaction) - With air - With water - With another cargo - With other materials			
4.1.3.2 Gives examples of each of the above reactions			

TOPIC 4.1 HAZARDS			
Knowledge, Understanding and Proficiency	**IMO Reference**	**Text books Bibliography**	**Teaching aid**
4.1.3.3 States that reactivity data of chemicals are given in the ICS or other cargo Data Sheets			
4.1.3.4 States that polymerization is the formation of larger molecules as a result of self-reaction			
4.1.3.5 States the effects of temperature on the reactivity of cargoes and polymerization			
4.1.3.6 States that the presence of impurities may act as catalysts on the reactivity of cargoes and polymerization			
4.1.3.7 States that polymerization may, under some circumstances, be dangerous			
4.1.4 Corrosion hazards			
4.1.4.1 States that some cargoes may be corrosive to human tissue and to a ship's equipment and structure			
4.1.4.2 States that instructions about the use of protective clothing should be observed			
4.1.4.3 States that care should be taken to ensure that unsuitable materials are not introduced into the cargo system			
4.1.4.4 States the effect of concentration and evolution of hydrogen on corrosion			
4.1.5 Explosion and flammability hazards			
4.1.5.1 Lists the three essentials necessary for a fire to commence as: - Oxygen - Flammable material (fuel) - Source of ignitron			
4.1.5.2 States that when flammable vapour is mixed with oxygen (usually from the atmosphere) an explosive mixture may be produced			
4.1.5.3 States that the ability of petroleum to generate flammable vapour is a major factor for starting a fire			
4.1.5.4 States that the ability of a substance to vaporize is its volatility			
4.1.5.5 States that volatility increases with temperature and reaches a maximum at the boiling temperature of the petroleum			

TOPIC 4.1 HAZARDS			
Knowledge, Understanding and Proficiency	**IMO Reference**	**Text books Bibliography**	**Teaching aid**
4.1.5.6 States that the concentration of hydrocarbon vapour present in air is used to define “flammable range”			
4.1.5.7 States that the working flammable range of a mixture of petroleum vapour and air can be taken to be from 1% to 10% by volume			
4.1.5.8 Explains the flammability diagram with respect to: Flammable range , Flammable zone and show how use of inert gas enhances safety in cargo operations			
4.1.5.9 States that the flashpoint of an oil indicates the lowest temperature at which the oil will give off sufficient hydrocarbon vapour to form a flammable gas mixture with air near the surface of the oil			
4.1.5.10 States that only the vapour from a flammable material will combine with oxygen to produce fire			
4.1.5.11 States that an explosive mixture may be produced when chemical cargo vapours are mixed with air			
4.1.5.12 States that corrosive liquids can become flammable and produce flammable gases when in contact with certain materials			
4.1.5.13 States that a mixture of vapour and air will only ignite and burn if its composition is within the “flammable range”			
4.1.5.14 States that within the flammable/explosive range, if a heat source is introduced, then it will result in a fire			
4.1.6 Sources of ignition, including electrostatic hazards			
4.1.6.1 Lists the sources of ignition as: - Direct heat - Mechanical sparks - Chemical energy - Electrical energy - Electrostatic discharge			
4.1.6.2 States that static electricity can arise when two dissimilar materials (solids liquids or gases) come in contact and charge separation occurs at the interface			
4.1.6.3 States that static electricity can cause sparks capable of igniting flammable mixture			

TOPIC 4.1 HAZARDS			
Knowledge, Understanding and Proficiency	**IMO Reference**	**Text books Bibliography**	**Teaching aid**
4.1.6.4 Lists causes of electrostatic charge generation as:- - Flow of liquids through pipes or filters - Settling of solids or immiscible liquids through a liquid - Ejection of particles or droplets from a nozzle - Splashing or agitation of a liquid against a solid surface - Vigorous rubbing together and subsequent separation of certain synthetic polymers			
4.1.6.5 States that some tanker operations can give rise to electrostatic charge generation			
4.1.6.6 Lists examples of such tanker operations			
4.1.6.7 States that certain cargoes are accumulators of static electricity because of their conductivity			
4.1.6.8 States that the three elements-air, source of ignition and flammable cargo are necessary for a fire to commence, may be represented by the sides of a triangle, and the complete triangle represents a fire or an explosion			
4.1.6.9 States that the way to prevent a fire is to prevent the formation of such a triangle			
4.1.6.10 States that the removal of any one side of the fire triangle will extinguish the fire			
4.1.6.11 States that removal of the flammable material is usually not possible with petroleum in bulk			
4.1.6.12 States that it is essential to keep ignition sources away from cargo areas, where flammable vapours are likely to be present			
4.1.6.13 States that it is essential to avoid the entry of flammable vapours into areas where ignition sources are present, such as living accommodation, engine-room, galley, etc			
4.1.6.14 States that the use of inert gas in cargo tanks can reduce the oxygen content below that necessary to produce a flammable mixture			
4.1.6.15 States that starving a gas fire by stopping the source of gas leak may be the most effective way to control a gas fire			
4.1.6.16 States that covering the surface of a flammable material with a blanket of inert material will prevent oxygen from			

TOPIC 4.1 HAZARDS			
Knowledge, Understanding and Proficiency	**IMO Reference**	**Text books Bibliography**	**Teaching aid**

making contact with the vapours from the flammable material

4.1.6.17 States that water in sufficient quantity can provide cooling

4.1.6.18 States that, compared with oil and other hydrocarbons, some liquid chemicals have unusual properties with regard to fire-fighting procedures

4.1.7 Toxicity hazards

4.1.7.1 States toxicity is the ability of a substance to harm damage and destroy living cells and is included in "health hazard"

4.1.7.2 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 for the human body and updated with changes observed over a period

4.1.7.3 Defines the terms and explains their significance:
- threshold limit value (TLV TWA)
- threshold limit value (TLV STEL)
- threshold limit value (TLV Ceiling)
- Occupational exposure limit (OEL)

4.1.8 Vapour leaks and clouds

4.1.8.1 States that persistent bubbling are signs of a possible leak around the pipeline or cargo area. A pool of liquid on the deck; a dense white cloud or fog on the deck or in the pipeline are also signs of a possible leak.

4.1.8.2 states that, an unusual noise / hissing sound could be a positive indication of a leak

4.1.8.3 States that personnel safety should be borne if a leak is suspected.

4.1.8.4 States that, donning of ELSA etc is required only on chemical tankers with some chemicals. Not required on oil tankers unless it is a catastrophic leakage

4.1.8.5 States that one must immediately report the leak to the duty officer

TOPIC 4.1 HAZARDS			
Knowledge, Understanding and Proficiency	**IMO Reference**	**Text books Bibliography**	**Teaching aid**
4.1.8.6 Lists the precautions on discovery of a leak as: - DO NOT create any sparks or heat sources which could ignite escaping gas or liquids. - DO NOT attempt to operate any pipeline valves. - DO NOT enter into or near a leak or vapour cloud to turn off equipment			

TOPIC 4.2	**BASIC KNOWLEDGE OF HAZARD CONTROLS**
COMPETENCE 2	**Take precautions to prevent hazards**

TRAINING OUTCOMES:

Demonstrates a knowledge and understanding of:

Hazard controls:

.1 inerting, water padding,
.2 drying agents and monitoring techniques
.3 anti-static measures
.4 ventilation
.5 segregation
.6 cargo inhibition
.7 importance of cargo Compatibility
.8 atmospheric control
.9 gas testing

TOPIC 4.2	BASIC KNOWLEDGE OF HAZARD CONTROLS			
Knowledge, Understanding and Proficiency		**IMO Reference**	**Text books Bibliography**	**Teaching aid**
4.2.1	**Inerting, water padding, drying agents and monitoring techniques**	**R1,R2, R4,R7,R8**	**B1,B2, B3,B4**	**A1,A11,A14**
4.2.1.1	Defines ”inert gas”			
4.2.1.2	States that inert gas is used in cargo tanks: - To replace air and thereby prevent fire and explosion - To protect the cargo from polymerization, oxidation and humidity			
4.2.1.3	States that inerting is done by replacing cargo vapours with an inert gas until the concentration of cargo vapours is lower than the LEL			
4.2.1.4	states that inert gas used on tankers is flue gas from boilers, nitrogen or inert gas produced in the ship’s inert-gas generator			
4.2.1.5	States that the correct inerting procedure is ensured by regular checks of the tank atmosphere			
4.2.1.6	states that atmosphere checks are done by measuring the percentage of oxygen and cargo vapours through all designated sampling points.			
4.2.1.7	States that the atmosphere in an inerted tank or void space is safe with regard to fire hazard but dangerous with regard to health			
4.2.1.8	States that Padding means filling the ullage spaces of cargo tanks with a liquid, gas or vapour to separate the cargo from air.			
4.2.1.9	States that Drying means filling the cargo tanks and associated piping or where required the spaces surrounding the tank with moisture free vapour having a dew point below -40^{o} Centigrade at atmospheric pressure will prevent the access of water or water vapour to the cargo			

TOPIC 4.2 BASIC KNOWLEDGE OF HAZARD CONTROLS			
Knowledge, Understanding and Proficiency	**IMO Reference**	**Text books Bibliography**	**Teaching aid**
4.2.1.10 States that means of monitoring ullage spaces and other gas dangerous spaces for safety and correct atmospheric controls is provided			
4.2.1.11 States that measuring instruments are to be fitted for continuous indication and permanent recording of the pressure in the inert gas main and the oxygen content of the inert gas being supplied. These instruments are to be arranged in the cargo control room, where provided, or in a location accessible to the cargo officer			
4.2.1.12 States that pressure sensing transmitters or equivalent equipment are fitted for this purpose			
4.2.1.13 States that for the control of the tank atmosphere, in addition to the oxygen analyzer, explosimeter and tank scope instruments, there is a requirement for an additional portable instrument, (gas detecting tubes) for measuring chemical gas vapours concentrations .			
4.2.1.14 State that Suitable equipment is to be provided for calibrating permanently installed and portable gas measuring appliances			
4.2.2 Anti-static measures			
4.2.2.1 States that to avoid electrostatic hazard; - an important counter measure is to bond all metal objects together - bonding to earth is effectively accomplished by connecting all metal objects to the ship's structure - the ship's hull is naturally earthed through the seawater			
4.2.2.2 Lists examples of objects which might be electrically insulated in hazardous situations and which must therefore be bonded			

TOPIC 4.2 BASIC KNOWLEDGE OF HAZARD CONTROLS			
Knowledge, Understanding and Proficiency	**IMO Reference**	**Text books Bibliography**	**Teaching aid**
4.2.2.3 States that when a cargo tank is maintained in an inerted condition anti-static precautions are not normally necessary			
4.2.2.4 Lists anti-static measures to be taken if the tank is in non-inerted condition with regard to: - safe flow rates - safe procedures for ullaging, sampling and gauging			
4.2.3 Ventilation			
4.2.3.1 States that mechanical ventilation, normally of the extraction type is provided for spaces normally entered during cargo operations (pump-rooms) of a chemical tanker and ensures atleast 30 changes of air per hour			
4.2.3.1.1 Explains requirement of pumproom on oil tankers			
4.2.3.2 States that the mechanical ventilation of extraction type is provided for pumproms of oil tankers and ensures atleast 20 changes of air per hour			
4.2.3.3 States that ventilation intakes are so arranged as to minimize the possibility of recycling hazardous vapours from any ventilation discharge opening			
4.2.3.4 States that the ventilation ducts are not to be led through engine-rooms, accommodation, working spaces or other similar spaces			
4.2.3.5 States that ventilation fans should be approved by the Administration for operation in explosive atmospheres when flammable cargoes are carried aboard the ship			
4.2.4 Cargo segregation			
4.2.4.1 States that cargoes, residues of cargoes or mixtures containing cargoes, which react in a hazardous manner with other cargoes, residues or mixtures, shall - be segregated from such other cargoes by means of a cofferdam, void space, cargo pumproom,			

TOPIC 4.2 BASIC KNOWLEDGE OF HAZARD CONTROLS			
Knowledge, Understanding and Proficiency	**IMO Reference**	**Text books Bibliography**	**Teaching aid**

pump-room, empty tank, or tank containing a mutually compatible cargo;
- have separate pumping and piping systems which shall not pass through other cargo tanks containing such cargoes, unless encased in a tunnel; and have separate tank venting systems;

4.2.4.2 Explains that in some countries a cruciform joint containment may be accepted as a double barrier for the purpose of segregation as:
1. between mutually hazardous reactive cargoes;
2. between water reactive cargoes and water.

4.2.4.3 States that the relevant compatibility regulations of certain Administrations may be required to be observed.

4.2.4.4 States that If cargo piping systems or cargo ventilation systems are to be separated, this separation may be achieved by the use of design or operational methods

4.2.5 Cargo inhibition

4.2.5.1 Explains that Products that are susceptible to polymerization are normally transported with added inhibitors to prevent the onset of the reaction

4.2.5.2 States that an inhibited cargo certificate should be provided to the ship before a cargo is carried

4.2.5.3 States that the action to be taken in case of a polymerization situation occurring while the cargo is on board should be covered by the ship's emergency contingency plan

4.2.6 Importance of cargo compatibility

4.2.6.1 States that between some chemicals violent reactions may occur if the chemicals are mixed in certain proportions. The result may possibly be

TOPIC 4.2 BASIC KNOWLEDGE OF HAZARD CONTROLS			
Knowledge, Understanding and Proficiency	**IMO Reference**	**Text books Bibliography**	**Teaching aid**

an eruption and tank rupture

4.2.6.2 States that such an occurrence must be prevented

4.2.6.3 States that water may also have to be considered in this respect

4.2.6.4 States that Leakages through bulkheads occur at times in any tanker

4.2.6.5 States that legislation as expressed in the IMO Chemicals Bulk Code and ICS tanker safety guide expressly prohibits the placement of inter-reactive cargoes on both sides of a bulkhead

4.2.6.6 States that there must be an empty tank, a cofferdam or a tank with a cargo neutral to both products in between.. "Diagonal contact" between tanks is normally considered as sufficient separation between reactive cargoes

4.2.6.7 States that complete separation of piping systems are required on a chemical tanker so that one product cannot inadvertently be pumped into another

4.2.6.8 States that to this effect strategic pipe bends may have to be removed and blind flanges fitted on each pipe end

4.2.7 Atmospheric control

For Oil Tankers

4.2.7.1 States that Oil tankers using an inert gas system should maintain their cargo tanks in a non-flammable condition at all times

4.2.7.2 States that tanks should be kept in an inert condition at all times, except when it is necessary for them to be gas free for inspection or work

4.2.7.3 States that the oxygen content should be not more than 8% by volume and the atmosphere should be maintained at a positive pressure

4.2.7.4 Explains with the use of a flammability diagram that the atmosphere within the tank should make the transition from the inert condition to the gas free condition without passing through the flammable condition. In practice, this means that before any tank is gas freed, it should be

TOPIC 4.2 BASIC KNOWLEDGE OF HAZARD CONTROLS			
Knowledge, Understanding and Proficiency	**IMO Reference**	**Text books Bibliography**	**Teaching aid**
purged with inert gas until the hydrocarbon content of the tank atmosphere is below the critical dilution line			
For Chemical Tankers			
4.2.7.5 States that for chemical tankers the IBC Code requires vapour spaces within cargo tanks to have specially controlled atmospheres, principally when the cargo is either air reactive resulting in a hazardous situation, or has a low auto-ignition temperature, or has a wide flammability range			
4.2.7.6 States that for chemical tankers the correct atmosphere in a tank, can be established either by inerting to prevent the formation of flammable mixtures of cargo vapour and air, or by padding to prevent chemical reaction between oxygen and the cargo. It may also be necessary to reduce the humidity (dew point) of the atmosphere within the cargo system			
4.2.7.7 States that the extent of atmosphere control to protect the quality of the cargo will normally be specified by the cargo shippers. Some cargoes are extremely sensitive to contamination or discoloration, and for quality control reasons are carried under a blanket of nitrogen that is very pure and which must often be obtained from shore			
4.2.8 Gas Testing			
4.2.8.1 Lists circumstances when the atmosphere in cargo tanks and enclosed spaces must be tested as: - prior tank washing - prior to entry by personnel - to establish that there is a gas-free condition prior to repair work, entry to a shipyard or dry-docking - during inerting, gas-freeing and purging operations - as a quality control before			

TOPIC 4.2 BASIC KNOWLEDGE OF HAZARD CONTROLS			
Knowledge, Understanding and Proficiency	**IMO Reference**	**Text books Bibliography**	**Teaching aid**
loading/changing cargo			
4.2.8.2 States that an evaluation is the only way to get correct information about the composition of the tank atmosphere			
4.2.8.3 Lists the information essential to evaluation of the tank atmosphere as: - the nature of the constituent gases - flammability - toxicity/oxygen deficiency - reactivity			
4.2.8.4 States that the atmosphere in tanks or enclosed spaces must be considered dangerous unless proper checks prove otherwise			
4.2.8.5 States the importance of taking measurements of the atmosphere at several positions within a tank			
4.2.8.6 States that before entry in enclosed spaces: - oxygen content must be 21% by volume - hydrocarbon content must be less than 1% LFL - toxic gas concentration must be less than 50% of its OEL			
4.2.8.7 States that after tank washing, manual removal of residue may be necessary			
4.2.8.8 States that residue removal generates more hydrocarbon gas			
4.2.8.9 States that gas-freeing operations must therefore be continuous			
4.2.8.10 States that adjacent bulkheads and pipelines may constitute additional sources of hydrocarbon gas			
4.2.8.11 States that the inert gas supply to the tank should be shut off			
4.2.8.12 States that a gas-free certificate is needed from a qualified chemist before contractor's work can be carried out			
4.2.8.13 States that an additional hot work permit is required for hot work			
4.2.8.14 States that such certificate and permit must be reissued every day that work is carried out, or such lesser period as the port authority stipulates			
Accommodation			

TOPIC 4.2 BASIC KNOWLEDGE OF HAZARD CONTROLS

Knowledge, Understanding and Proficiency		IMO Reference	Text books Bibliography	Teaching aid
4.2.8.15	States that the accommodation is located outside the cargo area			
4.2.8.16	States that superstructures for accommodation are designed to minimize the possibility of entry of cargo vapour and that this design feature should not be impaired in any way			
4.2.8.17	States that no entrances, air inlets or openings to the accommodation are facing the cargo area			
4.2.8.18	States that accommodation portholes and windows facing the cargo area, and those within a certain distance from the cargo area, are of the non-opening type			
4.2.8.19	States that all doors, portholes or windows in accommodation should be kept closed during cargo operations			
4.2.8.20	States that mechanical ventilation and air-conditioning units supply air to accommodation spaces			
4.2.8.21	States that all ventilation systems should be stopped or operated on internal circulation mode if there is any possibility of cargo vapour being drawn into accommodation spaces			
4.2.8.22	States that air intakes for accommodation and for the engine- room are subject to requirements with respect to minimum distance from ventilation outlets of gas-dangerous spaces			
4.2.8.22	States that access to accommodation or to the engine-room is subject to requirements with respect to the minimum distance from the forward bulkhead of the accommodation			
4.2.8.23	States that for the safety barrier concept to be successful it is essential that the ship's staff follow the safe operational practices			
4.2.9	**Understanding of Information on Material Safety Data Sheet (MSDS)**	**R2, R6, R7, R8,**	**B1,B2,B3, B4,B5, B6, T1,T2**	**A1, A11, A14**
4.2.9.1	States that information about cargoes to be handled is essential to the safety of the vessel and her crew			

TOPIC 4.2 BASIC KNOWLEDGE OF HAZARD CONTROLS			
Knowledge, Understanding and Proficiency	**IMO Reference**	**Text books Bibliography**	**Teaching aid**
4.2.9.2 States that such information may be found on ICS or other Cargo Data Sheets for each product, which also include all necessary data for the safe handling and carriage of the cargo			
4.2.9.3 States that cargo information for most tanker cargoes is kept on board and available for all concerned			
4.2.9.4 States that the cargo will not be loaded unless sufficient information necessary for its safe handling and transportation is available			
4.2.9.5 States that the responsible officer will see to it that the necessary cargo information is posted on the notice board prior to cargo operations			
4.2.9.6 States that all personnel engaged in cargo operations should familiarize themselves with the cargoes by studying the ICS or other Cargo Data Sheets			
4.2.9.7 States that cargo information is fundamental in cargo planning			
4.2.9.8 Lists reference books where cargo information may be found as IBC code, Chemical dictionaries, MSDS Sheets, Annually Updated MEPC circular no:2.			
4.2.9.9 States that a composite cargo sheet with current stowage plan must be prepared giving all important information with regards to details such as fire fighting medium, effects of cargo inhaled or skin contact with vapours/liquids for quick and correct actions in case of an emergency			

TOPIC 5	**SAFETY**
COMPETENCE 3	**Apply occupational health and safety precautions and measures**

TRAINING OUTCOMES:

Demonstrates a knowledge and understanding of

1. Function and proper use of gas-measuring instruments and similar equipment

2. Proper use of safety equipment and protective devices including proper use of:
- .1 breathing apparatus and tank-evacuating equipment
- .2 protective clothing and equipment
- .3 resuscitators
- .4 rescue and escape equipment

TOPIC 5 SAFETY				
Knowledge, Understanding and Proficiency		**IMO Reference**	**Text books Bibliography**	**Teaching aid**
5.1	**Function and proper use of gas-measuring instruments**	**R2,R7,R8**	**T1,T2,B1, B2, B3, B4,B11**	**A1,A4,A5, A6,A7,A8,A9, A11,A14,A15**
5.1.1	States that safety measuring instruments may be personal, portable, or fixed types			
5.1.2	States that gas measurements are the only way to get correct information about the composition of the atmosphere in a tank			
5.1.3	Lists the different types of gas-measuring equipment common on board tankers			
5.1.4	States that gas-measuring equipment for atmosphere evaluation is available on board			
5.1.5	Demonstrates use of: - Portable oxygen meter - Portable combustible-gas detector - Portable tankscope / Multi point flammable gas (infra-red gas analyzer) - Portable toxic-gas detector & chemical absorption tubes - Portable multigas – detector - Personal multigas – detector			
5.1.6	States that every gas tanker has a fixed gas-detection system			
5.2	**Proper use of safety equipments and protective devices, including:**	**R2,**	**T1,T2,B1,B2, B3, B4,B11**	**A1,A4,A5, A6,A7,A8,A9, A11,A14,A15**
5.2.1	**breathing apparatus and tank-evacuating equipment**			
5.2.1.1	States that spaces not normally entered (e.g. Double bottoms cofferdams and pipe tunnels) are capable of being ventilated to ensure a safe environment when entry into these spaces is necessary			
5.2.1.2	Defines “enclosed spaces” means a space which has any of the following characteristics: .1 limited openings for entry and exit .2 inadequate ventilation; .3 is not designed for continuous			

TOPIC 5 SAFETY			
Knowledge, Understanding and Proficiency	**IMO Reference**	**Text books Bibliography**	**Teaching aid**
worker occupancy and includes, but is not limited to, cargo spaces, double bottoms, fuel tanks, ballast tanks, cargo pump-rooms, cargo compressor rooms, cofferdams, chain lockers, void spaces, duct keels, inter-barrier spaces, boilers, engine crankcases, engine scavenge air receivers, sewage tanks, and adjacent connected spaces. This list is not exhaustive and a list should be produced on a ship-by-ship basis to identify enclosed spaces.			
5.2.1.3 Explains why enclosed spaces are dangerous to enter			
5.2.1.4 States that no person should open or enter an enclosed space unless authorized by the master or the nominated responsible person and unless the appropriate safety procedures laid down for the particular ship have been followed			
5.2.1.5 States that only a tank or space declared gas-free can be entered by personnel without breathing apparatus and protective clothing			
5.2.1.6 Lists safety precautions when entering enclosed spaces			
5.2.1.7 Lists precautions for entering cargo pump-rooms during cargo, ballast or tank-cleaning operations			
5.2.1.8 Demonstrates use of: - self-contained compressed-air breathing apparatus (SCBA) - Eye protective safety goggles - Emergency escape breathing device (EEBD) - a complete set of safety equipment, stretcher and tank evacuating equipment			
5.2.2 Proper use of protective clothing and equipment			
5.2.2.1 States that for the protection of personnel engaged in loading and discharging operations, there must be suitable protective clothing on board			

TOPIC 5 SAFETY				
Knowledge, Understanding and Proficiency		**IMO Reference**	**Text books Bibliography**	**Teaching aid**
5.2.2.2	States that for entering gas-filled spaces there must be adequate numbers of complete sets of safety equipment on board			
5.2.2.3	States that all equipment for personnel protection must be kept in clearly marked lockers			
5.2.2.4	States that all personnel should wear appropriate protective clothing when involved in cargo operations			
5.2.2.5	States that on chemical tankers, there must be respiratory and eye protection equipment for every person on board, for purposes of emergency escape			
5.2.2.6	Demonstrates the use of protective clothing			
5.2.2.7	States that on chemical tankers decontamination showers and eyewash must be available in certain locations on deck			
5.2.2.8	States that stretchers and medical first-aid equipment must be provided on board			
5.2.3	**Proper use of resuscitators**			
5.2.3.1	Lists the circumstances under which a resuscitator should be used			
5.2.3.2	Demonstrates the use of a resuscitator			
5.2.4	**Proper use of rescue and escape equipment**			
5.2.4.1	States that pump-rooms have permanent arrangements for hoisting an injured person with a rescue line			
5.2.4.2	Explains timely evacuation and resuscitation may save lives			
5.3	**Basic knowledge of safe working practices and procedures in accordance with legislation and industry guidelines relevant to oil and chemical tankers**	**R2,R7,R8, R10,**	**T1,T2,B1, B2,B3, B4, B11,B12**	**A1, A11, A14,A15**
5.3.1	**Precautions to be taken when entering enclosed spaces**			

TOPIC 5 SAFETY			
Knowledge, Understanding and Proficiency	**IMO Reference**	**Text books Bibliography**	**Teaching aid**
5.3.1.1 States that when entering enclosed spaces assess safety conditions with an appropriate check list verified by the master			
5.3.1.2 States that No person is permitted to enter any enclosed space as defined (cargo tank, cofferdam, double bottom tank, etc) unless authorized by the Master, who has ensured that the required checks have been carried out before passing these compartments as safe for entry. An enclosed space entry permit must be completed in every case			
5.3.1.3 States that for entry purposes, steady readings of all the following should be obtained: .1 21% oxygen by volume by oxygen content meter*; .2 not more than 1% of lower flammable limit (LFL) on a suitably sensitive combustible gas indicator, where the preliminary assessment has determined that there is potential for flammable gases or vapours; and .3 not more than 50% of the occupational exposure limit (OEL) of any toxic vapours and gases.**			
5.3.1.4 States that irrespective of the type of enclosed space, precautionary measures for entering tanks shall apply equally to any enclosed space, including the pump room			
5.3.1.5 States that Verification of the atmosphere tests must be recorded in the Entry Permit			
5.3.1.6 states that Entry permits may be made for multi cargo tank entries, however, tanks, which are not entered and worked within four hours of the initial test, must be retested and a new permit issued. It is therefore advisable to only test smaller groups of tanks at one time, e.g. only test as many as can be worked in a four-hour period. However, at no given time shall a permit be granted for entry into more than six tanks			

TOPIC 5 SAFETY			
Knowledge, Understanding and Proficiency	**IMO Reference**	**Text books Bibliography**	**Teaching aid**
5.3.1.7 Lists requirements for cargo tank entry as: - Tank to remain open to atmosphere at all times to ensure ventilation. - Rescue and resuscitation equipment easily available and ready for use. - Means of communication agreed and tested. - At least one person of the entry team to carry means of continuously testing the atmosphere using a multi gas personal monitor. - Communications set up between Bridge and deck or between Duty Officer and Enclosed Space entry team. - Duty officer to be kept informed that tank entry is in progress. - Authorising Officer has verified the entry permit			
5.3.1.8 Explains that Entry into a space that is not gas free or does not contain 21% Oxygen shall only be permitted in cases of an emergency or for unavoidable operational requirements. Such spaces can only be entered after informing/ consultation with office. Risk assessment to be approved by office.			
5.3.1.9 States that the number of persons entering the tanks shall be kept to a minimum required, but will normally be at least two, each wearing the appropriate PPE for that chemical			
5.3.1.10 Explains that a stand by team and additional appropriate PPE equipped with the required rescue equipment shall be available outside the enclosed space in which entry has been made			
5.3.1.11 Explains that if entry is absolutely required without the tanks being gas free, or with the presence of a chemical gas in a tank for operational requirement following shall be completed prior to undertaking such an operation: - Risk assessment and hazard identification. - Plan for work including briefing the concerned personnel on the			

TOPIC 5 SAFETY			
Knowledge, Understanding and Proficiency	**IMO Reference**	**Text books Bibliography**	**Teaching aid**
required precautions, proper techniques, PPE requirement & training. - Emergency response plan shall be prepared in advance and approved by the Master. - Suitable breathing apparatus, protective clothing and other equipment required for such entry shall be used by the persons entering the tank (Only persons suitably trained and capable of dealing with any unexpected event that may be encountered in the tank shall be sent for such an entry after making the supporting team stand by on the scene to assist the personnel in an unlikely event of an incident)			
5.3.2 Precautions to be taken before and during "repair and maintenance" work in a gas dangerous area			
5.3.2.1 States that the use of appropriate PPE is mandatory to protect the crew against the various hazards			
5.3.2.2 States Monitoring and evaluation of spaces adjacent to cargo tanks for vapour content must be carried out at regular intervals			
5.3.2.3 States that in case of a doubt on the integrity of cargo tank, the adjacent spaces also to be monitored and logged for toxic gases / cargo vapours			
5.3.2.4 States that if gas concentrations are observed, repairs and maintenance work must be stopped when working in the concerned area. Additionally, the cause of the presence of gas concentration must be investigated into and the same eliminated. Other adjoining spaces must be checked for similar defects.			
5.3.3 Safety measures for hot and cold work			
5.3.3.1 States that Hot work outside the main machinery spaces (and in the main machinery spaces when associated with			

TOPIC 5 SAFETY			
Knowledge, Understanding and Proficiency	**IMO Reference**	**Text books Bibliography**	**Teaching aid**
fuel tanks and fuel pipelines) must take into account the possible presence of flammable vapours in the atmosphere, and the existence of potential ignition sources			
5.3.3.2 States that Hot work should only be carried out outside the main machinery spaces if no other viable means of repair exists			
5.3.3.3 States that any hot work outside the designated hot work area in machinery room should be under SMS and Permit control. This would thus also include ALL work in ER outside designated hot work area. Hot work outside the main machinery spaces should only be permitted in accordance with prevailing national or international regulations and/or port/terminal requirements and should be subject to the restrictions of a shipboard hot work permit procedure			
5.3.3.4 States that Hot work for which a hot work permit is required and should be prohibited during cargo, ballast, tank cleaning, gas freeing, purging or inerting operations			
5.3.3.5 Lists the Checks by Officer Responsible for Safety - Oxygen is 21% by volume - Tests with a combustible gas indicator show not more than 1% LFL. - Adequate fire-fighting equipment must be laid out and be ready for immediate use. - Adequate fire-fighting equipment must be laid out and be ready for immediate use. - Fire-watch procedures must be established for the area of hot work, and in adjacent, non-inerted spaces where the transfer of heat, or accidental damage, may create a hazard e.g. .damage to hydraulic lines, electrical cables, thermal oil lines etc. Monitoring should be continued for sufficient time after			

TOPIC 5 SAFETY			
Knowledge, Understanding and Proficiency	**IMO Reference**	**Text books Bibliography**	**Teaching aid**

completion of hot work.
- Effective means of containing and extinguishing welding sparks and molten slag must be established.
- The work area must be adequately and continuously ventilated. The frequency of atmosphere monitoring must be established. Atmospheres should be re-tested after each break during work periods, and at regular intervals. Checks should be made to ensure there is no ingress of flammable vapours or liquids, toxic gases or inert gas from adjacent or connected spaces

5.3.3.6 States that Cold work permits are used in hazardous maintenance work that does not involve “hot work”. Cold work permits are issued when there is no reasonable source of ignition, and when all contact with harmful substances has been eliminated or appropriate precautions taken.

5.3.4 Electrical safety precautions

5.3.4.1 States all electrical equipment employed should be carefully inspected before each occasion of use to ensure it is in good condition. Where required it must be correctly earthed

5.3.4.2 Lists precautions when using electric-arc equipment as:
- That electrical supply connections are made in a gas free space;
- That existing supply wiring is adequate to carry the electrical current demanded without overloading, causing heating;
- The insulation of flexible electric cables laid across the deck is in good condition;
- The cable route to the worksite is the safest possible, only passing over gas free or inerted spaces; and
- The earthing connection is adjacent to the work site with the earth return cable led directly back to the

TOPIC 5 SAFETY				
Knowledge, Understanding and Proficiency		**IMO Reference**	**Text books Bibliography**	**Teaching aid**
	welding machine			
5.3.5	**Ship / shore safety checklist**			
5.3.5.1	States that the Ship/shore safety checklist concerns the ship, the terminal and all personnel and is to be completed jointly by the responsible officer and the terminal representative			
5.3.5.2	States that all items need to be verified physically before it is ticked			
5.3.5.3	Discuss the ship shore safety checklists			
5.3.5.4	States that the completed checklist is of no value if regarded as a paper exercise and should be physically used prior and during transfer of Cargo			
5.4	**Basic knowledge of first aid with reference to a Material Safety Data Sheet (MSDS)**	**R2,R7,R8, R10**	**T1,T2,B1, B2,B3, B4, B11,B12**	**A1, A11 A14**
5.4.1	Identify ‘health data’ from ICS Cargo Data Sheets or CHRIS CODE/CFR 46-150			
5.4.2	Identify health hazard criteria from the Code			
5.4.3	Show and explain a Material Safety Data Sheet for sample products			
5.4.4	Differentiate MSDS and Cargo Hazard Sheets			
5.4.5	Identify ‘health data’ from MSDS			
5.4.6	Extract first-aid procedures from Cargo Data Sheets			
5.4.7	Identify medical first-aid equipment provided onboard including oxygen resuscitation equipment and antidotes for products carried			
5.4.8	Explain when professional medical treatment and advice should be sought			
5.4.9	Extract information from MFAG for sample products			

TOPIC 6	**FIRE SAFETY AND FIRE FIGHTING OPERATIONS**
COMPETENCE 4	**Carry out fire-fighting operations**

TRAINING OUTCOMES:

Demonstrates a knowledge and understanding of:

.1 oil and chemical Tanker fire response organization and action to be taken.
.2 fire hazards associated with cargo handling and transportation of hazardous and noxious liquids in bulk
.3 fire-fighting agents used to extinguish oil and chemical fires
.4 fixed fire-fighting foam operations
.5 portable fire-fighting foam operations
.6 portable extinguishers and Fixed dry chemical system operations
.7 spill containment in relation to fire-fighting operations

TOPIC 6	FIRE SAFETY AND FIRE FIGHTING OPERATIONS			
Knowledge, Understanding and Proficiency		**IMO Reference**	**Text books Bibliography**	**Teaching aid**
6.1	**Oil and Chemical Tanker fire response organization and action to be taken**	**R1, R2, R4, R6, R7, R8, R10**	**T1, T2, B1, B2, B3, B4, B10**	**A1, A11, A14,A15**
6.1.1	States that on any vessel, especially Oil and Chemical Tankers, emergencies may have catastrophic consequences, unless proper action is taken. Actions, therefore, must be prompt, timely and adequate			
6.1.2	states that it is very essential for the ship's staff to know and understand the various properties of the cargo well. The MSDS sheets are the best guides for understanding the cargo			
6.1.3	State that the MSDS sheets must be placed at various spaces frequented by the ship's staff so as to enable them to familiarize themselves with the cargo. Training and drills specially fire fighting carried out, additionally prepare the fire response organization to become familiar with their duties and equipment and to respond to emergencies in a timely and correct manner			
6.1.4	States that any fire drills carried out with shore establishments shall be taken positively and the Master must take full advantage of this situation to learn from the exercise. A de-briefing of the crew must be carried out and lessons learnt from such drills pointed out			
6.1.5	States that the use of checklists as a reminder of things, which may require to be done in an emergency. This in most cases will ensure that the response is a little faster in getting things under control			
6.1.6	Explains the Find, Inform, Restrict and Extinguish techniques in attending to a Fire emergency			
6.1.7	Lists The fire fighting procedures as required in the Emergency and Contingency plan			
6.1.7.1	States that the Master must ensure that the Duty Officer is authorized to stop cargo in the event of an emergency or if in the opinion of the Duty Officer such stoppage			

TOPIC 6 FIRE SAFETY AND FIRE FIGHTING OPERATIONS			
Knowledge, Understanding and Proficiency	**IMO Reference**	**Text books Bibliography**	**Teaching aid**
is necessary to prevent an emergency situation.			
6.1.7.2 States that the Duty Officer must inform the Cargo Officer and / or the Master in any event of an emergency situation at the earliest opportunity.			
6.1.7.3 Lists the actions to be taken by the Duty Officer after informing the Master: - Stop Cargo work, bunkering, tank cleaning or ballasting operations immediately. - Disconnect hoses if alongside the terminal or a ship. - Inform the terminal/ship if alongside the terminal/ship. - If at the terminal, external help may be summoned. - Cast off any boats, which are alongside. - If at anchor, alert port authorities. - Identify oil / chemicals involved and any other chemical cargo which may be at risk if the fire spreads. - If at sea, manoeuvre the vessel in such a way that the spread of fire can be restricted and it can then be tackled from the windward side. - Cool other compartments especially if they carry flammable cargo. - Select the fire fighting equipment to be used.			
6.1.7.4 States that there is a need to be alert to the fact that toxic fumes may enter the accommodation and an evacuation of non-essential crew and visitors may become necessary			
6.2 Fire hazards associated with cargo handling and transportation of hazardous and noxious liquids in bulk	**R1,R2,R6, R7,R8**	**T1,T2,B1,B2, B3,B4,B11**	**A1,A2,A3, A4,A5,A6, A7,A8,A9, A11,A14**
6.2.1 Lists the fire hazards associated with NLS as: - Some cargoes give out oxygen when on fire, thereby supporting the fire. - Some chemical fires, the source of ignition may be heat from a reaction within the cargo itself or through			

TOPIC 6	FIRE SAFETY AND FIRE FIGHTING OPERATIONS			
Knowledge, Understanding and Proficiency		**IMO Reference**	**Text books Bibliography**	**Teaching aid**
	mixing with other chemicals. - Chemicals miscible in fire will render normal foam useless. For such chemicals alcohol resistant or dual-purpose foam shall be used. - Some chemicals are miscible in water and hence their presence may not be recognized - Some chemicals are heavier than water and insoluble in water. These may be smothered using water - Some chemicals evolve large volumes of toxic vapours when heated - Some chemicals have a low auto-ignition temperature. There is a risk of re-ignition of these chemicals			
6.3	**Fire-fighting agents used to extinguish oil and chemical fires**	**R1,R2,R6, R7,R8**	**T1,T2,B1,B2, B3,B4, B11**	**A1,A2,A11, A14,A15**
6.3.1	Lists the fire fighting agents as: - Water is the most common cooling agent. This is largely because water possesses very good heat absorbing qualities and is available in ample quantities at terminals and on ships - Foam is an aggregation of small bubbles, of lower specific gravity than oil or water, which flows across the surface of a burning liquid and forms a coherent smothering blanket. It will also reduce the surface temperature of the liquid by the absorption of some heat. - Carbon dioxide is an excellent smothering agent for extinguishing fires, when used in conditions where it will not be widely diffused. Carbon dioxide is therefore effective in enclosed areas such as machinery spaces, pump rooms and electrical switch rooms where it can penetrate into places that cannot be reached by other means. - Dry chemical powder is discharged from an extinguisher as a free flowing cloud. It is most effective in dealing			

TOPIC 6	FIRE SAFETY AND FIRE FIGHTING OPERATIONS			
Knowledge, Understanding and Proficiency		**IMO Reference**	**Text books Bibliography**	**Teaching aid**
	with a fire resulting from an oil spill on a jetty or on the deck of a chemical tanker and can also be used in confined spaces. It is especially useful on burning liquids escaping from leaking pipelines and joints			
6.4	**Fixed Fire fighting Foam system operations**	**R1,R2,R3, R6,R7,R8**	**T1,T2,B1,B2, B3,B4,B11**	**A1,A11, A14**
6.4.1	States that Alcohol-resistant foam extinguishing agents possess low-expansion properties and are adaptable to various low expansion foam generators. Alcohol-resistant foam extinguishing agents may be used in chemical tankers where water-soluble flammable liquids such as alcohol, ester, ether, aldehyde, ketone, and organic acids			
6.4.2	States that a foam system has storage tanks containing foam concentrate. Water from the fire pumps picks up the correct proportion of foam concentrate from the tank through a proportioner and the foam solution is then conveyed through permanent supply lines to off take points			
6.4.3	Describes Foam Mains			
6.4.4	States the use of Monitors and Cannons for Large capacity monitors would normally be on a fixed mounting. Minimum requirements for monitor operations are a jet length of 30 metres and a jet height of 15 metres in still air.			
6.5	**Portable fire-fighting foam operations**	**R1,R2,R3, R6,R7,R8**	**T1,T2,B1,B2, B3,B4, B11**	**A1,A11, A14**
6.5.1	States portable fire fighting equipment are Fire extinguishers and applicator foam system			
6.5.2	Describes Applicator foam systems			
6.5.3	Describes portable foam fire extinguishers			
6.6	**Fixed dry chemical system operations**	**R1,R2,R3, R6,R7,R8**	**T1,T2,B1,B2, B3,B4, B11**	**A1,A11, A14**
6.6.1	Explains Portable extinguishers and Fixed dry chemical system operations			

TOPIC 6	FIRE SAFETY AND FIRE FIGHTING OPERATIONS			
Knowledge, Understanding and Proficiency		**IMO Reference**	**Text books Bibliography**	**Teaching aid**
6.6.2	Describes the Piping Arrangements for DCP fire fighting systems of a chemical Tanker as:			
6.6.3	States that the Monitors and Hand held hose requirements are that the maximum discharge rate should be such as to allow operation by one man. Hand hose lines and nozzles should be of weather-resistant construction or stored in weather resistant housing or covers and be readily accessible			
6.6.4	States that the system capacity requirements of DCP should be of sufficient quantity and stored in each container to provide a minimum 45 seconds discharge time for all monitors and hand hose lines attached to each powder unit			
6.7	**Spill containment in relation to fire-fighting operations**	**R1,R2,R3, R9**	**T1,T2,B1,B2, B3,B4,B10, B11**	**A1,A11, A14**
6.7.1	Lists actions to be taken in case of a oil / chemical spillage and pool fire as: - Prompt initiation of the ESD will do much to limit the amount of liquid spilled and because of the fish plate, restrict the overflow of cargo overboard - restrict sources of ignition to ignite the vapour - foam gently spread over the pool fire will smother and restrict it from spreading. - Jets of water should never be directed onto burning liquid, as this will cause a violent increase in flame and spread the fire. - When contained in drip trays, the liquid may also be spilled onto the deck and water-jet should therefore be avoided. - wear full protective clothing and take advantage of water spray protection			

TOPIC 7	**Cargo Operations**
COMPETENCE 1	**Contribute to the safe cargo operation of oil and Chemical Tankers**

TRAINING OUTCOMES:

Demonstrates a knowledge and understanding of:

For oil tankers
- .1 piping systems and valves
- .2 cargo pumps
- .3 loading and unloading
- .4 tank cleaning, purging, gas freeing and inerting

For chemical tankers
- .1 piping Systems and valves
- .2 cargo pumps
- .3 loading and Unloading
- .4 tank cleaning, purging, gas freeing and inerting

TOPIC 7	CARGO OPERATIONS			
	Knowledge, Understanding and Proficiency	**IMO Reference**	**Text books Bibliography**	**Teaching aid**
7.1	**For Oil Tankers**	**R2, R4, R5, R6,R7, R8**	**T1, T2, B1, B2, B3, B4,**	**A1,A11, A12,A14**
7.1.1	**Cargo Information**			
7.1.1.1	States that information about cargoes to be handled is essential to the safety of the vessel and her crew			
7.1.1.2	States that such information may be found in MSDS for Oil cargoes supplied by shippers. These sheets include all necessary data for the safe handling and carriage of the cargo			
7.1.1.3	States that cargo information for most tanker cargoes is kept on board and available for all concerned personnel			
7.1.1.4	States that the cargo will not be loaded unless sufficient information necessary for its safe handling and transportation is available			
7.1.1.5	States that the responsible officer will see to it that the necessary cargo information is posted on the notice board prior to cargo operations			
7.1.1.6	States that all personnel engaged in cargo operations should familiarize themselves with the properties of the cargo to be loaded by studying the Cargo Data Sheets / MSDS			
7.1.2	**Loading**			
7.1.2.1	Explains need for compliance with all safety requirements			
7.1.2.2	States that the control valves are operated during loading according to planned sequence of filling tanks			
7.1.2.3	States that the quantity of cargo is checked by measuring ullages			
7.1.2.4	States that the venting of tanks into the atmosphere is controlled as necessary			
7.1.2.5	States that events during operations are recorded			
7.1.2.6	Explains how and when samples are drawn.			
7.1.3	**Unloading**			

TOPIC 7	CARGO OPERATIONS			
	Knowledge, Understanding and Proficiency	**IMO Reference**	**Text books Bibliography**	**Teaching aid**
7.1.3.1	Pump characteristics			
7.1.3.1.1	States suitability of the pump types listed above for cargo handling in terms of:			
7.1.3.1.2	States that maintaining flow at inlet under low heads			
7.1.3.1.3	States start-up procedures			
7.1.3.1.4	Describes the operating principles of the following pump types: - reciprocating positive-displacement pumps - rotary positive-displacement "screw' and screw-type pumps - rotary positive-displacement lobe- and vane type pumps - roto-dynamic (centrifugal) pumps - eductors			
7.1.3.1.5	States the suitability of pump types listed above for cargo handling in terms of volumetric and pressure requirements			
7.1.3.1.6	States that maintaining flow at inlet under low heads			
7.1.3.1.7	States the precautions to be observed during start-up procedures			
7.1.3.1.8	Lists the reasons for draining and stripping tanks, lines and pumps, and states the pumps suitable for this purpose in terms of: - maintenance of flow at inlet under low head conditions - ability to self prime - wear on moving parts when flow is intermittent or fluctuating			
7.1.3.1.9	States that the level of cargo in the tank can be determined by sounding or by measuring ullage and lists the various device used for this as: - flexible steel or alloy tapes - float indicators - pneumatic gauges - hydraulic gauges - electrical capacitance gauges - sonic gauges - radar gauges - multi-function unit			
7.1.3.1.10	States that cargo heating may be required for viscous cargo			
7.1.3.1.11	States that a particular viscosity range is			

TOPIC 7	CARGO OPERATIONS			
	Knowledge, Understanding and Proficiency	**IMO Reference**	**Text books Bibliography**	**Teaching aid**
	required for storage and handling and that this is maintained by controlling the temperature of the cargo.			
7.1.3.1.12	States that the methods of heating the cargo are the use of: - steam supplied to coils or other forms of extended heating surface, for normal petroleum cargoes - a mineral oil heating fluid supplied to heating apparatus for special (heavy) petroleum cargoes			
7.1.3.1.13	States that leakage in heat-exchanger pipes may permit oil to contaminate the condensate system in steam heating systems or water to contaminate the cargo			
7.1.3.1.14	States that dangers exist in heating heavy cargoes (such as bitumen) if water is present in the cargo			
7.1.3.1.15	States that steel heating coils suffer serious corrosive attack from some cargoes			
7.1.3.1.16	States that vaporization increases with a rise in temperature			
7.1.3.1.17	States pressure and temperature has to be monitored			
7.1.3.1.18	States that control valves are operated during unloading according to planned sequence of emptying tanks			
7.1.3.1.19	States that ballast is taken as required by the unloading plan			
7.1.3.1.20	States that line draining and stripping is carried out with required trim being maintained by ballasting operations			
	Ballast voyage			
7.1.3.1.21	Lists ballast requirements criteria as : - allocation of ballast tanks as per draft and trim requirements - stability considerations for allocating the amount of ballast - tankers with tanks solely designated for ballast, served by a dedicated ballast system are segregated ballast tanks - additional ballast is carried in cargo tanks if the segregated ballast			

TOPIC 7	CARGO OPERATIONS			
	Knowledge, Understanding and Proficiency	**IMO Reference**	**Text books Bibliography**	**Teaching aid**
	capacity is insufficient - such ballast is put in designated cargo tanks called heavy weather ballast			
7.1.3.1.22	States that the ship may have only clean or segregated ballast on board upon arrival in the loading port for pollution prevention.			
7.1.3.1.23	States changing ballast is a legislative requirement for pollution prevention			
7.1.3.1.24	States that the slop tank is filled with an oily water mixture after tank cleaning water is transferred.			
7.1.3.1.25	States that there is a need to decant the contents of the slop tank to minimise pollution.			
7.1.3.1.26	States that the decanting is carried out after oily water mixture is permitted 24 hrs. or settling down and separating. Then the water is pumped out through the ODMCS in line with MARPOL regulations keeping the interface at least one meter above the discharging point.			
7.1.3.1.27	States that the remainder of the slop tank may be utilized for the carriage of next cargo loaded on top of the balance.			
7.1.4	**Tank Cleaning**			
7.1.4.1	lists procedures for tank cleaning as: - tank washing machines are used - there are portable and fixed tank washing machines - tanks may be cleaned with water or crude oil - on the ballast voyage, only water is used, sometimes mixed with chemicals - hot or cold water may be used the tank washing system incorporates a water heater - tank washing should preferably be carried out in a non- explosive atmosphere - this may be an inert or, alternatively, too lean or too rich atmosphere - if an inert-gas system (IGS) is fitted and operating, tank washing should			

TOPIC 7	CARGO OPERATIONS			
	Knowledge, Understanding and Proficiency	**IMO Reference**	**Text books Bibliography**	**Teaching aid**
	take place in an inert atmosphere - if an IGS is not fitted, tank washing should preferably take place in a too lean atmosphere			
7.1.4.2	Explains uncontrolled and too lean atmospheres methods of tank cleaning			
7.1.4.3	States that ventilation is carried out until a too lean atmosphere is achieved			
7.1.4.4	States that gas-freeing should be continued during tank washing			
7.1.4.5	States that tank washing water is transferred to the slop tank for decanting			
7.1.4.6	States that Tank cleaning is carried out to: - Prepare tanks for the carriage of the next cargo. - Prevent the build-up of oily residues. - Facilitate gas-freeing and tank entry for repairs/tank mopping. - Comply with Charter Party requirements. - Comply with MARPOL regulations. - In extreme circumstances, prepare tanks for the carriage of clean ballast. - It can be accomplished by means of portable or fixed tank washing machines, or sometimes a combination of both using hot, cold, fresh or sea water and/or chemical detergents singly or in combination.			
7.1.4.7	States that the inert gas system, where fitted, should be operated appropriately during tank washing, gas-freeing and tank preparation operations. Additional safety precautions should be taken for vessels which do not have inert gas systems,			
7.1.4.8	States that inert gas supplied should have an oxygen content of not more than 5% by volume			
7.1.4.9	States that cleaned cooled boiler flue gas is often used for this purpose, its main constituents being nitrogen and carbon dioxide			
7.1.4.10	States that alternatively, cleaned and filtered combustion gas from an oil-burning gas generator can be used			
7.1.4.11	States that Inert gas has to be used when the method of cleaning is crude oil			

TOPIC 7	CARGO OPERATIONS			
	Knowledge, Understanding and Proficiency	**IMO Reference**	**Text books Bibliography**	**Teaching aid**
	washing or Recirculated wash water washing.			
7.1.4.12	States that it is important to keep cargo tanks and slop tanks inerted at all times			
7.1.4.13	States that the use of tank washing equipment using high- pressure jets of crude oil from the cargo to dissolve and remove cargo residues and deposits which cling to the internal surfaces and fillings of cargo is called crude oil washing			
7.1.4.14	States that crude oil washing may be carried out with single stage or multistage methods			
7.1.5	**Purging and gas-freeing**			
7.1.5.1	States that gas-freeing is usually done by mechanical means			
7.1.5.2	States that such means may be portable fans or a fixed system			
7.1.5.3	States that the IGS Blower may be used for gas-freeing			
7.1.5.4	States that gas-freeing is the replacement of hydrocarbon vapours or inert gas by air			
7.1.5.5	States that hydrocarbon vapours remain inside a cargo tank after cargo discharge			
7.1.5.6	States that the hydrocarbon vapours are mixed with inert gas on a ship fitted with an IGS or with air in a ship not so fitted			
7.1.5.7	States that in an inerted cargo tank there is no explosive atmosphere			
7.1.5.8	States that care must be taken that the tank atmosphere does not come within flammable range during gas-freeing operations			
7.1.5.9	States that soot particles in inert gas create an additional ignition hazard in an explosive tank atmosphere			
7.1.5.10	States that gas-freeing a non-inerted tank may bring the tank atmosphere within the explosive range for some time			
7.1.5.11	States that oil tankers should be supplied with meters to check oxygen content, hydrocarbon content and toxic gas content			
7.1.5.12	States that meters are available showing percentage lower flammable limit (LFL) by volume			

TOPIC 7	CARGO OPERATIONS			
	Knowledge, Understanding and Proficiency	**IMO Reference**	**Text books Bibliography**	**Teaching aid**
7.1.5.13	States that purging a tank with inert gas will prevent the development of an explosive atmosphere in a cargo tank			
	Tank cleaning and gas-freeing for repairs			
7.1.5.14	States that procedures for tank cleaning, purging and gas-freeing must be carried out			
7.1.5.15	States that before personnel enter any tank, the atmosphere must be checked for oxygen content, hydrocarbon content and, after carrying some cargoes, toxic gas content			
7.1.5.16	States that oxygen content must be 21% by volume			
7.1.5.17	States that hydrocarbon content must be less than 1% LFL			
7.1.5.18	States that after tank washing, manual removal of residue may be necessary			
7.1.5.19	States that residue removal generates more hydrocarbon gas			
7.1.5.20	States that gas-freeing operations must therefore be continuous			
7.1.5.21	States that adjacent bulkheads and pipelines may constitute additional sources of hydrocarbon gas			
7.1.5.22	States that the inert gas supply to the tank should be shut off			
7.1.5.23	States that a gas-free certificate is needed from a qualified chemist before contractor's work can be carried out			
7.1.5.24	States that an additional hot work permit is required for hot work			
7.1.5.25	States that permission to work should only be given for a period sufficient to complete the task. Under no circumstances should the period exceed one day.			
7.2	**For chemical tankers**	**R2,R3,R4, R6,R7,R8**	**T1, T2, B1, B2, B3, B4,**	**A1,A11, A13,A14**
7.2.1	**Cargo Information**			
7.2.1.1	States that based on cargo information obtained through Cargo Data Sheets,			

TOPIC 7	CARGO OPERATIONS			
	Knowledge, Understanding and Proficiency	**IMO Reference**	**Text books Bibliography**	**Teaching aid**
	Compatibility Data Sheets, Coating Compatibility of cargo tanks, cargo to be planned in compliance with all safety requirements providing adequate cargo segregation, keeping in mind the hazardous nature of the cargoes			
7.2.1.2	States that such information may be found in MSDS supplied by shippers / Cargo Data Sheets published by ICS for Chemical cargoes. These sheets include all necessary data for the safe handling and carriage of the cargo			
7.2.2	**Loading**			
7.2.2.1	States that all personnel must follow standing instructions at all times whether or not the cargo to be loaded is dangerous			
7.2.2.2	States that personnel on watch or involved in the loading operation should wear appropriate protective clothing, as indicated in the ICS or other Cargo Data Sheets, when handling dangerous cargoes			
7.2.2.3	States that cargoes are stowed according to a stowage plan that was prepared before loading bean			
7.2.2.4	States that prior to loading, cargo tanks are inspected for cleanliness and suitability for cargo according to the stowage plan			
7.2.2.5	States that prior to the loading of cargoes which present a major fire hazard, tanks are purged with nitrogen to remove air so that the atmosphere above the cargo will be non-flammable			
7.2.2.6	States that such cargoes are kept under a nitrogen “padding” during the voyage			
7.2.2.7	Explains, with the aid of a simple drawing: - how cargo is routed from the manifold to tanks on a chemical tanker with a pump-room - how cargo is routed from the manifold to tanks on a chemical tanker with separate lines for each tank			

TOPIC 7	CARGO OPERATIONS			
	Knowledge, Understanding and Proficiency	**IMO Reference**	**Text books Bibliography**	**Teaching aid**
	- how cargo vapour is removed from the tanks during loading - a “closed-circuit’ loading operation			
7.2.2.8	States that cargoes giving off vapours which present a major health hazard are loaded in a “closed circuit”, requiring a vapour- return line			
7.2.2.9	States that in order to check for impurities, cargo samples are taken from lines and tanks during loading			
7.2.2.10	States that a vessel’s trim, list and stability may be adjusted, if necessary, during loading by filling or emptying ballast tanks			
7.2.2.11	States that all events during cargo operations are recorded			
7.2.2.12	Lists procedures and duties for personnel on watch during the loading operation			
7.2.3	**Unloading**			
	CARGO PUMPS			
7.2.3.1	States that The main cargo pumps fitted on board chemical tankers are mainly of the centrifugal type. They are submerged pumps integral with hydraulic motors			
7.2.3.2	States that a centrifugal pump creates a partial vacuum at its inlet side. The pressure above the liquid surface moves the liquid to the impeller. If the liquid's temperature is close to its boiling point, the liquid's vapour pressure is easily reached at the pump inlet side. The liquid starts to boil, the bubbles so formed may collapse along the impellor, which may result in pump cavitation			
7.2.3.3	States that there are three main ways of checking the pumps, which are: - visual inspection - periodic maintenance checking for vibration and noise			
7.2.3.4	States that all personnel must follow standing instructions at all times during unloading, whether or not the cargo is considered dangerous			
7.2.3.5	States that personnel on watch involved in the unloading operation should wear appropriate protective clothing, as			

TOPIC 7	CARGO OPERATIONS			
	Knowledge, Understanding and Proficiency	**IMO Reference**	**Text books Bibliography**	**Teaching aid**
	indicated in the CS or other Cargo Data Sheets, when handling dangerous cargoes			
7.2.3.6	States that cargoes are unloaded according to a planned sequence of emptying tanks			
7.2.3.7	States that prior to unloading, cargo samples from each tank and from cargo lines are analyzed to check if a product has been contaminated on board during passage			
7.2.3.8	Explains, with the aid of a simple drawing: - how cargo is routed from tank to manifold on a chemical .tanker with a pump-room - how cargo is routed from the tank to manifold on a chemical tanker with deep well pumps and separate lines for each tank - the functioning of the cargo-tank venting system during unloading			
7.2.3.9	States that in tanks containing cargoes that present a major fire hazard, inert gas or nitrogen is used to maintain a positive tank pressure during unloading in order to avoid air entering the tank			
7.2.3.10	States that a vessel's trim, list and stability may be adjusted, as necessary, during unloading by filling or emptying ballast tanks			
7.2.4	**Tank cleaning and gas-freeing**			
7.2.4.1	Lists reasons for chemical tank cleaning as: - rules and regulations - the prevention of contamination of the cargo to be loaded - the prevention of contaminated ballast - maintenance of cargo tanks and equipment			
7.2.4.2	States that low capacity tank-washing machines are used as the size of the chemical tanks are small.			
7.2.4.3	States that tank-washing machines may be fixed or portable			

TOPIC 7	CARGO OPERATIONS			
	Knowledge, Understanding and Proficiency	**IMO Reference**	**Text books Bibliography**	**Teaching aid**
7.2.4.4	States that tank-cleaning equipment must be properly earthed to avoid accumulation of static electricity. Personnel involved in tank-cleaning operations may be exposed to cargo vapours and should, if necessary, use equipment for personal protection. Different cargoes require different tank-cleaning procedures			
7.2.4.5	States that cleaning may be done with hot or cold seawater or with fresh water, or by ventilation only			
7.2.4.6	States that water cannot be used for tank cleaning before or after some cargoes			
7.2.4.7	States that in some cases, detergents are added to the washing water			
7.2.4.8	States that in some cases, solvents are used for tank cleaning			
7.2.4.9	Describes the working of a tank-washing machine			
7.2.4.10	Describes how the electric bonding of tank-cleaning hoses may be checked			
7.2.4.11	Describes a safe procedure for the connection and disconnection of tank-cleaning equipment			
7.2.4.12	Lists phases in a tank-cleaning operation as: - pre-wash - main wash - fresh water rinse - gas-freeing - drying - inspection/testing			
7.2.4.13	Explains, with the aid of a simple drawing, the cycle in a tank- washing system from the seawater inlet to the underwater discharge outlet/slop tank			
7.2.4.14	States that the purpose of gas-freeing is to replace cargo vapours, inert gas or any other gases with air			
7.2.4.15	States that gas-freeing may be done by fixed or portable fans driven by air, steam, water or hydraulic fluid			
7.2.4.16	States that the gas-freeing operation is verified by regular checks of the tank atmosphere			
7.2.4.17	States that the tank atmosphere is checked by measuring the percentage of oxygen and the ppm values of cargo			

TOPIC 7	CARGO OPERATIONS			
	Knowledge, Understanding and Proficiency	**IMO Reference**	**Text books Bibliography**	**Teaching aid**
	vapours or of toxic constituents of inert gas			
7.2.4.18	States that a cargo tank is gas-free only when the oxygen content is 21% by volume, hydrocarbons less than 1% LFL and Toxicity less than 50% OEL			
	Slops and slops disposal			
7.2.4.19	Defines ‘slops” as tank washings or any residue/water mixtures from pump-room bilges, engine-room bilges or slop tanks			
7.2.4.20	States that modern chemical tankers are fitted with tanks for the storage of slops			
7.2.4.21	States that cargo tanks may also be used to contain slops			
7.2.4.22	States that in general, the discharge of slops into the sea is prohibited unless certain conditions are satisfied			
7.2.4.23	States that slops from certain noxious chemicals have to be discharged to shore facilities			
7.2.4.24	States that all slop-handling operations on chemical tankers are recorded in the Cargo Record Book			
7.2.4.25	Identifies international regulations covering: - the discharge of slops - the discharge of slops containing noxious chemicals			

TOPIC 8	**EMERGENCIES**
COMPETENCE 5	**Respond to emergencies**

TRAINING OUTCOMES:

Demonstrates a knowledge and understanding of:

- emergency procedures:
- emergency shutdown

TOPIC 8 EMERGENCIES			
Knowledge, Understanding and Proficiency	**IMO Reference**	**Text books Bibliography**	**Teaching aid**
8.1 Basic knowledge of emergency procedures, including emergency shutdown	**R2, R3, R9**	**T1, T2, B1, B2, B3, B4,**	**A1, A11, A14**
8.1.1 States that planning and preparation are essential for dealing successfully with emergencies 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 and instructions for its use - states that, in an emergency, important actions to take would include: - giving audible and visual warnings that an emergency exists by means of: - bells, whistles, klaxons or other audible devices - flashing lights - advising the command centre of the location and nature of the emergency - promptly activating the ESD and stopping any cargo-related operations, closing valves and openings in tanks as initiated by the ESD system - removing any craft alongside			
8.1.2 States that personnel in the vicinity of the emergency should take appropriate action to try and control the incident until the emergency team can take over			
8.1.3 States that all crew members should know the location of all safety equipment, such as; - breathing apparatus - protective clothing - approved portable electric lights - instruments for measuring oxygen and other gases - first-aid kits - tank evacuation equipment - fire-fighting equipment with instructions for its use			

TOPIC 8 EMERGENCIES			
Knowledge, Understanding and Proficiency	**IMO Reference**	**Text books Bibliography**	**Teaching aid**
8.1.4 States that all equipment which may be needed in an emergency must be maintained in good order and always be ready for use, and lists important items as: - fire-fighting equipment - breathing apparatus - protective clothing - alarm systems - communication systems - arrangement plans			
8.1.5 States that a plan for dealing with an outbreak of fire or an explosion must be prepared and all crew members briefed on its operation			
8.2 Organizational structure	**R2,R3, R9,R10**	**T1,T2,B1, B2,B3,B4,**	**A1,A11, A14**
8.2.1 States that the planning for and the implementation of an emergency procedure require an emergency organization			
8.2.2 States that the basic structure of the emergency organization should consist of four elements: - command centre - emergency party - back-up emergency party - engineers group or technical team			
8.2.3 States the need to identify a senior officer as being in control during the emergency, with another senior officer identified as his deputy			
8.2.4 States the general composition and the task of the command centre			
8.2.5 States the general composition and the task of the emergency party			
8.2.6 States the general composition and the task of the back-up emergency party			
8.2.7 States the general composition and the task of the engineers group			
8.2.8 States that all personnel on board should know their place in the emergency organization and their duty in case an emergency procedure is being initiated			
8.2.9 States the need for realistic drills to be undertaken periodically			

TOPIC 8 EMERGENCIES			
Knowledge, Understanding and Proficiency	**IMO Reference**	**Text books Bibliography**	**Teaching aid**
8.3 Alarms	**R2,R3, R9,R10**	**T1,T2,B1, B2,B3,B4,**	**A1,A11, A14**
8.3.1 States that a fire alarm signal or general alarm signals are given in case of: - fire - collision - grounding - man overboard - cargo hose burst - major cargo spillage or escape vapour - every other emergency situation which calls for emergency actions			
8.3.2 States that other alarm signals are given in case of: - high concentration of toxic or flammable vapours - unacceptable condition in cargo tanks or cargo systems - unacceptable conditions in auxiliary cargo systems - system failure in cargo plant and auxiliary systems - system failure in engine-room or machinery spaces - a CO2 discharge in engine-room or pump-rooms - a high level of oxygen in inert gas - high level of oil residues in overboard discharge			
8.3.3 States that the ships muster list and emergency instructions specify details of the emergency alarm signals			
8.3.4 States that all personnel on board should be able to identify the different alarm signals			
8.3.5 States that all crew members should be familiar with the emergency plan and act according to the plan when the alarm is raised			
8.3.6 States that any person who discovers an emergency should raise the alarm and pass on relevant information as quickly as possible			

TOPIC 8 EMERGENCIES				
Knowledge, Understanding and Proficiency		**IMO Reference**	**Text books Bibliography**	**Teaching aid**
8.4	**Emergency procedures**	**R2,R3, R9,R10**	**T1,T2,B1, B2,B3,B4,**	**A1,A11, A14**
8.4.1	States that the ship's muster list and emergency instructions specify action to be taken by each crew member and officer in case of an emergency			
8.4.2	States that all personnel should be familiar with the emergency instructions and act according to the instructions when the alarm is raised			
8.4.3	States that a vessel's safety plan and fire control plan specify details and location of all equipment for emergency use			
8.4.4	States that all personnel should know the location of emergency equipment and be familiar with its use			
8.4.5	States that it is essential that personnel are properly trained for emergency operations			
8.4.6	States that all equipment which may be used in an emergency must be maintained in good order and be ready for use at all times			
8.4.7	Lists basic emergency actions to be taken in case of: - fire - collision - grounding - cargo hose burst - accident involving personnel			
8.4.8	States that the correct emergency procedures for accidents involving dangerous chemicals are given in the ICS or other Cargo Data Sheets			
8.5	**First-aid treatment**	**R2,R6**	**T1,T2,B1, B2,B3,B4,**	**A1,A11, A14**
8.5.1	States that first-aid procedures for accidents involving dangerous chemicals are given in the ICS or other Cargo Data Sheets			
8.5.2	States that all personnel should be familiar with the first-aid procedure set out in the Data Sheets for the cargoes carried			
8.5.3	States that medical advice should be sought in the event of an accident			

TOPIC 8 EMERGENCIES			
Knowledge, Understanding and Proficiency	**IMO Reference**	**Text books Bibliography**	**Teaching aid**
8.5.4 States that the emergency showers should be used immediately in the event of spillage of cargo liquid in eyes or on skin			
8.5.5 States that the correct treatment for most cargoes is to flush with copious amount of water and to remove the affected clothing			
8.5.6 States that for symptoms of vapour exposure the treatment for most cargoes is: - to remove the victim to fresh air - to give artificial resuscitation if breathing has stopped or is weak irregular			
8.5.7 States that antidotes for cargoes carried are available on board			
8.5.8 states that all personnel should be instructed and trained in “Cardio Pulmonary Resuscitation” technique .			

TOPIC 9	**POLLUTION PREVENTION**
COMPETENCE 6	**Take precautions to Prevent pollution of the environment from the release of oil or chemicals**

TRAINING OUTCOMES:

Demonstrates a knowledge and understanding of:

1. **Effects of oil and chemical pollution on human and marine life**

2. **Shipboard procedures to prevent pollution**

3. **SOPEP and SMPEP**

4. **Measures to be taken in the event of spillage, including the need to:**
   - .1 report relevant information to the responsible persons
   - .2 assist in implementing shipboard spill-containment procedures

TOPIC 9	POLLUTION PREVENTION			
Knowledge, Understanding and Proficiency		**IMO Reference**	**Text books Bibliography**	**Teaching aid**
9.1	**Basic knowledge of the effects of oil and chemical pollution on human and marine life**	**R2,R3, R9**	**T1,T2,B1, B2, B3, B4,B10**	**A1,A11, A14**
9.1.1	States that in the case of oil or NLS spill, the first living receptors who may come in contact with the spill are the marine life, including the various fish species. Apart from affecting the coastal fishing and fisheries, exposure to spills may have negative health effects on marine life			
9.1.2	Explains that the negative effects on marine life & fish relate to the accumulation of persistent and bio-accumulative components of oil in the tissue and bodies of marine life & fish with potential to induce: - a variety of health and reproductive problems - as well as mass mortality events within fish & marine life in general			
9.1.3	States that the problem is more for the higher organisms on the food chain (who consumes other smaller organisms) and may seriously affect birds and marine mammals, as well as bigger fish and human life			
9.2	**Basic knowledge of shipboard procedures to prevent pollution**	**R2,R3, R9**	**T1,T2,B1, B2, B3, B4,B10**	**A1,A11, A14**
9.2.1	States that the International Maritime Organization is the international body responsible for controlling marine pollution			
9.2.2	States that IMO achieves this by adopting the International convention for the Prevention of Pollution from Ships commonly known as MARPOL			
9.2.3	States that Annex II of the MARPOL convention contains regulations for control of pollution by noxious liquid cargoes carried in bulk or tank washings from such cargoes			
9.2.4	States that to prevent hazards to the environment the following should be observed			
9.2.5	States that for oil tankers at sea:			
9.2.5.1	There are regulations for the discharge of oil			

TOPIC 9	POLLUTION PREVENTION			
Knowledge, Understanding and Proficiency		**IMO Reference**	**Text books Bibliography**	**Teaching aid**

into the sea which must be observed

9.2.5.2 In order to comply with these requirements, LOT procedures must be observed during deballasting, decanting and tank cleaning operations

9.2.5.3 Most crude carriers must:
- crude oil wash their cargo tanks to minimize oily wastes;
- have segregated ballast tanks; or have dedicated clean Ballast tanks

9.2.6 States that for oil tankers in port:

9.2.6.1 Ship movements alongside must be restricted by adjusting moorings

9.2.6.2 All pipelines, joints and valves must be kept under observation whilst handling cargo

9.2.6.3 Catchment trays must be fitted or placed at vulnerable points (hose connections, for example)

9.2.6.4 Strict control must be exercised whilst loading to prevent tanks overflowing

9.2.6.5 All scuppers must be closed to prevent a discharge of oil from the deck overboard

9.2.6.6 All valves and blanks must be checked prior to cargo operations

9.2.6.7 Valves not used should be secured if possible

9.2.6.8 Sea valves not in use should be closed by double valves or blanked off

9.2.6.9 If oil is spilt, cargo operations must be stopped and warnings given to all involved

9.2.7 States that for chemical tankers at sea and in port:

9.2.7.1 For the purpose of discharging slops containing cargo residues into the sea, Annex II divides NLS on chemical tankers into four pollution based categories

9.2.7.2 These categories are X, Y, Z and OS, and a cargo of category X represents the most pollutant and a cargo of category Z the least pollutant.

9.2.7.3 All operations on board involving cargo, ballast and bunkers should be done in accordance with the applicable pollution regulations

TOPIC 9 POLLUTION PREVENTION				
Knowledge, Understanding and Proficiency		**IMO Reference**	**Text books Bibliography**	**Teaching aid**
9.2.7.4	Carrying out operations in accordance with the ship's Procedures and Arrangements (P and A) Manual ensures that pollution regulations are complied with			
9.2.7.5	care should be taken to avoid cargo spillage during cargo transfer, ballasting or tank cleaning operations			
9.2.7.6	pollution-prevention procedures during the operations include keeping a watch on: - levels in cargo, slop or ballast tanks - cargo or ballast hoses or hard arms - pumps, valves, gaskets, connections and hatches - spill pans and scuppers - alarms and instrumentation - co-ordination of operation signals			
9.2.7.7	Personnel on watch should be present at all times during operations and regularly carry out the inspections on the pollution-prevention procedures			
9.2.8	**States that the measures to be taken in the event of spillage, are:**			
9.2.8.1	Immediately report all relevant information to the appropriate officials when a spill is detected or when a malfunction has occurred which poses a risk of a spill;			
9.2.8.2	Promptly notify shore-based response personnel; and			
9.2.8.3	Properly implement shipboard spill-containment procedures			
9.2.8.4	Assists in implementing shipboard spill-containment procedures			
9.3	**SOPEP and SMPEP**	**R2,R3, R9**	**T1,T2,B1, B2, B3, B4,B10**	**A1,A11, A14**
9.3.1	States that, as per the MARPOL Convention, most tankers shall carry a Shipboard Oil Pollution Emergency Plan (SOPEP) and Shipboard Marine Pollution Emergency Plan for NLS (SMPEP)			
9.3.2	States in brief that the concept of the plan is to assist personnel in dealing with an unexpected discharge of oil and NLS			

TOPIC 9	POLLUTION PREVENTION			
Knowledge, Understanding and Proficiency		**IMO Reference**	**Text books Bibliography**	**Teaching aid**
9.3.3	States that the SOPEP equipments & SMPEP equipments consist as per SOPEP manual and SMPEP manual.			
9.3.3.1	The procedure to be followed to report a marine pollution incident is shown in the SOPEP manual and SMPEP manual.			
9.3.3.2	The list of authority or persons to be contacted in an event of a oil / NLS pollution incident is also listed in the SOPEP manual and SMPEP manual.			
9.3.3.3	Description of action to be taken by persons on board to control the discharge of oil / NLS is listed in SOPEP manual and SMPEP manual.			
9.3.3.4	The procedures and point of contact on the ship for coordinating shipboard action with national and local authority is also shown SOPEP manual and SMPEP manual.			

TOPIC 10	CASE STUDY			
Knowledge, Understanding and Proficiency		**IMO Reference**	**Text books Bibliography**	**Teaching aid**
Discusses case studies:				
10.1	**Fire and Explosion during unloading operations on an oil tanker**	**R2, R4**	**T1**	**A1, A11, A14**
10.2	**Collapsing of seamen during squeegeeing operations**	**R2, R4**	**T2**	**A1, A11, A14**

Part D: Instructor's Manual

■ Introduction

This manual reflects the views of the course designer on methodology and organization, and what is considered relevant and important in the light of his experience as an instructor. Although the guidance given here would be of value initially, the course instructors are advised to work out their own methods and ideas, refining and developing it further what is found constructive, and discarding ideas and methods which are not found effective.

The course Instructors should also bear in mind that preparation and planning constitute a major contribution to effective presentation of the course.

The instructor's manual provides guidance on the material that is to be presented during the course. The course material reflects the mandatory minimum requirements for the training and qualifications of officers and ratings on Oil and chemical tankers as specified in STCW Code Regulation V/1-1 paragraph 2.2 of the International Convention on Standards of Training, Certification and Watch keeping for Seafarers 1978, as amended.

The competences mentioned in the above mentioned STCW regulation, is broken down in the following topics reflecting, how the trainer should design their course and delivery and is for guidance only.

To show consistency and adherence to STCW 2010, as given in STCW Code Chapter V, Table A-V/1-1-1, a mapping is provided for easy reference in Part A of this Model course from STCW's competences and training outcomes to the topics covered in the IMO Model course 1.01:

1. Basic knowledge of Oil Tankers and Chemical Tankers
2. Physical and Chemical properties of Oil and Chemicals
3. Tanker Safety Culture and Safety Management
4. Hazards and their controls
5. Safety
6. Fire Safety and Fire Fighting operations
7. Cargo Operations
8. Emergencies
9. Pollution Prevention
10. Case Studies

The texts used as references throughout the course are given in Part A Course framework and are; Teaching Aids (A), IMO Reference Books (R), Text books (T), Bibliography (B) and Videos (V)

The course outline and timetable (the scheme of work and lesson plan will replace this word, when completed and inserted within this Model course) provide guidance on the time allocations for the course material, but the instructor is free to make adjustments as necessary. The detailed teaching syllabus must be studied carefully, and lesson plans or lecture notes compiled where appropriate.

It will be necessary to prepare material for use with overhead projectors or for distribution to trainees as handouts. Some sketches and diagrams are provided at the end of the guidance notes. These will provide examples of the kind of material, which is useful in supporting the presentation of the course.

Throughout the course it is important to stress that, aboard ships rules and regulations must be strictly observed and all precautions taken to maximise safety and minimize harmful effects to the environment.

Topics marked with an asterisk (*) could be better taught using a simulator IMO Model Course 2.06, Oil Tanker Cargo and Ballast Handling Simulator and IMO Model Course 1.37, Chemical Tanker Cargo and Ballast Handling Simulator provides detailed training programme for oil and chemical Tanker operations using specially created cargo handling exercises on a simulator.

■ Guidance Notes

Topic 1 Basic Knowledge of tankers (1.5 hours)

1.1 Types of Oil tankers (0.25 hours)

The trainees should have a general knowledge about the important stages in the development of tankers and oil shipping. This is a brief overview of the manner in which tankers carrying oil, petroleum and its products have developed over the years. “Safe Oil Tanker Operations”, B3 will provide sufficient information in respect to dates, the carriage of oil in barrels in conventional cargo ships, their development into tank- type vessels to carry oil in bulk and subsequent development into the modern forms.

The Important stages in the development of tankers and oil shipping are:
- carriage of oil in barrels in conventional cargo ships
- construction of vessels to carry oil in bulk
- use of longitudinal divisions and transverse bulkhead to form tanks
- location of machinery aft
- increase in size to VLCCs and ULCCs
- transportation of liquefied gas and chemicals in bulk
- pollution problems and explosion/fire hazard leading to international controls
- the development of SOLAS and MARPOL
- increasing use of training to improve safety and reduce pollution
- the STCW Convention and Chapter V of the Convention
- the development of double-hull tankers
- the implementation of the International safety Management (ISM) code

Simple diagrams similar to figure 1.1 B in Appendix 1, showing the introduction of longitudinal bulkheads to form tank spaces, the placing of machinery aft and the use of pump-rooms, would assist the Instructors in their presentation. Such diagrams and others as shown in figures 1.1 A to 1.1 D are also useful in showing present tanker forms. The list of the important stages in the development of tankers is given in Part D2, figure 1.1 A to 1.1 D

The trainees should be able to describe different types of Oil tankers such as Crude oil Carriers, Product Tankers, and Combination carriers.

Combination carriers include:
- Ships intended for separate carriage of oil and dry cargoes in bulk (notation: Bulk Carrier or Tanker for Oil)

- Ships intended for separate carriage of oil and ore in bulk (notation: Ore Carrier or Tanker for Oil)
- Combination of the two above, so-called OBO (Oil/Bulk/Ore carrier)
- The trainees should appreciate that combination carriers are subject to demanding duties, which mean that they **must be built, loaded and operated with keen attention.**

1.2 Types of Chemical tankers (0.25 hours)

The trainees should have a general knowledge about the important stages in the development of Chemical tankers and bulk chemical shipping. This is a brief view of the manner in which Chemical tankers and the bulk chemical shipping have evolved over the years.

The Important stages in the development of bulk chemical shipping are:
- sea transport of chemicals started with the chemical industries rapid growth in the years after World War II
- at first chemicals were transported in bottles or drums on dry cargo ships; larger quantities were shipped in bulk in the deep tanks on these ships
- as the world's demand for chemicals increased, the need for a new type of seagoing ship became evident
- the first chemical tankers were converted war-built American oil tankers (T2 tankers)
- conversion work usually included adding bulkheads to provide more and smaller tanks extending the line system
- installing additional cargo pumps the first conversion of this type was done in 1948 on the R.E. Wilson, of 9073 tons gross tonnage
- in addition to these converted, relatively big chemical carriers, smaller tankers specially designed and constructed for the carriage of "acids" – e.g. sulphuric acid, were built during the early 1950s, the cargo tanks of which were made of special alloy steel, strengthened for cargo densities up to 2.0 kg/1
- in order to carry chemicals of high purity and sensitive to contamination, coating techniques were developed for cargo tanks of mild steel
- the first real chemical tanker specially designed for the carriage of liquid chemicals in bulk was the Norwegian M/T Lind, delivered in 1960; this was the first tanker equipped with stainless-steel cargo tanks
- a modern chemical tanker has a large number of cargo tanks and is designed for carriage of a wide variety of cargoes
- the cargo-tank section on these modern ships is normally divided into some stainless steel tanks and some coated mild-steel tanks, each of which is normally equipped with deepwell pumps and a separate piping system.

Chemical tankers are required to transport a wide range of different cargoes, and many tankers are designed to carry a large number of segregated products simultaneously. The operation of chemical tankers differs from any other bulk liquid transportation operations, on a single voyage a large number of cargoes with different properties, characteristics and inherent hazards may be carried.

Moreover, in port several products may be handled simultaneously at one berth, typically including different operations such as discharge and loading as well as tank cleaning. Even the less sophisticated chemical tankers are more complex to operate than oil tankers.

Transportation of bulk chemicals by sea not only requires specialist ships and equipment, but also specialist crew training, in both theoretical and practical aspect for those involved, in order to understand the characteristics of the various chemicals and be aware of the potential hazards involved in handling them. A particularly important aspect of this requirement is the

provision of a data sheet, or cargo information form, giving details specific to a substance, which is required to be held on board whenever that substance is carried by the ship.

A modem chemical tanker is primarily designed to carry some of the several hundred hazardous products now covered by the IMO Bulk Chemical Codes. The following general types of chemical carriers have developed since the trade began:

Sophisticated parcel chemical tankers

Typically up to 40,000 tonnes deadweight with multiple small cargo tanks - up to 54 - each with an individual pump and a dedicated pipeline, to carry small parcels of high grade chemicals. These ships have a significant proportion of the cargo tanks made with stainless steel, allowing maximum flexibility to carry cargoes that need their quality safeguarded. The list of the important stages in the development of bulk chemical shipping is given in Part D 2, figure no. 1.2

Product / chemical tankers

Of similar size to parcel tankers but with fewer cargo tanks, mostly of coated steel rather than stainless, and less sophisticated pump and line arrangements. Such ships carry the less difficult chemicals, and also trade extensively with clean oil products.

Specialised chemical carriers

Small to medium sized ships, often on dedicated trades and usually carrying a single cargo such as an acid, molten sulphur, molten phosphorus, methanol, fruit juice, palm oil and wine. Cargo tanks are coated or stainless steel according to the trade.

1.3 Basic knowledge of Ship arrangements of an Oil tanker (0.5 hours)

The trainees should be able to demonstrate / explain with a sketch the general tank arrangements of an Oil tanker. Part D2 Fig.1.3A to 1.3E can be used as an aid to Instructors for displaying general tank arrangements, including:

- cargo tanks
- pump-rooms
- segregated ballast tanks
- slop tanks
- cofferdams
- peak tanks
- deep tanks
- The trainees should also be able to describe the piping arrangements of an oil tanker, including:
- internal piping in tanks and pump-rooms
- external piping (deck lines)
- crossovers
- by-passes
- ring-main systems
- direct piping systems
- valves

1.4 Basic knowledge of Ships arrangements of a chemical tanker (0.5 hours)

Tankers for carrying chemicals

This section deals with the design and arrangements of tankers involved in transportation of chemicals in bulk. It is essential for the further progress of the course that the trainees are familiar with the different types and arrangements of chemical tankers when they have completed this section of the course

General ship arrangement

The purpose of this lecture is to describe general arrangements of a chemical tanker; the essential message is that segregation and separation of cargoes are fundamental to the safety of a chemical tanker display diagrams from Appendix 1fig. 1.4 A and describe the general arrangements of a chemical tankers, its, cargo equipment, pipelines and cargo systems

Survival capability and tank location

The purpose of this lecture is to explain some of the considerations for the IMO grouping of chemical tankers and the relationship between ship-type requirements and the cargo carried it is essential to point out that a chemical tanker may have sections of its cargo tanks that provide different degrees of protection.

Cargo equipment and instrumentation

Tanks, piping and hoses

The purpose of this lecture is to describe generally the different tank types and the cargo area and systems for loading and unloading cargo and ventilating cargo tanks. The ship's cargo hoses are frequently a part of these systems, and it is therefore important to discuss correct handling of the hoses

Tank coatings and material of construction

The aim of this lecture is to familiarize the trainees with material of construction, coatings of cargo tanks and cargo piping on chemical tankers It should be emphasized that it is most important that stainless steel and tank coatings are handled correctly and that tank coating guides and maintenance instructions are strictly followed by ship's personnel

Pumps and educators

The purpose of this lecture is to describe common types of cargo pump found on chemical tankers It is also important that the safety aspects concerning the different types and arrangements of pumps are discussed and summarized

Cargo heating systems

The purpose of this lecture is to describe generally the different cargo heating systems. The safety aspects concerning their use should be discussed and summarized.

Tank-washing and slop-retaining systems

The purpose of this lecture is to describe generally the tank-washing and slop-retaining systems

Inert-gas systems

The purpose of this lecture is to explain the term 'inert gas', to describe the different types and uses of inert gas and to describe the arrangement of an inert-gas generator. It is important to call attention to the composition of inert gas produced in an inert-gas generator and the potential hazards that some of these constituent gases may pose.

Instrumentation

The main purpose of this lecture is to describe different gauging devices used in cargo tanks and to explain how the user of the device may be exposed to the cargo vapour. Necessary precautions to avoid this potential hazard should be discussed.

Topic 2 Physical and chemical properties of oil and chemicals (4.5 hours)

2.1 Basic physics (1.5 hours)

The purpose of this lecture is to familiarize the trainees with cargo properties of oil & chemicals and the terms that are used to describe them. The learning objective is by the end of the course the trainees should be able to read and understand the necessary data given in the ICS or other Cargo Data Sheets.

The physical properties of oil & chemical cargoes that are important in their containment, handling and transportation are explained and discussed.

Properties and terminology

At the end of the course the trainees should be able to define and explain the terminology and abbreviations commonly used on board oil and chemical tankers and in terminals. It is not considered necessary to spend the whole lecture going through a dictionary of terms, but the most commonly used trade terms should be explained and used intentionally during the course so that the trainees will become familiar to them.

It would be useful to discuss and explain some of the more complicated or technical terms or definitions, such as airlock, anesthetics, anti-static additive, auto ignition, boil-off, dangerous area, earthing, explosion-proof, flame screen, flammable, flammable range, flashpoint, gas-free, gas-free certificate, hot work, inert condition, petroleum, petroleum gas, pour point, pressure surge, purging, spontaneous combustion, static electricity, TLV and toxic vapour. There may be other terms or definitions which are not listed or which may require further elaboration; these can be added to the list or dealt with during presentations.

If the necessary apparatus is available, some or all of the tests to evaluate these properties can be demonstrated or carried out as a group exercise.

2.2 Basic chemistry, chemical elements and groups (1.5 hours)

The purpose of this lesson is to familiarize the trainees with the basic chemical symbols and structure and the properties of different cargoes and/or groups of cargoes. The instructor should start with a description of atoms and explain the periodic system and the periodic

table9reference Appendix 1, figures 2.1). A chemical reaction and the forming of simple molecules can then be explained, using the most common examples.

The hydrocarbon structure

The aim here is to try and keep things simple and avoid complication. The essential message is that petroleum is made up of several different hydrocarbon molecules with molecular weights (or molecular masses) ranging from light to heavy. Although the structure consists of hydrogen atoms linking into carbon atoms, for simplicity it is only necessary to mention carbon atoms at this basic level to present a picture of a whole range of petroleum molecules, with the lightest molecules (such as methane, propane and butane, which are gaseous at atmospheric pressure) containing only small numbers of carbon atoms, with of course, an appropriate number of linked hydrogen atoms.

As more carbon atoms (with an appropriate number of linked hydrogen atoms) are used to form the petroleum molecule, the molecule will become heavier and have a higher boiling temperature at atmospheric pressure.

As it leaves the well bore, the petroleum will comprise a whole range of molecules from light to heavy.

The lightest molecules, methane, are stripped off at the well head together with any earthy Solids, the remaining petroleum is termed CRUDE OIL The process of refining the crude oil will produce a number of FRACTIONS.
Each fraction will consist of a range of petroleum molecules, which at atmospheric pressure and temperature will be gaseous, liquid or solid.

2.3 Physical properties of oil and chemicals carried in bulk (1.5 hours)

Using teaching aids T1,T2 B2 and B4, the trainees should be able to explain basic definitions with reference to:

- flashpoint
- volatility
- upper flammable/explosive limit
- lower flammable/explosive limit
- auto-ignition temperature
- spontaneous combustion
- reactivity
- toxicity
- corrosivity

The instructors should, if possible, perform the following experiments to show the trainees:

- the determination of cargo temperature
- the determination of cargo density
- determination of colour of cargoes and use of a colour scale
- determination of flashpoint
- test for contamination by hydrocarbons
- test for contamination by chloride
- test for contamination by water

Topic 3 Knowledge and understanding of tanker safety culture and safety management (1.5 hours)

The Instructors can use the checklist of a company's SMS (Safety management system) as applicable (Sample copy appended as Fig. 3.0Appendix 1).

The Oil Companies International Marine Forum (OCIMF) has been in the forefront of the drive to implement a common vessel inspection process through the introduction of the Ship Inspection Report Exchange (SIRE) system. This system promotes a uniformly high standard of common inspections. Member companies can then use the results within their own vetting systems.

The management and operation of vessels within a culture of safety and environmental excellence was formalized with the introduction of the International Safety Management (ISM) Code. This Code requires vessel operators to implement a safety management system that will help them to achieve incident-free operations. However, there is a clear distinction between the standards of those vessel operators that embrace the spirit of the ISM code and those that aim to fulfil only its minimum requirements. This variability may result in a charterer with due-diligence concerns requires to re-assess the operational standards of individual vessel operators.

Poor safety culture is caused by poor management not ensuring that work morale commitment, communication, crew qualifications, training, procedures, equipment and other resources are sufficient and efficient to meet aims.

OCIMF's Tanker Management and Self Assessment (TMSA) programme was introduced in 2004 as a tool to help vessel operators assess, measure and improve their management systems. The second edition of the publication provides an update that builds on operators' experience with TMSA and feedback from the industry. Significantly, the scope has been expanded to encompass all tank vessel operators, including those managing coastal vessels and barges.

The programme encourages vessel operators to assess their safety management systems against listed key performance indicators and provides best practice guidance. Best practice is an effective way to minimize the possibility of problems reoccurring. It creates opportunities and optimizes performance in crucial areas such as safety and environmental excellence. Companies should aim to transfer best practices across their fleet through the consistent application of improved processes and procedures.

The trainees should be able to list the twelve self assessment elements as:

- leadership and accountability
- recruitment and management of shore-based personnel
- recruitment and management of ships personnel
- reliability and maintenance standards
- navigational safety
- cargo ballasting and mooring operations
- management of change
- incident investigation and analysis
- safety management
- environmental management
- emergency preparedness and contingency planning
- measurement, analysis and improvement

Topic 4 Hazards and their Controls (6 hours)

Topic 4.1 **Hazards** (3 hours)

The purpose of the lesson is to make the trainees aware of the contents of the Safety Data Sheets and make them able to read and understand the necessary data given in the ICS or other Cargo Data Sheets.

The following topics should be explained and discussed using a Cargo Data Sheet. The instructor should guide the trainees in extracting information from a Cargo Data Sheet relevant to the safe handling and transportation of cargo. The Data Sheet in Appendix1, figures-5.13A and 5.13B may be used for this purpose.

4.1.1 **Health hazards** (0.5 hours)

The purpose of the lesson is to identify the different types of health hazards posed by the cargoes on tankers.

The Instructors should identify the toxicity hazards of petroleum and its products as well as that for Chemicals using Reference B2, B4 which gives a rather thorough coverage of the health hazards from chemicals. Display the small hand books T1 and T2.

The small handbooks T1, and T2 cover the same topic in a simple manner for trainees at support level.

Toxic effects

There are many chemicals transported by sea that can be hazardous. However, in order for them to affect your health, they must contact the body or be absorbed into the body. When assessing the potential health effects from working with a particular material it is necessary to understand difference between "toxicity" and "hazard".

TOXICITY is the ability of a substance to produce an unwanted effect when the chemical has reached a sufficient concentration at a certain site in the body.

The more toxic a material is, the smaller the amount of it necessary to be absorbed before harmful effects are caused. The lower the toxicity, the greater the quantity of it necessary to be absorbed. The toxicity of a chemical is generally measured by experiments on animals (quite often rats). If it is measured in terms of the amounts of material necessary to cause death in 50% of the test animals. These values are called LD50 (lethal dose) or LC50 (lethal concentration), and are usually given in weight of material per kg of body weight or airborne concentration of material per set time period respectively.

HAZARD is the probability that this concentration in the body will occur.

Toxicity is an inherent property of the material. A material may be very toxic, but not hazardous, if it is handled properly and is not absorbed into the body. On the other hand, a material may have a very low toxicity, but be very hazardous.

4.1.2 **Environmental hazards** (0.5 hours)

Pollution should be defined and discussed by the Instructors. Trainees should be made aware that tankers are a major source of marine pollution. Various effects of pollution on the environment should be discussed.

Carriage of chemicals in bulk is covered by regulations in SOLAS Chapter VII - Carriage of dangerous goods and MARPOL Annex II - Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk.

Both Conventions require chemical tankers built after 1 July 1986 to comply with the International Bulk Chemical Code (IBC Code), which gives international standards for the safe transport by sea in bulk of liquid dangerous chemicals, by prescribing the design and construction standards of ships involved in such transport and the equipment they should carry so as to minimize the risks to the ship, its crew and to the environment, having regard to the nature of the products carried.

The basic philosophy is one of ship types related to the hazards of the products covered by the Codes. Each of the products may have one or more hazard properties which include flammability, toxicity, corrosivity and reactivity.

The IBC Code lists chemicals and their hazards and gives both the ship type required to carry that product as well as the environmental hazard rating.

Chemical tankers constructed before 1 July 1986 should comply with the requirements of the Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (BCH Code) – the predecessor of the IBC Code.

4.1.3 Reactivity hazards (0.25 hours)

The Instructors should give details of various reactivity hazards of a sample cargo. USCG compatibility chart can be referred to and trainees may be required to find out the compatible groups.

A chemical may react in a number of ways; with itself, with water, with air, with other chemicals or with other materials.

Self-reaction

The most common form of self-reaction is polymerisation. Polymerisation generally results in the conversion of gases or liquids into viscous liquids or solids. It may be a slow, natural process which only degrades the product without posing any safety hazards to the ship or the crew, or it may be a rapid, exothermic reaction evolving large amounts of heat and gases. Heat produced by the process can accelerate it. Such a reaction is called a run-off polymerisation that poses a serious danger to both the ship and its personnel. Products that are susceptible to polymerisation are normally transported with added inhibitors to prevent the onset of the reaction.

An inhibited cargo certificate should be provided to the ship before a cargo is carried. The action to be taken in case of a polymerisation situation occurring while the cargo is on board should be covered by the ship's emergency contingency plan.

Reaction with water

Certain cargoes react with water in a way that could pose a danger to both the ship and its personnel. Toxic gases may be evolved. The most noticeable examples are the isocyanates; such cargoes are carried under dry and inert condition. Other cargoes react with water in a slow way that poses no safety hazard, but the reaction may produce small amounts of chemicals that can damage equipment or tank materials, or can cause oxygen depletion.

Certain chemical cargoes, mostly ethers and aldehydes, may react with oxygen in air or in the chemical to form unstable oxygen compounds (peroxides) which, if allowed to build up, could cause an explosion. Such cargoes can be either inhibited by an anti-oxidant or carried under inert conditions.

Reaction with other cargoes

The materials used in construction of the cargo systems must be compatible with the cargo to be carried, and care must be taken to ensure that no incompatible materials are used or introduced during maintenance (e.g. by the material used for replacing gaskets). Some materials may trigger a self-reaction within the product. In other cases, reaction with certain alloys will be non-hazardous to ship or crew, but can impair the commercial quality of the cargo or render it unusable.

4.1.4 Corrosion hazards (0.25 hours)

Acids, anhydrides and alkalis are among the most commonly carried corrosive substances. They can rapidly destroy human tissue and cause irreparable damage. They can also corrode normal ship construction materials, and create a safety hazard for a ship. Acids in particular react with most metals, evolving hydrogen gas which is highly flammable. The IMO Codes address this, and care should be taken to ensure that unsuitable materials are not included in the cargo system. Personnel likely to be exposed to these products should wear suitable personal protective equipment

4.1.5 Explosion and flammability hazards (0.5 hours)

FLAMMABILITY

When petroleum or a chemical is ignited, it is the gas progressively given off by the liquid which burns as a visible flame. The quantity of gas available to be given off by a liquid depends on its volatility which is frequently expressed for purposes of comparison in terms of Reid vapour pressure. A more informative measure of volatility is the true vapour pressure but unfortunately this is not easily measured.

Vapours can be ignited and will burn only when mixed with air in certain proportions. If there is too little or too much vapour the mixture cannot burn. The limiting proportions, expressed as percentage by volume of petroleum gas in air, are known as the lower and upper flammable limits. They vary amongst the different possible components of chemical vapours. For the gas mixtures from the petroleum liquids encountered in normal tanker practice the overall range is from a minimum lower flammable limit of

about 1 % gas by volume in air to a maximum upper flammable limit of about 10% gas by volume in air. For Chemicals the LFL and UFL vary enormously and must be checked from its MSDS sheets prior loading.

The Instructors should sketch and explain the flammability diagram for oil and chemicals separately showing the differences in LFL and UFL. The trainees should also be explained that some chemicals may have oxygen inherently in its compound and may be flammable and needs to be loaded with padding.

4.1.6 Sources of ignition, including electrostatic hazards (0.5 hours)

The Instructors should explain with a fire triangle stating that one side which can be controlled to prevent or put off a fire may be the source of ignition. The following are major sources of ignition.

- direct heat from a flame light, spontaneous combustion, Auto ignition etc.
- mechanical sparks from frictional sparks when chipping or scraping.
- chemical energy from aluminum in contact with steel
- electrical energy from electrical sparks
- electrostatic discharge

Static electricity presents fire and explosion hazards during the handling of petroleum, and tanker operations. Certain operations can give rise to accumulations of electric charge which may be released suddenly in electrostatic discharges with sufficient energy to ignite flammable hydrocarbon gas/air mixtures; there is, of course, no risk of ignition unless a flammable mixture is present. There are three basic stages leading up to a potential static hazard: charge separation, charge accumulation and electrostatic discharge. All three of these stages are necessary for an electrostatic ignition.

4.1.7 Toxicity hazards (0.25 hours)

General concepts and effects of toxicity

The toxic effects should be dealt with at some length to ensure that the trainees have a good appreciation of the dangers and hazards due to oil, and chemicals.

Acute poisoning occurs when a large dose is received by exposure to high concentrations of a short duration, i.e. a single brief exposure. Chronic poisoning occurs through exposure to low concentrations over a long period of time, i.e. repeated or prolonged exposures. Toxicity is objectively evaluated on the basis of test dosages under controlled conditions, and expressed as threshold limit values (TLVs).

Threshold Limit Value (TLV) means the "Time Weighted - Average (TWA)" concentration of a substance to which it is believed workers may be repeatedly exposed, for a normal 8 hour working day and 40 hour working week, day after day, without adverse effect. It may be supplemented by other limits.

Prevention of exposure is achieved through a combination of cargo containment, which prevents toxic fumes or liquid from contaminating the workplace, and the use of personal protective equipment (PPE).

To ensure safety on board one must adhere to the following points:

- knowledge,
- training and
- strict routine.

It is a clear responsibility for the Owner, the master and the officers to inform their personnel about the cargoes to be carried, safety procedures etc and to arrange for the proper training.

Information should be given partly in the form of written notices combined with informal meetings with the entire crew present when new cargoes are to be loaded or when inexperienced personnel are to be signed on. Among other things the following information should be given:

i. Cargoes to be loaded; their characteristics as regards handling, pumping, toxicity, corrosiveness, first aid etc.
ii. The cargo loading plan to be posted in places where it will be clearly seen by everyone on board and at the accommodation ladder, when in port.
iii. Post cargo information cards for products to be loaded or are contained on board. For "new" products ask the shipper for safety brochures and leaflets.
iv. the personal safety equipment to be used by those involved in cargo handling, pumping, sampling etc.
v. Have available on board literature on chemical cargoes, medical advice etc,
vi. Inform in particular if the cargo to be loaded has an odour threshold which is higher than the TLV-value. Of, and that danger cannot always be sensed in advance (e g. carbon tetra chloride, ethylene dichloride etc).
vii. Most hydrocarbon vapours are heavier than air and have a tendency to accumulate in lower spaces.

Therefore work below gratings in pump rooms, cofferdams, pipe tunnels etc is extra dangerous.

viii. Never take work clothes into your cabin! Soiled clothes must be washed before being used again or in the case of toxic products, destroyed.
ix. Wash your hands before meals!
x. Give information about fire fighting methods for each type of cargo on board.
xi. Give information if the cargo is water-reactive or reactive to other cargoes on board. Give information on segregation required.
xii. For some very toxic cargoes mouth to mouth artificial breathing might be dangerous to the rescuer (e.g. acrylonitrile, acetone etc).
xiii. Information must be given particularly if the cargo danger lies primarily in vapour inhalation (e.g. acrylonitrile, trichloroethylene) or skin contact (e.g. phenol, caustic soda, sulphuric acid).
xiv. State where eye washing bottles are located (deck office, at cargo manifolds on deck, in pump rooms, on fore deck etc).
xv. Insist on that nobody should work with cargo gear without anyone standing by. Have people report when going to and returning from pump rooms!
xvi. Give information if any cargo is so toxic that an escape breathing mask must be used in an emergency.

4.1.8 **Vapour leaks and clouds** (0.25 hours)

Reference is made in part C which is adequate.

Topic 4.2 Basic knowledge of hazard controls (3 hours)

4.2.1 Inerting, water padding, drying agents and monitoring techniques (0.5 hours)

Reference is made in part C which is adequate.

4.2.2 Anti-static measures (0.5 hours)

(More information will be available from references B2, B4, ISGOTT, ICS Chemical safety guide)
The most important counter measure that must be taken to prevent an electrostatic hazard is to bond all metal objects together. Bonding eliminates the risk of discharges between metal objects, which can be very energetic and dangerous. To avoid discharges from conductors to earth, it is normal practice to include bonding to earth (earthing or grounding).

On ships, bonding to earth is effectively accomplished by connecting metallic objects to the metal structure of the ship, which is naturally earthed through the sea. Some examples of objects which might be electrically insulated in hazardous situations and which must therefore be bonded are:

- Ship/shore hose couplings and flanges if more than one length of non-conducting hose or pipe is used in a string.
- Portable tank cleaning machines.
- Conducting manual ullaging and sampling equipment.
- The float of a permanently fitted ullage device if it lacks an earthing path through the metal tape.

The most certain method of bonding and earthing is by means of a metallic connection between the conductors. This method should be used whenever possible, although for electrostatic purposes an adequate bond can in principle be made using a material of intermediate conductivity. Certain objects may be insulated during tanker operations, for example:

- a metal object such as a can floating in a static accumulating liquid
- a loose metal object while it is falling in a tank during washing operations

Every effort should be made to ensure that such objects are removed from the tank, since there is evidently no possibility of deliberately bonding them. This necessitates careful inspection of tanks, particularly after shipyard repairs.

4.2.3 Explains why ventilation system are provided on oil and chemical tankers (0.25 hours)

The Ventilation exhaust ducts from gas-dangerous spaces should discharge upwards in locations at least 10 m in the horizontal direction from ventilation intakes and openings to accommodation, service and control station spaces and other gas-safe areas.

Ventilation intakes are so arranged as to minimize the possibility of recycling hazardous vapours from any ventilation discharge opening. The Ventilation ducts are not to be led through engine-rooms, accommodation, working spaces or other similar spaces.

Ventilation fans should be approved by the Administration for operation in explosive atmospheres when flammable cargoes are carried aboard the ship.

The VOC Plan describes the specific arrangement, operations and conditions onboard a crude oil tanker with respect to the emission and ability to control VOC emissions. This VOC Plan is not a safety guide and reference should be made to other publications to evaluate safety hazards. The aim of the VOC Plan is to identify the arrangements and equipment required to enable compliance with MARPOL 73/78 regulation 15.6 of the revised Annex VI and to identify for the ship's officers all operational procedures for VOC emission control.

4.2.4 Cargo segregation (0.25 hours)

Cargoes, residues of cargoes or mixtures containing cargoes, which react in a hazardous manner with other cargoes, residues or mixtures, shall be segregated from such other cargoes by means of a cofferdam, void space, cargo pumproom, pump-room, empty tank, or tank containing a mutually compatible cargo; have separate pumping and piping systems which shall not pass through other cargo tanks containing such cargoes, unless encased in a tunnel; and have separate tank venting systems.

In some countries a cruciform joint may be accepted as a double barrier for the purpose of segregation as:
- between mutually reactive cargoes;

The relevant compatibility regulations of certain Administrations may be required to be observed. If cargo piping or cargo ventilation systems are to be separated, this separation may be achieved by the use of design or operational methods. Operational methods shall not be used within a cargo tank and shall consist of one of the following types:
- removable spool-pieces
- Blank flanges at both ends of the pipeline.

4.2.5 Cargo inhibition (0.25 hours)

For the requirements of Cargo Inhibition of some cargoes, polymerization is the process of forming a polymer by combining large numbers of chemical units or monomers into long chains. Polymerization can be used to make some useful materials. However, uncontrolled polymerization can be extremely hazardous. Some polymerization processes can release considerable heat, can generate enough pressure to burst a cargo tank or can be explosive.

Some chemicals can polymerize on their own without warning. Others can polymerize upon contact with water, air or other common chemicals. Inhibitors are normally added to products to reduce or eliminate the possibility of uncontrolled polymerization. Most MSDS have a section called "Hazardous Polymerization" which indicates whether hazardous polymerization reactions can occur, an inhibited cargo certificate should be

provided to the ship before a cargo is carried. The action to be taken in case of a polymerization situation occurring while the cargo is on board should be covered by the ship's emergency contingency plan.

4.2.6 **Importance of cargo compatibility** (0.5 hours)

Leakages through bulkheads occur at times in any tanker. Normally, however, such leakages are only minor seepages. They will not cause any violent reaction due to the great disproportion in mixture from dangerous proportions. The cargo tanks are to be gauged daily to ensure that there are no inter tank leakages. In case the ullage in any tank is found to be increasing, the cause is to be investigated. If it is due to a leakage, the space into which the cargo is going must be identified. The space must be checked for compatibility of the tank material with the cargo. Any other cargo tank where this cargo may be transferred has to be identified. The leaking tank must be transferred to such a tank. It is necessary for the ship master before taking such a decision to consider all other options and in case it is not possible to transfer the cargo to compatible tanks, the cargo MSDS must be referred to and methods to reduce the potential of the cargo to cause damage to the vessel must be worked upon. The contaminated cargo must be transferred separately into another tank, if available. No cargo shall be pumped overboard except as mentioned in case to save life or ship and all options have been considered by the ship master only then jettisoning cargo can be considered.

4.2.7 **Atmospheric control** (0.5 hours)

The section is intended to provide the trainees with the best possible understanding of different safety aspects and of the necessity of safe working routines on board.

It is important that the instructor when dealing with this topic states that considerations are to be made even for

- *Accommodation and*
- Precautions *against fire*

When dealing with tank atmospheric control if cargo venting is involved

4.2.8 **Gas Testing** (0.25 hours)

Oil tankers using an inert gas system should maintain their cargo tanks in a non-flammable condition at all times.

Tanks should be kept in an inert condition at all times, except when it is necessary for them to be gas free for inspection or work, i.e. the oxygen content should be not more than 8% by volume and the atmosphere should be maintained at a positive pressure.

The atmosphere within the tank should make the transition from the inert condition to the gas free condition without passing through the flammable condition. In practice, this means that before any tank is gas freed, it should be purged with inert gas until the hydrocarbon content of the tank atmosphere is below the critical dilution line.

When a ship is in a gas free condition before arrival at a loading port, the tanks must be inerted prior to loading.

In order to maintain cargo tanks in a non-flammable condition the inert gas plant will be required to:

- *Inert empty cargo tanks*
- *Be in operation during cargo discharge, deballasting, crude oil washing and tank cleaning*
- *Purge tanks prior to gas freeing*
- *Top-up the pressure in the cargo tanks when necessary during other stages of the voyage. The Instructors must must emphasize that the protection provided by an inert gas system depends on the proper operation and maintenance of the entire system.*

4.2.9 Understanding of Information on Material Safety Data Sheet (MSDS) (0.5 hours of Practical session)

The instructors should explain the trainees that MSDS is a document containing important information about a hazardous chemical (which may be a hazardous substance and/or dangerous good) and must state:

- a hazardous substance's product name
- the chemical and generic name of certain ingredients
- the chemical and physical properties of the hazardous substance
- health hazard information
- precautions for safe use and handling

The MSDS provides us with the necessary information to assist in safely managing the risk from hazardous substance exposure.

It is important that everyone in the workplace knows how to read and interpret a MSDS.

Topic 5 SAFETY (6 hours)

5.1 Functions and proper uses of gas-measuring instruments

Gas measuring instruments (1 hour of Practical session)

The instructors should demonstrate the functions and proper uses of gas-measuring instruments. Although different Models/make/type may have different methods of operation, the basic remains the same. For the purpose of training any type / model available in the training centre (Reference - A4, A5, A6, A7,A8,,A9) should be used for this practical session.

Trainees should be given an adequate amount of hands on experience in using

- Portable oxygen meter
- Portable combustible-gas detector
- Portable tankscope / Multi point flammable gas (infra- red gas analyzer)
- Portable toxic-gas detector & chemical absorption tubes
- Portable multigas – detector
- Personal multigas – detector)

5.2.1 Proper use of breathing apparatus and tank-evacuating equipment (0.5 hours)

Experience has shown that the rescue of persons from within an enclosed space can be extremely hazardous and especially so in cases of oxygen deficiency. These risks are heightened where access to a compartment can only be achieved with difficulty.

In such circumstances, it is vital that rescuers always pay strict attention to the correct procedures and the use of proper equipment and do not rush into ill-considered action. Many fatalities have resulted from failure to comply with these basic rules. For training purposes, full-scale exercises in non-hazardous atmospheres have been found extremely beneficial. Exercises involving weighted dummies, with rescuers wearing protective equipment and breathing apparatus, are essential if rescue teams are to be properly prepared for a real emergency. Such simulations are often conducted by ship's personnel. They can also involve terminal employees and shore based emergency services such as the fire brigade. A9 can be used to conduct a simulated training, include the use of SCBA (Reference A3).

5.2.2 Proper use of Protective clothing and equipment (0.5 hours)

The instructors should note that it is recommended that the trainees should be drilled in the use of:

- self-contained compressed-air breathing apparatus
- EEBD
- a complete set of safety equipment
- tank evacuating equipment

Trainees should be made familiar in the use of protective clothing and equipment. All recommended PPE must be shown for demonstration purpose (Video / CBT can be used instead of physical equipments)

5.2.3 Proper use of Resuscitators (0.25 hours)

Trainees should be drilled in the use of resuscitation equipment (A2).

5.2.4 Proper use of Rescue and escape equipment (0.25 hours)

Pump-rooms have permanent arrangements for hoisting an injured person with a rescue line. Timely evacuation and resuscitation may save lives.

5.3 Basic knowledge of safe working practices and procedures in accordance with legislation and industry guidelines relevant to oil and chemical tankers. (0.5 hours)

The Instructors should make use of appropriate check list and conduct exercises using the code of safe working practices for merchant seamen emphasize that no person is permitted to enter any enclosed space as defined (cargo tank, cofferdam, double bottom tank, etc) unless authorized by the Master, who has ensured that the required

checks have been carried out before passing these compartments as safe for entry. An enclosed space entry permit must be completed in every case.

Pre entry tests must be carried out, any reading of not more than 1% LFL from flammable vapour and 0 ppm for toxic vapour, taken on an approved gas measuring meter, only shall be considered safe for entry.

Entry permits may be made for multi cargo tank entries, however, tanks which are not entered and worked within four hours of the initial test, must be retested and a new permit issued. It is therefore advisable to only test smaller groups of tanks at one time, e.g. only test as many as can be worked in a four-hour period. However, at no given time shall a permit be granted for entry into more than six tanks.

5.3.1 Precautions to be taken when entering Enclosed spaces

Entry into a space that is not gas free or does not contain 21% Oxygen shall only be permitted in cases of an emergency or for unavoidable operational requirements. (0.25 hours)

The number of persons entering the tanks shall be kept to a minimum required, but will normally be at least two, each wearing the appropriate PPE.

A stand by team and additional appropriate PPE equipped with the required rescue equipment shall be available outside the enclosed space in which entry has been made.

If entry is absolutely required without the tanks being gas free, or with the presence of gas in a tank for operational requirement following shall be completed prior to undertaking such an operation:

- Risk assessment and hazard identification.
- Plan for work including briefing the concerned personnel on the required precautions, proper techniques, PPE requirement & training.
- Emergency response plan shall be prepared in advance and approved by the Master.
- Suitable breathing apparatus, protective clothing and other equipment required for such entry shall be used by the persons entering the tank.

(Only persons suitably trained and capable of dealing with any unexpected event that may be encountered in the tank shall be sent for such an entry after making the supporting team stand by on the scene to assist the personnel in an unlikely event of an incident.)

5.3.2 Precautions to be taken before and during "repair and maintenance" work in a gas dangerous area. (0.25 hours)

The use of appropriate PPE is mandatory to protect the crew against the various hazards.

Monitoring and evaluation of spaces adjacent to cargo tanks for vapour content must be carried out at regular intervals.

In case of a doubt on the integrity of cargo tank, the adjacent spaces also to be monitored and logged for toxic gases / cargo vapours.

If gas concentrations are observed, repairs and maintenance work must be stopped when working in the concerned area. Additionally, the cause of the presence of gas concentration must be investigated into and the same eliminated. Other adjoining spaces must be checked for similar defects.

5.3.3 **Safety measures for hot and cold work** (0.25 hours)

The Instructors should explain the trainees that the checks carried out for hot and cold work by Officer responsible for Safety are:

- Oxygen is 21% by volume
- tests with a combustible gas indicator show not more than 1% LFL.
- Adequate fire-fighting equipment must be laid out and be ready for immediate use.
- Fire-watch procedures must be established for the area of hot work, and in adjacent, non-inerted spaces where the transfer of heat, or accidental damage, may create a hazard e.g. .damage to hydraulic lines, electrical cables, thermal oil lines etc. Monitoring should be continued for sufficient time after completion of hot work.
- Effective means of containing and extinguishing welding sparks and molten slag must be established.
- The work area must be adequately and continuously ventilated. The frequency of atmosphere monitoring must be established. Atmospheres should be re-tested after each break during work periods, and at regular intervals. Checks should be made to ensure there is no ingress of flammable vapours or liquids, toxic gases or inert gas from adjacent or connected spaces.

5.3.4 **Electrical safety precautions** (0.25 hours)

The instructors should make the trainees aware that the safety precautions that needs to be ensured are:

- That electrical supply connections are made in a gas free space;
- That existing supply wiring is adequate to carry the electrical current demanded without overloading, causing heating;
- The insulation of flexible electric cables laid across the deck is in good condition;
- The cable route to the worksite is the safest possible, only passing over gas free or inerted spaces; and
- The earthing connection is adjacent to the work site with the earth return cable led directly back to the welding machine.

5.3.5 **Ship/shore safety checklist** (1.5 hours)

Ship / shore liaison

The essential message of this lecture should be that safety regulation, good communication and the best possible co-operation between ship and terminal are fundamental to the safety of personnel and material when alongside a terminal.

The routines and responsibilities of personnel on watch should be elucidated and discussed. Information related to this section can be obtained from references B1.

5.4 Basic knowledge of first aid with reference to a Material Safety Data Sheet (MSDS) (1.5 hours for practical session)

The IMO Codes require the MSDS (Material Safety Data sheets) for the oil and NLS cargoes should be on board and the information should be available to every ship and for each cargo.

The master and all those concerned should use the data sheet and any other relevant information to acquaint themselves with the characteristics of each cargo to be loaded. If the cargo to be loaded is a mixture, information on the composition of the mixture should be sought; First aid for inhalation, absorption and ingestion are available on each MSDS, special notes should be made for any contaminants that may be present in the cargo, e.g. water. MFAG (Medical First Aid guide is also to be consulted for Chemical Cargoes. MSDS sheets must be placed at various spaces frequented by the ship's staff so as to enable them to familiarize themselves with the cargo. Training and drills especially fire fighting carried out, additionally prepare the fire response organization to become familiar with their duties and equipment and to respond to emergencies in a timely and correct manner.

Topic 6Fire Safety and Fire fighting operations (4.5 hours)

Specialized fire-extinguishing appliances

As all trainees would have attended a fire-fighting course prior gaining eligibility for this course, the instructors would only need to stress on specialized fire-fighting appliances and the need to conduct frequent drills applicable to tankers. Figure 5.1 of Appendix 1 can be used as reference.

6.1 Oil and Chemical Tanker fire response organization and action to be taken (1.5 hours)

On any vessel, especially Oil and Chemical Tankers, emergencies may have catastrophic consequences, unless proper action is taken. Actions therefore, must be prompt, timely and adequate. Any fire drills carried out with shore establishments shall be taken positively and the Master must take full advantage of this situation to learn from the exercise, a de-briefing of the crew must be carried out and lessons learnt from such drills pointed out.

Use of maxim "Find, Inform, Restrict and Extinguish" techniques in attending to a fire emergency.

6.2 Fire hazards associated with cargo handling and transportation of hazardous and noxious liquids in bulk (1.5 hours)

- The fire hazards associated with Noxious Liquid substances (NLS) are : Some cargoes give out oxygen when on fire, thereby supporting the fire.

- Some chemical fires, the source of ignition may be heat from a reaction within the cargo itself or through mixing with other chemicals.
- Chemicals miscible in fire will render normal foam useless. For such chemicals alcohol resistant or dual-purpose foam shall be used.
- Some chemicals are miscible in water and hence their presence may not be recognized.
- Some chemicals are heavier than water and insoluble in water. These may be smothered using water.
- Some chemicals evolve large volumes of toxic vapours when heated.
- Some chemicals have a low auto-ignition temperature. There is a risk of re-ignition of these chemicals

6.3 Fire-fighting agents used to extinguish oil and chemical fires (0.5 hours)

The fire fighting agents are: Water is the most common cooling agent. This is largely because water possesses very good heat absorbing qualities and is available in sample quantities at terminals and on ships Foam is an aggregation of small bubbles, of lower specific gravity than oil or water, which flows across the surface of a burning liquid and forms a coherent smothering blanket. It will also reduce the surface temperature of the liquid by the absorption of some heat.

- Carbon dioxide is an excellent smothering agent for extinguishing fires, when used in conditions where it will not be widely diffused. Carbon dioxide is therefore effective in enclosed areas such as machinery spaces, pumprooms and electrical switch rooms where it can penetrate into places that cannot be reached by other means.
- Dry chemical powder is discharged from an extinguisher as a free flowing cloud. It is most effective in dealing with a fire resulting from an oil spill on a jetty or on the deck of a chemical tanker and can also be used in confined spaces. It is especially useful on burning liquids escaping from leaking pipelines and joints
- Alcohol-resistant foam extinguishing agents possess low-expansion properties and are adaptable to various low expansion foam generators. Alcohol-resistant foam extinguishing agents may be used in chemical tankers where water-soluble flammable liquids such as alcohol, ester, ether, aldehyde, ketone, and organic acids

6.4 Fixed Fire fighting Foam system operations (0.25 hours)

The lines were foam Mains for foam solution or concentrate are provided the lines should have a number of accessible take off (hydrant) points, which should be spaced not more than two or three standard hose lengths apart. The take off (hydrant) points generally consist of a header fitted with two outlets individually valved and fitted with a fire hose connection suitable for the particular type of fire hose coupling in use locally. Isolating valves should be fitted so as to maintain the integrity of the line in the event of fracture. Suitable pipeline drain valves and wash out facilities should be provided. A foam solution pipeline of this type should cater for a design minimum of 115 cubic metres/hour of solution. Foam concentrate can be distributed through a smaller bore pipe system to the tanks supplying the inductors of fixed or mobile foam making appliances. Fixed pipelines for generated (aerated) foam are of limited value owing to pressure losses in the system and lack of projection.

Large capacity monitors would normally be on a fixed mounting. Minimum requirements for monitor operations are a jet length of 30 metres and a jet height of 15 metres in still air.

Describes Foam Mains

Where pipelines for foam solution or concentrate are provided and the lines should have a number of accessible take off (hydrant) points which should be spaced not more than two or three standard hose lengths apart. The take off (hydrant) points generally consist of a header fitted with two outlets individually valved and fitted with a fire hose connection suitable for the particular type of fire hose coupling in use locally. Isolating valves should be fitted so as to maintain the integrity of the line in the event of fracture. Suitable pipeline drain valves and wash out facilities should be provided. A foam solution pipeline of this type should cater for a design minimum of 115 cubic metres/hour of solution. Foam concentrate can be distributed through a smaller bore pipe system to the tanks supplying the inductors of fixed or mobile foam making appliances. Fixed pipelines for generated (aerated) foam are of limited value owing to pressure losses in the system and lack of projection

6.5 Portable fire-fighting foam operations (0.25 hours)

Applicator Foam

Medium expansion foam is used for Applicator foam. It has an expansion ratio from about 15:1 up to 150:1. It is made from the same concentrates as high expansion foam, but its aeration does not require a fan. Portable applicators can be used to deliver considerable quantities of foam on to spill fires, but their throw is limited and the foam is liable to be dispersed in moderate winds.

Foam applicators are a supplement to the foam monitors. Sheltered areas not reachable by the foam monitors can be covered by a foam applicator. This gives increased flexibility. Different applicators are available, covering varying needs for proportioning ratio, Typically, an applicator needs to be supplied with a fire hose and a foam concentrate container and is stored in a foam station.

6.5.2 Describes Applicator foam systems

Medium expansion foam is used for applicator foam. It has an expansion ratio from about 15:1 up to 150:1. It is made from the same concentrates as high expansion foam, but its aeration does not require a fan. Portable applicators can be used to deliver considerable quantities of foam on to spill fires, but their throw is limited and the foam is liable to be dispersed in moderate winds. Foam applicators are a supplement to the foam monitors .Sheltered areas not reachable by the foam monitors can be covered by a foam applicator. This gives increased flexibility. Different applicators are available, covering varying needs for proportioning ratio, Typically, an applicator needs to be supplied with a fire hose and a foam concentrate container and is stored in a foam station

6.5.3 Describes portable foam fire extinguishers

A **fire extinguisher, flame extinguisher**, or simply an **extinguisher**, is an active fire protection device used to extinguish or control small fires, often in emergency

situations. It is not intended for use on an out-of-control fire, Applied to fuel fires as either an aspirated (mixed & expanded with air in a branch pipe) or non aspirated form to form a frothy blanket or seal over the fuel, preventing oxygen reaching it. Unlike DCP, foam can be used to progressively extinguish fires without flashback.

- AFFF (aqueous film forming foam), used on A and B fires and for vapour suppression. The most common type in portable foam extinguishers. It contains fluoro tensides
- AR-AFFF (Alcohol-resistant aqueous film forming foams), used on fuel fires containing alcohol. Forms a membrane between the fuel and the foam preventing the alcohol from breaking down the foam blanket.
- FFFP (film forming fluoroprotein) contains naturally occurring proteins from animal by-products and synthetic film-forming agents to create a foam blanket that is more heat resistant than the strictly synthetic AFFF foams. FFFP works well on alcohol-based liquids and is used widely in motorsports.

6.6 **Explains Fixed dry chemical system operations** (0.25 hours)

Dry chemical powder is discharged from an extinguisher or a fixed installation as a free flowing cloud. It is most effective in dealing initially with a fire resulting from an oil or chemical spill on a jetty or on the deck of a tanker but can also be used in confined spaces. It is especially useful on burning liquids escaping from leaking pipelines and joints. It is a non-conductor and therefore suitable for dealing with electrical fires. It must be directed into the flames. Dry chemical powder has a negligible cooling effect and affords no protection against re ignition, arising, for example, from the presence of hot metal surfaces.

Certain types of dry chemical powder can cause a breakdown of a foam blanket and only those labelled 'foam compatible' should be used in conjunction with foam. Dry chemical powder clogs and becomes useless if it is allowed to become damp when stored or when extinguishers are being filled.

Piping Arrangements for DCP fire fighting systems of a chemical Tanker

A fire-extinguishing unit with two or more monitors, hand hose lines or a combination thereof should have independent pipes (with a manifold at the powder container), unless a suitable alternative means is provided to ensure proper performance. Where two or more pipes are attached to a unit, the arrangement should be such that any or all of the monitors and hand hose lines capable of simultaneous or sequential operation at their rated capacities. at their rated capacities. Where fixed piping is provided between the powder container and a hand hose line or monitor, the length of piping should not exceed that length which is capable of maintaining the powder in a fluidized state during sustained or intermittent use, and which can be purged of powder when the system is shut down.

6.7 **Spill containment in relation to fire-fighting operations** (0.25 hours)

The actions to be taken in case of a oil/chemical spillage and pool fire are:

- Prompt initiation of the ESD will do much to limit the amount of liquid spilled and because of the fish plate, restrict the overflow of cargo overboard.
- restrict sources of ignition to ignite the vapour
- Foam gently spread over the pool fire will smother and restrict it from spreading.

- Jets of water should never be directed onto burning liquid, as this will cause a violent increase in flame and shall spread the fire.
- When contained in drip trays, the liquid may also be spilled onto the deck and water-jet should therefore be avoided.
- Wear full protective clothing and take advantage of water spray protection.

Topic 7 Cargo Operations (7.5 hours)

General awareness of safe cargo operational procedures on tankers

The lecturers should have in mind that a trainee is to be capable of assisting during cargo operations on board, and may be part of the Watch keeping team in port. The aim is therefore to make the trainees familiar with operational sequences. The duties and responsibilities of personnel on watch during operations should also be focused upon in this connection.

For oil tankers

This section covers an introduction to the operation of oil tankers and is divided to address the following topics:

Loading, loaded voyage, unloading, ballast voyage, tank cleaning, crude oil washing, use of inert gas, purging and gas-freeing, tank cleaning and gas freeing for repairs.

For chemical tankers

This section covers an introduction to the operation of chemical tankers and is divided to address six topics:

Cargo information, cargo planning, loading, unloading, tank cleaning and gas freeing, slops and stops disposal.
The purpose of the lessons under this section is to give the trainees a general explanation of the different sequences in cargo, ballast and slop-handling operations and to show how these are linked together.

The cargo-handling, tank- cleaning, and slop-handling operations can be explained to the trainees by using schematic drawings as found in figures Appendix 12 Fig. 7.1A and also use Simulator photographs appended therein.

(For this section the training may preferably be carried out on an oil and chemical simulator.)

7.1 For oil tankers (1.0 hour)

7.1.1 *Cargo Information* (0.5 hour)

Such information may be found in MSDS for Oil cargoes supplied by shippers and Cargo Data Sheets published by ICS for Chemical cargoes. These sheets include all necessary data for the safe handling and carriage of the cargo

7.1.2 *Loading* (0.5 hour)

Safety Confirmations and Clearance:

- Once the Chief Officer is satisfied that all preparations have been made in accordance with the cargo oil loading plan and the shore facility representative has confirmed that

the facility is ready to load cargo, he may order the opening of the designated manifold valves and loading operation to commence in accordance with the loading plan.

- Commence loading at reduced rate (to avoid static generation), watching the manifold back pressure at all times.

- The first loading tank shall be documented in the 'Tanker Cargo Log Book' and the number should be restricted to a minimum.

- Ullage confirmation shall be carried out to confirm cargo oil flowing as planned into the designated cargo tank.

- In case of heated cargo, confirmation of temperature of cargo is as per agreed value and within the Charterer's instruction. Also, the loaded cargo temperature shall be within the vessel's design criteria (of valve / tank coating limitations)

- Only after receiving reports of all safety checks confirmed from all stations of deck / pump room watch and the chief officer may open other loading tanks and carefully increase the loading rate. Close watch of the manifold back pressure shall be maintained, until completion of settling down of final maximum agreed loading rate.

- Close communication to be kept with shore side, until all parameters have stabilized.

- Loading cargo tanks IG back pressure shall be adjusted to maintain slight positive, at all times. The same shall be monitored, for any change.

Deck Watch and Personnel Arrangement

- The deck watch shall check for oil leaks in the cargo area throughout the cargo oil loading operation.

- At the beginning of the operations, confirm that no oil leaks from piping joints and that no oil in flowing into tanks other than the tank being loaded.

- Keep continuous monitoring of the Oil Level of the loading tanks, until settling down of shore flow rate. Also, monitor other tanks (unused) for any change in the level.

- After reaching the desired full loading rate and confirmation reports have been received from all stations at deck / pump room watch, (including the cargo piping and sea surface around the vessel) the Chief Officer may dismiss the off duty crew and revert to the routine Watch Schedule

- During loading operations, monitor the manifold back pressure, especially when changing over the valves / tanks

Leakage Monitoring System

Cargo leakage, however small shall be paid attention to at an early stage of operations. Leakages from piping system, joints and valves shall be monitored. Tanks not being loaded shall be monitored to ensure that no oil is flowing into tanks other than the loading tanks.

During loading operations, watch oil loading pressure all the time, and monitor portions where oil is likely to leak. Excessive vibrations on piping systems must be attended to immediately.

Cargo Loading Rates:

a) General

The vessel's maximum loading rate and maximum venting capacity must be posted in the cargo control room giving details of the rates for homogenous(entire the vessel), Group-by-group and Tank-wise loadings.

Such information, based on calculations, shall assist the Master to determine how fast the ship can safely load a particular cargo at a particular facility, taking into account the vessel's design parameters and the cargo involved.

The Chief Officer should indicate, in the loading plan, rates required at stages throughout the operation.

b) Theoretical Rates

The maximum flow rate into any single tanks shall be less than the maximum venting capacity (SOLAS). To allow for generation of gas when loading, the venting rate shall be taken as 125% of the oil loading rate.

Maximum loading rates are affected by a number of factors:
Diameter of manifold.
Number of tanks being loaded
Gas venting capacity

c) Setting Loading Rates

The initial and maximum loading rates, topping off rates and normal stopping times should be considered, having regard to: -

The nature of the cargo to be handled;
The arrangement and capacity of the ship's cargo lines and gas venting systems: the vent line pressure should not exceed that indicated by the builder and must be closely monitored at terminals where loading rates are known to be high.

Builder's maximum vent pressure may be based on a rate for loading all tanks simultaneously; rates must be reduced accordingly for a smaller number of tanks tank being loaded..
The loading rate should also be governed by the age, condition and reliability of the vessel's pipeline system and the venting system.
Precautions to be observed to avoid static electricity.
Any other limitation..

De-Ballasting of Segregated Ballast:

- Obtain the Berth (Loading) Master's permission before starting to de-ballast the segregated ballast tanks. In principle, de-ballasting operations should commence, after starting of cargo operations.

- De-ballast, as per the cargo plan to achieve ample trim, especially towards the completion of de-ballasting operations.

Such period should be planned well before the level in cargo tanks are near Topping-off ullages.

CARGO SAMPLING REQUIREMENTS & PROCEDURES

In any bulk liquid shipment, whether chemical, petrochemical, petroleum product or crude oil, comprehensive and reliable control procedures are required to identify, and minimise the effect of, potential contamination of the cargo. The procedure of cargo sampling and sample retention provides the most effective means of determining when and/or how such contamination might have occurred and allows unfounded allegations of shipboard liability to be challenged. In practice, this is the most potent device available to ship's officers who otherwise are dependant upon the competence, and integrity, of the locally-appointed surveyors.

Sampling serves two purposes. In the case of high purity cargoes, inspection of samples drawn at the manifold, or at 'first-foot' level in the cargo tanks, allows the crew to assess the quality of the incoming cargo as well as the cleanliness of the lines. Obviously analysis cannot be carried out on the samples immediately but visual inspection allows the observer to assess any change in colour, the presence of water (if water is not soluble in the cargo), the presence of foreign particulate matter and, less straightforward, odour taint. Odour is not an issue for all cargoes. Toxic or highly odoriferous cargoes should not be tested for odour.

Any observed deviation in quality should result in cargo operations being halted and further investigations conducted.

The main (shipboard) sampling points where cargo quality can be monitored are as follows:-

Manifold at commencement of loading and spot checks during loading. Special care should be taken when a switch of shore tanks occurs.
Ship's cargo tanks at 'first-foot' level.
Ship's tanks after loading.
Ship's tanks before discharge.
Ship's manifold at commencement of discharge and spot checks during discharge.

Sampling should be carried out in compliance with industry standards (ASTM, IP, ISO etc). In general, for high purity cargoes, a 'running' sample is appropriate from each shore tank. If the cargo is not homogeneous, careful 'zone' sampling is required to assess the quality. The dangerous properties of some chemical cargoes require specialised sampling techniques using specialised equipment and sampling points. In such instances, the sampling procedure is prescribed by the specific equipment in use. Safety remains of paramount importance when dealing with toxic or dangerous cargoes.

Clear glass bottles are the most useful containers for samples as they allow rudimentary visual checks to be carried out. Some cargoes are light-sensitive (e.g. some kerosene, amines and phenol) and should be stored in brown glass bottles. Other cargoes such as caustic soda and potash require plastic sample containers. Lacquer-lined, tinplate containers used for petroleum products are generally unsuitable for chemical cargoes. Bottle closures should be chosen for the specific cargo in question. Waxed disc types are suitable only for petroleum products and crude oils. Aluminium foil faced discs are unsuitable for acid and alkaline samples. The preferred closures are sealed with polypropylene or PTFE inserts. Sample containers should be 500ml capacity.

Samples must be clearly labelled with the ship's name, the date, time, port, sample location, sample-type (e.g. running) and the identity of the sampler. The samples must be signed, sealed and, if possible, counter-signed by the local surveyor. Ideally samples are retained in a

dedicated locker on board for 12 months but this is often impractical. If, however, there is a query on the quality of the cargo, any samples should be retained until instructed otherwise. Normally, they will be handed to a representative of the P&I Association in the event of a claim.

*7.1.3 Unloading (*0.5 hour)

Operation of Cargo Pumps

When starting to ballast, cargo pumps should be operated so that no oil is allowed to escape overboard when the sea suction valve is opened. See the ICS/OCIMF publication "Prevention of Oil Spillages Through Cargo Pumproom Sea Valves".

Sequence of Valve Operations

The following procedures should be adopted when loading ballast into non-inerted tanks which contain hydrocarbon vapour:

- The tank valves should be the first valves opened.
- he initial flow of ballast should be restricted so that the entrance velocity is less than meter / second until the longitudinal are covered or, if there are no longitudinal, until the depth of the ballast in the tank is at least 1.5 metres. These precautions are required to avoid a geyser effect which may lead to the build up of an electrostatic charge in a mist or spray cloud near the point where the ballast enters the tank. When a sufficient charge exists the possibility of a discharge and ignition cannot be excluded.
- The Chief Officer shall also prepare a watch schedule and Person in-Charge list for oil transfer operations for the discharge operation.
- Prior to commencement of discharge operation the Chief Officer shall conduct a “Pre transfer cargo safety meeting” with all the concerned crew and shall have a duty officer read aloud such discharge plan to all the attending officers and crew.
- Special details, port requirements and special precautions or procedures should be discussed with all personnel involved in the discharge operation.

Preparation for Cargo Equipment

Cargo oil transfer pumps and IGS should be well prepared for use prior to arrival at discharge port terminal.

Cargo Oil Transfer Check Lists

The Chief Officer shall complete the following check lists prior to, during and upon completion of cargo oil transfer operations.
The Chief Officer, after confirmation, shall affix his signature on the related checklist.
The Master, shall then sign on the completed “Tanker Discharging Checklist”.

If there is to be a multi-port discharge, the pre-arrival tests, as listed herein, can be completed before the arrival at the first port.

- “Crude Oil Washing Checklist”
- “Ship / Shore Safety Checklist”
- “Double Hull Operation/COT (Cargo Oil Tank) Monitoring Record”
- “Ship to Ship Transfer Checklist”, as required.

Display of Warning Notices and Signs

Should be taken into account

Hose Connection

The chief Officer or deck duty officer must be in attendance during connection of cargo oil transfer arms/hoses.

Cargo Oil Transfer Meetings with Terminal representative

The Master, Chief Engineer and Chief Officer must attend and carry out a “pre-transfer cargo safety meeting” with the shore facility representative to ensure full agreement with the cargo oil discharge plan, and to agree on method of communication during emergencies.

The “Ship/Shore Safety Check List” or relevant “Ship to Ship Transfer Check List” must be completed and signed for in agreement by both parties after successful completion of safety checks and confirmation and prior to starting of operations.

Ullage measurement and Cargo Quantity Calculation

Ullage and Temperature measurement, Water measurement, and Sampling are carried out by the terminal side or surveyors.

Normally, one watch Officer shall attend the measurement and assist to calculate the cargo quantity. Ensure that all ullage ports (vapor locks) and other openings have been closed after the measurement and prior to start of operations.

Lining up Pipelines and Valves

Prepare the lines between tanks and pumps after the completion of ullage measurement. Tanks not to be discharged are to be suitably marked and protected from accidental miss-operation. Carry out the filling of the separator with utmost caution, taking care to avoid “Liquid Hammer”. Ensure through passage of vapor so as to fill separator evenly.

Prior to commencing discharge the cargo tank line and pump room valves to be set as per the plan for start of discharge. Use the ship specific ‘Valve Checklist” prudently.

Valves not in use should be secured and lashed shut.
Line / Valve settings are to be supervised and checked by the Watch-Officer and re-confirmed by the Chief Mate.

The order for opening of manifold valve shall be under the chief officer’s permission. On opening of the manifold valves, the manifold pressure shall be monitored regularly. Operate major valves as per the terminal representative’s order.

Personnel arrangement at beginning of operations

In principle, for the start up of operations, all deck crew shall be in attendance and distributed as per chief officer’s instruction.

Tool Box meeting

Have the crew know the beginning of operations to call their attention to smoking, use of fire, designated emergency exits and other safety matters

- in an inerted cargo tank there is no explosive atmosphere

- care must be taken that the tank atmosphere does not come within flammable range during gas-freeing operations
- soot particles in inert gas create an additional ignition hazard in an explosive tank atmosphere
- gas-freeing a non-inerted tank will bring the tank atmosphere within the explosive range for some time
- oil tankers should be supplied with meters to check oxygen content, hydrocarbon content and toxic gas content
- meters are available showing percentage lower flammable limit (LFL) by volume
- Tank cleaning and gas-freeing for repairs
- procedures for tank cleaning, purging and gas-freeing must be carried out
- before personnel enter any tank, the atmosphere must be checked for oxygen content, hydrocarbon content and, after carrying some cargoes, toxic gas content
- oxygen content must be 21% by volume
- hydrocarbon content must be less than 1% LFL
- after tank washing, manual removal of residue may be necessary
- residue removal generates more hydrocarbon gas
- gas-freeing operations must therefore be continuous
- adjacent bulkheads and pipelines may constitute additional sources of hydrocarbon gas
- the inert gas supply to the tank should be shut off
- a gas-free certificate is needed from a qualified chemist before contractor's work can be carried out I'
- an additional hot work permit is required for hot work
- that such certificate and permit must be reissued every day that work is carried out, or such lesser period as the port authority stipulates

7.2 For chemical tankers (4.5 hours)

7.2.1 *Cargo information* (0.5 hour)

- information about cargoes to be handled is essential to the safety of the vessel and her crew
- such information may be found on ICS or other Cargo Data Sheets for each product, which also include all necessary data for the safe handling and carriage of the cargo
- cargo information for most tanker cargoes is kept on board and available for all concerned
- the cargo will not be loaded unless sufficient information necessary for its safe handling and transportation is available
- the cargo will not be loaded unless sufficient information necessary for its safe handling and transportation is available
- the responsible officer will see to it that the necessary cargo information is posted on the notice board prior to cargo operations
- all personnel engaged in cargo operations should familiarize themselves with the cargoes by studying the ICS or other Cargo Data Sheets
- cargo operations on chemical tankers may involve simultaneous loading, unloading and tank cleaning

7.2.2 *Loading* (1 hour)

- all personnel must follow standing instructions at all times whether or not the cargo to be loaded is dangerous

- personnel on watch or involved in the loading operation should wear appropriate protective clothing, as indicated in the ICS or other Cargo Data Sheets, when handling dangerous cargoes
- cargoes are stowed according to a stowage plan that was prepared before loading bean
- prior to loading, cargo tank are inspected for cleanliness and suitability for cargo according to the stowage plan
- prior to the loading of cargoes which present a major fire hazard, tanks are purged with nitrogen to remove air so that the atmosphere above the cargo will be non-flammable
- such cargoes are kept under a nitrogen “padding” during the voyage
- how cargo is routed from the manifold to tanks on a chemical tanker with a pump-room
- how cargo is routed from the manifold to tanks on a chemical tanker with separate lines for each tank
- how cargo vapour is removed from the tanks during loading
- a “closed-circuit’ loading operation
- cargoes giving off vapours which present a major health hazard are loaded in a “closed circuit”, requiring a vapour- return line
- in order to check for impurities, cargo samples are taken from lines and tanks during loading
- a vessel’s trim, list and stability may be adjusted, if necessary, during loading by filling or emptying ballast tanks
- all events during cargo operations are recorded

7.2.3 ***Unloading*** (0. 5 hour)

- all personnel must follow standing instructions at all times during unloading, whether or not the cargo is considered dangerous
- personnel on watch or involved in the unloading operation should wear appropriate protective clothing, as indicated in the CS or other Cargo Data Sheets, when handling dangerous cargoes
- cargoes are unloaded according to a planned sequence of emptying tanks
- prior to unloading, cargo samples from each tank and from cargo lines are analyzed to check if a product has been contaminated on board during passage

PUMPS AND UNLOADING SYSTEMS OF A CHEMICAL TANKER

Types of pump used on chemical tankers as:
- Centrifugal pumps
- Screw pumps
- Piston pumps (reciprocating pumps)

The main cargo pumps fitted on board chemical tankers are mainly of the centrifugal type. They are either submerged pumps integral with hydraulic motors or of extended shaft with deck mounted electric motors (referred to as deep well pumps)

The benefits of using centrifugal pumps are;
- simple in construction
- there being no valve in its construction
- its relatively small in size, because the pump can operate in high speed
- its continuous pumping and thereby no pulsation

The drawbacks of using centrifugal pumps

- difficulty of constructing a pump with a high differential pressure per stage
- CF pump having a high efficiency only within a limited field
- Its normally not being self priming
- The back flow through the pump when it stops
- The difficulty of pumping high viscosity liquids

Centrifugal cargo pumps are usually supplied with a graph often referred to as pump characteristics, which gives performance curve. The graph supplied with centrifugal pump is developed on the basis of the pumping tests with a specific liquid at a specific temperature and density, with a specific impeller and at specific rate of revolution. The Q-H curve describes the relationship between total head and flow. The graph is normally supplied with curves describing the pump's power consumption efficiency and NPSH. The design point will be the efficiency, the NPSH, the power consumption and the flow give the best general result. The total head is independent of the liquid's density, but the differential pressure and the power consumption will vary proportionally to the density. When evaluating a centrifugal pump's graph it must be remembered that the curves are made for a specific liquid.

Use simulator drawings from Appendix 1 section 2 for demonstration

- how cargo is routed from tank to manifold on a chemical .tanker with a pump-room
- how cargo is routed from the tank to manifold on a chemical tanker with deep well pumps and separate lines for each tank
- the functioning of the cargo-tank venting system during unloading
- in tanks containing cargoes that present a major fire hazard, inert gas or nitrogen is used to maintain a positive tank pressure during unloading in order to avoid air entering the tank
- a vessel's trim, list and stability may be adjusted, as necessary, during unloading by filling or emptying ballast tanks

7.2.4 Tank cleaning and gas-freeing reasons for tank cleaning as: (1.5 hour)

- rules and regulations
- the prevention of contamination of the cargo to be loaded
- the prevention of contaminated ballast
- maintenance of cargo tanks and equipment
- tank-washing machines are used
- tank-washing machines may be fixed or portable
- tank-cleaning equipment must be properly earthed to avoid accumulation of static electricity personnel involved in tank-cleaning operations may be exposed to cargo vapours and should, if necessary, use equipment for personal protection different cargoes require different tank-cleaning procedures
- cleaning may be done with hot or cold seawater or with fresh water, or by ventilation only
- water cannot be used for tank cleaning before or after some cargoes
- in some cases, detergents are added to the washing water
- in some cases, solvents are used for tank cleaning
- Use the diagram given in Appendix 1section 2 of this course to explain the working of a tank-washing machine
- how the electric bonding of tank-cleaning hoses may be checked
- a safe procedure for the connection and disconnection of tank-cleaning equipment

- pre-wash
- main wash
- fresh water rinse
- gas-freeing
- drying
- inspection/testing
- the purpose of gas-freeing is to replace cargo vapours, inert gas or any other gases with air
- gas-freeing may be done by fixed or portable fans driven by air, steam, water or hydraulic fluid
- the gas-freeing operation is verified by regular checks of the tank atmosphere
- the tank atmosphere is checked by measuring the percentage of oxygen and the ppm values of cargo vapours or of toxic constituents of inert gas
- a cargo tank is gas-free only when the oxygen content is 21% by volume and no vapours from cargo or toxic constituents of inert gas can be measured in values above the threshold limit value (TLV)
- Slops and slops disposal
- modern chemical tankers are fitted with tanks for the storage of slops
- cargo tanks may also be used to contain slops
- in general, the discharge of slops into the sea is prohibited unless certain conditions are satisfied
- slops from certain noxious chemicals have to be discharged to shore facilities
- all slop-handling operations on chemical tankers are recorded in the Cargo Record Book

Topic 8 Emergencies (1.5 hours)

8.1 Basic knowledge of emergency procedures, including emergency shutdown (0.5 hours)

This section covers the aspects of emergency operations on board. It includes emergency measures, organizational structure, alarms, emergency procedures and first-aid treatment. The syllabus provides the necessary guidelines for this topic.

The main purpose for first-aid treatment is to emphasize the importance of familiarizing with the ‘emergency procedures’ in the Cargo Data Sheet of the cargo carried. In the event of an accident involving cargo, the trainee should be able to take proper action as recommended in the Cargo Data Sheet.

For planning and preparation are essential for dealing successfully with emergencies, the information which should be readily available:

- type of cargo and its disposition
- location of other hazardous substances
- general arrangement plan of the ship
- stability information
- location of fire-fighting equipment and instructions for its use in an emergency, important actions to take would include:
- giving audible and visual warnings that an emergency exists by means of:
- bells, whistles, klaxons or other audible devices

Flashing lights

- advising the command centre of the location and nature of the emergency
- Promptly activating the ESD and stopping any cargo-related operations, closing valves and openings in tanks as initiated by the ESD system.
- removing any craft alongside

Location of all safety equipment, such as;

- breathing apparatus
- protective clothing
- approved portable electric lights
- instruments for measuring oxygen and other gases
- first-aid kits
- tank evacuation equipment
- fire-fighting equipment with instructions for its use

All equipment which may be needed in an emergency must be maintained in good order and always be ready for use, and lists important items as:

- fire-fighting equipment
- breathing apparatus
- protective clothing
- alarm systems
- communication systems
- arrangement plans

8.2 Organizational structure (0.25 hour)

Emergency Organization
An emergency organization should be set up which will come into operation in the event of an emergency. The purpose of this organization will be in each situation to:
a. Raise the alarm and muster at designated station.
b. Locate and assess the incident and possible dangers.
c. Organize manpower and safety equipment.

The following suggestions are for guidance in planning an emergency organization, which should cover the following four elements:

Command Centre

There should be one group in control of the response to the emergency with the master or the senior officer on board in charge. The command centre should have means of internal and external communication.
Communication is of the utmost importance and the possibility of communication failing should always be taken into account as such back up for communication means should always be provisioned for – such as spare batteries for W/T sets, spare W/T sets, loudhailers, PA system and messengers.

Emergency Party

This group should be under the command of a senior officer and should assess the emergency and report to the command centre on the situation, advising what action should be taken and what assistance should be provided, either from on board or, if the ship is in port, from ashore.

Back up Emergency Party

The back up emergency party under the command of an officer should stand by to assist the emergency party as instructed by the command centre and to provide back up services, e.g. equipment, stores, medical services including cardio-pulmonary resuscitation etc.

Engineering Group

This group should be under the command of the chief engineer or the senior engineering officer on board and should provide emergency assistance as instructed by the command centre. The prime responsibility for dealing with any emergency in the main machinery spaces will probably rest with this group. It may be called on to provide additional manpower elsewhere.
The plan should ensure that all arrangements apply equally well in port and at sea.

Duties assigned for the operation of remote controls such as:
a. main engine stop
b. ventilation stops
c. lubricating and fuel oil transfer pump stops
d. dump valves
e. CO2 discharge
f. watertight doors

Operation of essential services such as:
a. emergency generator and switchboard
b. emergency fire and bilge pumps

Balance crew
The rest of the crew if not allotted any of the duties under the different groups as mentioned above would act as back up for the emergency parties.

As backup they may be utilized in various other duties such as accumulating passengers and herding them away from danger to the evacuation decks. Escorting feeble passengers or crew including any injured crew to the safe places as designated. Rendering first aid and trauma counseling. Filling extinguishers as required, mustering fire hoses from elsewhere, recharging and supplying W/T batteries. In case of abandoning ship possibility then taking in additional provisions and clothing/ water. Preparation of the survival crafts such that it does not lead to any panic. Making rounds of areas adjacent of the fire area.

Preliminary Action

The person who discovers the emergency must raise the alarm and pass on information about the situation to the officer on duty who, in turn, must alert the emergency organization. While this is being done, those on the scene should attempt immediate measures to control the emergency until the emergency organization takes effect.

A fire in the galley is dangerous since it can spread very easily into the rest of the accommodation. The fire is dangerous as well as the fumes from burning plastics and any cooking oil.

The person in charge of the galley or the person first locating the fire should try and extinguish the fire himself after alerting the officer of the watch. Generally the fire as it is detected and begins is a small fire and later develops into a major one. Thus the fire may be put off by a single person with the equipment available in the galley and nearby areas

Fire dampers should be engaged and DCP extinguishers used to put out he galley fire if anywhere on the stove area since these are electric circuits.

In case of cooking oil fire in the provision locker (rare) this may be put out using foam extinguishers and also with DCP extinguishers.
An accommodation fire may be caused by a short circuit or due to smoking or flammable material catching fire inadvertently.

The items to be available would be:
a. DCP extinguishers
b. Fire hoses – low to moderate pressure on the fire mains
c. Insulated fire axe
d. Fire mans out fit
e. Safety lamps – many
f. Fire blanket

8.3 Alarms (0.25 hrs)

Use fig.9.3 high level alarms and over fill alarms also state the following:
1 a fire alarm signal or general alarm signals are given in case of:
- fire
- collision
- grounding
- cargo hose burst
- major cargo spillage or escape vapour

- every other emergency situation which calls for emergency actions

Other alarm signals are given in case of

- high concentration of toxic or flammable vapours
- unacceptable condition in cargo tanks or cargo systems
- unacceptable conditions in auxiliary cargo systems
- system failure in cargo plant and auxiliary systems
- system failure in engine-room or machinery spaces
- a CO2 discharge in engine-room or pump-rooms
- a high level of oxygen in inert gas
- high level of oil residues in overboard discharge

8.4 Emergency procedures (0.25 hrs)

basic emergency actions to be taken in case of: Standard Emergencies
- fire
- collision
- grounding
- cargo hose burst
- accident involving personnel

Note: the correct emergency procedures for accidents involving dangerous chemicals are given in the ICS or other Cargo Data Sheets

8.5 First-aid treatment (0.25 hour)

Using the MFAG guide discuss the impact of oil and chemical Cargoes. It would be preferable to have a medical practitioner do this section

Topic 9 Pollution Prevention (1 hour)

Causes of marine (air and water) pollution

Oil in the oceans is one of the ugliest forms of marine pollution. Just thinking about oil pollution in the oceans conjures up images of massive tanker spills, oiled seabirds and shorelines covered with gooey black oil. However, oil spills are not the major cause of oceanic oil pollution. Instead the majority of marine oil pollution comes from other sources. This page will examine the causes of marine oil pollution and methods for pollution prevention and spill cleanup.

Types of Marine Oil Pollution

Oil spills are actually just a small percent of the total world oil pollution problem. According to Ocean Planet there are 706 million gallons of oil pollution in a given year. That is a massive amount of oil! The following chart will indicate the different methods of oil pollution and their respective percentage of total pollution.

The definitions of the different forms of oil pollution are as follows. Offshore drilling pollution comes from operation discharges and drilling accidents during oceanic oil exploration. Large oil spills typically result from and oil tanker accidents such as collisions and groundings. Natural oil pollution (seeps) comes from seepage off the ocean floor and eroding sedimentary rocks. Natural oil pollution into the marine environment has occurred for thousands if not millions of years. Up in Smoke: This type of oil pollution comes from oil consumption in automobiles and

industry. Typically the oil hydrocarbons find their way into the ocean through atmospheric fallout. Oil pollution from routine maintenance occurs from ship bilge cleaning and so forth. Lastly, oil pollution occurs from people dumping oils and oil products down stormdrains after oil changes, urban street runoff and so forth. The worst oil pollution comes from oil dumped into the drains and road runoff. The following images illustrate some oil spills and accidents that have occurred.

Prevention of marine pollution

The section is divided into prevention of marine pollution by oil tankers and chemical tankers at sea and in port. The trainee should be made aware of regulations adopted by IMO regarding marine pollution.

The instructor should explain that air pollution is a matter of growing international concern. Trainees should be made aware that there may be local or national rules which must be complied with.

Definition of volatile organic compounds. (VOCs) is given in Appendix I. Trainees should be directed to regulation 15 of Annex VI of MARPOL *73/78.*

Reference: R3, Annex VI

Measures to be taken in the event of spillage

This lecture essentially focuses on the actions to be taken on board upon the occurrence of a spill and the importance of prompt notification to all relevant authorities.

9.1 Basic knowledge of the effects of oil and chemical pollution on human and marine life (0.5 hour)

For oil tankers at sea and in port:

SOPEP (0.25 hour)

A ship's SOPEP must be in the approved form, and include the following particulars -

(a) the procedure to be followed by the ship's master, or someone else having charge of the ship, in notifying a reportable incident that is a discharge or probable discharge of oil involving the ship (see below);
(b) a list of the entities to be notified by persons on board if the reportable incident happens;
(c) the procedure to be followed for coordinating with entities notified about the reportable incident;
(d) the name of the person on board through whom all communications about the reportable incident are to be made;
(e) a detailed description of the action to be taken, immediately after the reportable incident, by persons on board to minimise or control any discharge of oil from the ship resulting from the reportable incident.

For chemical tankers at sea and in port:

SMPEP (0.25 hour)

A shipboard marine pollution emergency plan for noxious liquid substances must be in accordance with the prescribed form and set out the following particulars:

a) the procedures to be followed by the master of the ship, or any other person having charge of the ship, in notifying a prescribed incident in relation to the ship;
b) a list of the authorities or persons that are to be notified by persons on the ship if a prescribed incident occurs in relation to the ship;
c) a detailed description of the action to be taken, immediately after a prescribed incident, by persons on board the ship to reduce or control any discharge from the ship resulting from the incident;

Topic 10 Discusses Case Studies on oil and NLS (0.5 hours)

Please use the case studies appended in this IMO model course.

APPENDIX 1

DIAGRAMS FOR USE BY THE INSTRUCTOR
PRINT OFF AS HANDOUTS
OR
USE FOR OHP TRANSPARENCIES
IF SUITABLY ENLARGED

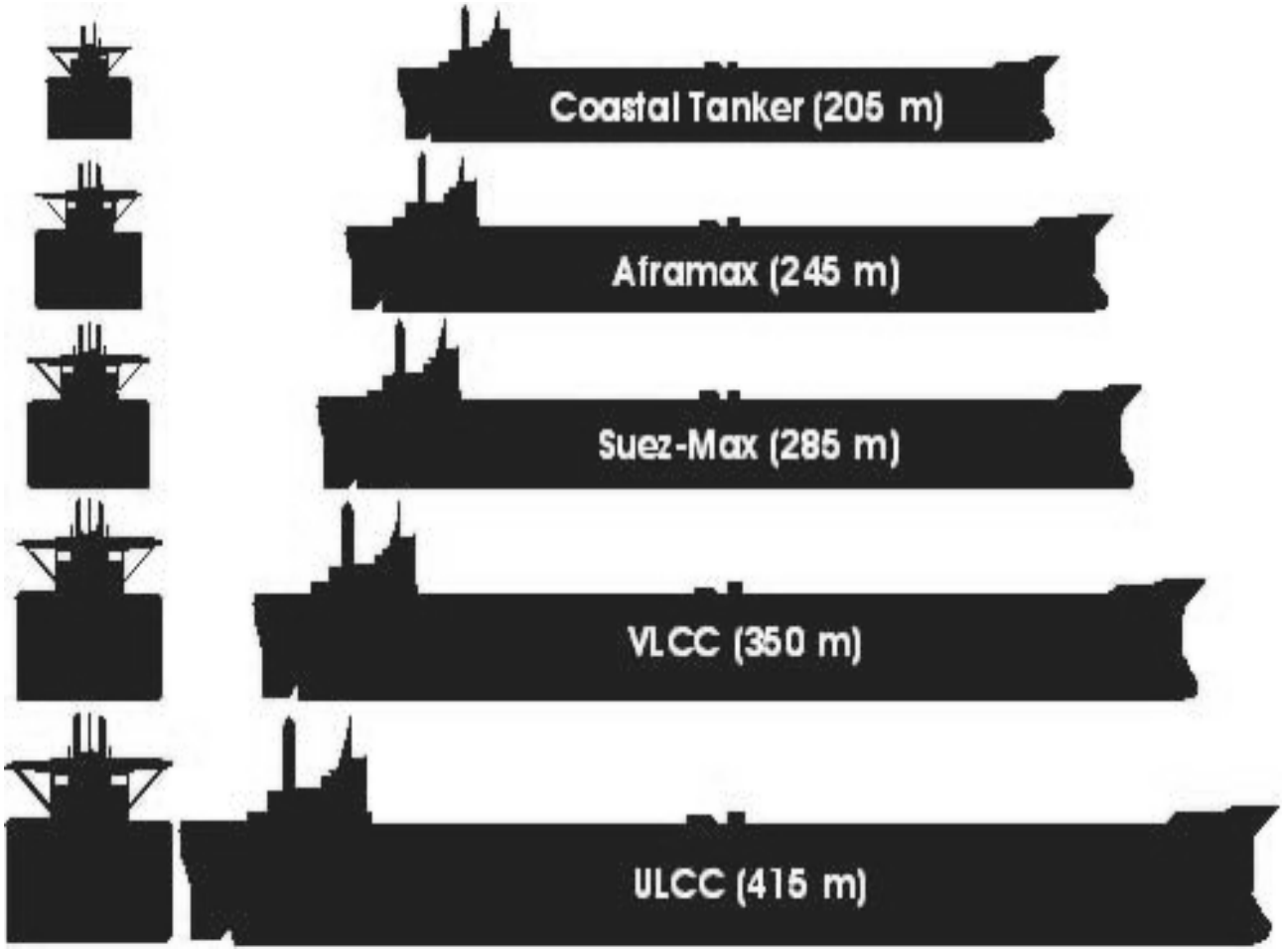


Fig. 1.1 A: Types of Oil Tankers

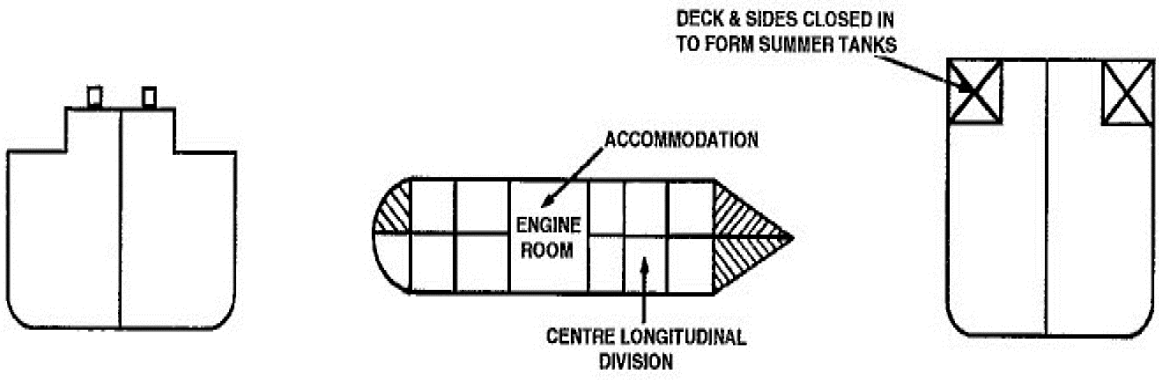


Fig. 1.1 B: History of Tanker development

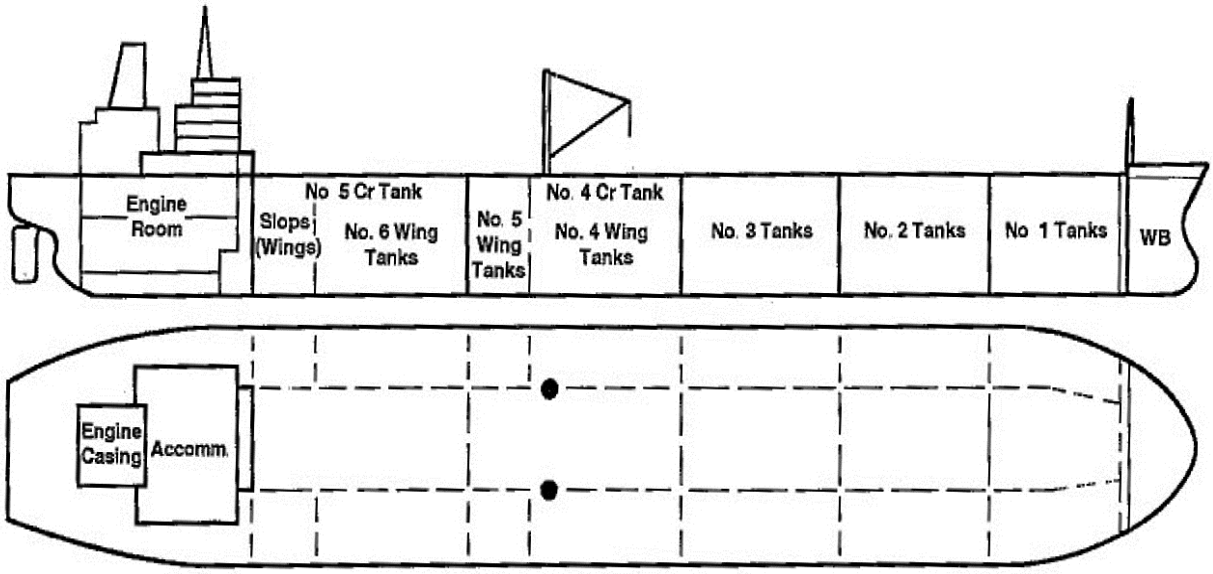


Fig. 1.1 C: Single hull Crude oil Tanker

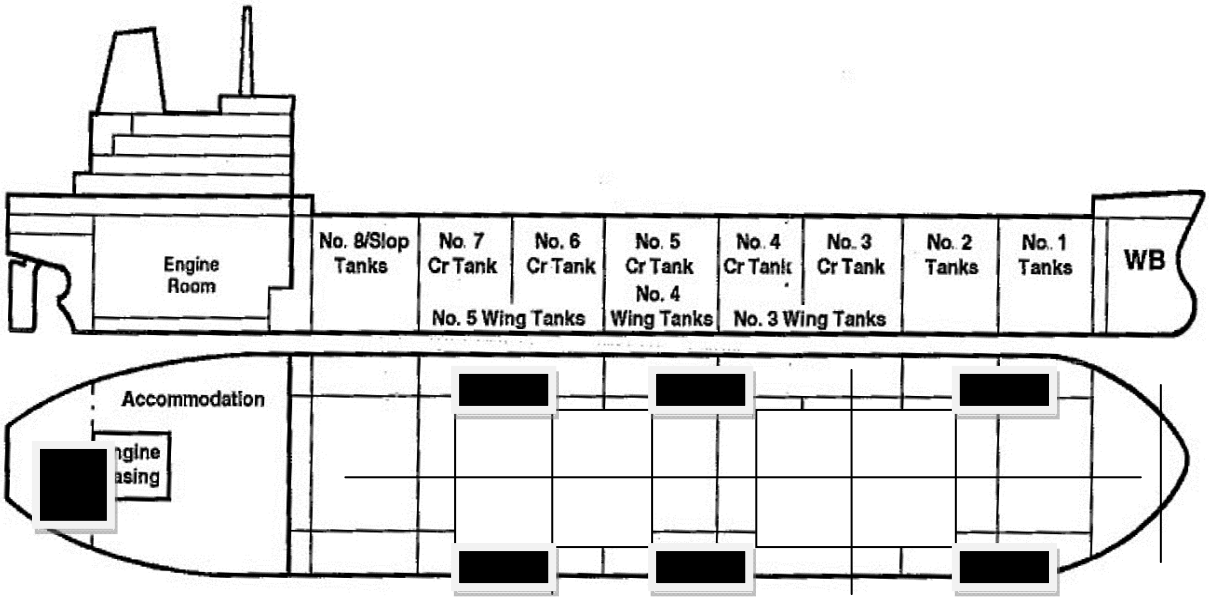


Fig. 1.1 D: Double hull tanker with SBT in P/L.

Fig. 1.2: Sophisticated Parcel Chemical Tanker with Transverse and Vertically corrugated Stainless Steel Bulkheads

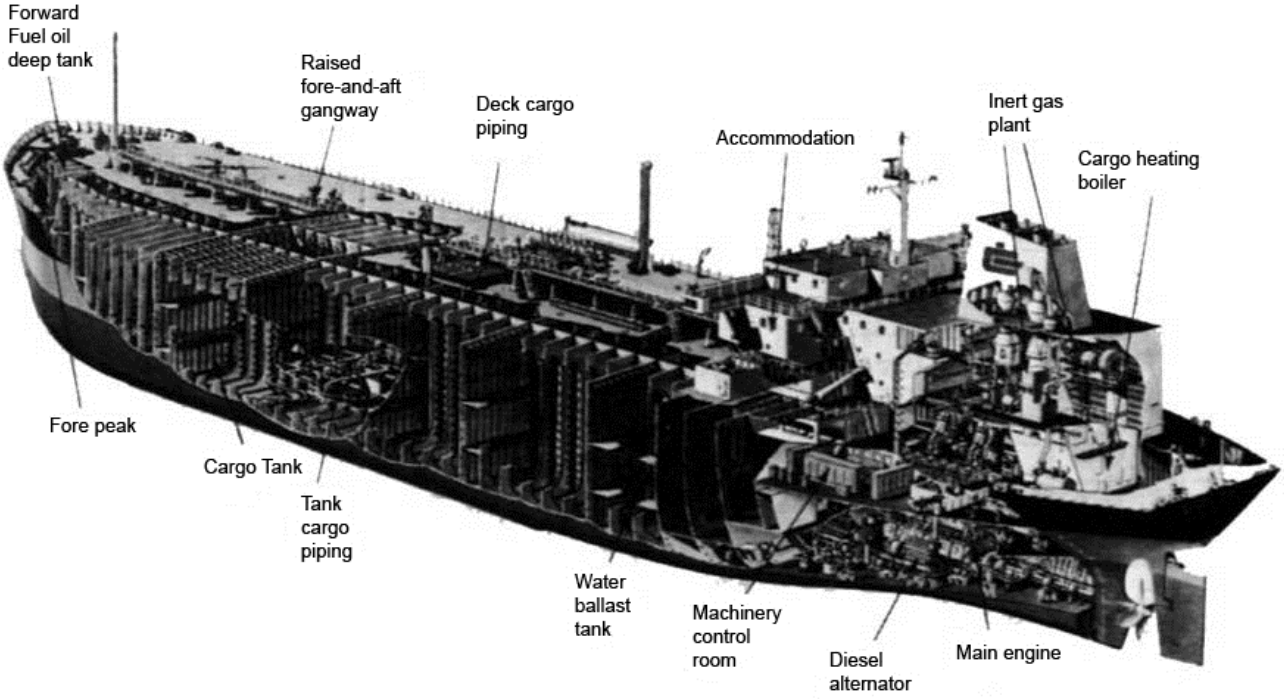


Fig. 1.3 A: Ship arrangements of an oil tanker

Fig. 1.3 B: Oil Tanker Deck pipeline arrangements.

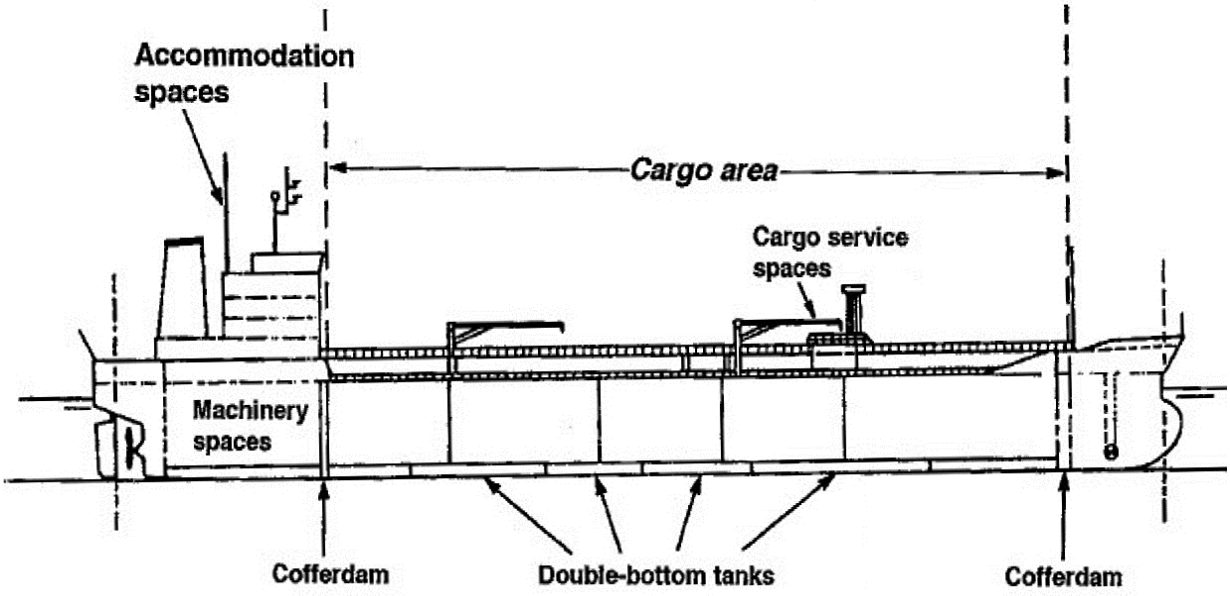


Fig. 1.3 C: General Arrangements of a Tanker

Fig. 1.3 D: Eductor used for stripping oil tanks

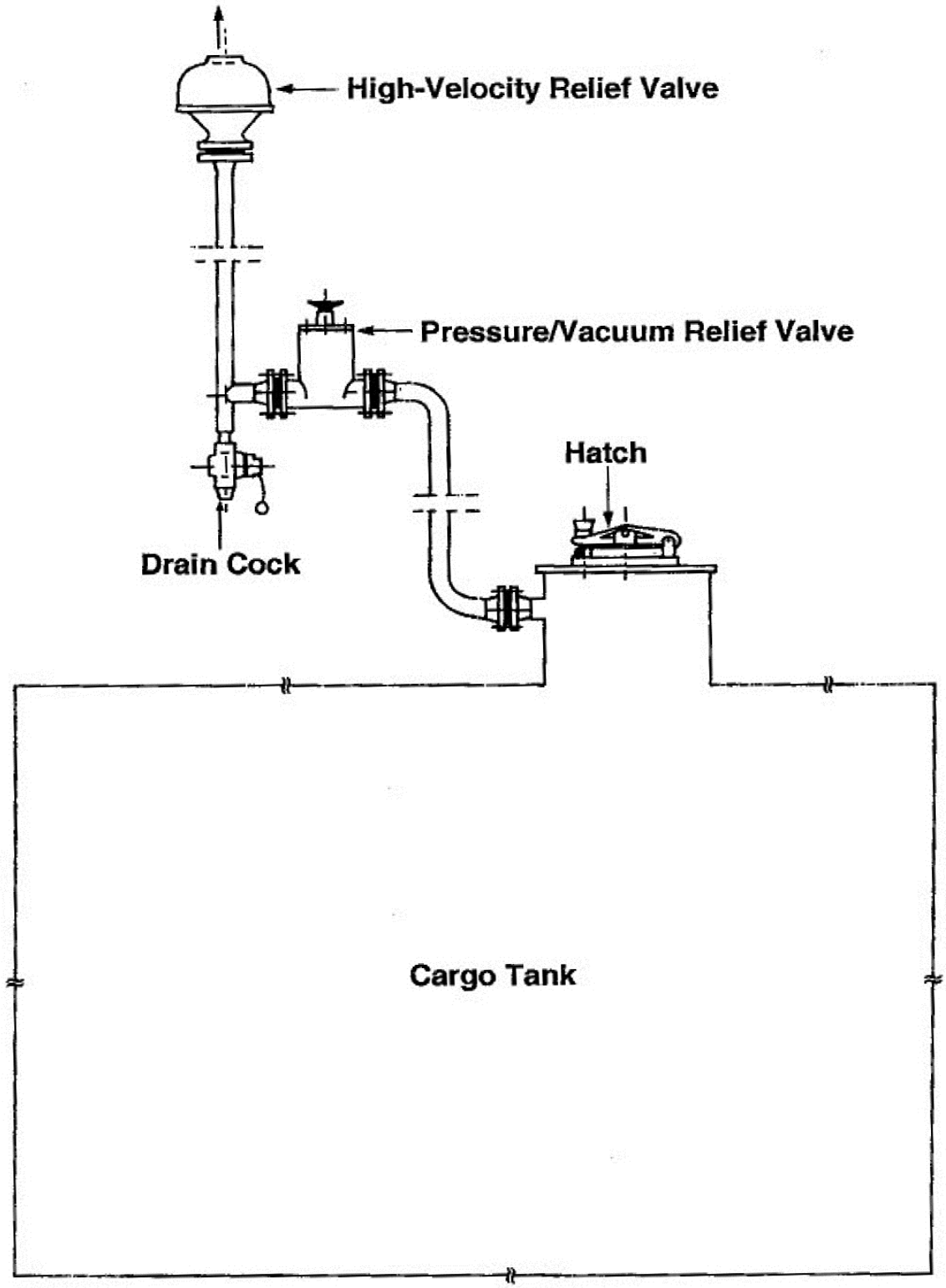


Fig. 1.3 E: Venting arrangements of an Oil tanker

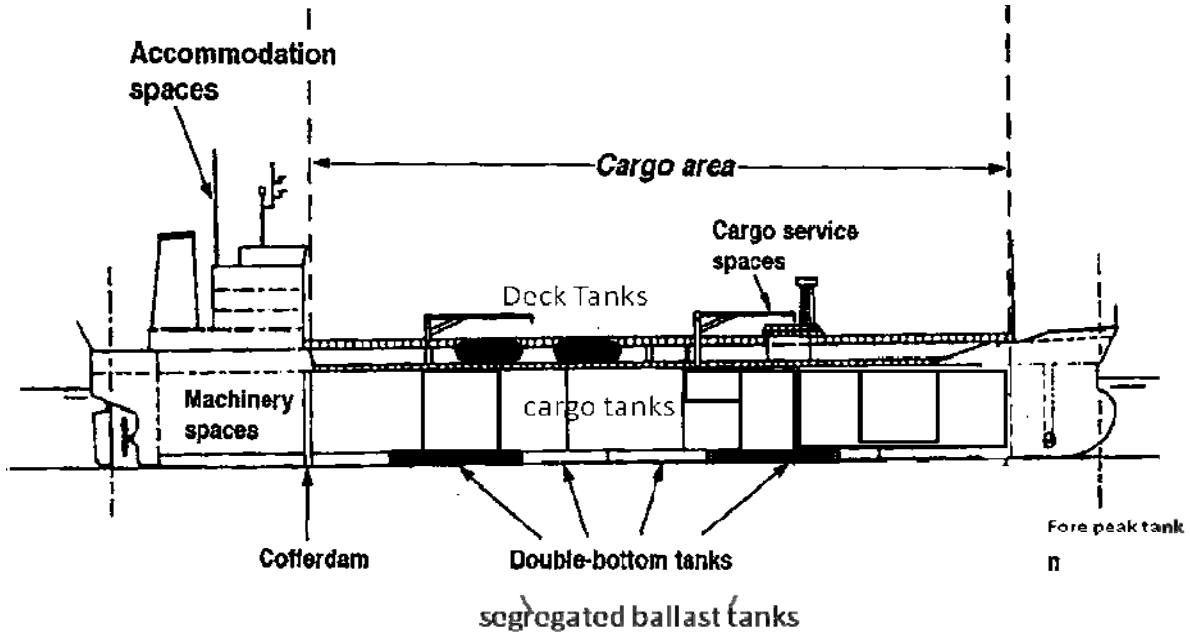
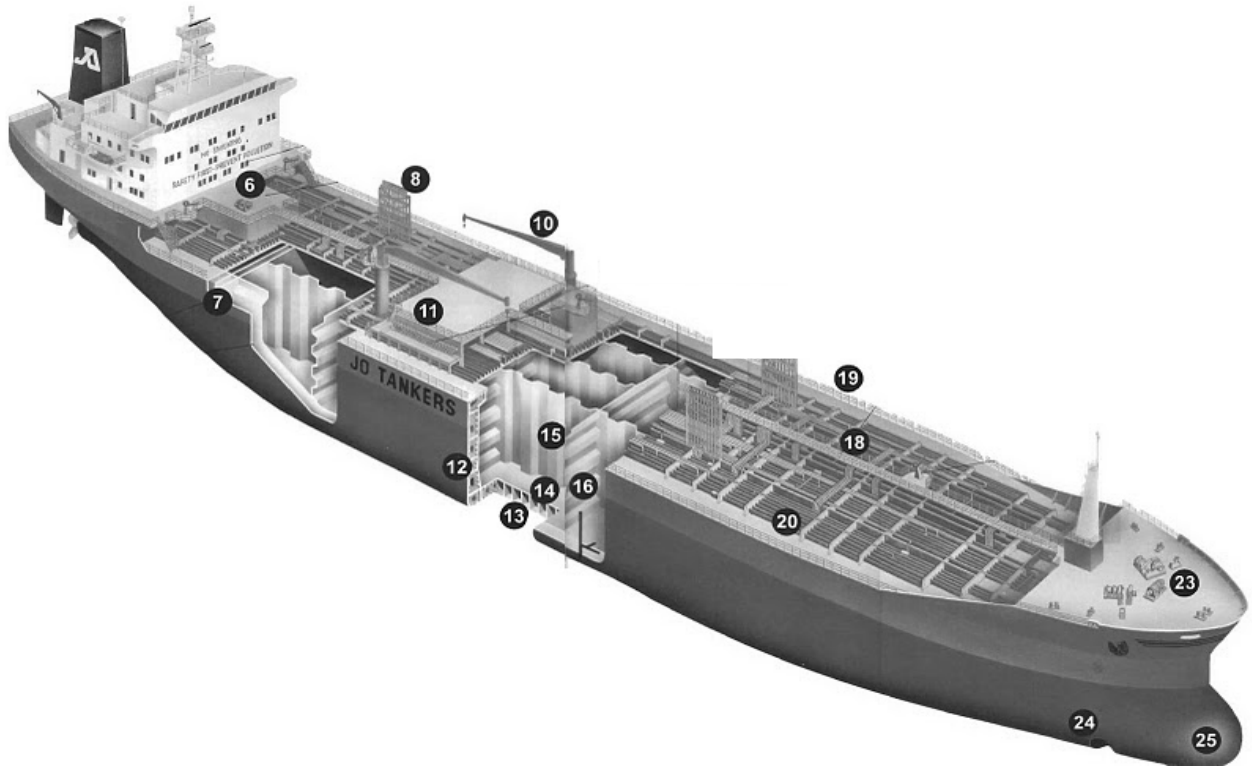


Fig. 1.3 F: Cargo Area of a Chemical Tanker



1. Balanced rudder with conventional propeller
2. Auxiliary unit
3. Lifeboat in gravity davits
4. Hydraulic prime mover
5. Cargo control room
6. Tank heating / tankwash room
7. Cofferdam, empty space between two tanks
8. Vent pipes with pressure-vacuum valves

9. Hydraulic high pressure oil-and return lines for anchor and mooring gear,
10. Hose crane
11. Manifold
12. Wing tank in double hull
13. Double bottom tank
14. Tank-top
15. Longitudinal vertically corrugated bulkhead
16. Transverse horizontally corrugated bulkhead
17. Cargo pump
18. Catwalk
19. Railing
20. Deck longitudinal
21. Deck transverses
22. Cargo heater
23. Forecastle deck with anchor-and mooring gear
24. Bow thruster
25. Bulbous bow

Fig. 1.4 A: Ship arrangements of a chemical tanker

Fig. 1.4 B: Chemical tanker Deck pipeline arrangements

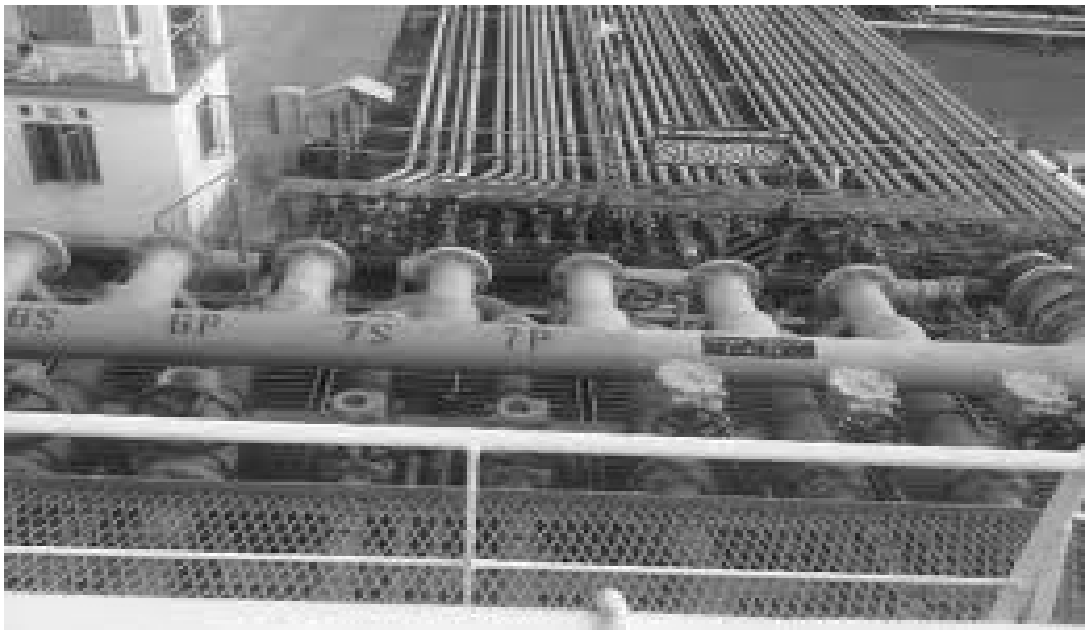


Fig. 1.4 C: Manifold arrangements of a chemical tanker

Fig. 1.4 D: Heating arrangements of a Chemical Tanker

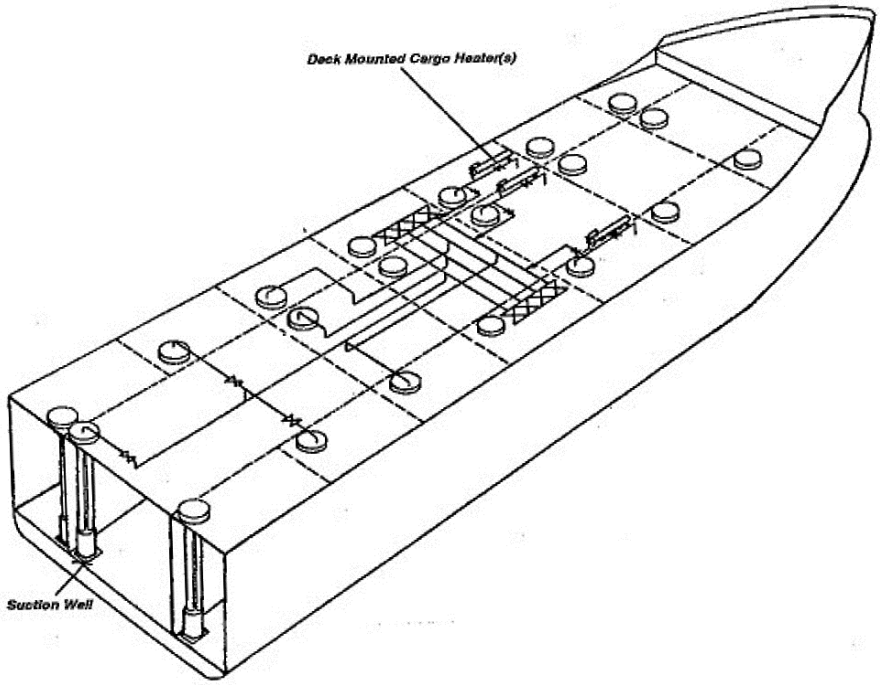
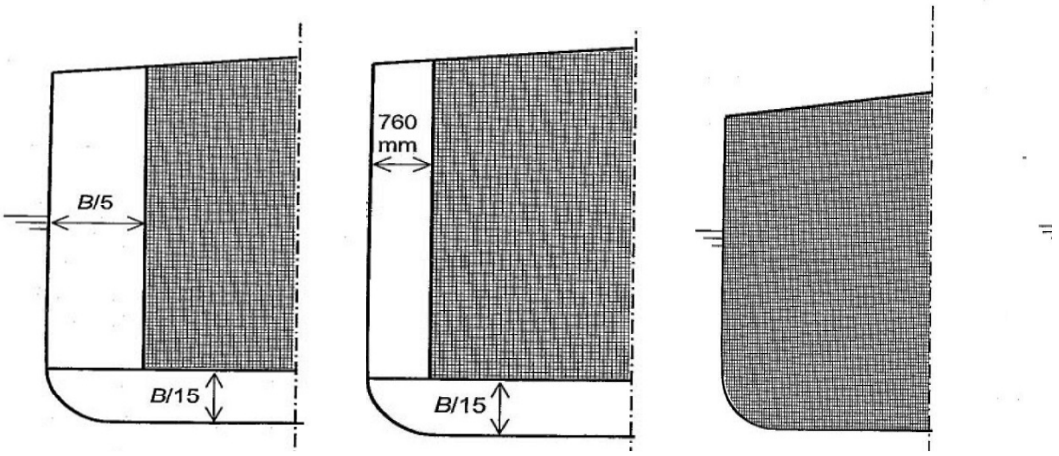


Figure 1.4 E: Tank section of a product/chemical tanker with deepwell pumps



Type 1 tank configuration Type 2 tank configuration Type 3 tank configuration

Note: IBC Code requirements for:
Ship Type 1 each tank capacity not more than 1250 m^3;
Ship Type 2 each tank capacity not more than 3000 m^3;
Ship Type 3 each tank capacity not regulated.

Fig. 1.4 F: Chemical Tanker Ship type configuration as per IBC code

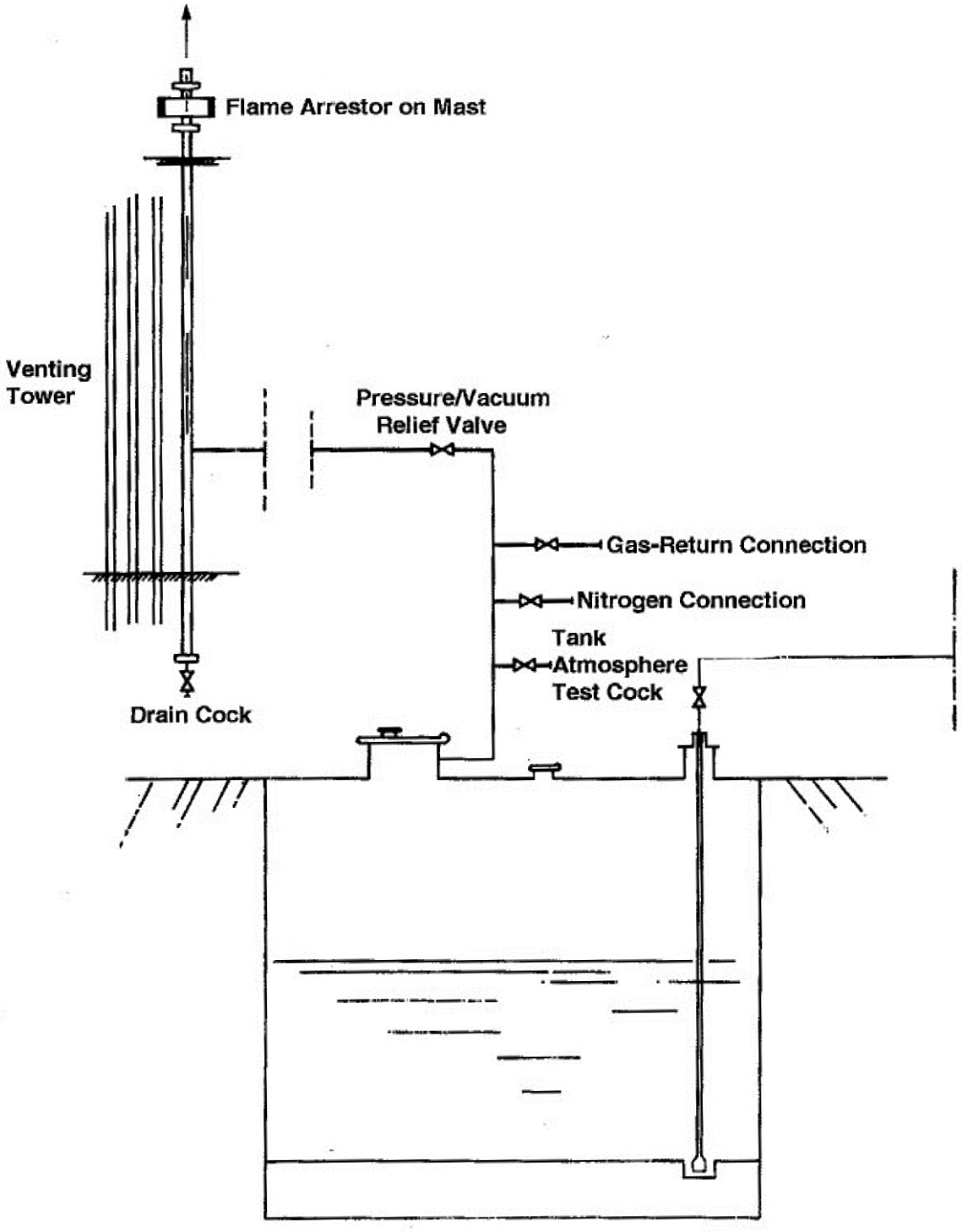


Fig. 1.4 G: Venting arrangements of a Chemical Tanker

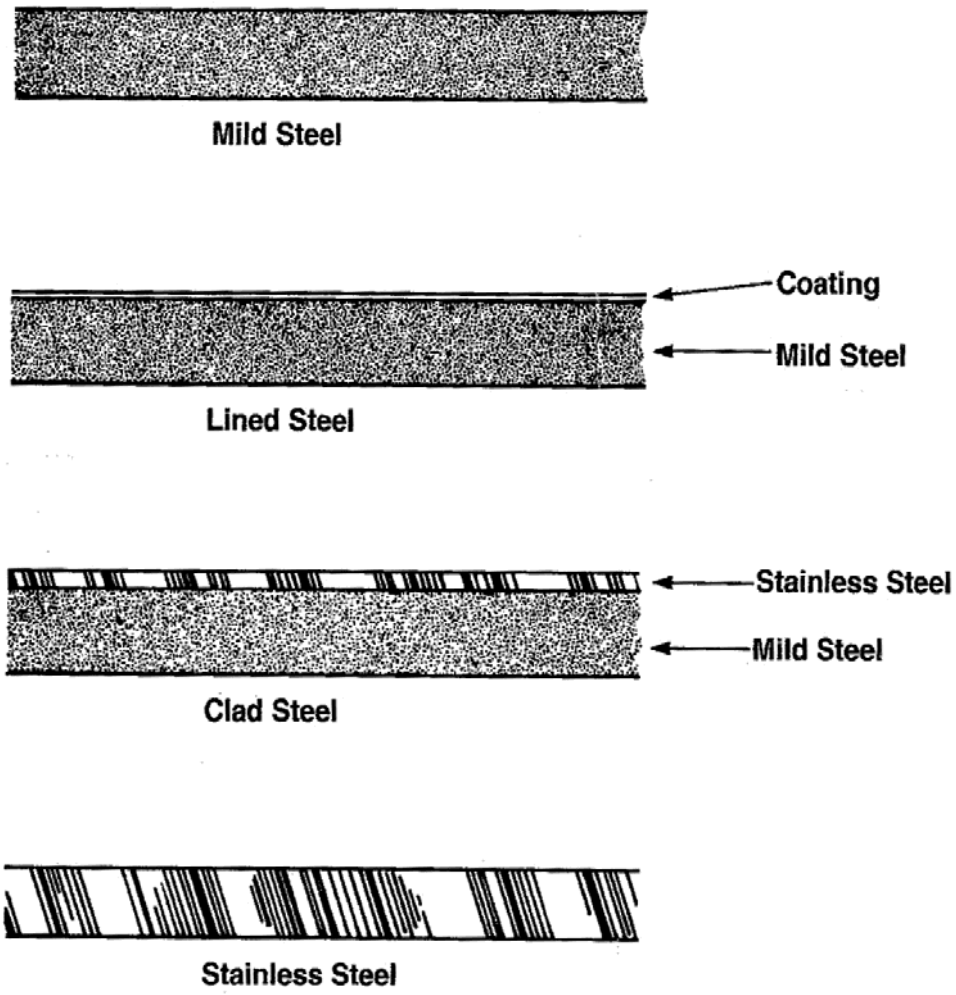


Fig.1.4 H: Tank construction materials & Coatings

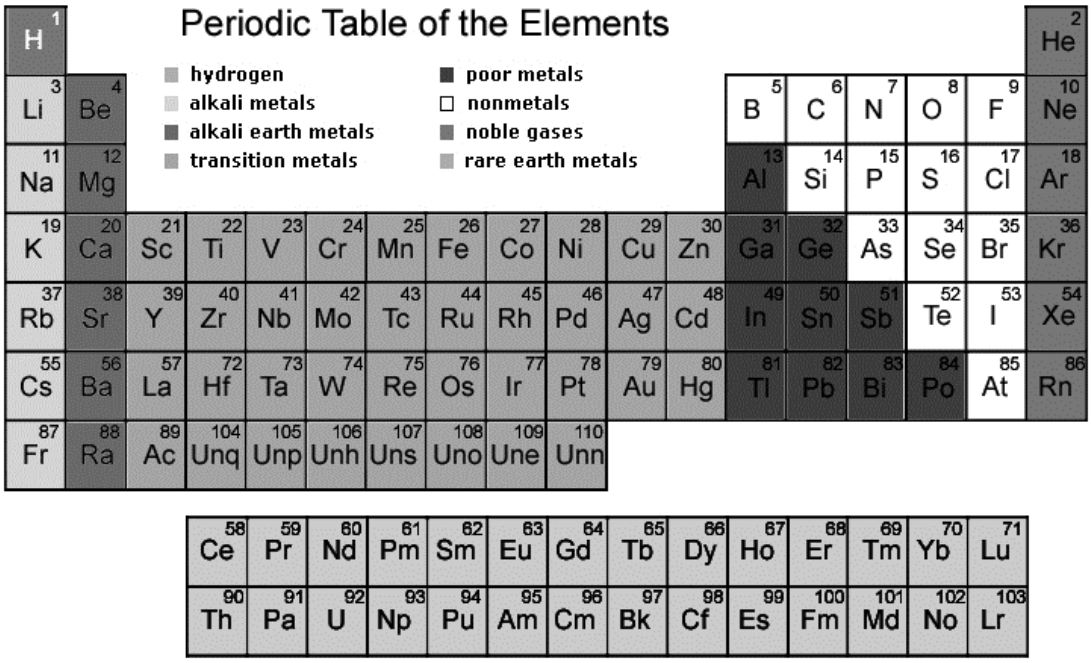


Fig. 2.1 A: Periodic table

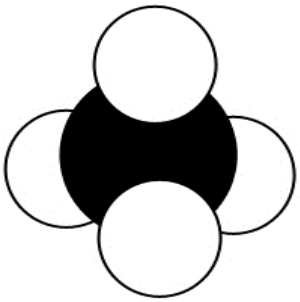


Fig 2.1 B: Methane Molecule CH_4

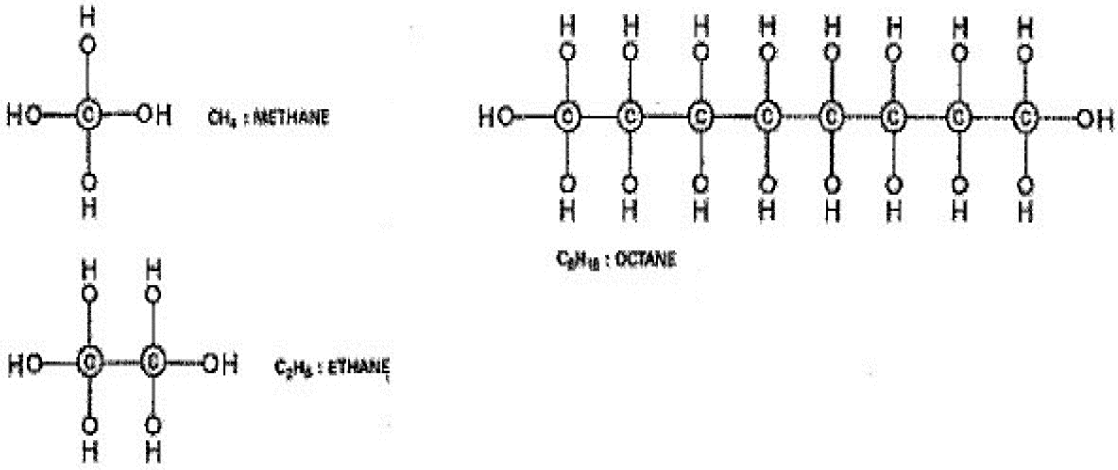


Fig. 2.1 C: Schematic representation of hydrocarbon molecules

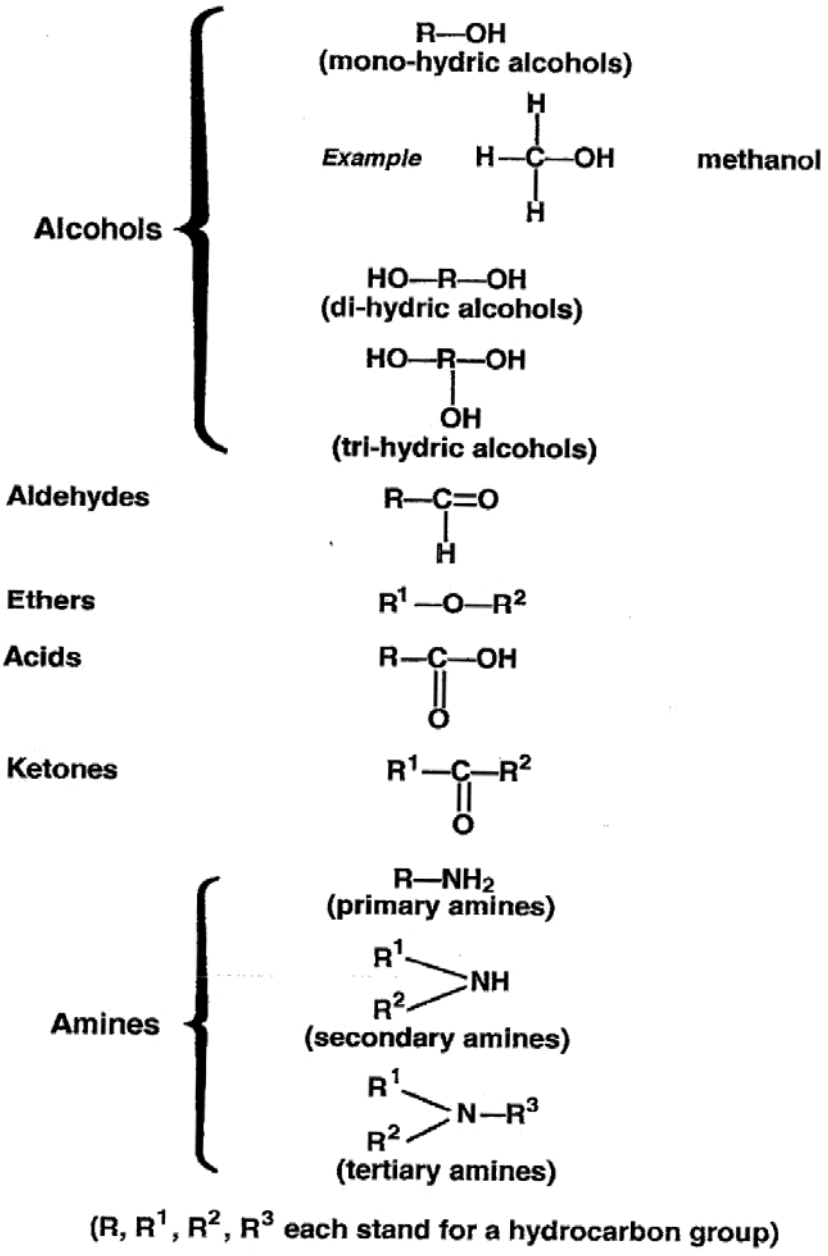


Figure 2.1 E: Molecular structure

Self Checklist for Company Safety Management System

IMO Company ID. No.: _____ **Number of relevant employees who carry out or have responsibility to the SMS of the Company ashore.** ☐

Company Name: _____ **Type of Audit** _____ **Record No.** _____

Company Address: _____ **Country:** _____

Designated Person(s): _____ **Tel.:** _____ **Fax:** _____

Date of Checking: _____ **Checked by:** _____ **E-mail:** _____

Title & Latest Revision Date of Manual: _____ **Website:** _____

Note:
(1) This Checklist indicates items to be included at least in the samples at self checking.
(2) In principle, the verification over the Company's implementation of SMS should be made comprehensively for the past one year. However, in the Renewal, the verification over the Company's implementation of SMS should be extended to include the reports issued by the external audits, PSC or marine casualties, and the company's investigation and analysis conducted in response to them, for the past five years.

(1) Items to be checked prior to audit

Items to be checked	*CHK*	*Remarks*
1-1 Changes of ships under management		As for new acquisition, a copy of owner's report to the Administration as required in ISM Code 3.1 to be available.
If there are any SMC of ships left from the Company's management, the SMC should be returned to ClassNK Head Office for "Termination of ISM registration".		
1-2 Changes in Company's name/address		If Additional Audit has not yet started, an Additional audit for changes shall be applied to the ClassNK Local Office.
1-3 Confirmation of ship types covered by DOC		If any ship type no longer exists under management for more than 1 year, rewrite of DOC shall be requested at next Audit.
1-4 Confirmation of ship flags covered by DOC		If no ship under management remains with any Flag, the DOC of same Flag shall be returned at next Audit.
1-5 Confirmation of reporting to Flag States		A copy of owner's report to the Administration as required in ISM Code 3.1 to be confirmed, for every ship.

(2) Items to be confirmed prior to audit

Type of ship*	Flag & number of ships under management	Type of ship*	Flag & number of ships under management
Oil Tanker		Bulk Carrier r**	
Chemical Tanker		Other Cargo Ship	
Gas Carrier		Passenger Ship	
* Refer to SOLAS IX/1 & 2		** Dry cargo ships assigned with "ESP" within the Class Notation	
Active Crew nationality			
Masters		Chief Engineers	
Deck Officers		Engineers	
Deck Ratings		Engine Ratings	
Radio Operators		Cooks	
Language	Manual, Procedures and Instructions	Working Language Onboard	

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Fig. 3.0 A: Safety Management checklist

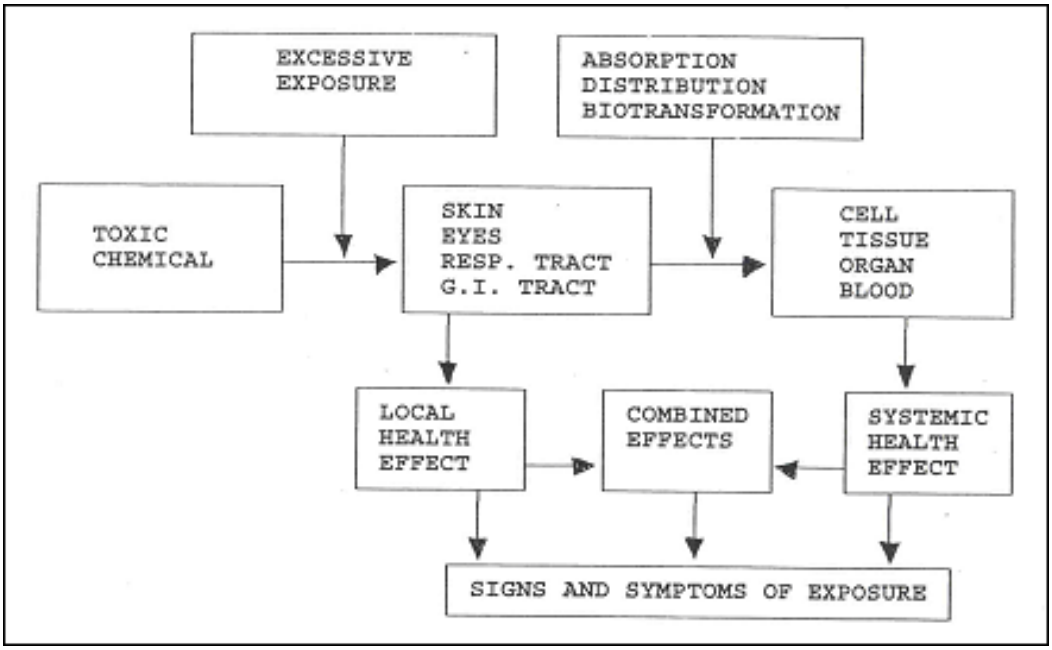


Fig. 4.1.1 A: Health Hazards

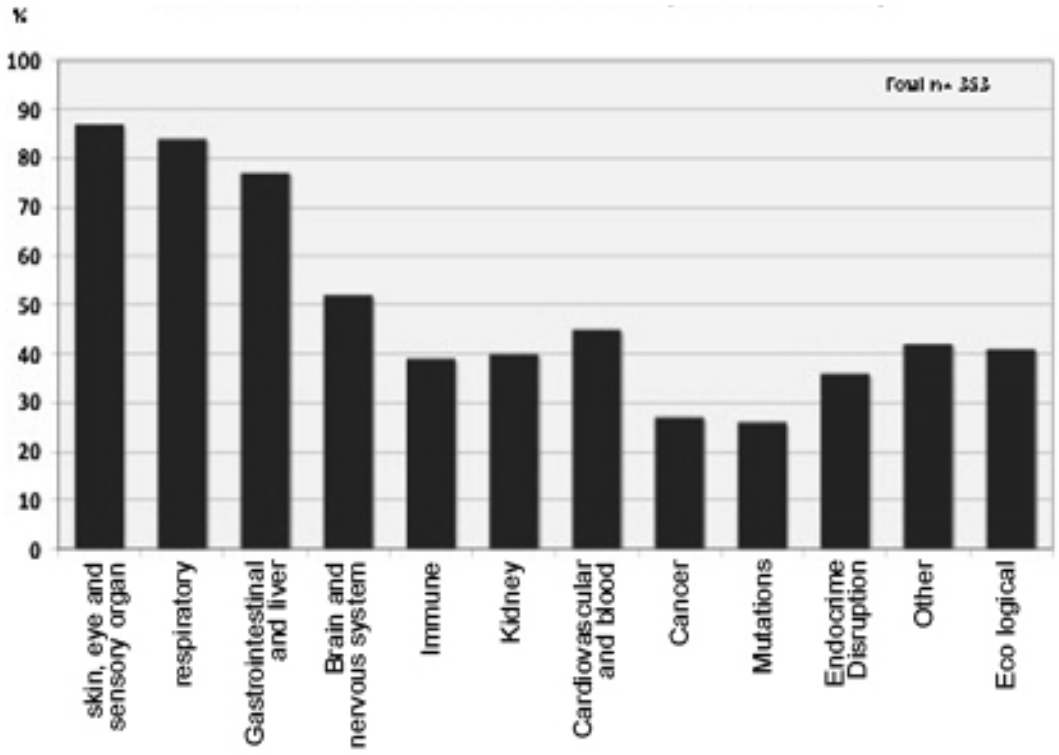


Fig. 4.1.1 B: Health Hazards in percentage of exposures to oil and Chemicals

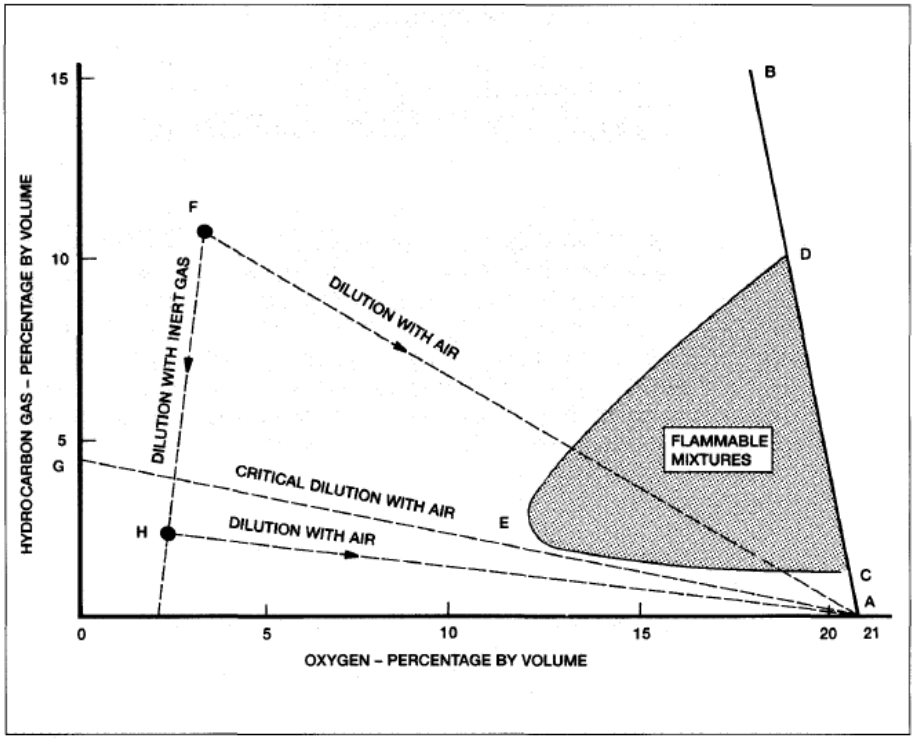


Fig. 4.1.5 A: Flammability diagram

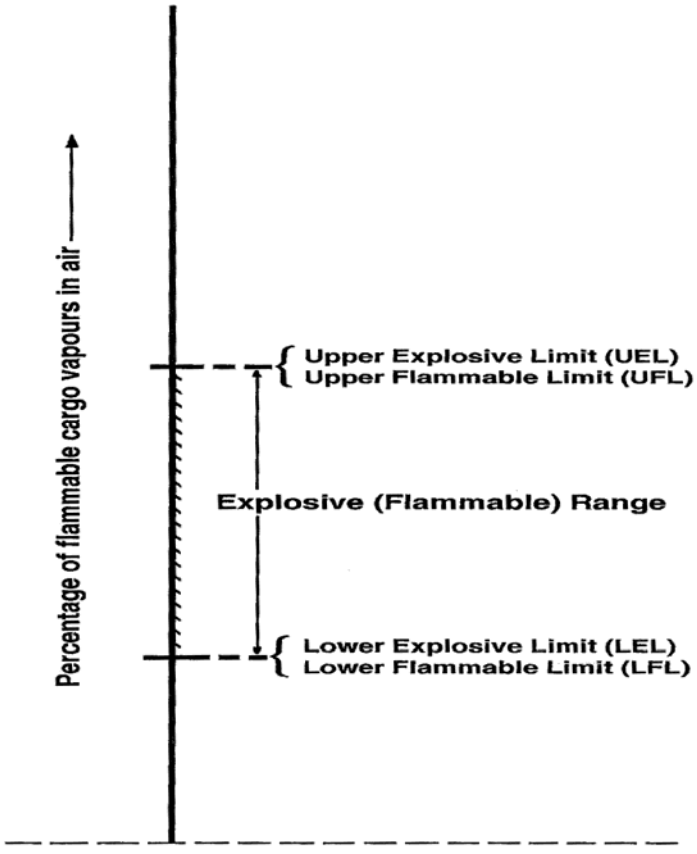


Fig. 4.1.5 B: Flammable Range

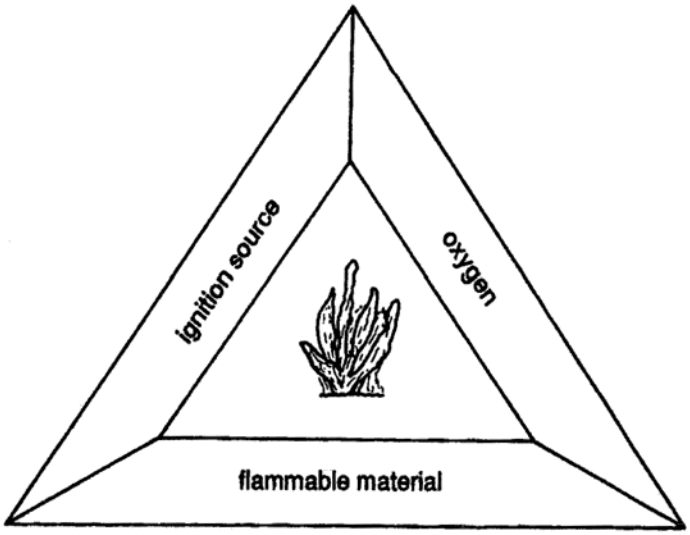
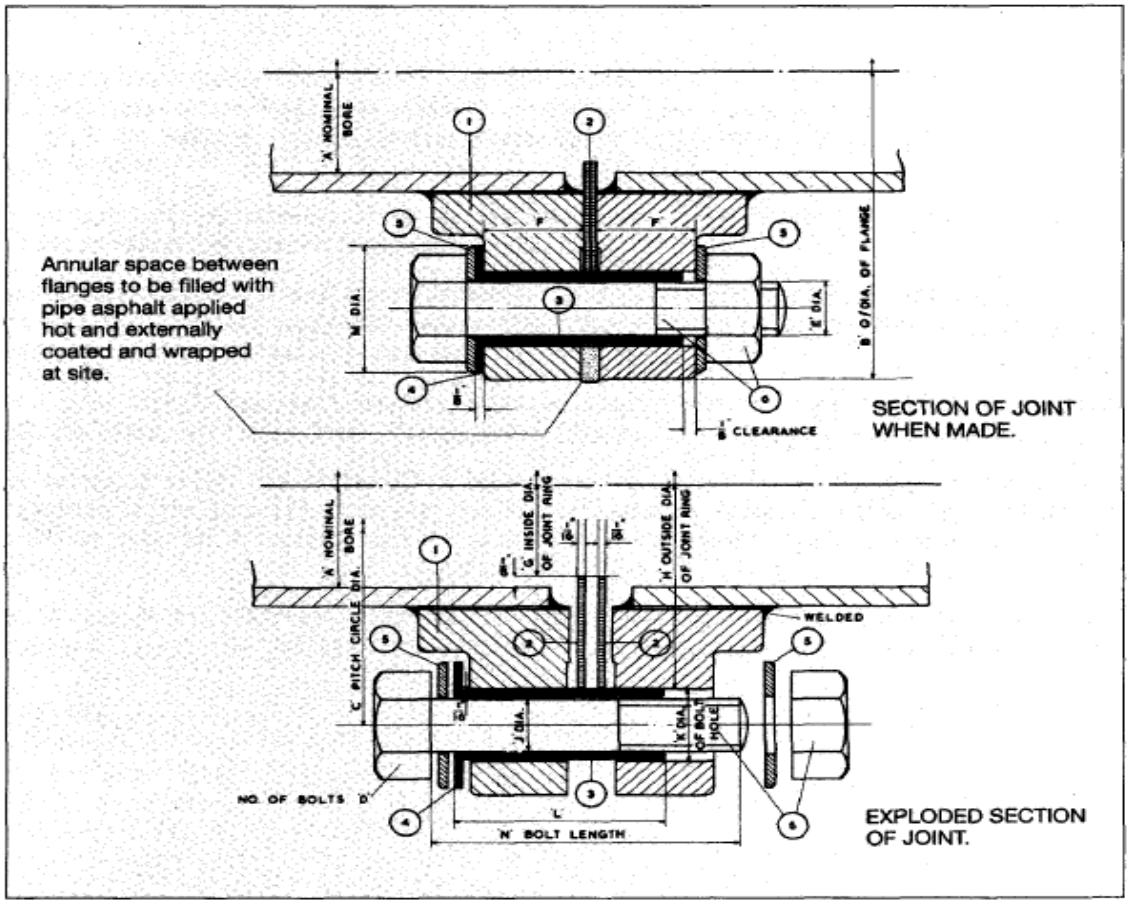


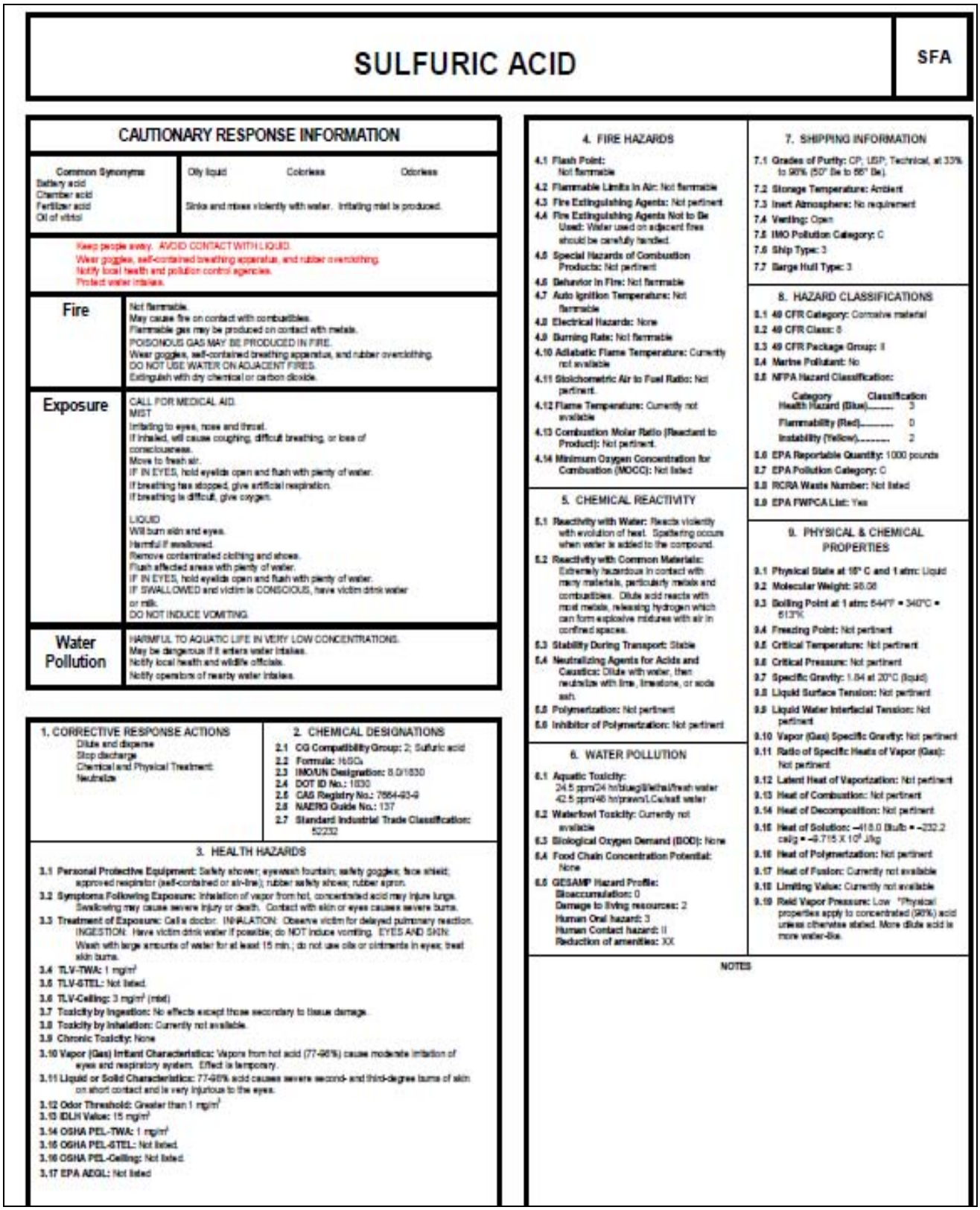
Fig. 4.1.5 C: The Fire Triangle



ITEM	MATERIAL	DESCRIPTION
1	Steel	Flange to ANSI B 16.5-Bolt holes drilled to suit dimensions scheduled opposite, can be screw-on, slip on or weld neck
2	Klingerite	Joint rings 1/16” thick See note
3	Tufnol	Bolt insulating sleeves – Crow Grade
4	Tufnol	Bolt Washer1/8” thick – Crow Grade
5	Steel	Plain round washer B.S.
6	Steel	B. S.W. Bright bolts and nuts

Fig. 4.1.6; A Typical construction of an insulating Flange

Fig. 4.2.9 (A): MSDS



SULFURIC ACID

SFA

CAUTIONARY RESPONSE INFORMATION

Common Synonyms			
Battery acid Chamber acid Fertilizer acid Oil of vitriol	Oily liquid	Colorless	Odorless

Stinks and mixes violently with water. Irritating mist is produced.

Keep people away. AVOID CONTACT WITH LIQUID.
Wear goggles, self-contained breathing apparatus, and rubber overclothing.
Notify local health and pollution control agencies.
Protect water intakes.

Fire

Not flammable.
May cause fire on contact with combustibles.
Flammable gas may be produced on contact with metals.
POISONOUS GAS MAY BE PRODUCED IN FIRE.
Wear goggles, self-contained breathing apparatus, and rubber overclothing.
DO NOT USE WATER ON ADJACENT FIRES.
Extinguish with dry chemical or carbon dioxide.

Exposure

CALL FOR MEDICAL AID.
MIST
Irritating to eyes, nose and throat.
If inhaled, will cause coughing, difficult breathing, or loss of consciousness.
Move to fresh air.
IF IN EYES, hold eyelids open and flush with plenty of water.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Will burn skin and eyes.
Harmful if swallowed.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
May be dangerous if it enters water intakes.
Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. CORRECTIVE RESPONSE ACTIONS

Dilute and disperse
Stop discharge
Chemical and Physical Treatment:
Neutralize

2. CHEMICAL DESIGNATIONS

2.1 **CG Compatibility Group:** 2; Sulfuric acid
2.2 **Formula:** H_2SO_4
2.3 **IMO/UN Designation:** 8.0/1830
2.4 **DOT ID No.:** 1830
2.5 **CAS Registry No.:** 7664-93-9
2.6 **NAERG Guide No.:** 137
2.7 **Standard Industrial Trade Classification:** 52232

3. HEALTH HAZARDS

3.1 **Personal Protective Equipment:** Safety shower; eyewash fountain; safety goggles; face shield; approved respirator (self-contained or air-line); rubber safety shoes; rubber apron.
3.2 **Symptoms Following Exposure:** Inhalation of vapor from hot, concentrated acid may injure lungs. Swallowing may cause severe injury or death. Contact with skin or eyes causes severe burns.
3.3 **Treatment of Exposure:** Call a doctor. INHALATION: Observe victim for delayed pulmonary reaction. INGESTION: Have victim drink water if possible; do NOT induce vomiting. EYES AND SKIN: Wash with large amounts of water for at least 15 min.; do not use oils or ointments in eyes; treat skin burns.
3.4 **TLV-TWA:** 1 mg/m³
3.5 **TLV-STEL:** Not listed.
3.6 **TLV-Ceiling:** 3 mg/m³ (mist)
3.7 **Toxicity by Ingestion:** No effects except those secondary to tissue damage.
3.8 **Toxicity by Inhalation:** Currently not available.
3.9 **Chronic Toxicity:** None
3.10 **Vapor (Gas) Irritant Characteristics:** Vapors from hot acid (77-98%) cause moderate irritation of eyes and respiratory system. Effect is temporary.
3.11 **Liquid or Solid Characteristics:** 77-98% acid causes severe second- and third-degree burns of skin on short contact and is very injurious to the eyes.
3.12 **Odor Threshold:** Greater than 1 mg/m³
3.13 **IDLH Value:** 15 mg/m³
3.14 **OSHA PEL-TWA:** 1 mg/m³
3.15 **OSHA PEL-STEL:** Not listed.
3.16 **OSHA PEL-Ceiling:** Not listed.
3.17 **EPA AEGL:** Not listed

4. FIRE HAZARDS

4.1 **Flash Point:** Not flammable
4.2 **Flammable Limits in Air:** Not flammable
4.3 **Fire Extinguishing Agents:** Not pertinent
4.4 **Fire Extinguishing Agents Not to Be Used:** Water used on adjacent fires should be carefully handled.
4.5 **Special Hazards of Combustion Products:** Not pertinent
4.6 **Behavior in Fire:** Not flammable
4.7 **Auto Ignition Temperature:** Not flammable
4.8 **Electrical Hazards:** None
4.9 **Burning Rate:** Not flammable
4.10 **Adiabatic Flame Temperature:** Currently not available
4.11 **Stoichometric Air to Fuel Ratio:** Not pertinent.
4.12 **Flame Temperature:** Currently not available
4.13 **Combustion Molar Ratio (Reactant to Product):** Not pertinent.
4.14 **Minimum Oxygen Concentration for Combustion (MOCC):** Not listed

5. CHEMICAL REACTIVITY

5.1 **Reactivity with Water:** Reacts violently with evolution of heat. Spattering occurs when water is added to the compound.
5.2 **Reactivity with Common Materials:** Extremely hazardous in contact with many materials, particularly metals and combustibles. Dilute acid reacts with most metals, releasing hydrogen which can form explosive mixtures with air in confined spaces.
5.3 **Stability During Transport:** Stable
5.4 **Neutralizing Agents for Acids and Caustics:** Dilute with water, then neutralize with lime, limestone, or soda ash.
5.5 **Polymerization:** Not pertinent
5.6 **Inhibitor of Polymerization:** Not pertinent

6. WATER POLLUTION

6.1 **Aquatic Toxicity:** 24.5 ppm/24 hr/bluegill/lethal/fresh water
42.5 ppm/48 hr/prawn/LC₅₀/salt water
6.2 **Waterfowl Toxicity:** Currently not available
6.3 **Biological Oxygen Demand (BOD):** None
6.4 **Food Chain Concentration Potential:** None
6.5 **GESAMP Hazard Profile:**
Bioaccumulation: 0
Damage to living resources: 2
Human Oral hazard: 3
Human Contact hazard: 1
Reduction of amenities: XX

7. SHIPPING INFORMATION

7.1 **Grades of Purity:** CP, USP, Technical, at 33% to 98% (50° Be to 66° Be).
7.2 **Storage Temperature:** Ambient
7.3 **Inert Atmosphere:** No requirement
7.4 **Venting:** Open
7.5 **IMO Pollution Category:** C
7.6 **Ship Type:** 3
7.7 **Barge Hull Type:** 3

8. HAZARD CLASSIFICATIONS

8.1 **49 CFR Category:** Corrosive material
8.2 **49 CFR Class:** 8
8.3 **49 CFR Package Group:** II
8.4 **Marine Pollutant:** No
8.5 **NFPA Hazard Classification:**

Category	Classification
Health Hazard (Blue).....	3
Flammability (Red).....	0
Instability (Yellow).....	2

8.6 **EPA Reportable Quantity:** 1000 pounds
8.7 **EPA Pollution Category:** C
8.8 **RCRA Waste Number:** Not listed
8.9 **EPA FWPCA List:** Yes

9. PHYSICAL & CHEMICAL PROPERTIES

9.1 **Physical State at 15° C and 1 atm:** Liquid
9.2 **Molecular Weight:** 98.08
9.3 **Boiling Point at 1 atm:** 644°F = 340°C = 613°K
9.4 **Freezing Point:** Not pertinent
9.5 **Critical Temperature:** Not pertinent
9.6 **Critical Pressure:** Not pertinent
9.7 **Specific Gravity:** 1.84 at 20°C (liquid)
9.8 **Liquid Surface Tension:** Not pertinent
9.9 **Liquid Water Interfacial Tension:** Not pertinent
9.10 **Vapor (Gas) Specific Gravity:** Not pertinent
9.11 **Ratio of Specific Heats of Vapor (Gas):** Not pertinent
9.12 **Latent Heat of Vaporization:** Not pertinent
9.13 **Heat of Combustion:** Not pertinent
9.14 **Heat of Decomposition:** Not pertinent
9.15 **Heat of Solution:** –418.0 Btu/lb = –232.2 cal/g = -9.715×10^8 J/kg
9.16 **Heat of Polymerization:** Not pertinent
9.17 **Heat of Fusion:** Currently not available
9.18 **Limiting Value:** Currently not available
9.19 **Reid Vapor Pressure:** Low *Physical properties apply to concentrated (98%) acid unless otherwise stated. More dilute acid is more water-like.

NOTES

Fig.4.2.9 (B) : MSDS for Sulphuric acid

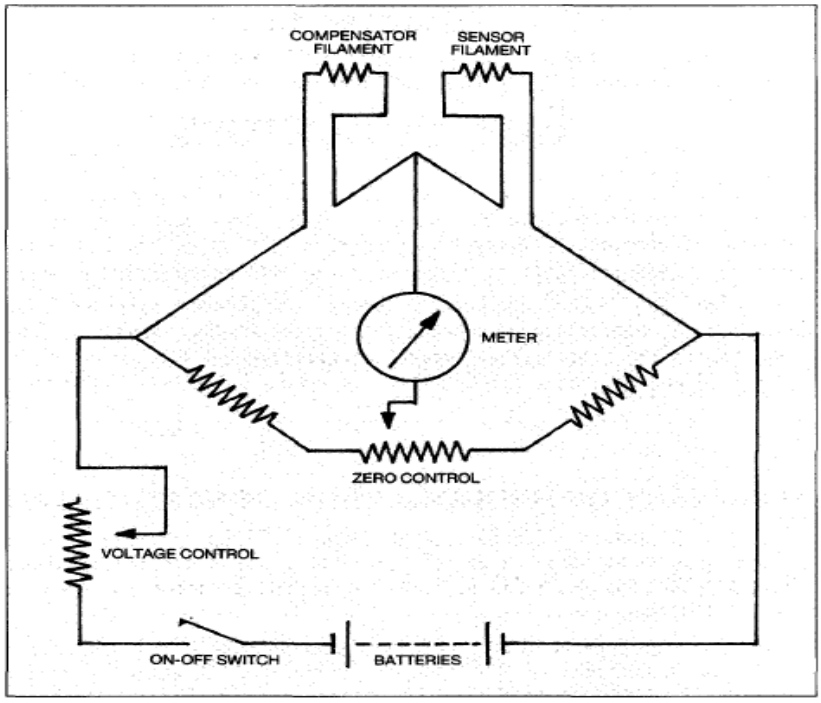


Fig. 5.1: A Circuit diagram of a Tankscope

Fig. 5.2.2: A Protective Clothing

Fig. 5.3.1: Entering enclosed space with SCBA

Fig 6.1: Fire Safety- Fire drill on a ship

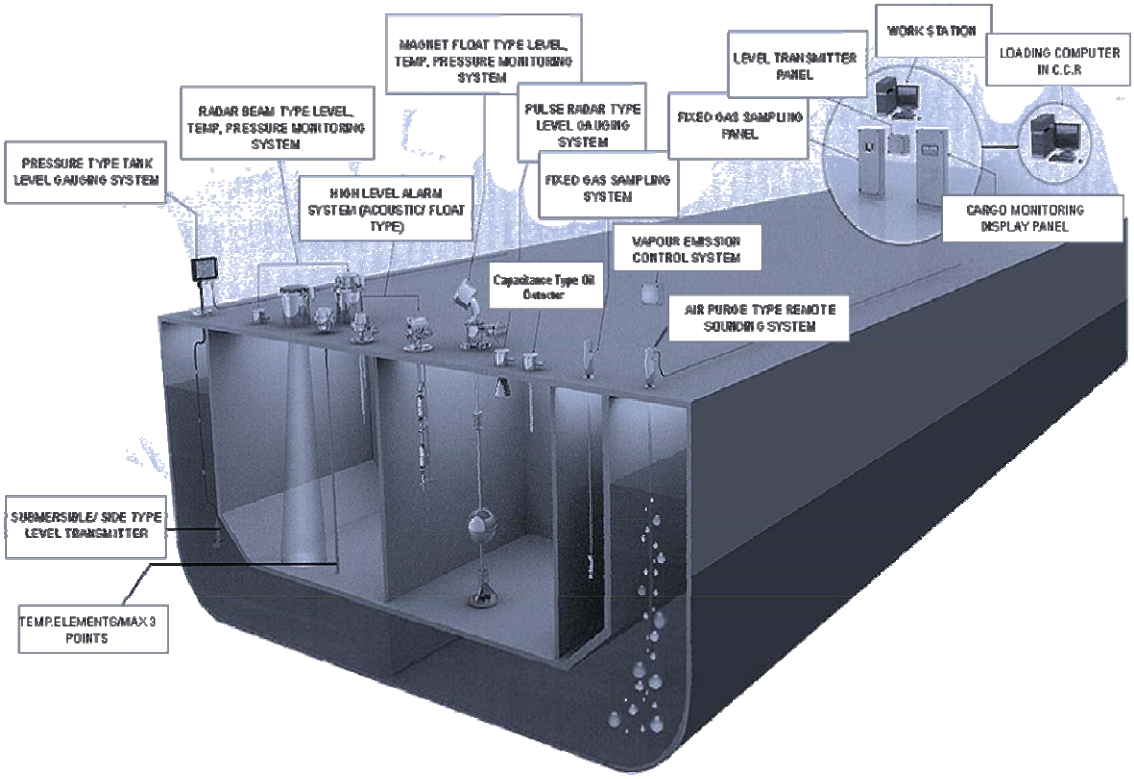


Fig 7.0: Various tank instrumentation systems

Fig. 7.1 A: Chemical Tank cleaning machines

Fig. 7.1 B: Restricted gauging and sampling equipment

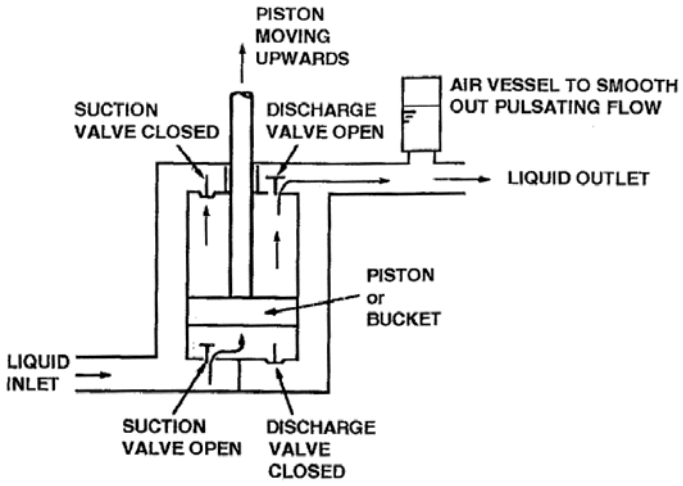


Fig. 7.1 C: Operation of a Reciprocating displacement pump

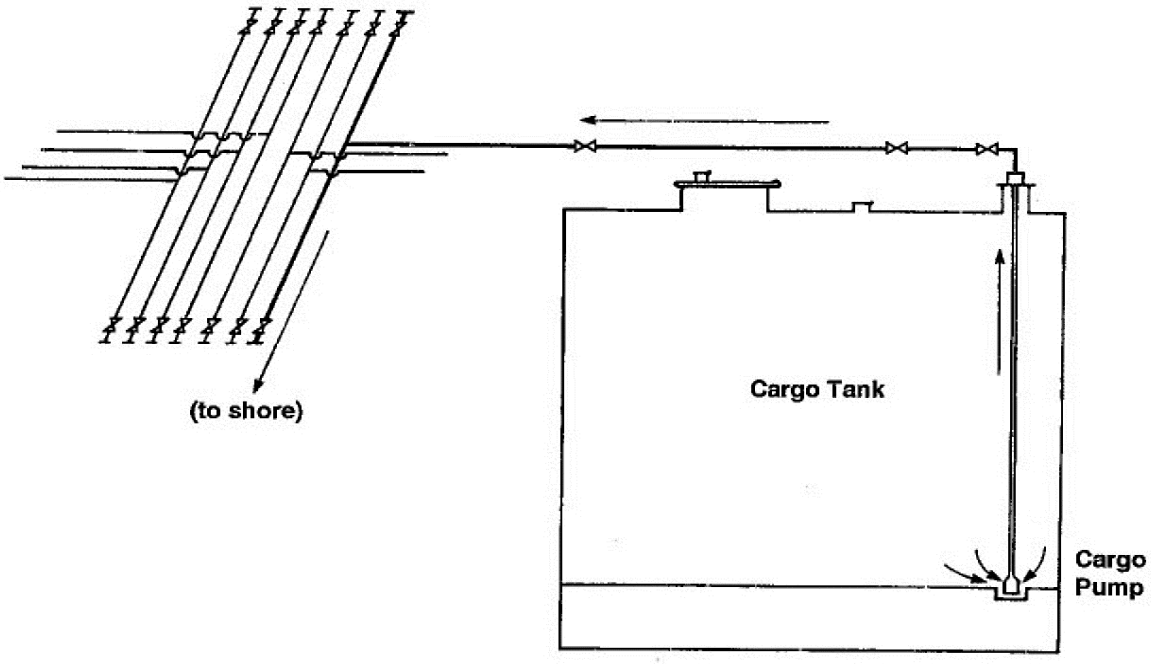


Fig. 7.2 A: Unloading arrangements of a Chemical Tanker

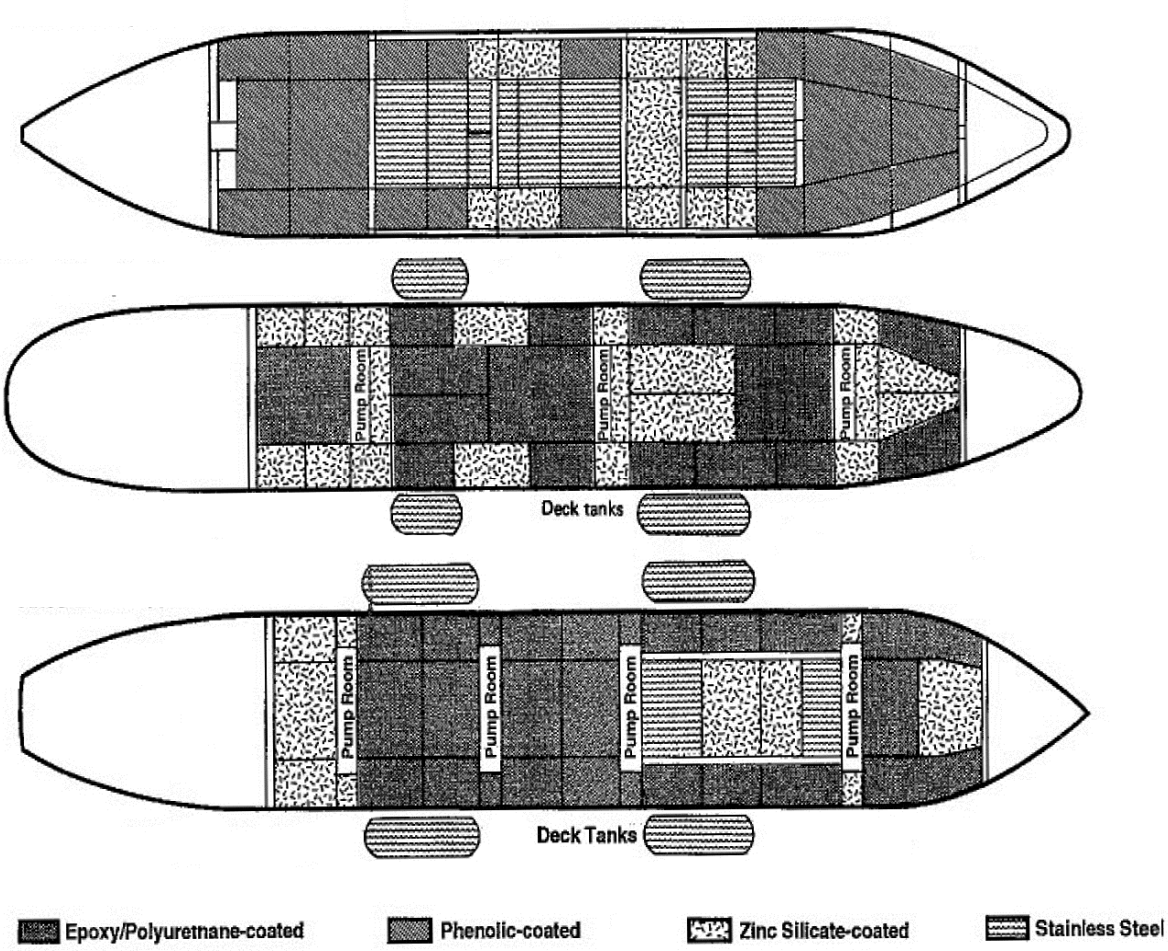


Fig. 7.2 B: Various types of parcel tankers tank coatings

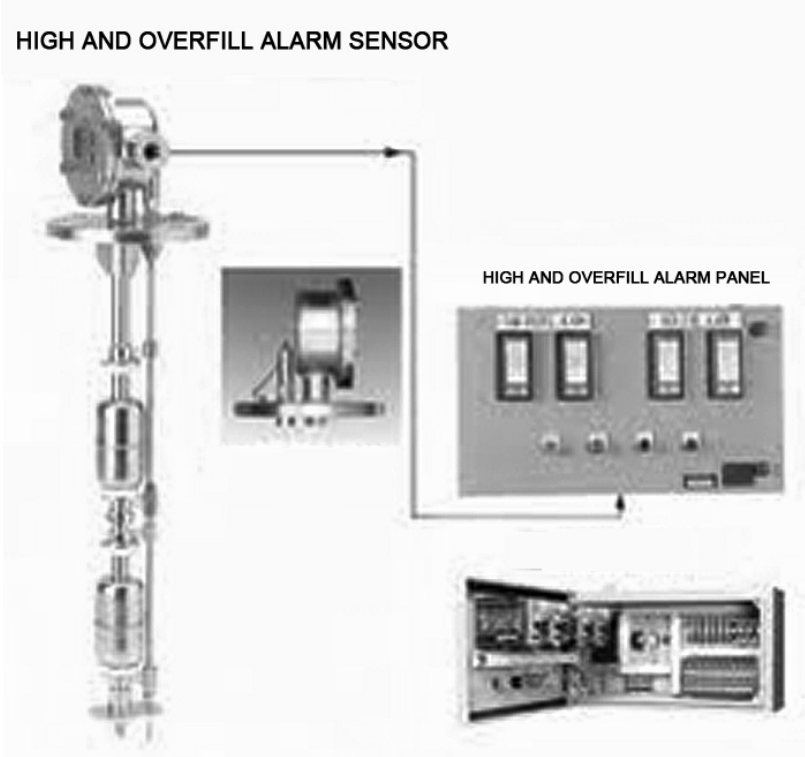
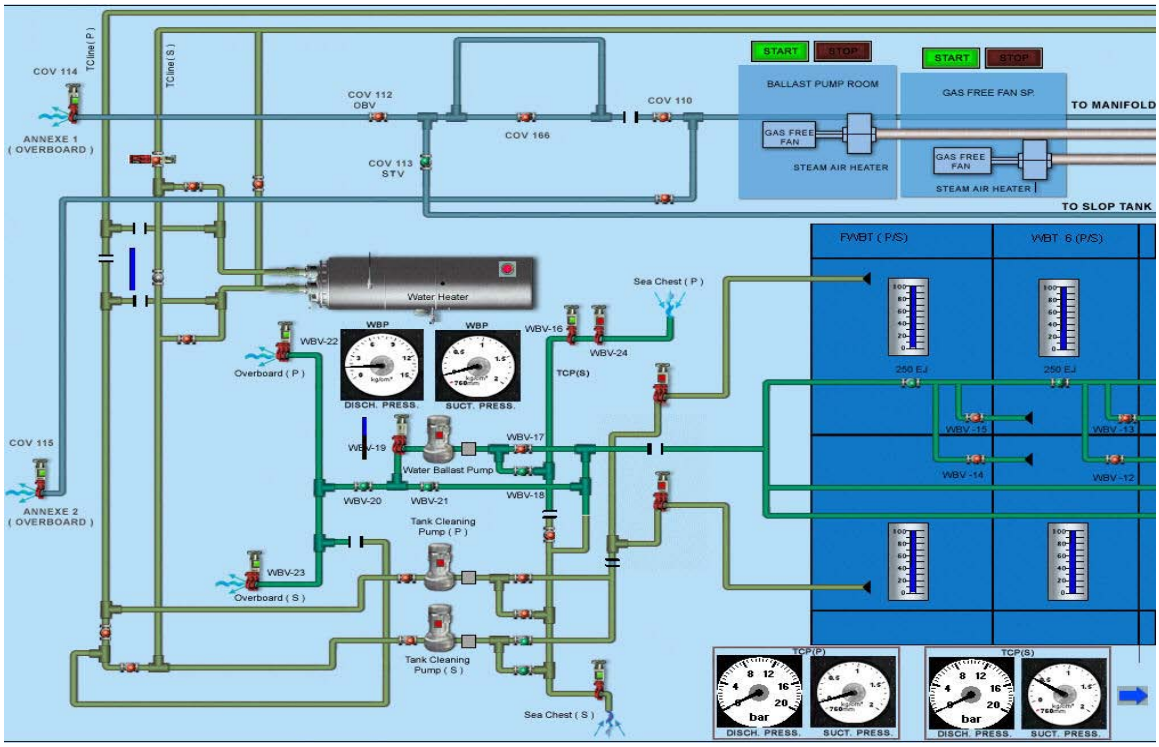
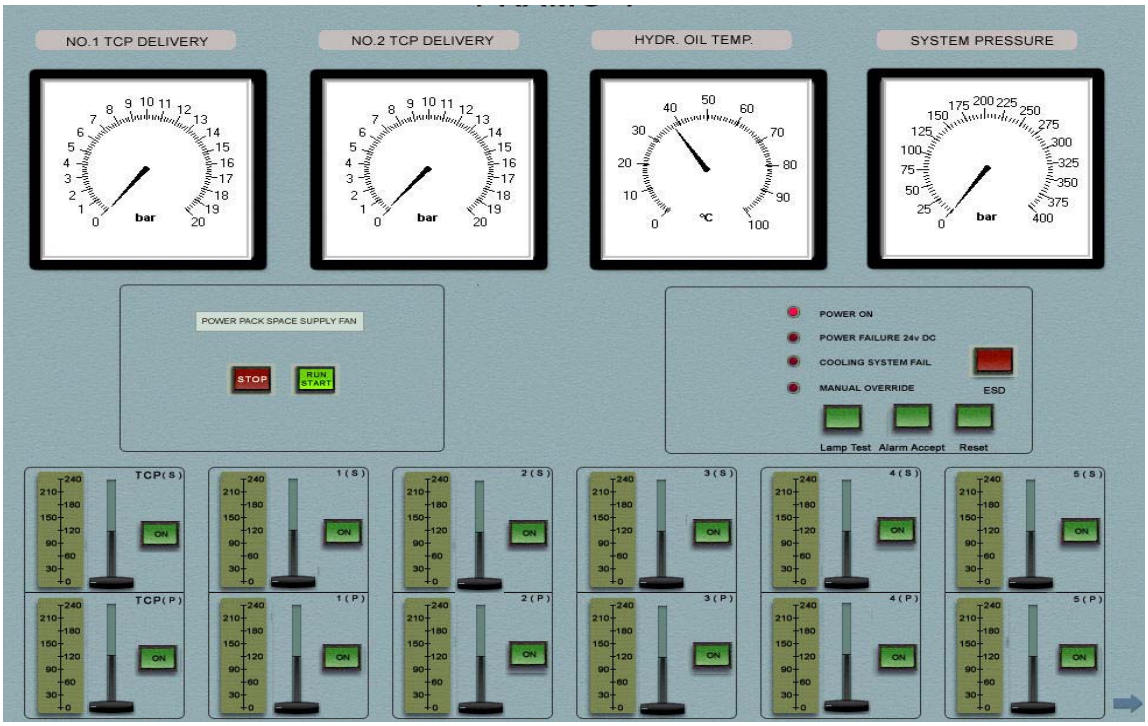


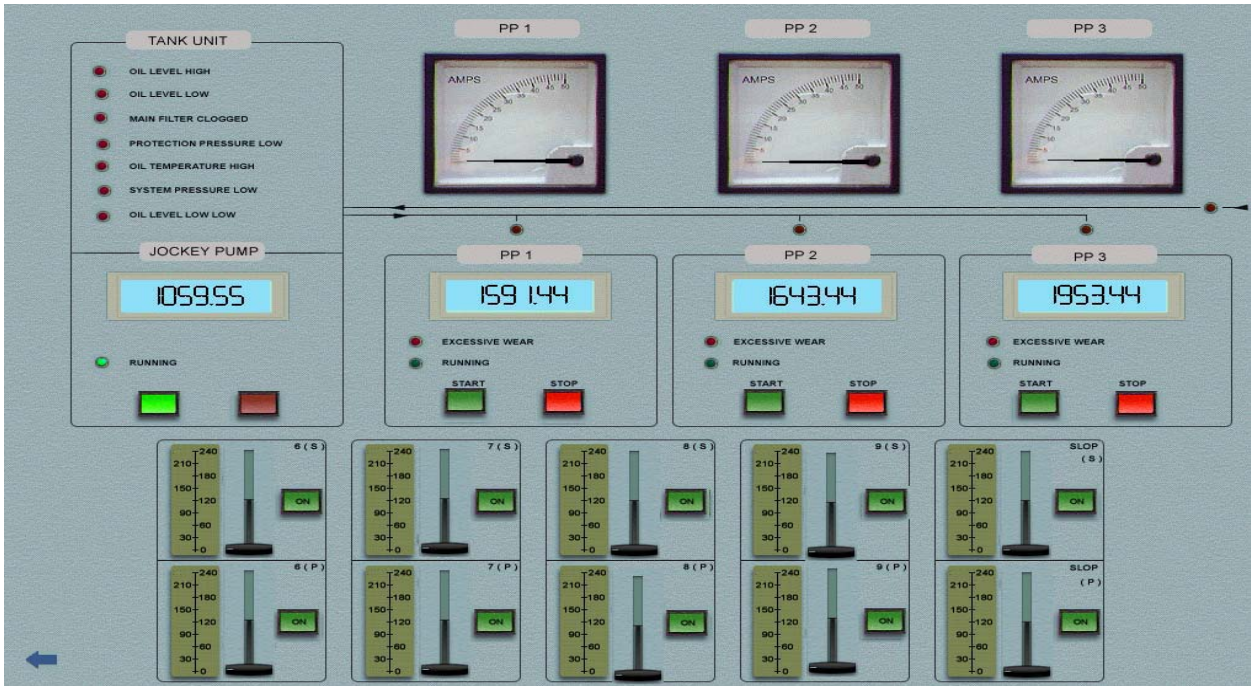
Fig. 9.3: High level and overfill alarms



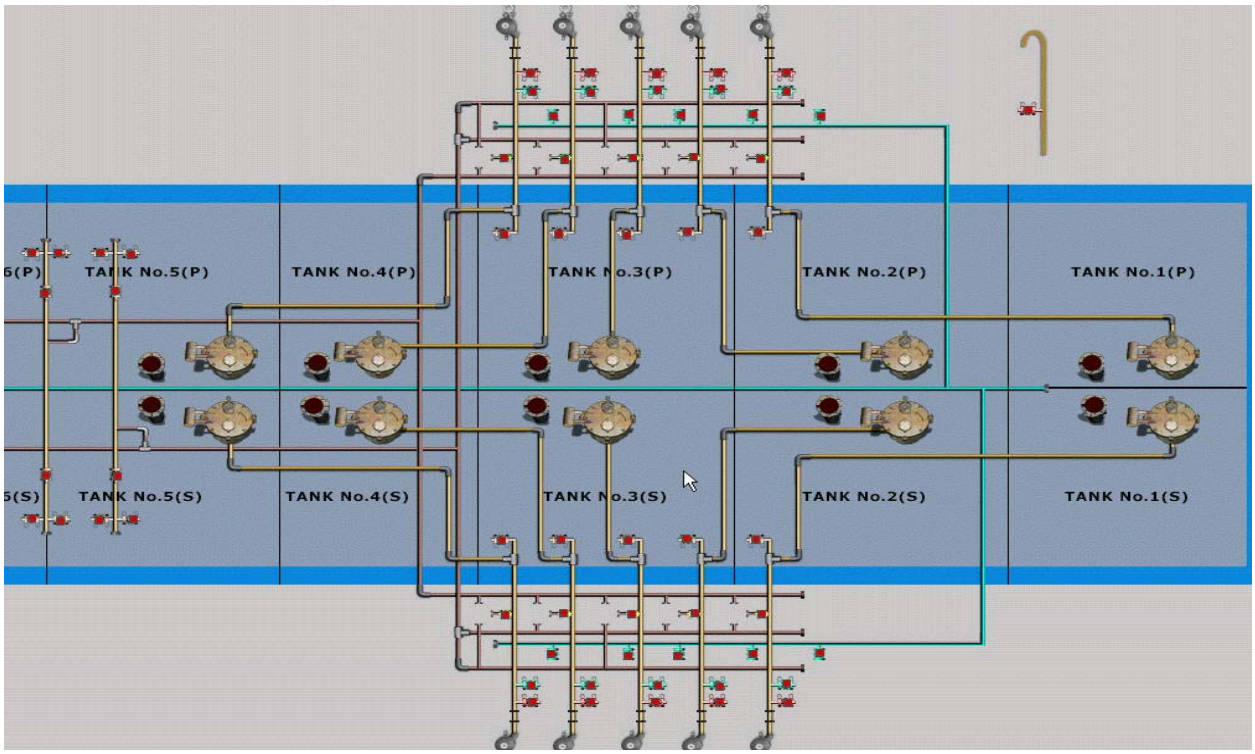
Chemical Simulator Fig 1: Ballast Pump room on a Chemical Tanker



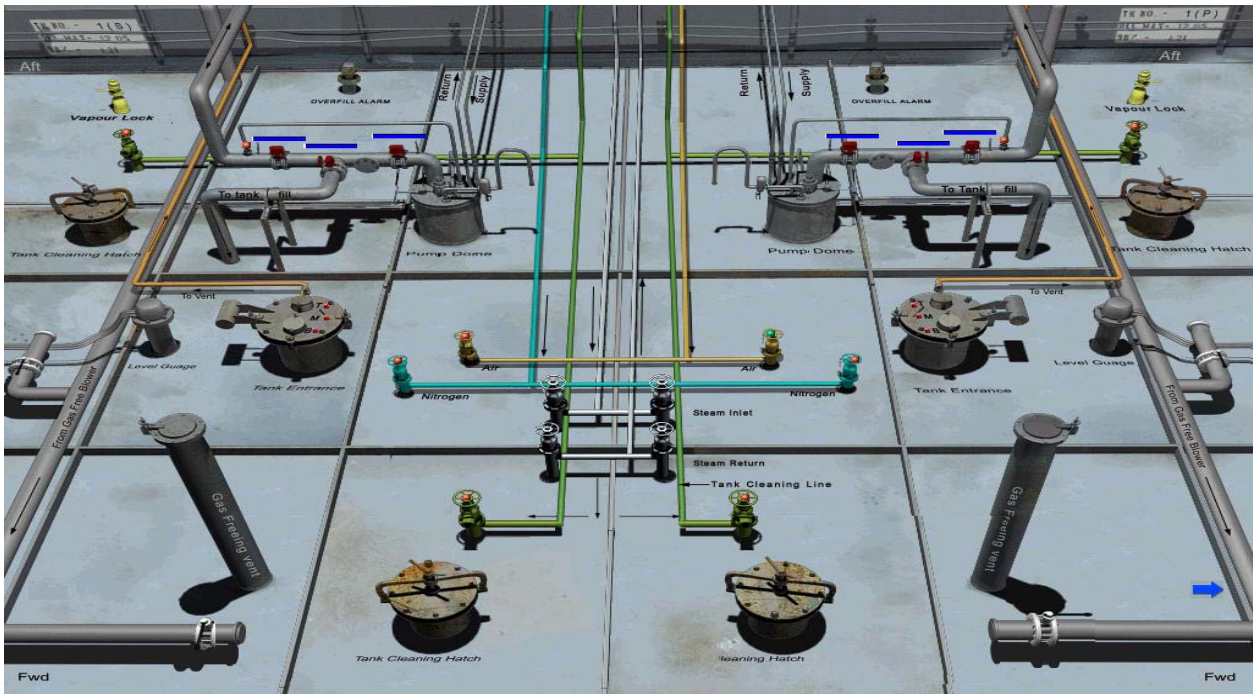
Chemical Simulator Fig 2: Pump Operating System on a Tanker



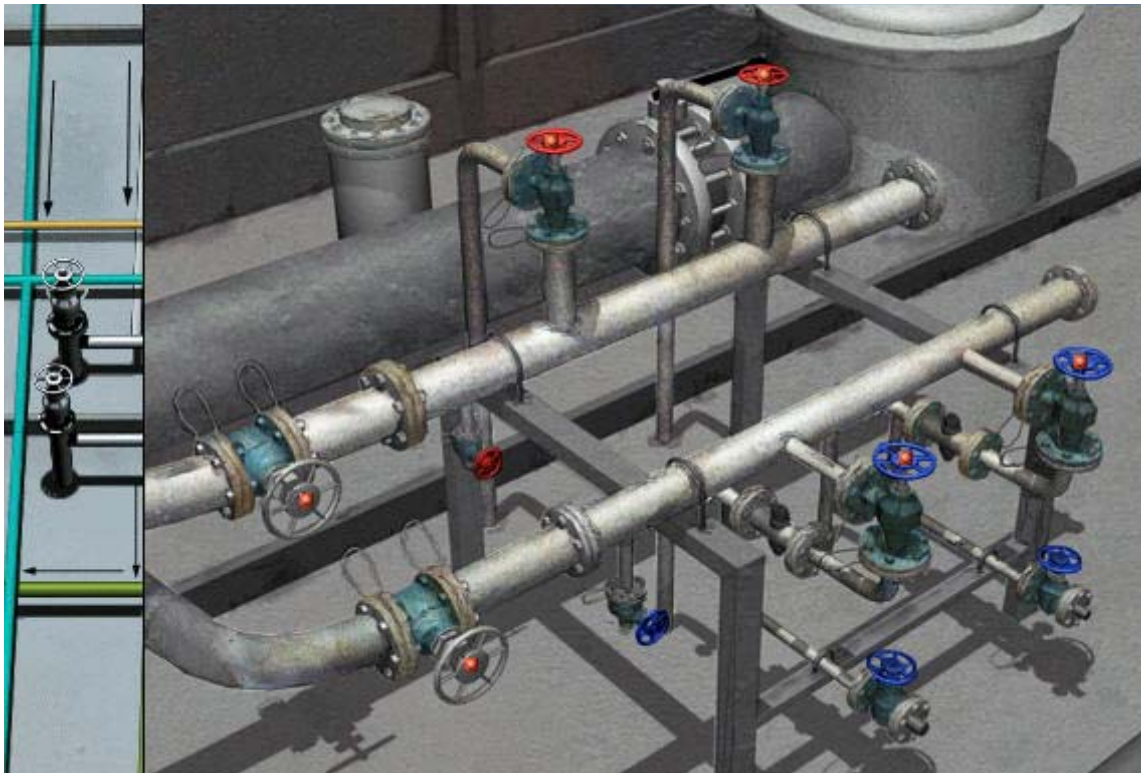
Chemical Simulator Fig 3: Power Pack and Hydraulic controls of a Cargo pumping system



Chemical Simulator Fig 4: Venting system of a Chemical Tanker

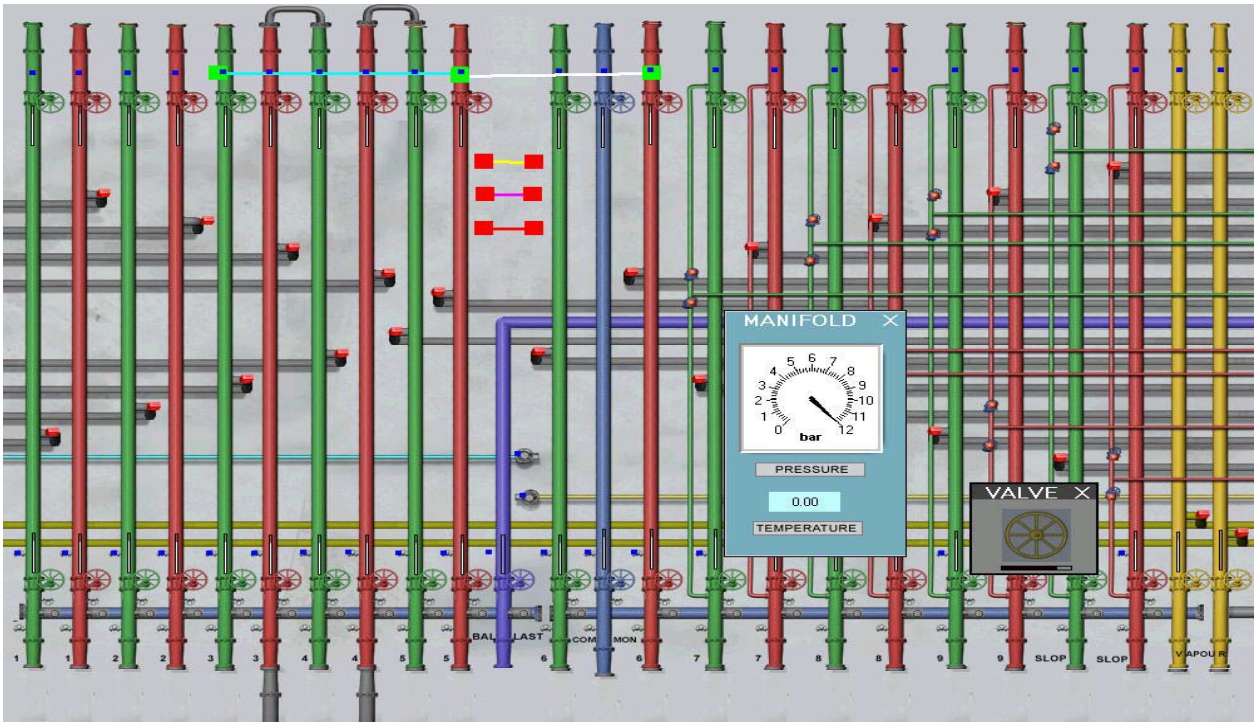


Chemical Simulator Fig 5: Main Deck arrangements of a Chemical Tanker

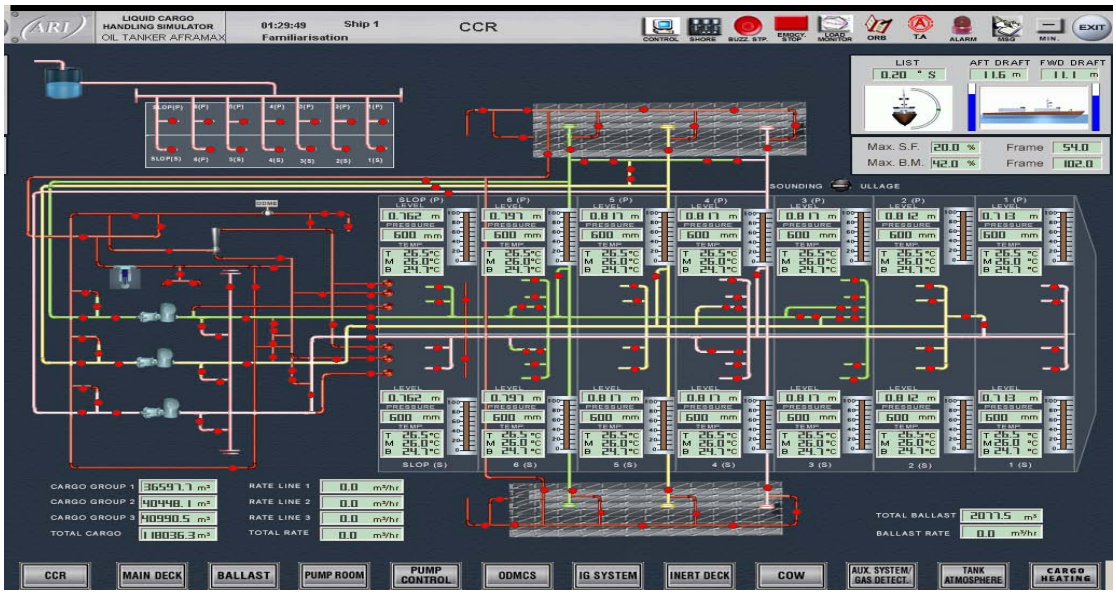


Chemical Simulator Fig 6: Tank Heating arrangements on a Chemical Tankers main deck

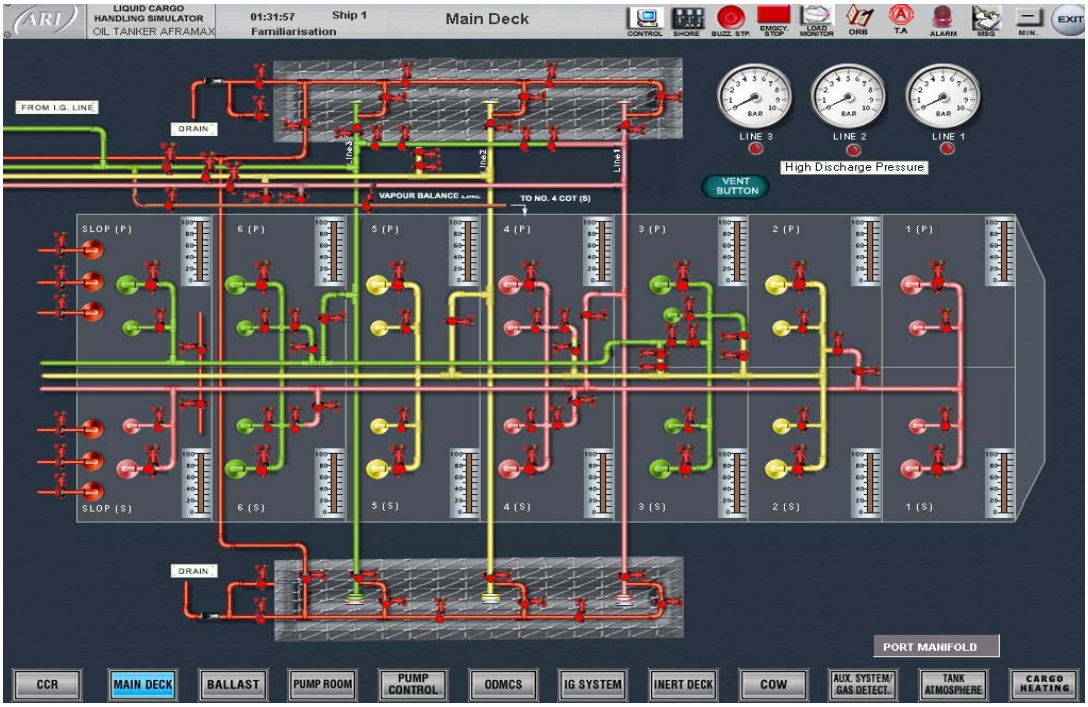
Chemical Simulator Fig 7: Tank Cleaning heater



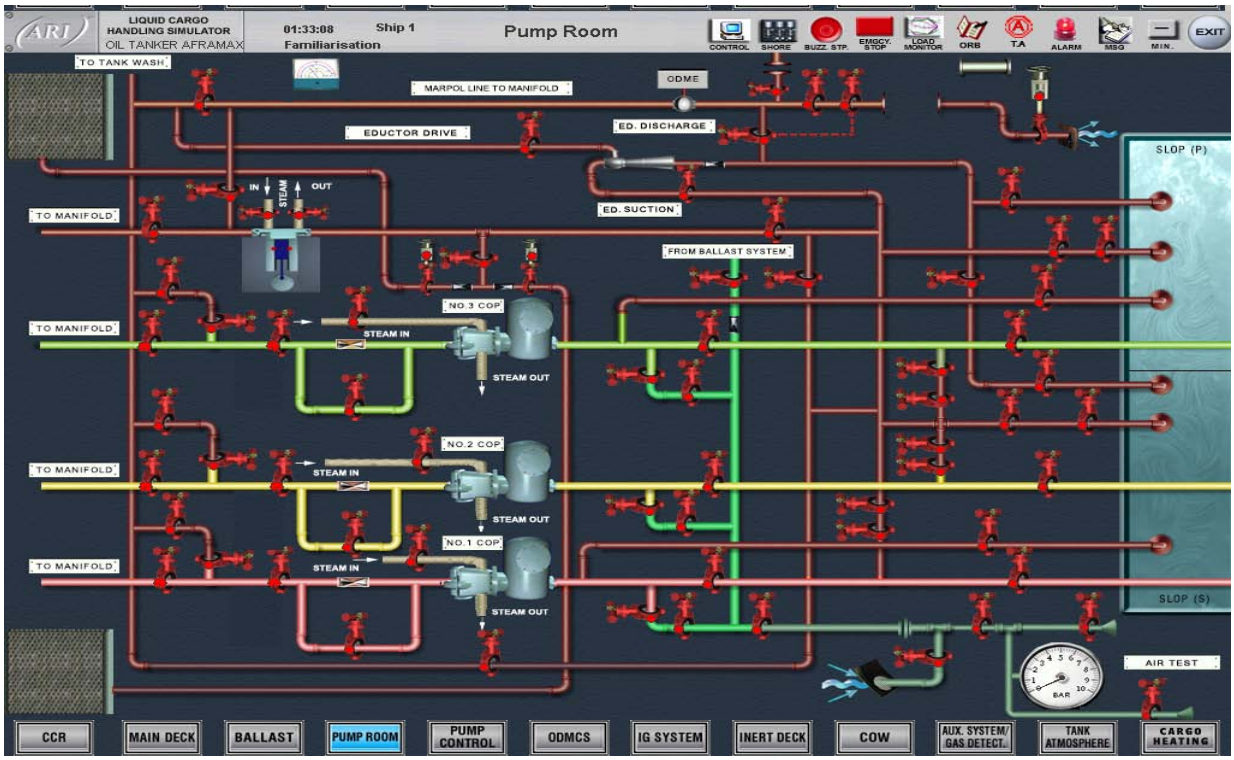
Chemical Simulator Fig 8 Manifold connections on a Chemical tanker Simulator



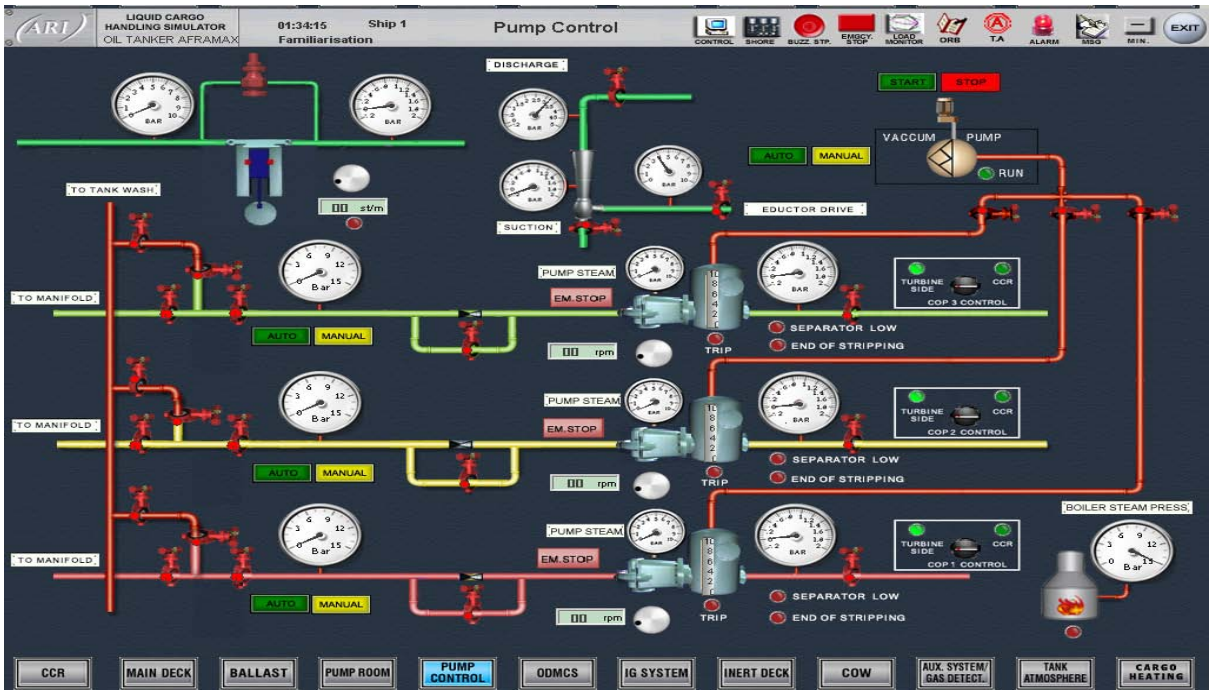
Oil Tanker Fig 1: Cargo Control Room Simulator Screen



Oil Tanker Fig 2: Oil Tanker Pipeline arrangements Simulator Screen

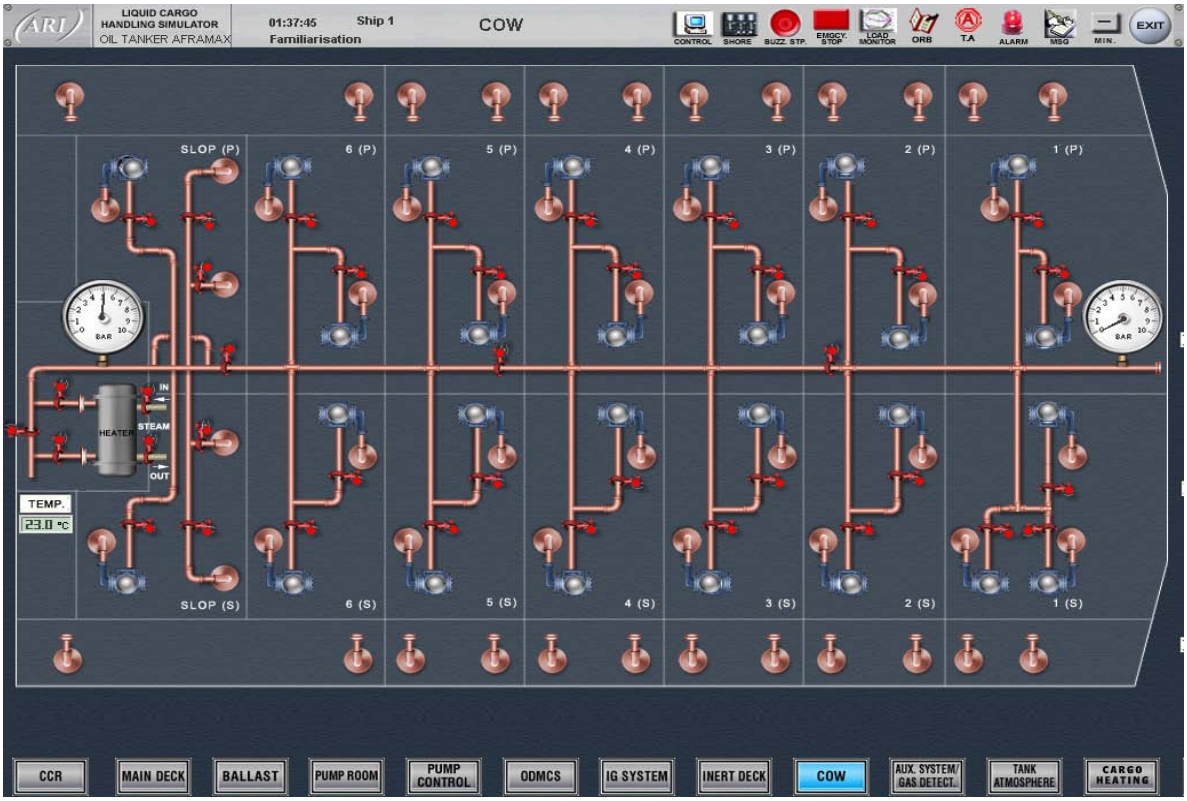


Oil Tanker Fig 3: Pump Room Arrangements



Oil Tanker Fig 4: Pump Control Simulator Screen

Oil Tanker Fig 5: IG and Venting arrangements of an oil tanker Simulator Screen



Oil Tanker Fig 6: Crude oil washing arrangements Oil Tanker Simulator Screen

APPENDIX 2

INSTRUCTOR SIMULATOR GUIDANCE NOTES

INSTRUCTOR SIMULATOR MANUAL

General

This manual reflects the views of the course designer on methodology and organization, and what is considered relevant and important in the light of his experience as an instructor. Although the guidance given should be of value initially, the course instructor should work out his own methods and ideas, refine and develop what is successful, and discard ideas and methods which are not effective.

Preparation and planning constitute a major contribution to effective presentation of the course. The Operational requirements of the course are recommended with the use of Simulators.

Simulator exercises

The cargo-handling plant and systems used aboard merchant ships which transport liquefied gases in bulk listed in chapter 19 of IGC code can differ in their layout and in the types of machinery units and associated systems, so that the trainees will have varied knowledge and experience of such plant.

It is important, therefore, to use the briefing period to explain precisely which machinery units and systems are being simulated in the exercise, as well as their function, how they interact with each other and the role of the trainees during the exercise.

The trainees should be encouraged to co-operate with each other, working together as a team during the exercise, and to show the initiative and enthusiasm that will bring the exercise to a successful conclusion.

An important aspect of cargo and ballast handling is safety, and it is vital to ensure that safe practices are used throughout the exercise. Safety should be stressed during the briefing. One major contribution to safety is the use of checklists, which should be prepared beforehand, possibly as part of the briefing procedure.

During an exercise it is useful if one trainee assumes the role of officer-in-charge, with the responsibility of ensuring that the requirements and activities of the exercise are properly carried out. Role playing is an important element in the learning process, and with a number of trainees taking part in the exercises on the simulator, this aspect could provide a stimulus to the process of gaining knowledge and understanding.

Preparing and conducting exercises

If further exercises are to be developed, or the ones supplied in the course modified, it is important that they should not be too complex; otherwise the trainees might have difficulties in carrying out their tasks and duties within an allotted period of time.

An exercise should start with simple activities, making use of uncomplicated components such as valves, pumps, fluid systems, tanks etc., and move step by step into more complex activities.
The aim of the training programme is to use a step-by-step process to introduce the trainees to the range of activities associated with the operations of loading and unloading a liquefied gas cargo.

For this reason a number of activities termed "Special Operations and Procedures" have been grouped together to form section 2 of the course outline.

Of course, on board ship these operations would not be carried out in isolation, because they are all linked to other operations. For example, use of cargo heater vaporiser and booster pump in series with deep well pump during unloading.

However, initially it is beneficial to study such operations in isolation, so that what is taking place can be observed and studied without reference to some other activity.

When the course has progressed to section 4 of the syllabus, all activities dealt with in sections 1, 2, and 3 will be used in the simulated activity of loading and unloading a liquefied gas cargo.

The simulator is designed to provide training for normal operational procedures and for the input of abnormal or malfunction conditions. It is important that the trainees achieve a satisfactory level of competence under normal conditions before proceeding to abnormal operations due to the introduction of faults.

The exercises should provide the trainees with the most realistic impression of actually being in a cargo control centre aboard ship. Realism is important for this type of learning process. For this reason, if the simulator has an associated sound system, it should be used.

Exercise scenarios

The content of a scenario is governed to a large extent by the units and systems that are being simulated.

The syllabus used for the basic oil and Chemical tanker course has been structured to provide some flexibility in this respect, and the scenarios can be prepared using those syllabus elements which match a specific simulator design.

For this course, scenarios should be designed to cover the operational areas contained in the syllabus; for example:

- ❑ Familiarization with Equipment and Instrumentation.
- ❑ Loading
- ❑ Unloading
- ❑ Operational Problems.

The familiarization scenarios should aim at making the trainees not only feel "at home" with the units and systems being simulated, but should also provide some "hands-on" experience with the controls and some of the more basic equipment and operations, such as valves, pumps, pipe systems, instrumentation, filling and emptying tanks etc.

The operational scenarios should aim at providing experience in preparing and carrying out the various tasks and procedures that are involved with the safe transportation of liquefied gases in bulk. If the institution does not have Simulators then the simulator photographs appended in Appendix 2 Part D can be used to project and let the trainees trace out and execute the operations.

The trouble-shooting scenarios should be designed to provide experience in identifying malfunctions and faults, and applying remedial procedures. It should be noted that most simulator designs can introduce a large number of malfunctions and faults. In this course, the scenarios can only deal with a few faults because of time constraints. The course implementer is free to introduce additional faults if time allows, or to change the faults to comply with a particular simulator design.

Further details regarding the content of the scenarios are provided in the guidance notes (pages 41 & 46 of the instructor manual).

Monitoring the exercises

During the exercises the instructor should monitor the trainees' progress and record particular events which relate to safety or correct procedure in the exercise, making a summary for use in the debriefing period. However, even an experienced instructor may occasionally find things going wrong when trainees are trying to control all the parameters and actions involved in an exercise, and any resulting incidents should be noted and discussed at the debriefing.

If a second instructor is available, he should assist in monitoring the trainees in their work. His task will vary according to the trainees' abilities and competence. He will be involved not only in the briefing and debriefing activities, but also when the trainees become more experienced, assisting and guiding them in the use of the equipment. He should follow their work closely, but should avoid interrupting them and save important observations for the debriefing.

Debriefing

The time spent on debriefing should generally occupy between 10 and 15 per cent of the total time used for simulator exercises. Various facilities may be used in debriefing, such as playback (in which the whole exercise is recorded and any sequence is available for discussion), multi-channel recorder or data-logging equipment or snap shots.

The instructor should refer to the summary made during the exercise, raise important points and direct the discussion among the trainees. He should encourage them to examine critically the actions taken during the exercises. He should try to avoid imposing his own views, but should ensure that the trainees have used safe and correct procedures at all times.

Guidance on specific subject areas

The guidance notes which follow contain advice on the treatment of the subject areas listed in the course outline. The instructor should develop a methodology based on his own experience, together with the advice and guidance provided with the simulator being used in the course.

EXERCISE: CARGO HANDLING OIL SIMULATOR LAYOUT

Objectives:

Understanding of the sub-systems and their overall
Interactivity in the cargo handling simulator and the operations involved. Getting familiarized with terminology used in liquid cargo transport and operations.

Prerequisites:

The theoretical aspects of the various kinds of liquid cargo transport should be known to the trainees. Basic Naval architecture related to tankers will have been studied prior to simulator exercises. Basic stability, strength and stress theory will have to be known by the trainees.

Training Materials:

Pipeline diagram of the vessel modeled in the liquid cargo simulator

Simulator Condition:

Not applicable

Briefing:

Explanation of the ship type modeled.
Explanation of the various sub-systems and how they connect in real life.
Explanation of the Loadicator. Trim, draft, heel & other parameters in the simulator.

Student action:

Attend lecture.
Repeat various theories learned on cargo systems, naval architecture, stability and stress.

Instructor action:

Apart from system mimics emphasize overall connection of the systems in the vessel.
Explain symbols used in mimics
Explain Loadicator

Debriefing:

Check if all systems understood and interconnection of Systems in simulator.
Discuss if relationships with previous theory are properly understood.

Evaluation:

By means of one or more diagrams, have trainees show understanding of sub-systems and symbols by describing system and/or indicating various symbols etc.

EXERCISE: LOADING OIL CARGO

Objectives:

By loading a full cargo into the vessel, appreciating efficient cargo planning, stability and stress criteria and maximum allowable draft and trim.

Prerequisites:

The trainees will have performed familiarization exercises on the simulator and they will have knowledge of loading zones, stability, shear forces and bending moments.

Training Materials:

Diagram of the vessel cargo system, loadicator and Loading zone chart.

Simulator Condition:

Cargo tanks empty, tanks inerted. Normal ballast condition.
Shore connection for 1 grade and 1 temperature of cargo in all tanks.

Briefing:

Trainees should be told that all tanks are empty and segregated ballast tanks full for normal ballast condition.
Tanks have to be filled to 98% Shear forces and bending moments to be kept within limits; preliminary check can be done by off-line Loadicator.
When loading, tank gas to be vented to shore (or vent riser on vessel or from individual high velocity pv valves according to instructor choice).

Student action:

Trainees can perform preliminary stress check with the Loadicator.
Connection of shore manifold to be made and tank filling to commence simultaneously or in order according to stress limitations. When loading tanks, levels to be monitored as well as tank atmosphere and shear forces and bending moments.
Ballast to be pumped out in accordance with the loading sequence.

Instructor action:

Check preliminary stress calculations. Check tanks loaded in planned sequence in order to keep stresses within limits. Check tank levels after filling and topping off. Check ballast pumping operation in synchronization with loading sequence.

If the exercise of filling all tanks takes too long in real time, a start can be made and then continued fast time until a further stage whereby topping off of tanks is again a useful learning experience. Alternatively, fast speed simulation can be skipped and replaced by another scenario where cargo tanks are at or near topping off level and exercise commenced from that condition.

Debriefing:

Trainees should understand possibilities and limitations of a full cargo being loaded.

Stability and stresses to be monitored and final draft, heel, tank ullages and atmospheres to be checked.

Evaluation:

By means of observation of final condition assessing if trainees have reached required condition and that all values of levels, volumes, trim and list, shear forces and bending moments are within the limits.

EXERCISE: UNLOADING OIL CARGO WASHING (COW) AND BALLASTING

Objectives:

By means of this exercise the relationship between the various sub-systems is supposed to be demonstrated and the overall understanding of simultaneously discharging, ballasting and COW to be demonstrated and realized.

Prerequisites:

Familiarization exercises
Discharging exercise
Washing/cleaning exercise
Ballasting exercise
IG usage exercise
Theoretical knowledge of shear force, stress, trim, heel is required.
Pollution prevention rules and procedures have been discussed.

Training Materials:

Diagram of the vessel cargo, IG and tank cleaning systems.

Simulator Condition:

Cargo tanks loaded with crude oil.
Slop tanks 50% full.
Tanks inerted, IG system standby.
No ballast

Briefing:

The trainees should be convinced of the complexity of the exercise, which should be built up step by step.
Discharging and inerting to be started first.
Stress, trim and heel to be monitored.
Discharging, Cow'ing and ballasting according to pre-prepared plan.

Student action:

The trainees will start with preparing a discharging and COW plan, which will keep stress, trim and heel within the acceptable limits.
Discharging, inerting, Cow'ing and ballasting and stripping will take place simultaneously.
In this order operations will continue until all tanks empty, COW'ed and ballasted according to IMO requirements.

Instructor action:

The instructor should ascertain that the choice of discharging order takes stress, trim and heel into consideration.
During discharging the tank atmospheres are monitored and inert gas supplied.
That COW commences at the right tank level and ballasting commences in time for vessel's trim, heel and stresses to be maintained within limits.

As this exercise includes several aspects and comprises a full cargo, breakdown in separate sessions is possible or alternatively routine parts can be run in fast time by the instructor if the trainees have started up the sub-processes properly.

Debriefing:

By means of discussion bring up problems in operations and problems due to complexity.
Check which order tanks have been handled and in which order ballast has been loaded.
Check that inerting has taken place during discharging as well as during COW.

Evaluation:

By means of question and answer determine understanding of operations.
Time needed to complete operations will be a measure of efficient conduct of operations.
All cargo should be unloaded, tanks COW'ed and inerted.
Pump performance during discharging (including, rpm racing, overheat and tank residue) is an indicator of correct use of AUS and pump operating procedures.
After completion of unloading operations, vessel should be in correct trim, heel and within acceptable limits of stresses and stability.

EXERCISE NO 1. FAMILIARIZATION CHEMICAL CARGO HANDLING SIMULATOR LAYOUT AND FUNCTIONS

Objectives: Understanding of the subsystems and their overall interactivity in the Chemical cargo handling simulator and the operations involved. Becoming familiar with terminology used in chemical cargo transport and operations.

Prerequisites: The theoretical aspects of the various kinds of liquid cargo transport should be known to the trainee. Basic naval architecture related to chemical tanker will have been studied prior to simulator exercises. Basic stability, strength and stress theory will have to be known by the trainees.

Training materials: OHP (Over Head Projector) sheets of the mimic diagrams used in the CHT (Cargo Handling Trainer) CCR (Cargo Control Room) Layout and general arrangements of the vessel modeled in the liquid cargo simulator.

Simulator Condition: Familiarisation exercise enabling operations of all Chemical Tanker systems.

Briefing: Explanation of the ship type modeled.
Explanation of the various subsystems and how they interconnect in real life.
Explanation of the Load Master functions, trim draft, heel indicators in the simulator.

Student action: Attend lecture. Operate PC operate control valves, switches, gauges on pipeline panel and Familiarize with Operational equipment.

Repeat previous theory, learn on cargo systems, naval architecture, stability and stress.

Instructor action: Apart from system mimics emphasize overall connection of the systems in the vessel.

Explain symbols used in mimics.

Explain Load Master.

Debriefing: Check if all systems understood and interconnection of systems in simulator.

Discuss if relationships with previous theory are properly understood.

Evaluation: By means of one or more diagrams have trainees show understanding of subsystems and symbols by describing system and / or indicating various symbols etc.

EXERCISE NO 2. : LOADING FULL CARGO OF VARIOUS CHEMICALS

Objectives: By loading a full cargo into the vessel, appreciating efficient cargo planning, stability and stress criteria and maximum allowable draft and trim.

Prerequisites: The trainees will have performed familiarization exercises on the simulator and they will have knowledge of loading zones, stability, shear forces and bending moments.

Training materials: OHP sheets of mimic diagrams of cargo deck lines, manifold connections ,loading/unload and cargo tanks.

General plan CHEMSHIP displacement scales. Loading zone chart.

Simulator Condition: Vessel cargo tanks empty no ballast on board Shore connection for 3 grades and in different group of tanks.

Briefing: Trainees should be told that all tanks are empty and no ballast for this exercise.

Tanks to be filled up to 98%.

Shear forces and bending moments to be kept within limits. Preliminary check can be done by off – line Load Master. Load plan to be prepared on the Loadicator.

When loading tank gas to be vented to shore (if applicable)

Student action: Trainees can perform preliminary stress check with the Load Master.

Connection of shore manifold to be made, manifold lines with jumper connection completed and tank filling to commence simultaneously or in order according to stress limitations. When loading tanks, levels to be monitored as well as tank atmosphere and shear forces and bending movements.

Instructor action: Check loading plan and preliminary stress calculations.

Check tanks loaded in planned sequence in order to keep stresses within limits. Check tank levels after filing and topping off.

If the exercise of filing all tanks takes too long in real time, a start can be made and then continued in fast time until a further stage where slowed down as topping off of tanks is again a useful learning experience.

Debriefing: Trainees should understand possibilities and limitations of a full cargo being loaded.

Stresses and stability to be monitored and final draft, heel, tank ullages and atmosphere to be checked.

Evaluation: By means of observation of final condition assessing if trainees have reached required condition and that all values of levels, volumes, trim and list, shear force and bending moments are within the determined limits.

EXERCISE NO 3: UNLOADING FULL CARGO OF VARIOUS CHEMICALS

Objectives: By discharging a full cargo from the vessel, appreciating efficient cargo planning, stability and stress criteria and maximum allowable draft and trim. Starting and stopping Cargo whilst delivering smaller parcels into tank trucks, barges and shore tanks

Prerequisites: The trainees will have performed familiarization exercises on the simulator and they will have knowledge of loading zones, stability, shear forces and bending moments.

Training materials: OHP sheets of mimic diagrams of cargo deck lines, manifold connections, loading/unload and cargo tanks. General plan CHEMSHIP displacement scales. Loading zone chart.

Simulator Condition: Vessel cargo tanks full, no ballast on board Shore connection for 3 grades and in different group of tanks.

Briefing: Trainees should be told that all tanks are loaded to 98% and ballasting to be done during unloading for this exercise.

Tanks to be unloaded with pre planned sequential quantities and pump operations to be familiarized with.

Shear forces and bending moments to be kept within limits. Preliminary check can be done by ballast conditions with off – line Load Master.

When unloading tank stripping and draining shall be carried out using special techniques (if applicable)

Student action: Trainees can perform preliminary stress check with the Load Master and prepare Unload Plan.

Connection of shore manifold to be made, manifold lines with jumper connection completed and unloading to commence simultaneously or in order according to stress limitations. When unloading tanks, levels to be monitored as well as tank atmosphere and shear forces and bending movements frequently checked

Instructor action: Check preliminary stress calculations.

Check tanks unloaded in planned sequence in order to keep stresses within limits. Check tank ROB after unloading.

If the exercise of unloading all tanks takes too long in real time, a start can be made and then continued fast time until a further stage whereby stripping and draining of tanks is again a useful learning experience.

Debriefing: Trainees should understand possibilities and limitations of a full / part cargo being unloaded.

Stresses and stability to be monitored and final draft, heel, tank ullages and atmosphere to be checked.

Evaluation: By means of observation of final ballast condition assessing if trainees have reached required condition of ballast water and empty tanks and that all values of levels, volumes, trim and list, shear force and bending moments were within the determined limits

CASE STUDY – 1 (Oil Tanker)

Fire and Explosion during offloading operations on an oil tanker

Incident Summary

At 0845 on September 16, 1990, the tanker vessel “M.T.ABC” caught fire and exploded during offloading operations at the Total Oil Company refinery on the Xxx river near Bay City, Michigan. A wake from a passing bulk carrier apparently caused the parting of the M.T.ABC’s transfer hose, grounding cable, and all but one of its mooring lines. Residual gasoline in the broken transfer hose was believed to have been ignited by a spark on the dock. The M.T.ABC’s stern swung around into the Xxx River and grounded perpendicular to the direction of the river flow. The grounding resulted in a crack in the vessel’s hull from the manifold on the starboard side to 75 feet aft of the manifold on the port side.

Area was evacuated and vessel traffic was halted. The pier fire was extinguished in an attempt to save the last mooring line while the fire onboard the vessel remained out of control. A shore company from Houston, Texas, was contracted to fight the fire due to the lack of locally available trained personnel and equipment. At 1315 on September 17, the shore personnel extinguished the blaze by applying foam. Carbon black accumulations falling from the overhead re-ignited the fire at 2300. This second blaze was cooled with water and extinguished with foam on September18. The shore personnel also applied foam inside the vessel’s cargo tanks to prevent re-ignition of the vessel.

River flow data were obtained to predict the oil movement Shock waves from the explosion may have contributed to the deaths of several fish that were recovered from around the vessel. Neither pollution nor shoreline contamination was observed during the final survey of the area on October 22.

Behavior of Oil

Automotive gasoline is a very lightweight, refined product with an API gravity of 60 to 63. No spill of product into the Xxx River was reported until first light on September 17 when fuel up to three inches thick was observed in the water immediately surrounding the vessel. Some of the spilled product was held against the hull of the vessel by the wind until the starboard side submerged, releasing an additional 100 barrels of the fuel. Since the gasoline was not released rapidly, little environmental damage resulted from the incident.

Countermeasures and Mitigation

On September 16, containment boom was deployed around the vessel as a precaution against further spillage. The boom remained in place until the vessel was re-floated on October 16 and moved to the north side of the river. No product was observed leaking from the vessel as it was relocated. Vacuum trucks were used to recover the gasoline and water mixture Approximately 262 barrels were recovered by September 28. Small amounts of carbon residue that impacted the shoreline were manually raked frombeaches in the area. On September 19, gasoline odours were reported in the sewers of a residential community near the incident site. Contractors were dispatched to flush and foam the sewers. Sections of boom and a combustible gas detector were set up to monitor the sewer outfall.

On September 27, approximately 770 barrels of product were offloaded from the M.T.ABC to a lightering barge. Gas freeing operations began on October 5, due to the explosion threat posed by some isolated pockets of product remaining in the #6 starboard cargo tank. Offloaded

product was replaced with water to reduce the structural stress to the damaged vessel. Since trace concentrations of benzene, toluene, ethyl benzene, and xylene isomers were found in water samples near the M.T.ABC, water at a nearby water treatment plant was treated with ozone as a precaution.

Other Special Interest Issues

The fire-fighting foam that was used on the fire was water soluble and moderately toxic. Contaminated water from the fire-fighting operation was collected and brought to a Bay City Wastewater.

Sample Questions for discussion with course participants

Q1. What is/are the main cause of fire and explosion on board MT ABC?

Q2. In your opinion what could be the essential precautions/good practices that might not have been followed led to this eventuality? Where are these precautions/good practices captured?

Q3. What other damages occurred on board and in the river Xxx near Bay City area, Michigan?

Q4. Discuss the actions that would have prevented fire and explosion on board MT ABC?

Q5. Discuss the lessons learnt from this case.

Case Study 2 - (Chemical Tanker)

Time	Event
4th April	
	Following personnel entered 3S COT for squeegeeing the remaining cargo of Tallow. The tank's atmosphere had been checked. Enclosed space entry permit issued. Gases were measured as O_2: 20.9%; HC: 0% LEL; CO: 0 ppm; H2S: 0 ppm: 1) AB 2) AB 3) AB 4) Pump man 5) OS 6) DTSM **WHAT HAPPENED?** While squeegeeing the cargo of Tallow (US packer Inedible Tallow) in 3S COT. DTSM & AB collapsed and became unconscious. **INCIDENT:** Both of the above mentioned crew members were among the 6 persons who went down to squeeze the cargo. While halfway through the squeezing, these men felt little uneasy and decided to come up. At 0305LT DTSM came up and within 5 minutes AB also came up. After coming up on deck both collapsed and became unconscious. By that time vessel had already inform terminal and agents had called for medical help from shore. AT 0325 both the men were transferred to the Hospital by two ambulances. Before they were taken to the hospital, they were administered First Aid in the form of Oxygen and I. V. fluids by the medical staff inside the ambulance. Both returned to the vessel and both signed off being unfit for duty for 3 weeks.

Sample Questions for discussion with course participants

Q1. What could be the main cause(s) of collapsing of DTSM and AB?

Q2. In your opinion what could be the essential precautions/good practices that might not have been followed led to this eventuality? Where are these precautions/good practices captured?

Q3. What should be the immediate action to be taken in such cases? From where will you get the information for taking such action?

Q4. Discuss the lessons learnt from this case.

NOTE: The questions mentioned above are sample questions and are for reference. The lecturers, instructors are free to modify, add more questions as per the skill, level of knowledge and experience of the participants.

Part E: Evaluation

The effectiveness of any evaluation depends to a great extent on the precision of the description of what is to be evaluated. The detailed teaching syllabus is thus designed, to assist the Instructors, with descriptive verbs, mostly taken from the widely used Bloom's taxonomy.

Evaluation/Assessment is a way of finding out if learning has taken place. It enables the assessor (Instructor), to ascertain if the learner has gained the required skills and knowledge needed at a given point towards a course or qualification.

The purpose of evaluation/assessment is to:

- To assist student learning.
- To identify students' strengths and weaknesses.
- To assess the effectiveness of a particular instructional strategy.
- To assess and improve the effectiveness of curriculum programs.
- To assess and improve teaching effectiveness.

The different types of evaluation/assessment can be classified as:

Initial / Diagnostic assessment

This should take place before the trainee commences a course/qualification to ensure they are on the right path. Diagnostic assessment is an evaluation of a trainee's skills, knowledge, strength and areas for development. This can be carried out during an individual or group setting by the use of relevant tests.

Formative assessment

Is an integral part of the teaching/learning process and is hence is a "Continuous" assessment. It provides information on trainee's progress and may also be used to encourage and motivate them.

Purpose of formative assessment

- To provide feedback to students.
- To motivate students.
- To diagnose students' strengths and weaknesses.
- To help students to develop self-awareness.

Summative assessment

It is designed to measure trainee's achievement against defined objectives and targets. It may take the form of an exam or an assignment and takes place at the end of a course.

Purpose of summative assessment

- To pass or fail a trainee
- To grade a trainee

Evaluation for Quality assurance

Evaluation can also be required for quality assurance purposes.

Purpose of assessment with respect to quality assurance

- To provide feedback to Instructors on trainee's learning.
- To evaluate a module's strengths and weaknesses.
- To improve teaching.

Assessment Planning

Assessment planning should be specific, measurable, achievable, realistic and time-bound (SMART).

Some methods of assessment that could be used depending upon the course/qualification are as follows and should all be adapted to suit individual needs.

- Observation (In Oral examination, Simulation exercises, Practical demonstration);
- Questions (written or oral);
- Tests;
- Assignments, activities, projects, tasks and/or case studies
- Simulations (also refer to section A-I/12 of the STCW code 2010);
- CBT;

Validity

The evaluation methods must be based on clearly defined objectives, and it must truly represent what is meant to be assessed, for example only the relevant criteria and the syllabus or course guide. There must be a reasonable balance between the subject topics involved and also in the testing of trainees' KNOWLEDGE, UNDERSTANDING AND PROFICIENCY of the concepts.

Reliability

Assessment should also be reliable (if the assessment was done again with a similar group/learner, would you receive similar results). We may have to deliver the same subject to different group of learners at different times. If other assessors are also assessing the same course / qualification as us, we need to ensure we are all making the same decisions.

To be reliable an evaluation procedure should produce reasonably consistent results no matter which set of papers or version of the test is used.

If the Instructors are going to assess their own trainees, they need to know what they are to assess and then decide how to do this. The *what* will come from the standards/learning outcomes of the course/qualification they are delivering. The *how* may already be decided for them if it is an assignments, tests or examinations.

The instructors need to consider the best way to assess the skills, knowledge and attitudes of our learners, whether this will be formative and/or summative and how the assessment will be valid and reliable.

All work assessed should be valid, authentic, current, sufficient and reliable; this is often know as VACSR – "valid assessments create standard results".

- Valid – the work is relevant to the standards/criteria being assessed:
- Authentic – the work has been produced solely by the learner;
- Current – the work is still relevant at the time of assessment;
- Sufficient – the work covers all the standards/criteria:
- Reliable – the work is consistent across all learners, over time and at the required level.

It is important to note that no single methods can satisfactorily measure knowledge and skill over the entire spectrum of matters to be tested for the assessment of competence.

Care should therefore be taken to select the method most appropriate to the particular aspect of competence to be tested, bearing in mind the need to frame questions which relate as realistically as possible to the requirements of the officer's job at sea.

STCW Code 2010

The training and assessment of seafarers, as required under the Convention, are administered, supervised and monitored in accordance with the provisions of section A-I/6 of the STCW Code.

Column 3 - Methods for demonstrating competence and Column 4 - Criteria for evaluating /in Table A-V/1-1-1 (Specification of minimum standard of competence in basic training for oil and chemical tanker cargo operations) of STCW Code 2010, sets out the methods and criteria for evaluation.

Instructors should refer to this table when designing the assessment.

Instructors may follow the same guidelines for evaluating competence as stated in section B – V/1-1 para 20, 21 and 22, 23 for assessment as given below:

Evaluation of competence

17. The arrangements for evaluating competence should be designed to take account of different methods of assessment which can provide different types of evidence about candidates' competence, e.g.:

1. direct observation of work activities (including seagoing service);
2. skills/proficiency/competency tests;
3. projects and assignments;
4. evidence from previous experience; and
5. written, oral and computer-based questioning techniques.

18. One or more of the first four methods listed should almost invariably be used to provide evidence of ability, in addition to appropriate questioning techniques to provide evidence of supporting knowledge and understanding.

Assessment is also covered in detail in another IMO Model Course, however to assist and aid the Instructors, some extracts from the Model course is used to explain in depth.

Multiple choice questions

Marking or scoring is easier if multiple-choice test items are used, but in some cases difficulties may arise in creating plausible distracters.

Detailed sampling a allow immediate identification of errors of principle and those of a clerical nature. It must be emphasized that this holds true, in general, only if the test item is based on a single step in the overall calculation. Multiple-choice items involving more than one step may, in some cases, have to be resorted to in order to allow the creation of a sufficient number of plausible distracters, but care must be exercised to ensure that distracters are not plausible for more than one reason if the nature of the error made (and hence the distracter chosen) is to affect the scoring of the test item.

Compiling tests

Whilst each examining authority establishes its own rules, the length of time which can be devoted to assessing the competence of candidates for certificates of competency is limited by practical, economic and sociological restraints. Therefore a prime objective of those responsible for the organization and administration of the examination system is to find the most efficient, effective and economical method of assessing the competency of candidates. An examination system should effectively test the breadth of a candidate's knowledge of the subject areas pertinent to the tasks he is expected to undertake. It is not possible to examine candidates fully in all areas, so in effect the examination samples a candidate's knowledge by covering as wide a scope as is possible within the time constraints and testing his depth of knowledge in selected areas.

The examination as a whole should assess each candidates comprehension of principles, concepts and methodology; his ability to apply principles, concepts and methodology; his ability to organize facts, ideas and arguments and his abilities and skills in carrying out those tasks he will be called upon to perform in the duties he is to be certificated to undertake.

All evaluation and testing techniques have their advantages and disadvantages. An examining authority should carefully analyse precisely what it should be testing and can test. A careful selection of test and evaluation methods should then be made to ensure that the best of the variety of techniques available today is used. Each test shall be that best suited to the learning outcome or ability to be tested.

Quality of test items

No matter which type of test is used, it is essential that all questions or test items used should be as brief as possible, since the time taken to read the questions themselves lengthens the examination. Questions must also be clear and complete. To ensure this,
it is necessary that they be reviewed by a person other than the originator. No extraneous information should be incorporated into questions; such inclusions can waste the time of the knowledgeable candidates and tend to be regarded as 'trick questions'. In all cases, the questions should be checked to ensure that they measure an objective which is essential to, the job concerned.

Advantages and disadvantages of oral and practical tests

It is generally considered advisable that candidates for certificates of competency should be examined orally. Some aspects of competency can only be properly judged by having the

candidate demonstrate his ability to perform specific tasks in a safe and efficient manner. The safety of .the ship and the protection of the marine environment are heavily dependent on the human element. The ability of candidates to react in an organized, systematic and prudent way can be more easily and reliably judged through an oral/practical test incorporating the use of models or simulators than by any other form of test.

One disadvantage of oral/practical tests is that they can be time-consuming. Each test may take up about 1 to 2 hours if it is to comprehensively cover the topics concerned.
Equipment must also be available in accordance with the abilities that are to be tested. Some items of equipment can economically be dedicated solely for use in examinations.

A sample format of both multiple choice question and assessing candidates in simulator exercises are provided below for guidance sake only.

1. Types of Chemical Tankers are
   a) Ship types I,II,III
   b) Pollution Categories X,Y Z that they carry.
   c) Parcel, Bulk, small chemical Tankers
   d) All of the above

2. The requirements for tank cleaning on a chemical tanker are given in:
   a) Marpol Annex II
   b) Marpol Annex VI
   c) Solas 74
   d) STCW 95

3. Cargoes carried on chemical tankers are called:
   a) IBC
   b) IMO
   c) ISM
   d) NLS

4. If the ODME is not working an entry is required to be made in:
   a) Official log Book
   b) Oil record Book
   c) Cargo log Book
   d) IG log

5. The main purpose of the Deck water Seal is:
   a) Cool the I.G
   b) Remove impurities from I.G.
   c) Prevent backflow of gases.
   d) Maintains I.G pressure in the tanks.

6. IF only one tank is to be washed for inspection purpose the method preferable is:
   a) One tank closed cycle system
   b) Two tank closed cycle system
   c) One tank open cycle system
   d) A combination of (a) & (c)

7. While doing COW the O2 Content in the tank being washed should not exceed:
   a) 8%
   b) 11%
   c) 10%
   d) 21%

8. Before starting reciprocating pumps keep: (2)
   a) Suction valves shut
   b) Discharge valves open
   c) Pump/steam lines drained
   d) (b) and (c)

9. The temperature at which a substance which is in the solid state begins to convert to the liquid state is called:
   a) Boiling point
   b) Flash point
   c) Ignition point
   d) Melting point

10. Deep well pumps may not have a non return Valve- True/False

SIMULATOR ASSESSMENT

Sr. No	HUMAN FACTORS	Name		Name	
		Rank		Rank	
		Company		Company	
		Cert no:		Cert no:	
1.	Leadership				
2.	Team Work				
3.	Communication Skills				
	OPERATIONAL SKILLS				
4.	Ability to recognize faults				
5.	Ability to take remedial actions				
Self Appraisals	**EXERCISES**				
6.	Exercise 1				
7.	Exercise 2				
8.	Exercise 3				
9.	Written Test Marks				
10.	Overall Grading				
REMARKS:					

Please address your comments to:

Maritime Safety Division
International Maritime Organization
4 Albert Embankment
London SE1 7SR
U.K.
[Telefax (+) 44 171 587 3210]

Annexes

Annex 1

Support Materials

This additional material is meant for guidance only and plays a secondary role to the Model course.

The following support materials are designed to motivate instructors and facilitate different teaching techniques.

- Sample Scheme of work
- Sample Lesson Plan
- Sample Participant's Handout and Presentation

They are designed for **Basic training for oil and chemical tanker cargo operations**

Competence – Contribute to the safe Cargo operations of oil and Chemical Tankers.

Training Outcome – Basic Knowledge of tankers

Required Performance: Basic knowledge of Cargo operations on Oil and Chemical Tankers.

The Scheme of Work and sample Lesson Plan are provided in Word format – so that Instructors can use it as a foundation to build upon and amend the content to suit their teaching style and students' needs.

Scheme of Work

The scheme of work sets out the teaching programme, batch by batch, for each course being taught. It includes the content that needs to be covered, the learning objectives involved at each stage, the main activities and resources which will enable these to be achieved and the ways in which they will be assessed. It will also identify which Instructors are involved in teaching the entire unit, in case there is more than one Instructor to cover the entire unit. This facilitates the same learning conditions to all the batches even if different faculty is involved.

Lesson Plan

A lesson plan, is a well structured plan of the objective, goals, activities for a particular class on a particular subject for a particular duration, say for an hour, or a 3 hour lesson and acts as a guide for the Instructor in order to teach the topic efficiently in that stipulated time covering all the topics required to be taught.

It is usually developed by the Instructor themselves, who is teaching or lecturing on that topic, however, departments, institutes may have their own planners, curriculum leaders, who would want the Instructors to teach the particular subject in a particular manner, of course, subject to tailoring by the Instructor to meet their style and students requirement, and to improve the teaching-learning cycle.

The Scheme of work and Lesson plan provided is for the sake of guidance only as no two Scheme of work and Lesson plan are likely to be the same, and certainly no two Instructors construct a Scheme of work and Lesson plan in the same way.

Annex 2

Scheme of Work

Academic Year:	Start Date:	End Date:	Lecturer (s):	Module / Unit / Topic:
2012-13	XX XXX 2012	XX XXXX 2012	XXXX	Contribute to the safe cargo operation of oil and chemical tankers (Topic 1 Basic knowledge of tankers)

Aims/Outcomes: To demonstrate basic knowledge of tankers

General Learning Objectives :

At the end of the session the students will be able to :

1. Identify and distinguish types of oil and chemical tankers
2. list important stages in the development of oil and chemical tankers
3. Identify with the aid of a sketch the general arrangements of oil and chemical tankers
4. describe the piping arrangements of oil and chemical tankers

Duration : 2 hours

Scheme of Work

S. No.	Week	No of hours	Objectives	Resources	Lecturer	Assessment
1	XX	0.25	Identify and distinguish types of oil tankers. list important stages in the development of oil tankers.	Lesson plan, Participant's handout, Instructor manual, Textbooks / Reference books Power point presentation(s), Loose printouts of all Activity sheet, Transparencies and blank papers, OHP, OHP Markers, White board Pens / Black board chalks.	XXXX	Q & A session
X	XX	0.25	Identify and distinguish types of chemical tankers. List important stages in the development of chemical tankers.	Lesson plan, Participant's handout, Instructor manual, Textbooks / Reference books, Power point presentation(s), Loose printouts of all Activity sheet, Transparencies and blank papers, OHP, OHP Markers, White board Pens / Black board chalks (different colours), Quiz sheets for recapping previous learnt topic, Answers for above quiz	XXXX	Verbal / Written Q & A session
X	XX	0.5	Identify with the aid of a sketch the general arrangements of oil tankers. Describe the piping arrangements of oil tankers.	Lesson plan, Participant's handout, Instructor manual, Textbooks / Reference books, Power point presentation(s), Loose printouts of all Activity sheet, Transparencies and blank papers, OHP, OHP Markers, White board Pens / Blackboard chalks (different colours), Quiz sheets for recapping previous learnt topic, Answers for above quiz	XXXX	Verbal / Written Q & A session

S. No.	Week	No of hours	Objectives	Resources	Lecturer	Assessment
X	XX	0.5	Identify with the aid of a sketch the general arrangements of chemical tankers. Describe the piping arrangements of chemical tankers.	Lesson plan, Participant's handout, Instructor manual, Textbooks / Reference books, Power point presentation(s), Loose printouts of all Activity sheet, Transparencies and blank papers, OHP, OHP Markers, White board Pens / Blackboard chalks (different colours), Quiz sheets for recapping previous learnt topic, Answers for above quiz	XXXX	Verbal / Written Q & A session

Annex 3

Lesson Plan

Unit : Contribute to the safe cargo operation of oil and chemical tankers	**Lecturer's Name :** XXXX
Topic: Identify with the aid of a sketch the general arrangements of oil tankers.	**Date :**
Week No. / Session No : XX / XX	**No of students :** 24
Duration : 0.5 hour	**Teaching method :** Classroom (Lecturing and explaining)

Aim : To Identify the different parts of Oil tankers

General Learning Objectives :

At the end of the session the students will be able to :

1. Identify and illustrate the different parts of oil tankers, especially tank and piping arrangements.

Recap of the previous session / class / topic :

- Identify and distinguish types of chemical tankers.
- List important stages in the development of chemical tankers.

Link to the next session / class / topic :

- Identify with the aid of a sketch the general arrangements of chemical tankers.
- Describe the piping arrangements of chemical tankers.

Preparation checklist for session resources (References, instructional aids, materials, or tools needed):

1. Course syllabus
2. Scheme of work
3. Lesson plan
4. Attendance sheet
5. Participant's handout
6. Instructor manual
7. Textbooks / Reference books
8. Computers/Laptops
9. Presenters/pointers
10. Power point presentation(s)
11. Loose printouts of all Activity sheets
12. Transparencies and blank papers
13. OHP
14. OHP Markers
15. Colour pens sets for students
16. White board Pens / Blackboard chalks (different colours)
17. Quiz sheets for recapping previous learnt topic
18. Answers for above quiz
19. Internet connection in classroom available
20. Web links identified if using internet

Lesson Plan

Time From - To	Content	Objectives	Lecturer Activity	Student Activity	Resources / References	Assessment
0900 – 0905 (5 minutes)	Attendance and Introduction to the Topic	Identifies the topics that will be covered in this session	Register and Introduce the topic by verbal or power point presentation, List and outline the main topics on the board. Answer to queries raised by students.	Respond to attendance call and listen to the Lecturer. Question if there is any doubt.	Attendance register / Online register. Power point presentation, White board, blackboard, coloured pens	N.A
0905 – 0925 (20 minutes)	Quiz to recall the previously covered topic	Reinforces and Recalls previously learnt topic.	If verbal quiz is carried out, questions put forward to random students. Discuss the right answers. Identify weak students or analyse if learning was achieved for previously taught subject for future reference, and conclude. If written quiz is given, distribute the quiz sheets. Once completed, let the students interchange the papers among each other and read the right answers, collect the answer papers for future reference to gauge group and individual learner's knowledge. Discuss the answers with the class. Answer to question raised	Answer questions of the quiz, mark the papers and discuss with lecturer. Note the right answers.	Quiz sheets	Verbal / Written

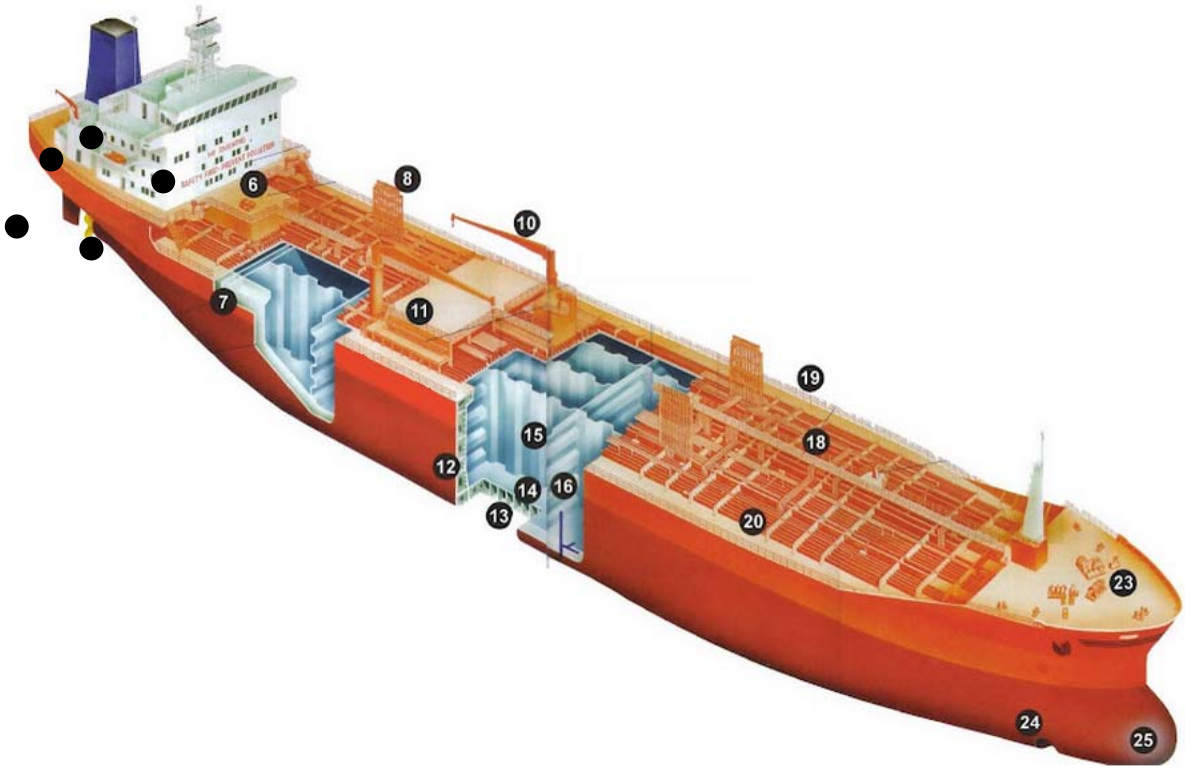
Time From - To	Content	Objectives	Lecturer Activity	Student Activity	Resources / References	Assessment
			by students.			
	Distribute Participant's handout.	Illustrates the different parts of oil tankers, especially tank and piping arrangements.	Explain and demonstrate using power point presentation on the content, addressing the page numbers from the Participant's Handout and elucidate wherever necessary using white board / black board / interactive board. Answer to question raised by students.	Collect the handouts. Listen to the Lecturer. Watch the power point presentation. Note down points if necessary. Discuss and Question if there is any doubt.	Participants handouts, Power point presentation, White board, blackboard, coloured pens	Q & A session
0925 – 0930 (5 minutes)	Recap and review of the session	Summarize all the main points covered in this session	Summarize all the main points covered in this session and discuss knowledge gained by this lecture and conclude.	Listen to the Lecturer. Q & A and discuss.	Participants handouts, Power point presentation, White board, blackboard, coloured pens.	Q & A sessions

Annex 4

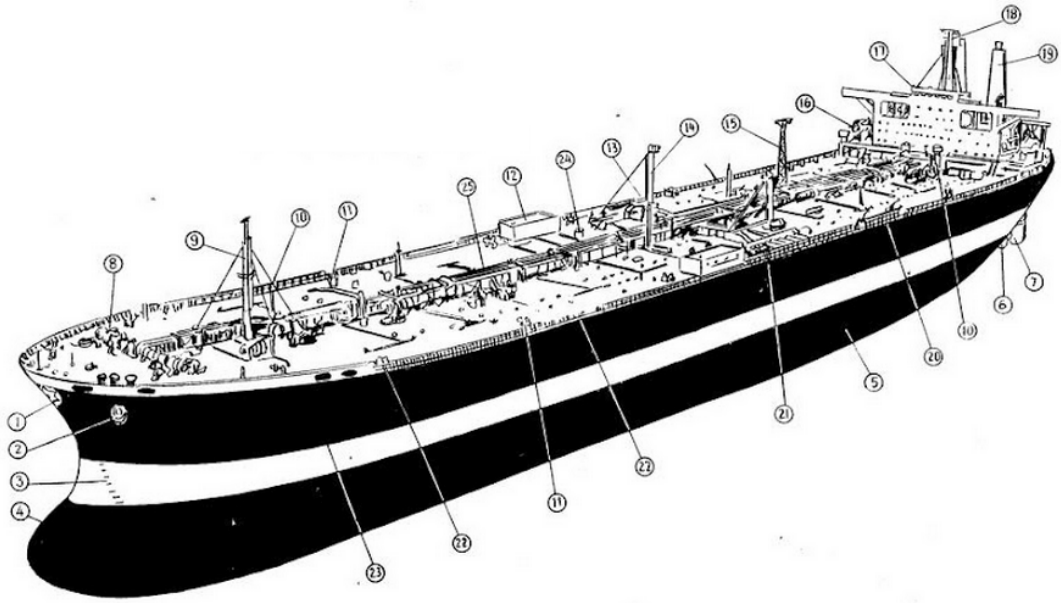
Topic 1.3 - Ship Arrangements of an Oil Tanker

SAMPLE_PARTICIPANTS HANDOUT

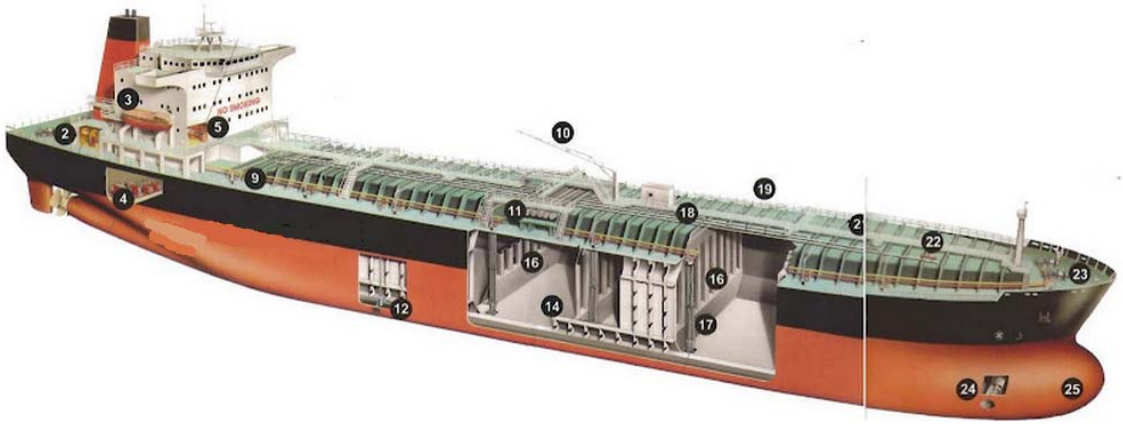
Topic 1.3 Basic Knowledge of Ship Arrangements of an Oil Tanker



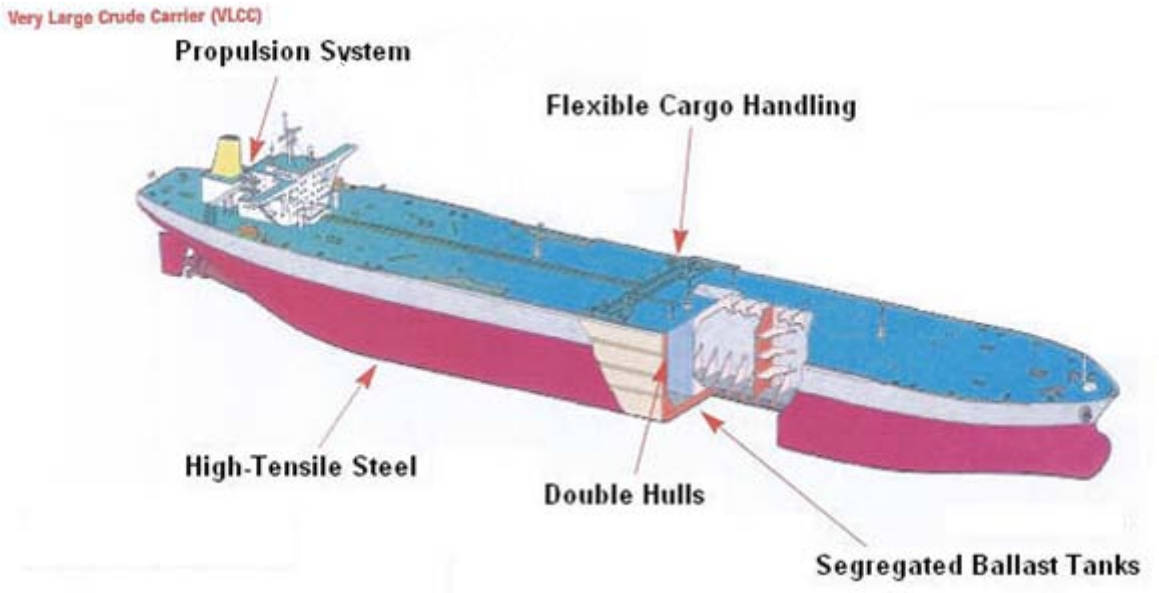
1. Balanced rudder with conventional propeller 2. Auxiliary unit 3. Lifeboat in gravity davits 4. Hydraulic prime mover 5. Cargo control room 6. Tank heating / tankwash room 7. Cofferdam, empty space between two tanks 8. Vent pipes with pressure-vacuum valves 9. Hydraulic high pressure oil-and return lines for anchor and mooring gear, 10. Hose crane 11. Manifold 12. Wing tank in double hull 13. Double bottom tank 14. Tanktop 15. Longitudinal vertically corrugated bulkhead 16. Transverse horizontally corrugated bulkhead 17. Cargo pump 18. Catwalk 19. Railing 20. Deck longitudinals 21. Deck transverses 22. Cargo heater 23. Forecastle deck with anchor-and mooring gear 24. Bow thruster 25. Bulbous bow

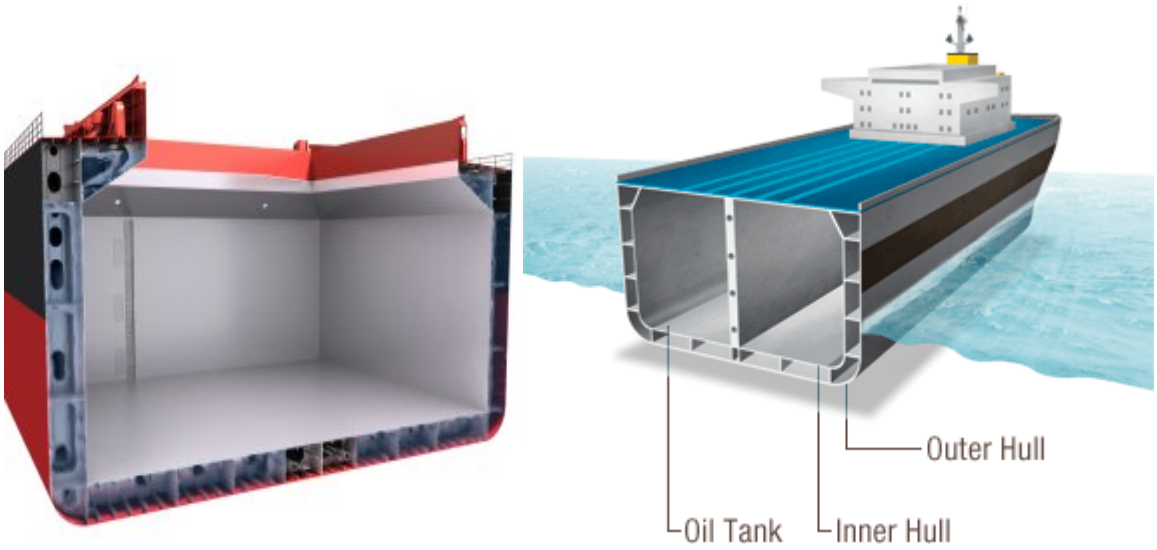


1.	**Head mark**	**13 and 14.**	**Derrick boom**
2.	**Anchor**	**15.**	**Antenna poles**
3.	**Forward draft marks**	**16.**	**Lifeboat**
4.	**Bulbous bow**	**17.**	**Bridge**
5.	**Midship draft marks**	**18.**	**Radar mast**
6.	**Propeller**	**19.**	**Funnel**
7.	**Rudder**	**20.**	**Accommodation ladder**
8.	**Windlass**	**21.**	**Loading station**
9.	**Foremast**	**22.**	**Universal chock**
10.	**Ventilator**	**23.**	**Draft line**
11.	**Cross bitt**	**24.**	**Cargo oil hatch**
12.	**Deck store**	**25.**	**Cargo oil pipe**

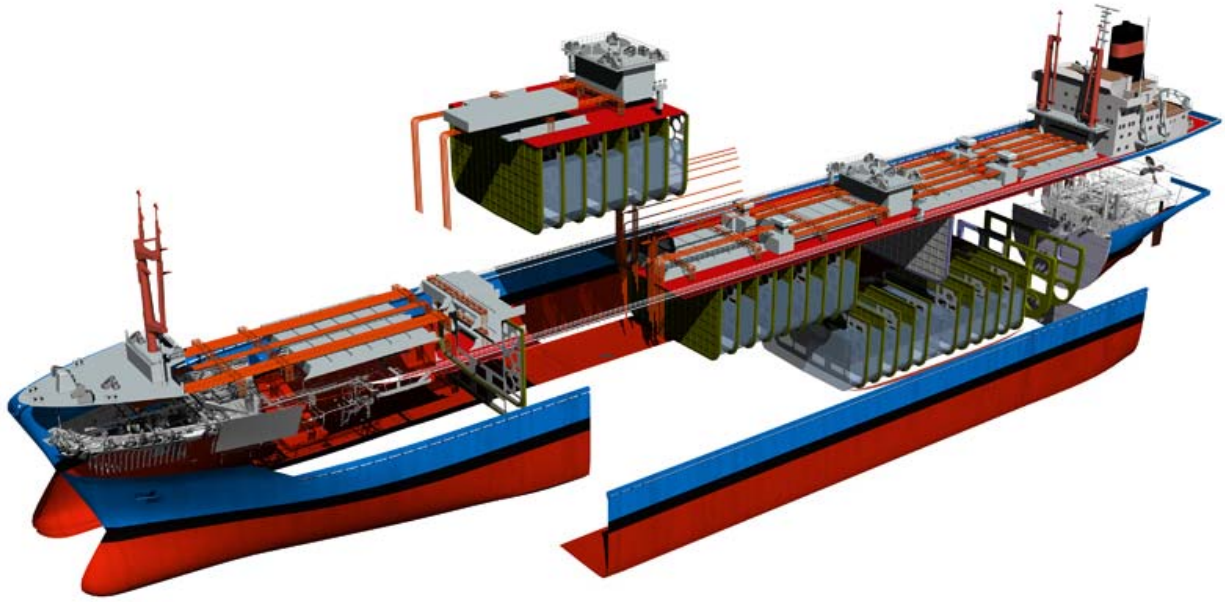


1. Balanced rudder with conventional propeller 2. Auxiliary unit 3. Lifeboat in gravity davits 4. Hydraulic prime mover 5. Cargo control room 6. Tank heating / tankwash room 7. Cofferdam, empty space between two tanks 8. Vent pipes with pressure-vacuum valves 9. Hydraulic high pressure oil-and return lines for anchor and mooring gear, 10. Hose crane 11. Manifold 12. Wing tank in double hull 13. Double bottom tank 14. Tanktop 15. Longitudinal vertically corrugated bulkhead 16. Transverse horizontally corrugated bulkhead 17. Cargo pump 18. Catwalk 19. Railing 20. Deck longitudinals 21. Deck transverses 22. Cargo heater 23. Forecastle deck with anchor-and mooring gear 24. Bow thruster 25. Bulbous bow



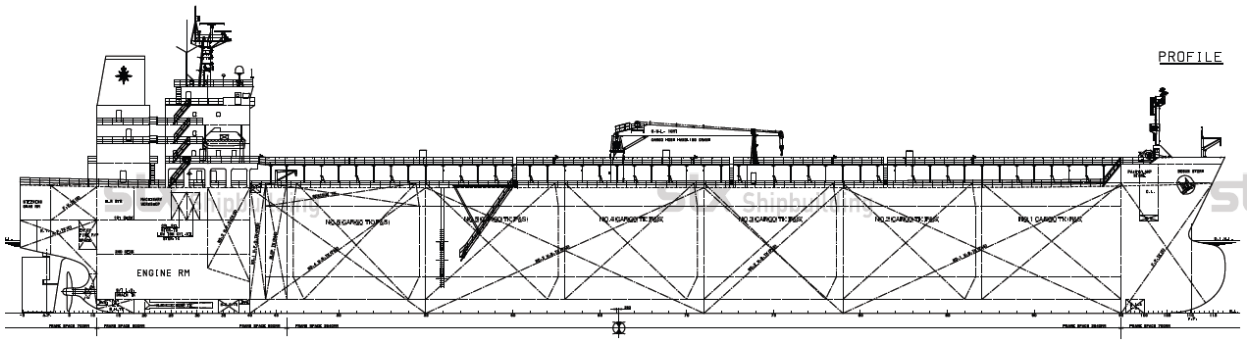


Cut section of on product/chemical tanker

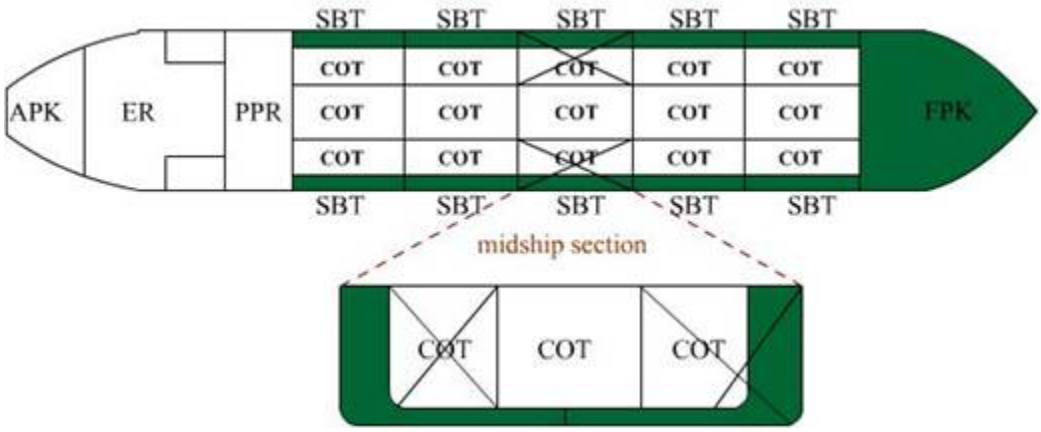


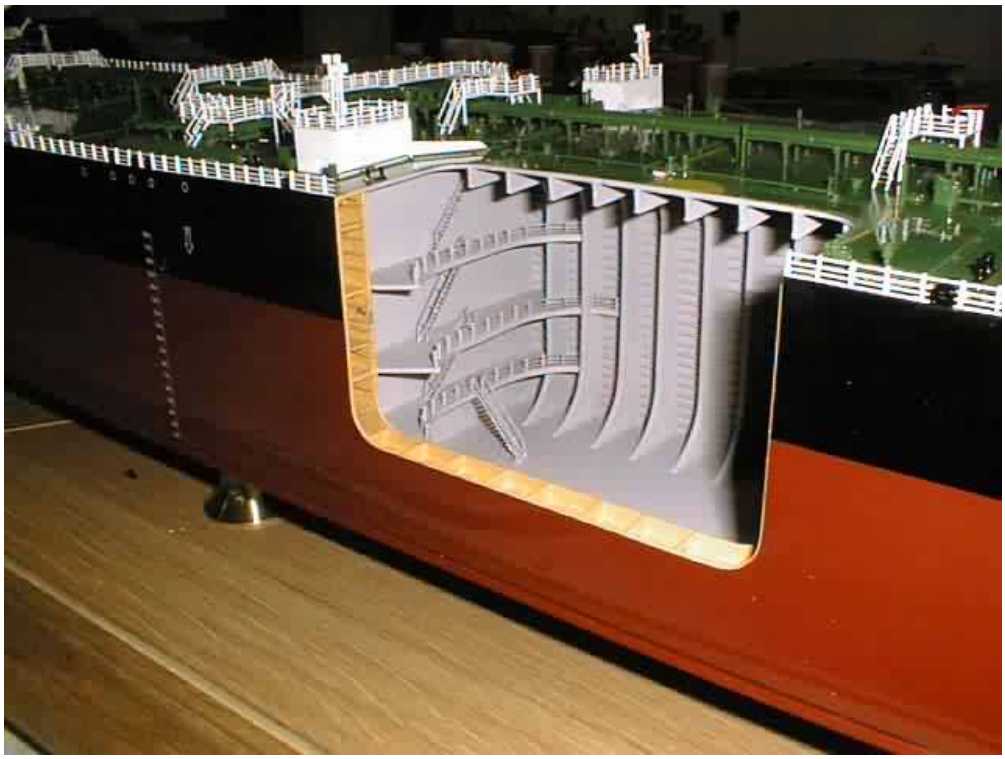
Cut section of on product/chemical tanker

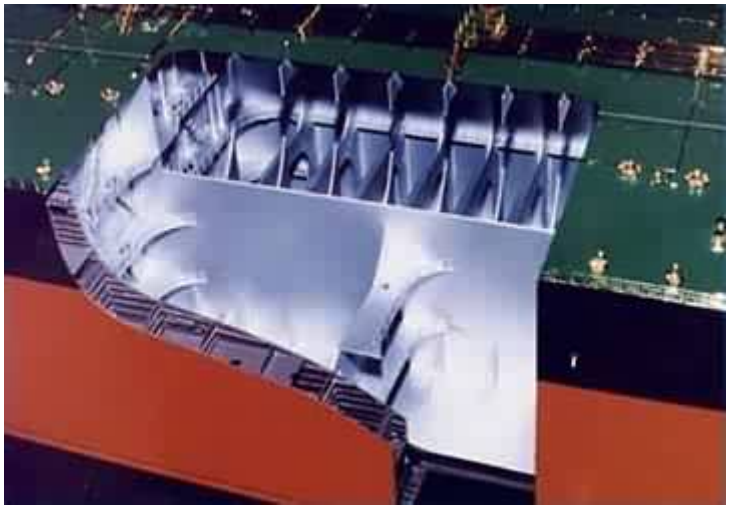
Profile of an Oil Tanker



Tank layout of a crude oil tanker:







The Pipeline system of an Oil Tanker:

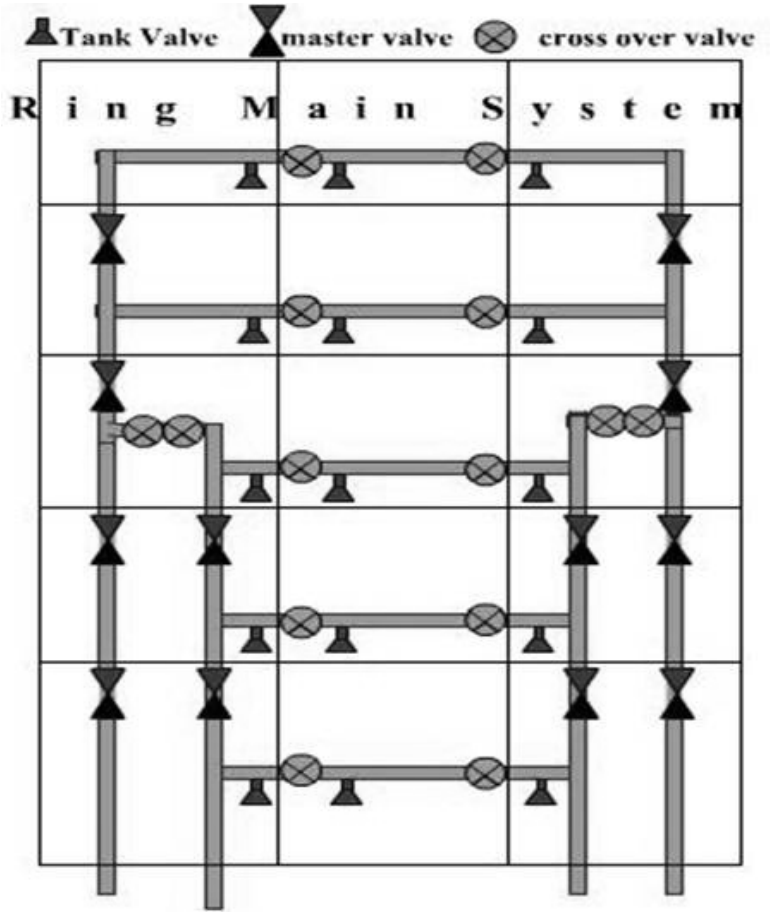
Pipeline systems on tankers differ in their degree of sophistication, depending on employment of the tanker.

ULCC's and VLCC's have relatively simple pipeline systems usually the direct line system.
Some product (parcel) tankers may have very sophisticated piping systems. This could be the ring main system or in case of a chemical product tanker it could mean an individual pipeline and an individual pump for every tank on board.

Basically there are three systems of pipelines found on tankers, and the fourth system being the free flow system found on large crude carriers

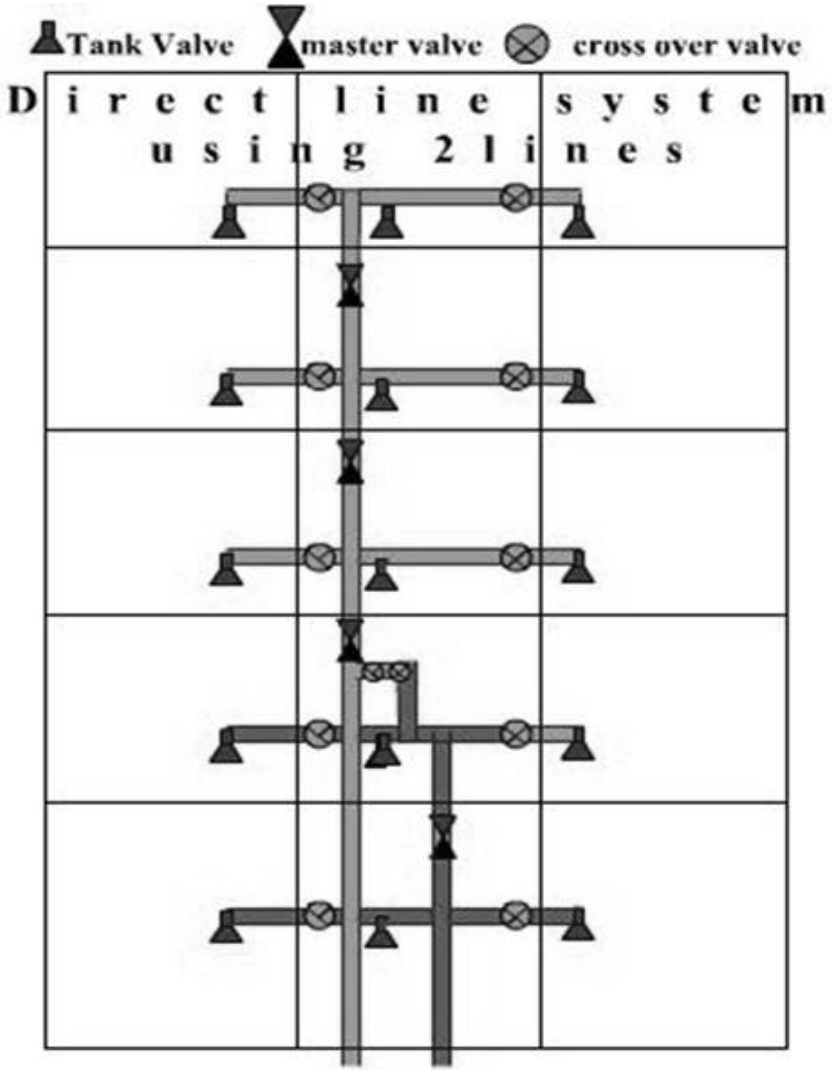
- Ring Main System
- Direct line system
- Single line to Single tank system (Chemical/Product ship)
- Free Flow system

Ring Main System:



It is generally of a square or circular layout.
It is used mostly on product tankers, as segregation of cargo is required.
Though the system is expensive, as more piping, and extra number valves are used.
However if the vessel is carrying many grades of cargo, the advantages compensate for the extra cost of the original outlay.

Direct Line System:



This system is mainly found on crude oil carriers where up to 3 grades of cargo can be carried as most of the direct pipeline systems is fitted with three direct lines.

This system is cheaper to construct. The disadvantages over the ring main system, is that line washing is more difficult, the system has fewer valves which make pipeline leaks difficult to control, as the system lacks versatility there is problem with line and valve segregation.

This system provides the vessel to carry as many grades as there are tanks.
The disadvantage is the cost factor having a multitude of pumps on board.

Free flow Tanker:

This system is usually found on large crude carriers, where the cargo piping is not used for the discharge of cargo.

Instead, gate valves are provided on the bulkheads of the tanks which when opened; allow the oil to flow freely in the aft most tank and into the COP.

The advantages of this system are primarily the cost factor, it allows for fast drainage and efficient means of pumping the cargo tanks. Disadvantages are of single crude being shipped.

Independent System:

This layout is not very common in the tanker trade.

This system is quite normal on chemical ships.

There are some Product Tankers that have this system fitted on the ships.

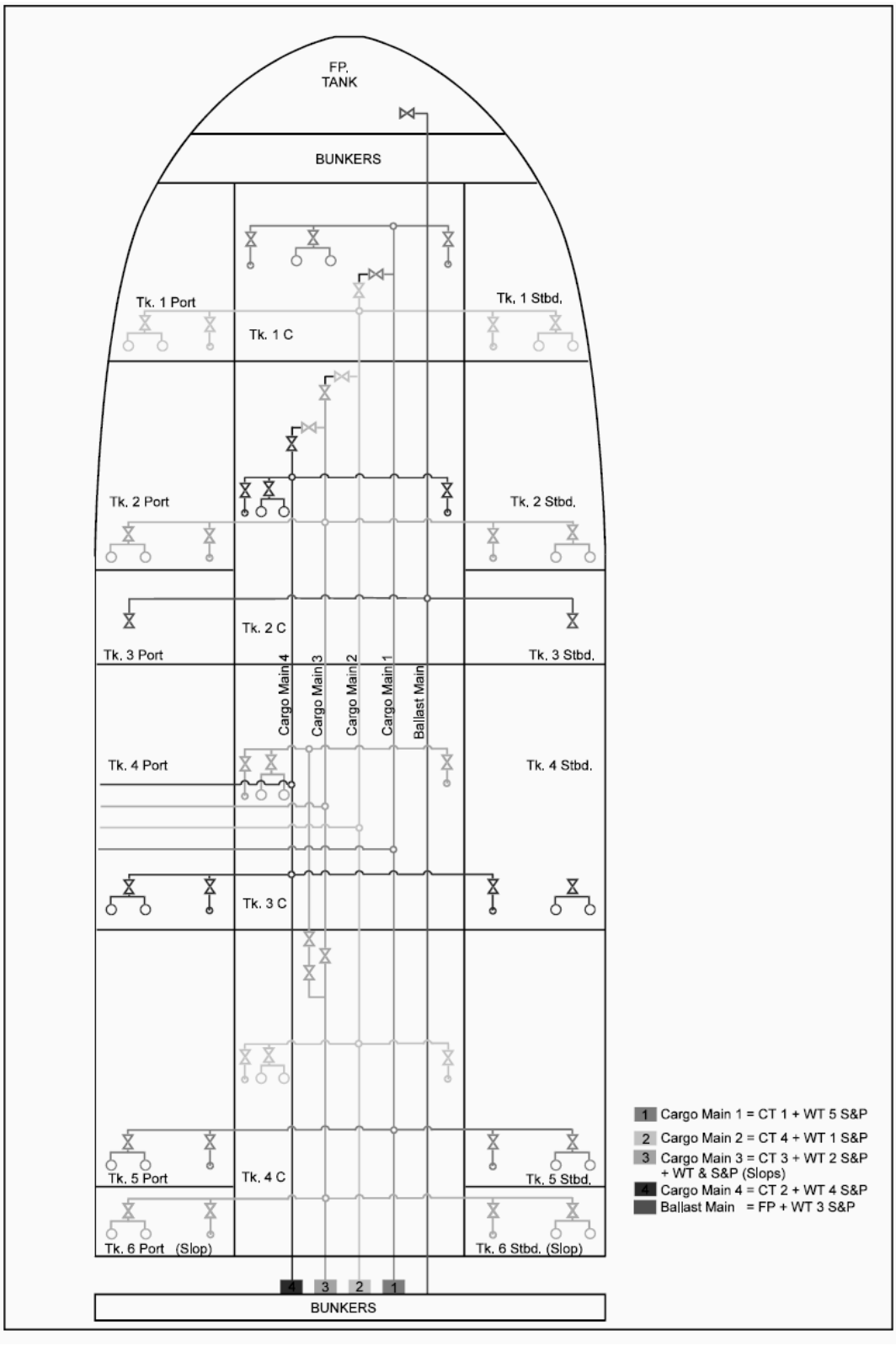
This is a single line servicing an individual tank through an independent pump that could be either a submersible pump or a deep well pump.

Bottom lines

The vessel is fitted with 4 centre tanks and 5 pairs of wing tanks for cargo.

The cargo main lines are located in the vessel's centre tanks. With the term "bottom lines" we understand that the location of these lines will be on the bottom of the vessel, usually supported about 4 - 6 feet above the vessel's bottom. Crossover valves, two valves on each crossover, connect the bottom lines to each other. When carrying more than one grade, a two-valve segregation complies with the regulations in force.

From the drawing you find that, from the bottom lines, there are lines, which lead to each cargo tank. These lines end on the cargo tanks suction bellmouth. Each bottom line serves its own set of cargo tanks; for example bottom line no.1 serves CT1 and WT5 p/s. Bottom line no.2 serves WT1 p/s and CT4. Bottom line no. 3 serves WT2 p/s, CT3 and WT6 p/s.


FP.
TANK
BUNKERS
Tk. 1 Port
Tk. 1 C
Tk. 1 Stbd.
Tk. 2 Port
Tk. 2 Stbd.
Tk. 2 C
Tk. 3 Port
Tk. 3 Stbd.
Cargo Main 4
Cargo Main 3
Cargo Main 2
Cargo Main 1
Ballast Main
Tk. 4 Port
Tk. 4 Stbd.
Tk. 3 C
Tk. 5 Port
Tk. 4 C
Tk. 5 Stbd.
Tk. 6 Port (Slop)
Tk. 6 Stbd. (Slop)
4
3
2
1
BUNKERS
1 Cargo Main 1 = CT 1 + WT 5 S&P
2 Cargo Main 2 = CT 4 + WT 1 S&P
3 Cargo Main 3 = CT 3 + WT 2 S&P
+ WT & S&P (Slops)
4 Cargo Main 4 = CT 2 + WT 4 S&P
Ballast Main = FP + WT 3 S&P

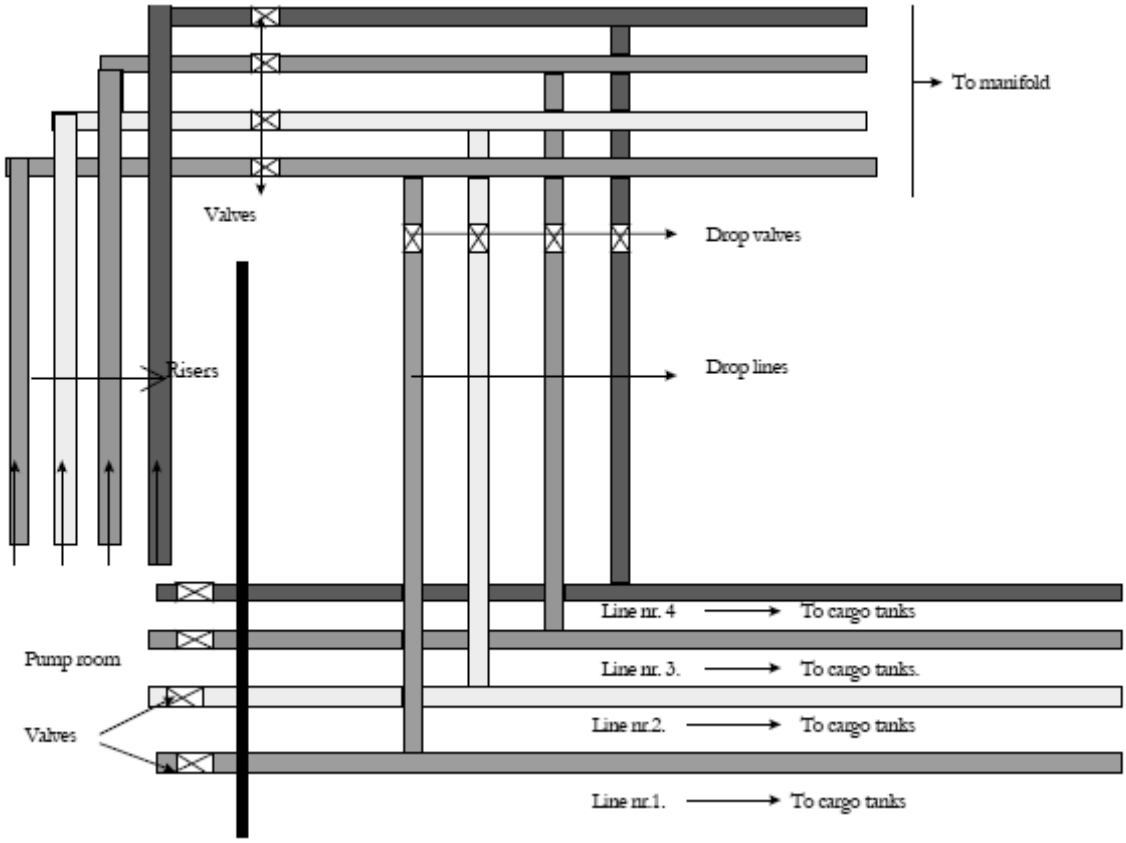
Drop lines

From the manifold area on the main tank deck, the drop line is connected to the deck main lines which leads to the bottom lines. on the drawing below you will also find the drop line and the drop valves on the lines leading vertically downwards from the main deck lines to the cargo lines in the vessels bottom.

These drop lines are used during loading. By closing the deck line's master valves, the cargo is lead to the vessel's cargo tanks when using these drop lines.

So, the pump room is completely isolated from the cargo during loading. However, during discharging the drop lines are isolated from the cargo by keeping the drop valves closed.

You must, however, during loading not forget to keep a routine for checking the pump room both for leaks and being gas free for entry.



Pump room piping

On a crude oil carrier the pump room is the main point between the cargo tanks and the main deck, all the way to the manifold, where the ship lines are connected to shore lines. From the cargo tank the bottom lines lead all the way to the main cargo pumps.

To simplify the matter we divided the pump room in two parts. One part is called the cargo pumps free flow side; the other part is called the cargo pumps deliver side. These sides are commonly called suction side and pressure side. Note: a centrifugal pump does not have any ability of suction.

On the cargo pumps free flow side, the bottom lines end at the cargo pumps. On this side, some cross over lines connect the systems to each other. The first crossover after the tank area is the stripping cross, marked on the drawing as “Crude oil suction -x-over line”. The stripping cross is located crosswise from the bottom lines, and connected to the bottom lines with pipe bending and valves. By using this crossover, it is, i.e. possible to discharge from cargo tanks on line system no.2 with COP no. 3. And so on.

Further towards the COP, on the bottom lines, there is a valve on each of these lines, usually called the “bulkhead valve”. This is because the location is normally close to the bulkhead, separating cargo tank area and pump room area.

Further on the free flow side of the cargo pump, is the seawater suction crossover line. This line is also crosswise from the bottom lines and is connected to the sea chest on each side (port and starboard). This line supplies the cargo pumps with seawater during water washing of tanks and lines, and used when ballasting for departure, if or when necessary. Crossing between different lines and pumps is also a possibility with this cross over line. We are now leaving the free flow side of the system, and the next step is to pay attention to the delivery side of the pumps.

The first stop is the first valve after the cargo pumps, the delivery valve or throttling valves. Names like discharging-valve, pressure-valve is also common. The most descriptive is “delivery valve”. With this valve, we can adjust the backpressure and the load conditions for what the pump is going to work against. Centrifugal pumps are working their best against a certain load.

When starting a centrifugal pump, start it against a closed delivery valve, which compares with the recommendation.

On the delivery side, the rise lines lead from the cargo pumps to the main deck. The first is the cow cross over line. With this line, we can bleed off from any riser for supplying crude oil washing during discharging, or supplying water during tank washing. The same line also supplies “drive” when using the ejector for stripping.

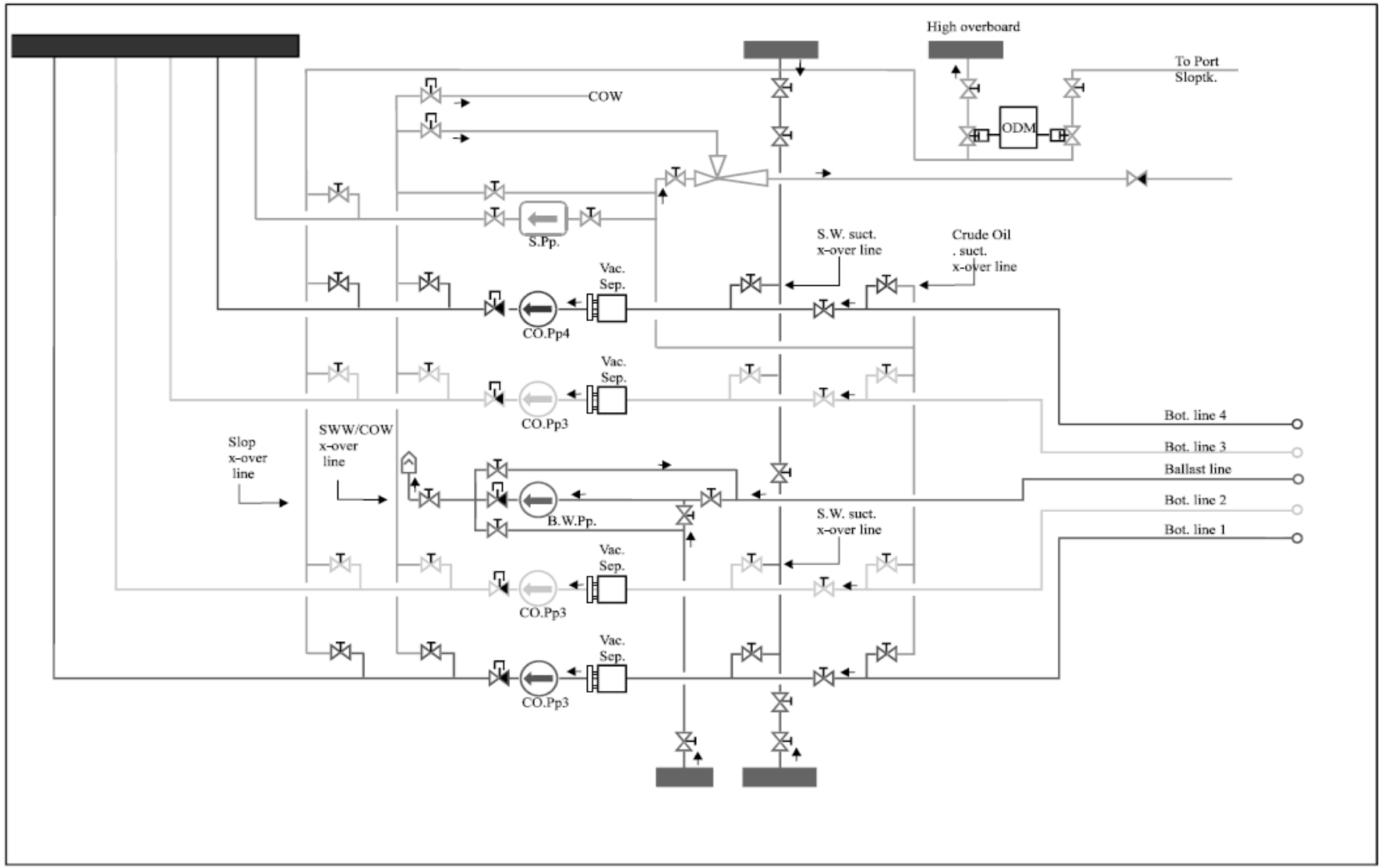
The second cross over line leads to a higher inlet in the port slop tank (primary slop) and to the line called “High Overboard”.

The high overboard line is the line where ballast water and washing water is discharged overboard via oil detection monitor equipment. As the drawing shows, it is possible with any cargo pump to cross over to any of the risers.

The pump room is also fitted with other equipment for handling cargo and ballast. The ballast pump is only used for the segregated ballast. The segregated ballast system is totally isolated from the cargo systems.

The ballast pump is connected to the FP-tank and the WT 3 s/p. The ballast system has its own sea chest. Still there are some vessels, among them M/T Seagull, which have separated lines from the ballast pump to the main deck, which end in drop lines to the cargo tanks that are dedicated for departure/arrival ballast. These tanks can be ballasted without involving any part of the cargo line systems.

The stripping pump is operating its own system, which (via a stripping cross over) strip the last amount of cargo from tanks, cargo pumps and lines, through the small diameter line and ashore. In addition to a stripping pump and an ejector, the vessel is equipped with a vacuum stripping system, which gives the cargo pumps the ability to maintain suction when only a small quantity is left in a tank.


High overboard
To Port
Sloptk.
COW
ODM
S.Pp.
S.W. suct.
x-over line
Crude Oil
. suct.
x-over line
Vac.
Sep.
CO.Pp4
Vac.
Sep.
CO.Pp3
Bot. line 4
Bot. line 3
Ballast line
Bot. line 2
Bot. line 1
Slop
x-over
line
SWW/COW
x-over
line
B.W.Pp.
S.W. suct.
x-over line
Vac.
Sep.
CO.Pp3
Vac.
Sep.
CO.Pp3

Deck lines

On a crude oil carrier, the main line system changes name, depending on where it is placed. From cargo tanks to the cargo pumps, the main lines are called “bottom lines”. From the cargo pumps delivery side, the name changes to risers. When they appear on the main deck, the names are deck lines.

Very often the systems are numbered from one side of the ship to the other, for instance from port to starboard or vice versa.

The deck lines are a lengthening of the risers from the pump room. Each deck line can be isolated to the pump room by the deck master valve. The deck lines end up at the manifold crossover lines. These manifolds are where the vessel is connected to the terminal by hoses, kick arms etc.

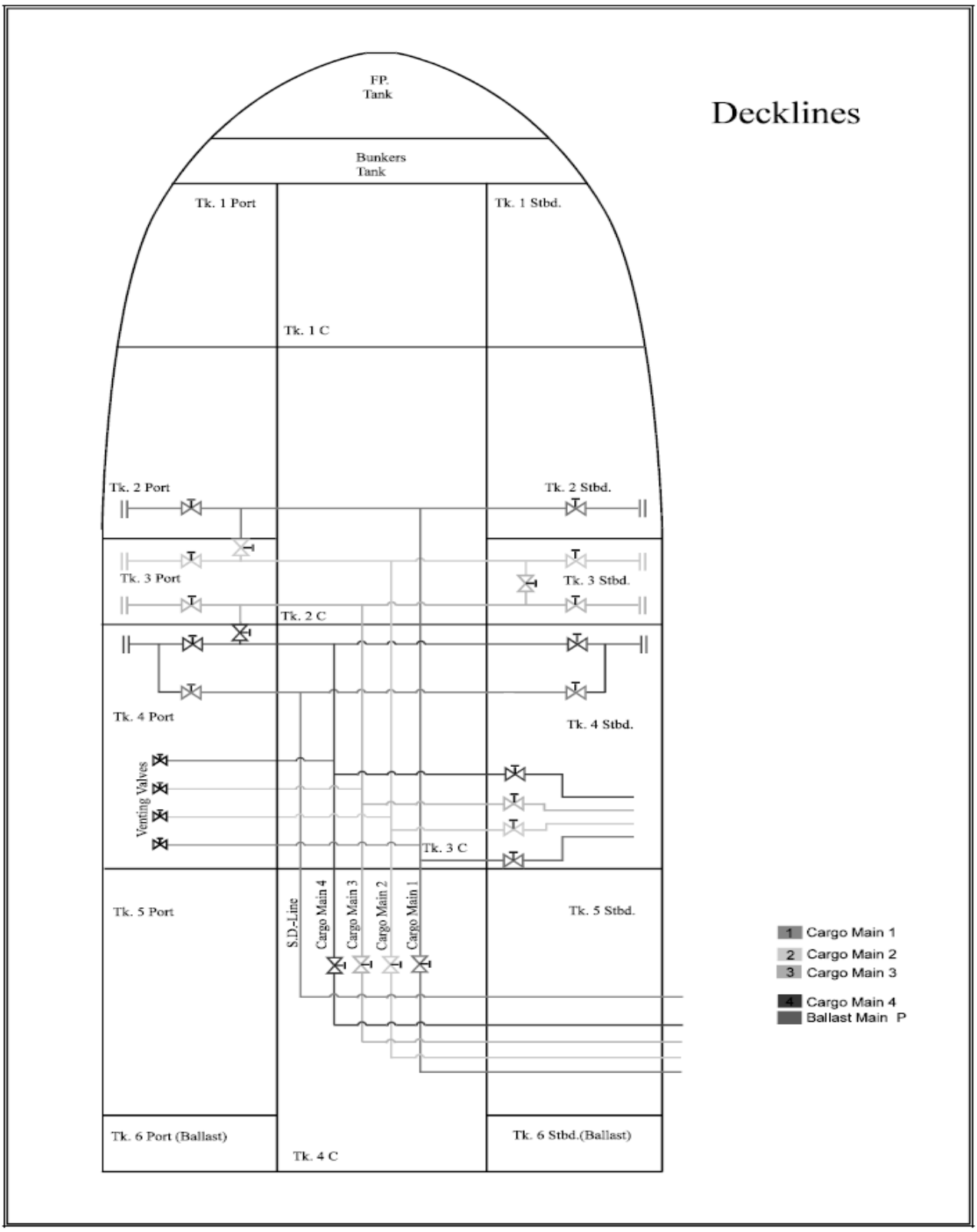
The manifold line is numbered with the same number as the main line it belongs to. The conclusion will then be: Manifold no 1 is connected to drop line no 1, which leads down to bottom line no 1, which leads to cargo pump no 1, which leads to riser no 1, which leads to deck line no 1, which leads to manifold no 1. The same occurs with system no 2, 3, and 4.

The vessel is also equipped with manifold cross over, which makes it possible to operate between deck lines, drop lines and manifolds depending on which manifold(s) the vessel is connected to.

By studying the ships line system all over, including valves and crossovers, you will find all the possibilities of leading cargo or water through the systems. The more you are familiar with the line system and its drawings, better you can utilise the system’s possibilities.

On the main deck you also find the small diameter line (MARPOL-line) which leads from the vessel’s stripping pump to one of the vessel’s manifolds. The small diameter line is connected on the outside of the manifold valve. It is connected to the “presentation flange”.

The purpose with this line is to strip the last amount of cargo ashore from the tanks, pumps and lines. When using this line, it is important to keep the specific manifold valve closed, to avoid the cargo returning into the vessel’s lines.

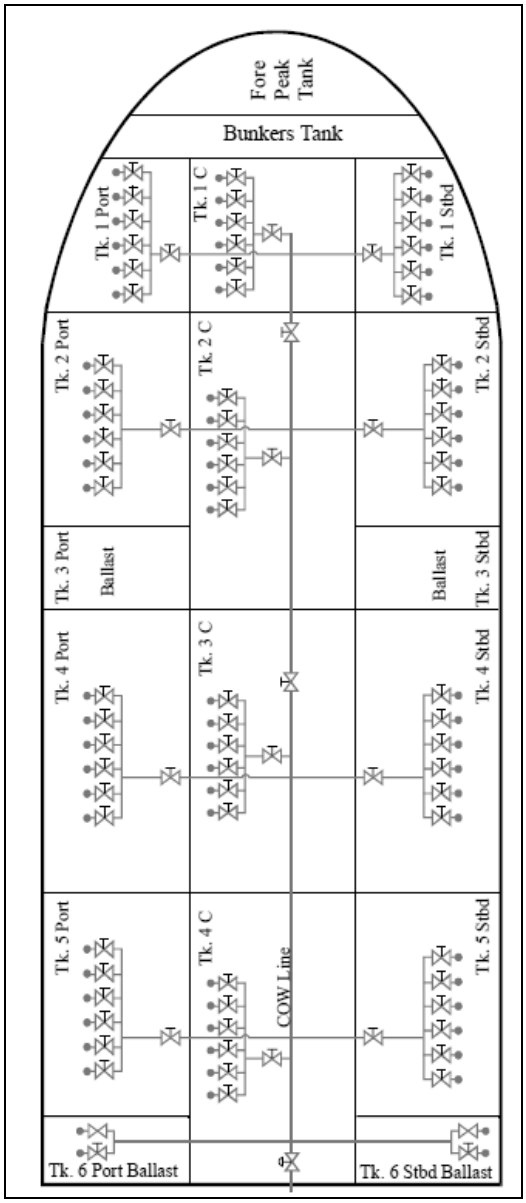


COW Lines

On the main deck you will find the Crude Oil Washing (COW) main line with branches leading to the ships crude oil washing machines. This line comes from the COW cross over line on the delivery side in the pump room.

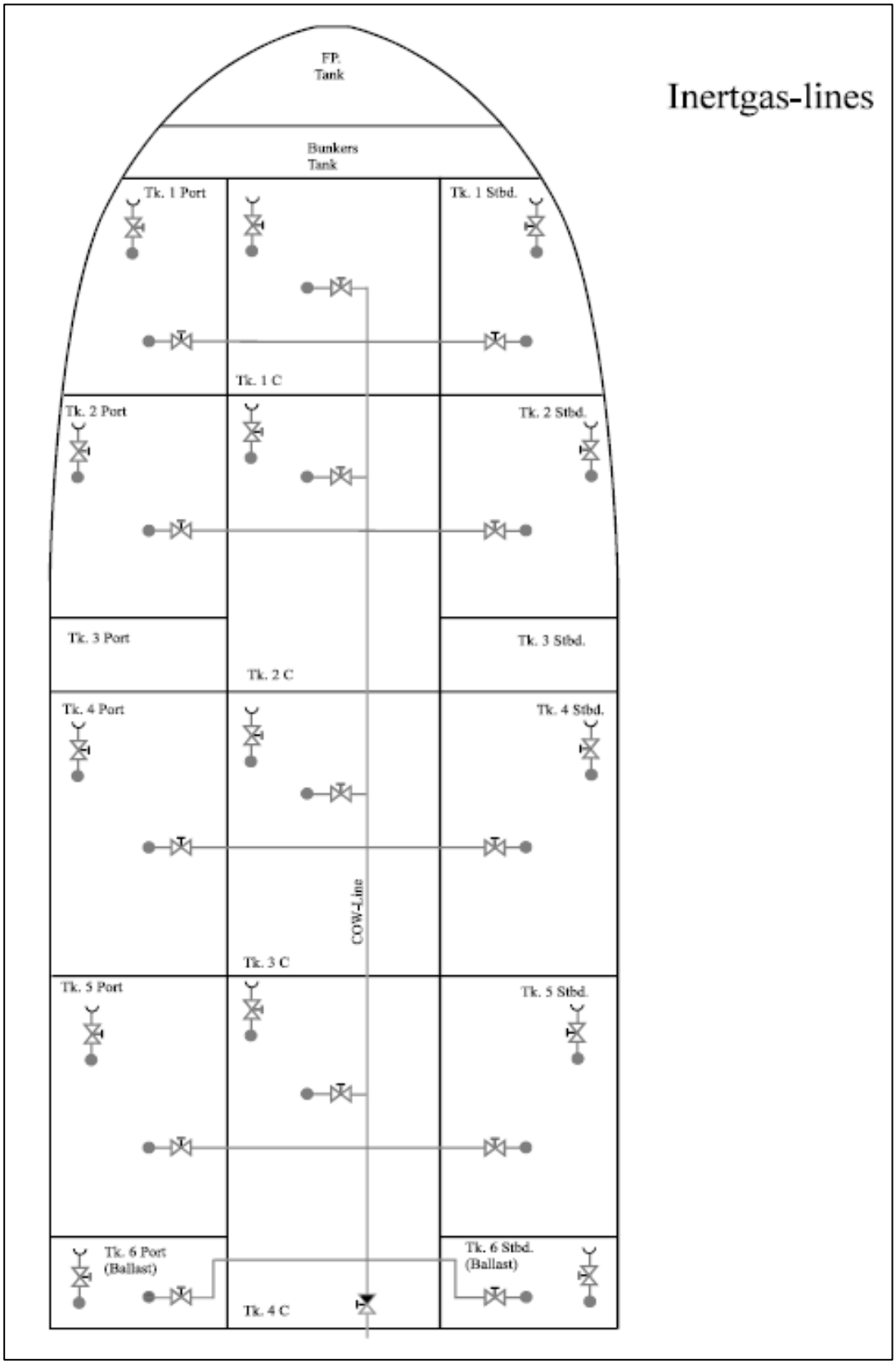
The branch lines from the COW main line are gradually reduced in dimension all the way forward to the COW machines. This reduction is to avoid pressure fall on the flow used for crude oil washing.

It is possible to bleed off to the COW main line from any of the main cargo lines. This contributes to several alternative solutions in the COW operation. There are always variations from ship to ship, but the main principle is the same.



Inert gas Lines

To control the atmosphere in the cargo tanks you will find inert lines on the main deck leading to each tank. These lines are for supplying inert gas during discharging or tank washing. Some inert gas systems are connected to a main riser, which are fitted with a press/vacuum valve for regulation of the pressure and vacuum in the cargo tanks. Other inert gas systems have these press/vacuum valves installed on each cargo tank with the same function as the riser.


Inertgas-lines
FP.
Tank
Bunkers
Tank
Tk. 1 Port
Tk. 1 Stbd.
Tk. 1 C
Tk. 2 Port
Tk. 2 Stbd.
Tk. 3 Port
Tk. 3 Stbd.
Tk. 2 C
Tk. 4 Port
Tk. 4 Stbd.
COW-Line
Tk. 3 C
Tk. 5 Port
Tk. 5 Stbd.
Tk. 6 Port
(Ballast)
Tk. 6 Stbd.
(Ballast)
Tk. 4 C

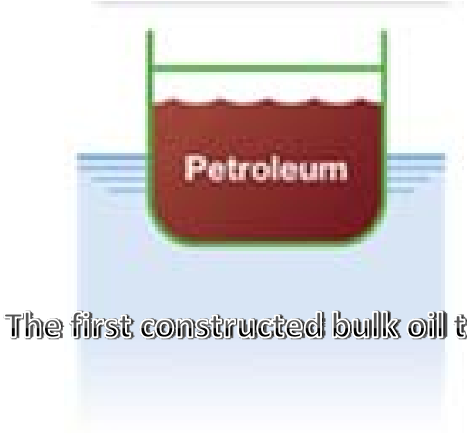
POWER POINT PRESENTATION EXAMPLE

Basic Training for Oil and Chemical Tanker Cargo Operations

Types of Oil Tankers

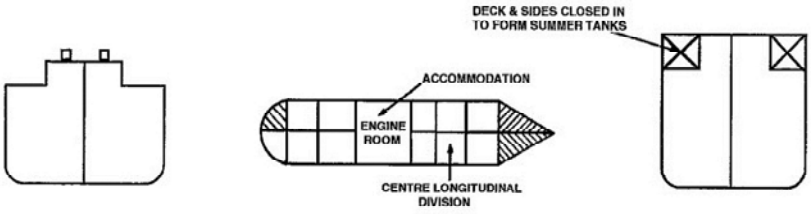
Types of Oil Tankers

Important stages in the development of oil tankers



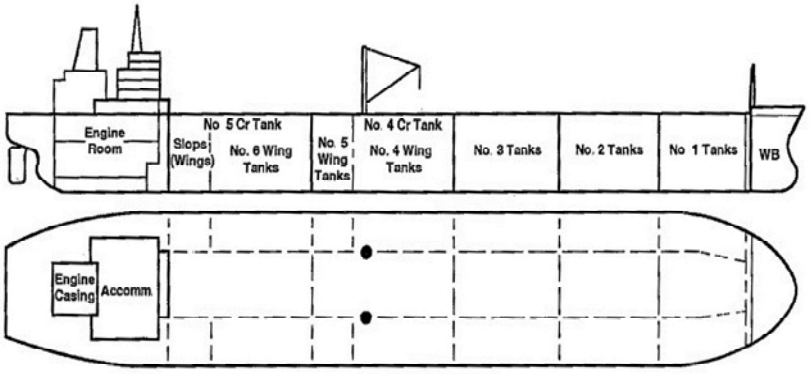
Small Single hull tankers without Centre line bulkheads

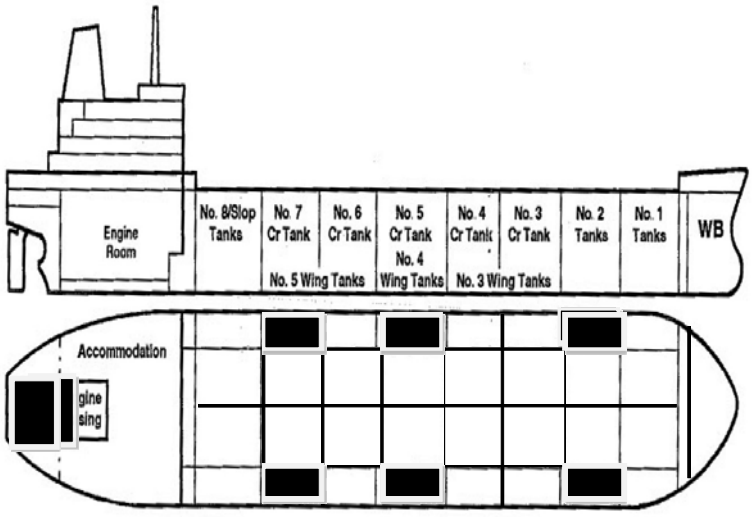
History of Construction and Development of an oil Tanker



•The initial vessels were transporting oil in barrels
•Then came the time to carry bulk oil in small single hull without Center line bulkheads
•The stability would not allow more than 50% volumetric use for fear of spillage and loss in cargo
•A centre line bulkhead enabled quantities to be increased as free surface reduced.
•Summer tanks were developed for further increase in quantity loaded allowing for expansion in warm climate
•Then a further increase of bulkheads gave us the cargo wing tanks and a centre tank

Single hull Crude oil Tanker





Double hull tankers with Segregated Ballast tanks in protected Locations