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TP 8129E
(01/2009)

Tanker Safety, Crude Oil Washing and Inert Gas, and Supervisor of Transfer Operations Training Courses

2nd EDITION
JANUARY 2009



TC-1002985



Canada

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Original Date Issued: March 2007

Date Revised: January 2009

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TABLE OF CONTENTS

General.....	1
1.1 Background	1
1.2 Goals.....	1
1.3 Effective date.....	1
1.4 Certification scheme.....	1
Approval of Training Courses	3
2.1 General	3
2.2 Recognized Institution.....	3
Oil and Chemical Tanker Familiarization Training	4
3.1 General	4
3.2 Objectives.....	4
3.3 Duration.....	4
3.4 Prerequisites	4
3.5 Specific instructor qualifications.....	4
3.6 Equipment requirements.....	4
3.7 Outline	5
3.8 Syllabus	6
Liquefied Gas Tanker Familiarization Training	19
4.1 General	19
4.2 Objectives.....	19
4.3 Duration.....	19
4.4 Prerequisites	19
4.5 Specific instructor qualifications.....	19
4.6 Equipment requirements.....	19
4.7 Outline	20
4.8 Syllabus	21
Specialized Oil Tanker Safety Training.....	29
5.1 General	29
5.2 Objectives.....	29
5.3 Duration.....	29
5.4 Prerequisites	29
5.5 Specific instructor qualifications.....	29
5.6 Equipment requirements.....	29
5.7 Outline	30
5.8 Syllabus	31

Specialized Chemical Tanker Safety Training.....	48
6.1 General	48
6.2 Objectives	48
6.3 Duration.....	48
6.4 Prerequisites	48
6.5 Specific instructor qualifications.....	48
6.6 Equipment requirements.....	48
6.7 Outline	49
6.8 Syllabus	50
Specialized Liquefied Gas Tanker Safety Training.....	63
7.1 General	63
7.2 Objectives.....	63
7.3 Duration.....	63
7.4 Prerequisites	63
7.5 Specific instructor qualifications.....	63
7.6 Equipment requirements.....	63
7.7 Outline	64
7.8 Syllabus	65
Supervision of an Oil Transfer Operation Course.....	79
8.1 General	79
8.2 Part A – Basic.....	79
8.3 Part B – Industry experience	79
8.4 Part C – Advanced.....	79
8.5 Duration.....	79
8.6 Prerequisites	79
8.7 Specific instructor qualifications.....	79
8.8 Goals.....	79
8.9 Outline	80
8.10 Syllabus	80
8.11 References	88
Supervision of a Chemical Transfer Operation Course.....	90
9.1 General	90
9.2 Duration.....	90
9.3 Prerequisites	90
9.4 Specific instructor qualifications.....	90
9.5 Goals.....	90
9.6 Outline	91
9.7 Syllabus	91
9.8 References	92

GENERAL

1.1 Background

- 1) The *International Convention on Standards of Training, Certification and Watchkeeping for seafarers*, as amended (STCW Convention), contains standards regarding training requirements for personnel on board tankers in Section A-V/1 of the mandatory Code “A”.
- 2) The duties and responsibilities of the transfer operations supervisors on board vessels are set out in the *Regulations for the Prevention of Pollution from Ships and Dangerous Goods*.
- 3) The requirements regarding certification of personnel employed on board tankers are set out in the *Marine Personnel Regulations*.

1.2 Goals

- 1) To comply with the requirements set out in the above standards and regulations and meet mandatory minimum requirements for training of personnel on board tankers.
- 2) To provide seafarers with the knowledge and understanding of the hazards associated with the marine environment and their vessel.
- 3) To provide training in the skills required to cope with such hazards to an extent appropriate to their functions on board in shore-based approved training courses.

1.3 Effective date

This document enters into force on the day the *Marine Personnel Regulations* come into effect.

1.4 Certification scheme

- 1) With the coming into force of the *Marine Personnel Regulations*, there are two levels of certification on board tankers: familiarization and specialized, which are in line with the STCW convention. The familiarization level is required for the crew and the junior officers who may be assigned specific duties in a transfer operation, while the specialized level is required for the Master, Chief mate, Chief engineer and Second engineer, with immediate responsibility for loading, discharging and care in transit or handling the cargo and operating the cargo equipment.
- 2) Upon successful completion of a familiarization training course described in this TP or three months of sea service on board a tanker, the holder of an STCW-endorsed certificate will be issued a familiarization endorsement, corresponding to the type of tanker, in the form of a sticker applied in his certificate; this endorsement will have no expiry date for ratings, while the period of validity for officers will be 5 years. Other crewmembers not holding any STCW-endorsed certificate will be issued a stand-alone, STCW-endorsed familiarization certificate, also valid for life.
- 3) The specialized training endorsement will be issued to officers who have completed the specialized training described in this TP and have completed at least three months of service on the appropriate type of tanker while holding the familiarization endorsement. The certification will be in the form of a sticker applied in their certificate and will be valid for five years.
- 4) Applicants holding a proficiency (rating) certificate or a “level 1” (officer) certificate at the time of coming into force of the *Marine Personnel Regulations* will be issued a familiarization certificate or endorsement, as per 2) above, at the time of renewal or exchange of their certificate, and holders of a “level 2” certificate will be issued an equivalent Specialized Training Endorsement at the time of renewal, subject to the necessary experience or training specified in part one of the Regulations.

- 5) The certificates of Supervisor of an Oil Transfer Operation, a Chemical Transfer Operation or a Liquefied Gas Transfer Operation remain domestic, non-STCW certificates but now have a five-year period of validity. This was brought in during public consultations, taking into consideration the sensitive nature of these operations and the need for the holders of these certificates to stay proficient with their trade and informed of the latest regulations.

APPROVAL OF TRAINING COURSES

2.1 General

- 1) Canada's accession to the STCW Convention means that all approved marine training programs and courses must be delivered and monitored through a quality management system.

2.2 Recognized Institution

- 1) Courses are to be provided by a "recognized institution" as defined in the *Marine Personnel Regulations*. Approval procedures are provided in the chapter entitled *Approval of Marine Training Courses and Programs of the Quality Management Manual – Marine Personnel Standards and Pilotage*, published by the Department of Transport, Marine Personnel Standards and Pilotage Directorate.
- 2) Institutions must submit for approval their course syllabus, training manual, instructor qualifications and any other information required by the above-mentioned document to the following address:

Marine Personnel Standards & Pilotage (AMSP)
Transport Canada, Marine Safety
330 Sparks Street, Tower C, 8th Floor
Ottawa, Ontario K1A 0N8

OIL AND CHEMICAL TANKER FAMILIARIZATION TRAINING

3.1 General

This course applies to officers and ratings who will be assigned specific duties and responsibilities related to cargo and cargo equipment on oil or chemical tankers, taking into account section A-V/1 of the STCW Code.

3.2 Objectives

- 1) Provide the training required under Section 159 of the *Marine Personnel Regulations* in order to obtain an *Oil and Chemical Tanker Familiarization* certificate or endorsement.
- 2) Enable the participants to assume the duties and responsibilities relating to the loading, discharging or transfer of cargo and the operation of cargo equipment.

3.3 Duration

60 hours

3.4 Prerequisites

MED with respect to STCW Basic Safety

3.5 Specific instructor qualifications

The main course instructor must hold a master certificate not lower than a Master 3000 Gross tonnage, Near Coastal certificate, or an engineer certificate not lower than Second-class Engineer certificate, with a valid *Oil and Chemical Tanker Familiarization* endorsement. If the course is under the supervision of more than one instructor, the assistant instructors must hold qualifications related to the marine industry or have related skills and be approved in accordance with the *Quality Management Manual – Marine Personnel Standards and Pilotage*, referred to in Chapter 2.

3.6 Equipment requirements

- 1) Personnel safety equipment, including breathing apparatus;
- 2) Set of protective equipment, including chemical and gas-tight suits;
- 3) Respiratory protection equipment for emergency escape;
- 4) Tankscope for detecting and measuring hydrocarbon vapours in inert gas spaces;
- 5) Portable oxygen meter and oxygen analyser;
- 6) Portable combustible-gas indicator (explosimeter);
- 7) Portable gas detector with sample detector tubes for vapours and gasses;
- 8) Sample cargo data sheets and MSDS;
- 9) Latest versions of International Safety Guide for Oil Tankers and Terminals (ISGOTT);
- 10) Audio-visual presentation equipment.

3.7 Outline

Subject Area	Hours	
	Lecture	Practical
1. The Oil Tanker 1.1 Give a brief overview of oil tanker design and development 1.2 Describe types of oil tanker in current service 1.3 Describe types of cargo shipped in oil tankers	4	
2. The Chemical Tanker 2.1 Summarize the development of the chemical tanker trade 2.2 Establish elements of design 2.3 Describe types of chemical tanker in current service 2.4 Describe types of cargo shipped in chemical tankers	4	
3. Rules and Regulations 3.1 Identify international and national rules and regulations 3.2 Describe the Bulk Chemical Codes	4	
4. Basic Science Concepts 4.1 Outline physical and chemical properties of petroleum cargoes 4.2 Outline physical and chemical properties of chemical cargoes 4.3 Explain the principle of the controlled tank atmosphere 4.4 Explain the principles of electrostatics	6	
5. Oil Tanker Cargo Handling Systems 5.1 Describe pipeline, pumping and discharge arrangements 5.2 Identify cargo and ballast measuring devices 5.3 Describe venting arrangements 5.4 Describe cargo-heating systems 5.5 Locate bunker systems and bunker transfer equipment	6	
6. Chemical Tanker Cargo Handling Systems 6.1 Describe pipeline, pumping and discharge arrangements 6.2 Describe cargo-heating systems 6.3 Describe venting arrangements 6.4 Outline instrumentation requirements	6	
7. Oil Tanker Operations 7.1 Plan for port arrival 7.2 Describe ballasting and de-ballasting operations 7.3 Prepare for loading and discharge operations 7.4 Describe the Inert Gas System (IG) 7.5 Describe cargo loading and cargo discharging operations 7.6 Describe crude oil washing 7.7 Explain tank washing procedures 7.8 Describe purging and gas-freeing 7.9 Describe general procedures for combination carriers	8	
8. Chemical Tanker Operations 8.1 Plan for safe carriage and correct handling of cargo 8.2 Describe procedures for loading 8.3 Care for cargo during transit 8.4 Discharge cargo and conduct ballast operations 8.5 Conduct tank cleaning procedures and disposal of residues 8.6 Gas-free cargo tanks and test for cleanliness	8	

Subject Area	Hours	
	9. Health, Safety and Emergency Procedures 9.1 Describe health hazards associated with petroleum cargoes 9.2 Describe health hazards associated with chemical cargoes 9.3 Identify personal protection and safety equipment 9.4 Implement control measures for enclosed space safety 9.5 Review fire-fighting principles and control 9.6 Describe terminal emergency procedures 9.7 Describe shipboard emergency procedures 9.8 Give an overview of general safety precautions	3
10. Pollution prevention 10.1 Discuss pollution of the marine environment 10.2 Describe operational requirements of oil and chemical tankers 10.3 Respond to marine spills 10.4 Conduct safe transfer operations	6	
	55 hours	5 hours
Total	60 hours	

3.8 Syllabus

Topics and Learning Objectives	
1. The Oil Tanker	
1.1 Give a brief overview of oil tanker design and development	
1.1.1	Introduce the concept of carriage of oil at sea
1.1.2	Discuss the evolution of the oil tanker
1.1.3	Show a typical double hull oil tanker general arrangement
1.1.4	Identify general tank and ship arrangements
1.1.5	Describe safety aspects of design
1.2 Describe types of oil tanker in current service	
1.2.1	Distinguish:
1.2.1.1	oil tanker
1.2.1.2	crude oil tanker
1.2.1.3	product carrier
1.2.1.4	combination carrier
1.2.2	Differentiate single hull and double-hull oil tanker
1.2.3	Describe the features of a double-hull oil tanker
1.2.4	Explain the term combination carrier
1.2.5	Identify an OBO and O/O carrier
1.3 Describe types of cargo shipped in oil tankers	
1.3.1	Differentiate clean oils/products and crude oil
1.3.2	Identify a range of oil cargoes typically carried onboard
1.3.3	List examples of industrial products derived from crude oil
1.3.4	Identify cargoes carried in oil/bulk/ore vessels
2. The Chemical Tanker	
2.1 Summarize the development of the chemical tanker trade	
2.1.1	Outline the growth of the chemical trade from the mid-1940's
2.1.2	Describe the evolution of the transportation of chemicals in ships
2.1.3	Explain the requirement for standardized international regulations
2.2 Establish elements of design	
2.2.1	Identify ship types from the Bulk Chemical Codes
2.2.2	Explain the general concept of chemical Ship Types 1, 2 and 3

Topics and Learning Objectives

- 2.2.3 Use a general arrangement plan and identify:
 - 2.2.3.1 General tank and ship arrangements
 - 2.2.3.2 The inboard location of cargo tanks for each ship type
 - 2.2.3.3 Means of cargo segregation and containment
 - 2.2.3.4 Other safety aspects of design
- 2.3 Describe types of chemical tanker in current service**
 - 2.3.1 Identify:
 - 2.3.1.1 Parcel/chemical tanker
 - 2.3.1.2 Product/chemical tanker
 - 2.3.1.3 Specialized chemical tanker
 - 2.3.2 Explain the term parcel tanker
 - 2.3.3 Explain the difference between product tankers carrying refined product and chemical tankers carrying chemicals
- 2.4 Describe types of cargo shipped in chemical tankers**
 - 2.4.1 Differentiate hazardous goods in package form and liquid bulk chemicals
 - 2.4.2 Define 'noxious liquid substance' (NLS)
 - 2.4.3 Identify a range of chemical cargoes typically carried onboard
 - 2.4.4 List examples of industrial products derived from chemicals
 - 2.4.5 Identify additional cargoes carried on chemical tankers unrelated to chemicals

3. Rules and Regulations

3.1 Identify international and national rules and regulations

- 3.1.1 Differentiate international and national legislation
- 3.1.2 List the most important rules affecting oil and chemical tankers as:
 - 3.1.2.1 International conventions
 - 3.1.2.2 National regulations
 - 3.1.2.3 Classification society rules
- 3.1.3 Identify the IMO as the international forum for shipping matters
- 3.1.4 Identify the main IMO conventions affecting tankers
 - 3.1.4.1 Define SOLAS 1974 as the International Convention for the Safety of Life at Sea, 1974
 - 3.1.4.2 Define MARPOL 73/78 as the International Convention for the Prevention of Pollution from Ships, 1973/1978
 - 3.1.4.3 Define STCW 1995 as the International Convention for Standards of Training, Certification and Watchkeeping, 1995
 - 3.1.4.4 Explain how amendments affect the IMO conventions
- 3.1.5 Explain how the conventions are incorporated in national legislation
- 3.1.6 Differentiate MARPOL 73/78 Annex I and Annex II
- 3.1.7 Define 'oil tanker' from MARPOL Annex I
- 3.1.8 Define 'chemical tanker' from MARPOL Annex II
- 3.1.9 Define 'NLS tanker' from MARPOL Annex II
- 3.1.10 Introduce the ISM Code as the International Safety Management Code
- 3.1.11 Summarize the basic requirements of a Safety Management System
- 3.1.12 Identify regulations under the CSA affecting oil and chemical tankers

3.2 Describe the Bulk Chemical Codes

- 3.2.1 Identify the IBC Code and BCH Code
- 3.2.2 Summarize the purpose of the Codes
- 3.2.3 Identify tankers to which the Codes apply
- 3.2.4 State the dates of compliance for the Codes
- 3.2.5 Link the Codes to SOLAS 74 and MARPOL 73/78
- 3.2.6 Provide an overview of the content of the Codes
- 3.2.7 Differentiate chapter 17 and chapter 18 of the IBC Code

Topics and Learning Objectives

4. Basic Science Concepts

4.1 Outline physical and chemical properties of petroleum cargoes

- 4.1.1 Discuss general characteristics of crude petroleum
- 4.1.2 Explain why the composition of crude varies from source
- 4.1.3 State that crude oil is a mixture of hydrocarbons:
 - 4.1.3.1 Partly gaseous at normal atmospheric conditions
 - 4.1.3.2 Liquid at normal atmospheric conditions
 - 4.1.3.3 Solid at normal atmospheric conditions
- 4.1.4 Give a brief overview of the refining process
- 4.1.5 List examples of refined products
- 4.1.6 Define volatility of petroleum
- 4.1.7 Link volatility to vapour pressure

4.2 Outline physical and chemical properties of chemical cargoes

- 4.2.1 Introduce Cargo Data Sheets for chemicals
- 4.2.2 Explain the physical data of liquid chemicals given in Cargo Data Sheets
- 4.2.3 Describe the use of the Index of Products Carried in Bulk
- 4.2.4 Explain the importance of correct technical names and synonyms
- 4.2.5 Explain the term cargo compatibility
- 4.2.6 Provide examples of cargoes which:
 - 4.2.6.1 Self-react
 - 4.2.6.2 Polymerize
 - 4.2.6.3 Require an inhibitor
 - 4.2.6.4 React with air
 - 4.2.6.5 React with water
 - 4.2.6.6 React between cargoes
- 4.2.7 Identify reactions of cargoes with tank coatings and tank materials

4.3 Explain the principle of the controlled tank atmosphere

- 4.3.1 Identify the components of the fire triangle
 - 4.3.1.1 Explain the related chemical reaction
- 4.3.2 Explain how variables in a tank, after discharge, can affect the tank atmosphere:
 - 4.3.2.1 Volatility of the cargo in the tank
 - 4.3.2.2 Ambient temperature
 - 4.3.2.3 Amount of residual cargo
 - 4.3.2.4 Distribution of gases
 - 4.3.2.5 Inert gas
- 4.3.3 Describe the process of gas evolution in a tank
- 4.3.4 Explain why it is important to measure the tank concentrations
- 4.3.5 Define:
 - 4.3.5.1 Flashpoint
 - 4.3.5.2 Auto-ignition temperature
- 4.3.6 Describe flammable range, lower flammable limit (LFL) and upper flammable limit (UFL)
- 4.3.7 Explain flammable range in relation to different oils and chemicals
- 4.3.8 Define inert gas (IG)
- 4.3.9 Identify the regulatory limits of oxygen content in inert gas
- 4.3.10 Describe how the tank atmosphere is affected during:
 - 4.3.10.1 gas freeing
 - 4.3.10.2 purging
 - 4.3.10.3 dilution with air
 - 4.3.10.4 dilution with inert gas
- 4.3.11 Differentiate inert and non-inert tank atmosphere

Topics and Learning Objectives

- 4.3.12 Explain how inert gas is used in chemical cargo tanks for:
 - 4.3.12.1 Protection against polymerization, oxidation and humidity
 - 4.3.12.2 Replace air to prevent fire and explosion
- 4.3.13 Explain why nitrogen is used instead of inert gas
- 4.4 Explain the principles of electrostatics**
 - 4.4.1 Explain what charge separation is and when it occurs
 - 4.4.2 Describe the process of charge relaxation
 - 4.4.3 Explain charge retention by insulation
 - 4.4.4 Explain when liquids are considered non-conductors
 - 4.4.5 Define a static accumulator oil
 - 4.4.6 List some static accumulator oils
 - 4.4.7 Explain the function and use of anti-static additives
 - 4.4.8 Explain why distillates must be treated as static accumulator oils unless they contain anti-static additives
 - 4.4.9 Summarize the reasons why low load rates are important for some oils
 - 4.4.10 Explain the hazards associated with introducing portable devices and equipment into a tank, and the measures to minimize the hazard
 - 4.4.11 Explain the types of tank operations that can cause a charged mist to develop
 - 4.4.12 Explain the risk of introducing the following into a charged atmosphere:
 - 4.4.12.1 Steam
 - 4.4.12.2 Inert gas
 - 4.4.12.3 Carbon dioxide
 - 4.4.13 Identify the risk of free-fall liquids in a cargo tank
 - 4.4.14 Explain the concept of the ship-to-shore bonding wire and insulating flange

5. Oil Tanker Cargo Handling Systems

5.1 Describe pipeline, pumping and discharge arrangements

- 5.1.1 Describe general pipeline systems including:
 - 5.1.1.1 Hoses and hard-arms
 - 5.1.1.2 Cargo manifold
 - 5.1.1.3 The ship-shore hard-arm operating envelope
 - 5.1.1.4 The difference between a pipeline and free-flow system
 - 5.1.1.5 The types of pipeline system found on a product tanker and a crude oil tanker
 - 5.1.1.6 The types of valve typically found on a pipeline arrangement
 - 5.1.1.7 A typical VLCC ballast pipeline arrangement
 - 5.1.1.8 A stripping system and its uses
 - 5.1.1.9 The MARPOL line
- 5.1.2 Describe a general pump-room pipeline configuration
- 5.1.3 List the main types of cargo pump
 - 5.1.3.1 The centrifugal pump
 - 5.1.3.2 The deepwell pump
 - 5.1.3.3 The reciprocating pump
 - 5.1.3.4 The simplex and duplex pump
- 5.1.4 Give an overview of basic pumping concepts
- 5.1.5 Explain the pressure surge, including risks and dangers
 - 5.1.5.1 Downstream
 - 5.1.5.2 Upstream
 - 5.1.5.3 At the pump
- 5.1.6 Describe the centrifugal pump characteristics
- 5.1.7 Explain the function of the deepwell pump including its stripping capability
- 5.1.8 Describe the reciprocating stripping pump
- 5.1.9 Describe the following valves and their uses:
 - 5.1.9.1 Gate or sluice valve
 - 5.1.9.2 Butterfly valve

Topics and Learning Objectives

5.1.9.3	Non-return valve
5.1.9.4	Angle stop valve
5.1.10	Describe, with the use of a diagram, an eductor
5.1.11	Explain how an eductor is used in the cargo and stripping system
5.1.12	Identify the vacuum-strip system and explain its use
5.1.13	Locate emergency cargo pump stops
5.1.14	Explain the use of the emergency remote cargo pump shutdown
5.2	Identify cargo and ballast measuring devices
5.2.1	Explain the use of the ullage measuring tape
5.2.2	Differentiate innage and ullage
5.2.3	Explain the importance of reliable and accurate measuring devices
5.2.4	Identify closed system electronic ullage gauges (i.e. MMC or Hermetic type)
5.2.5	Describe, generally, liquid level gauges found on oil tankers
5.2.6	Describe, using diagrams, the basic operating principle of a tank radar liquid level gauge
5.2.7	Describe control measures to avoid tank overflow:
5.2.7.1	By use of high-level alarms or overflow-control systems
5.2.7.2	By use of gauging devices and tank-filling control procedures
5.2.8	Explain the danger of exceeding the design head of the cargo tank
5.3	Describe venting arrangements
5.3.1	List reasons for venting from cargo and ballast spaces
5.3.2	Discuss the evolution of gases from cargo tanks
5.3.3	Explain the importance of gas dispersion
5.3.4	Describe still air conditions and safety risks
5.3.5	Illustrate typical gas dispersion patterns
5.3.6	Discuss factors affecting gas dispersion
5.3.7	Describe independent and combined tank venting arrangements
5.3.8	Describe tank isolation arrangements for combined systems
5.3.9	Describe the pressure-vacuum valve (P/V)
5.3.10	Show, with the aid of a diagram, typical P/V locations
5.3.11	Explain the reasons for flame screens in venting systems
5.3.12	Describe the use of a high velocity valve
5.4	Describe cargo-heating systems
5.4.1	List oils which may require heating
5.4.2	List examples of oils which should never be heated
5.4.3	Describe cold weather conditions affecting oil heating requirements
5.4.4	Describe a typical steam heating coil arrangement
5.4.5	Explain how to detect steam heating coil contamination
5.4.6	Compare steam heating to thermal oil heating
5.4.7	State the disadvantages of steam heating coils
5.4.8	Explain the importance of proper cargo temperature control
5.5	Locate bunker systems and bunker transfer equipment
5.5.1	Show, with the aid of a diagram, a typical bunker pipeline arrangement
5.5.2	Show, with the aid of a plan, a typical bunker tank arrangement
5.5.3	Identify bunker transfer pump emergency stops
5.5.4	Identify hazards of light hydrocarbons in the tank headspace
6.	Chemical Tanker Cargo Handling Systems
6.1	Describe pipeline, pumping and discharge arrangements
6.1.1	Describe general cargo piping arrangements on chemical tankers
6.1.2	Describe cargo segregation in terms of:
6.1.2.1	Segregation by two valves
6.1.2.2	Spool-pieces
6.1.3	Discuss the care, handling and use of cargo hoses:
6.1.3.1	Compatibility and suitability with chemical cargoes
6.1.3.2	Cargo temperature limitations

Topics and Learning Objectives

- 6.1.3.3 Inspection and testing procedures
- 6.1.3.4 Certification of hoses
- 6.1.3.5 Maintenance and correct handling
- 6.1.4 Explain basic pumping concepts using deepwell pumps and submerged pumps
- 6.1.5 Discuss the benefits of the deepwell and submerged pump
- 6.1.6 Discuss the limitations of deepwell and submerged pumps
- 6.1.7 Explain different conditions affecting discharge rate
- 6.1.8 Describe stripping using an eductor
- 6.1.9 Describe stripping arrangements using a deepwell pump
- 6.2 Describe cargo-heating systems**
 - 6.2.1 Explain the importance of heating for some cargoes
 - 6.2.2 Describe different heating medium
 - 6.2.3 Describe heating systems using:
 - 6.2.3.1 Heating coils
 - 6.2.3.2 Deck mounted heat exchanger
 - 6.2.4 Explain the risks associated with overheating cargo
 - 6.2.5 Explain the risks and dangers associated with poor maintenance of heating systems
- 6.3 Describe venting arrangements**
 - 6.3.1 Use the Code to define open and controlled ventilation systems
 - 6.3.2 Discuss load rates and ventilation capacity
 - 6.3.3 Explain the design of safe ventilation to minimize cargo vapours in areas open to access by personnel
 - 6.3.4 Explain the limitations and risks of open-venting
 - 6.3.5 Explain when controlled venting is required
 - 6.3.6 Describe the reason for and use of the vapour return
 - 6.3.7 Describe safety aspects of vent design, including:
 - 6.3.7.1 Flame arrestors
 - 6.3.7.2 Flame screens
 - 6.3.7.3 High-velocity vents
 - 6.3.8 Explain the purpose and operation of a pressure/vacuum valve (P/V's)
 - 6.3.9 Discuss general precautions and maintenance of P/V's
- 6.4 Outline instrumentation requirements**
 - 6.4.1 Explain the terms intrinsically safe, flameproof and increased safety equipment
 - 6.4.2 Describe the principles of operation and types of gauging devices for cargo tanks
 - 6.4.3 Explain the terms:
 - 6.4.3.1 Open gauging
 - 6.4.3.2 Restricted gauging
 - 6.4.3.3 Closed gauging
 - 6.4.4 Explain the use of high-alarm systems for cargoes
 - 6.4.5 Explain the tank overflow control system
 - 6.4.6 Describe, briefly, the test instruments necessary for toxic and flammable cargoes

7. Oil Tanker Operations

7.1 Plan for port arrival

- 7.1.1 Complete pre-arrival checklists
- 7.1.2 Inspect and test relevant cargo operations systems
- 7.1.3 Prepare fire equipment for cargo operations
- 7.1.4 Identify personnel for cargo operations

7.2 Describe ballasting and de-ballasting operations

- 7.2.1 Describe typical ballast and de-ballast sequence
 - 7.2.1.1 For single hull tanker
 - 7.2.1.2 For double-hull tanker
 - 7.2.1.3 Heavy weather ballast tank
 - 7.2.1.4 CBT
 - 7.2.1.5 SBT
 - 7.2.1.6 Change of ballast at sea

Topics and Learning Objectives

- 7.2.2 Outline the requirements for international ballast water exchange
- 7.2.3 Describe ballast stripping arrangements
- 7.2.4 Outline procedures and restrictions for contaminated ballast
- 7.2.5 Discuss use of the slop tank
- 7.2.6 Explain limitations for ballast discharge at sea and in port
- 7.3 Prepare for loading and discharge operations**
 - 7.3.1 Identify the ship/shore safety checklist
 - 7.3.2 Discuss, using the ship/shore checklist, general safety aspects
 - 7.3.3 Line-up cargo system
 - 7.3.4 Describe the precautions, use and connection of cargo hoses
 - 7.3.4.1 Using terminal hoses
 - 7.3.4.2 Using ship hoses
 - 7.3.5 Describe the precautions, use and connection of hard-arms
 - 7.3.6 Discuss emergency shut-down procedures
- 7.4 Describe the Inert Gas System (IG)**
 - 7.4.1 Specify the reasons for inerting
 - 7.4.2 Define inert gas
 - 7.4.3 Describe the effect of inert gas on flammability
 - 7.4.4 Identify sources of inert gas
 - 7.4.4.1 Flue gas system
 - 7.4.4.2 Inert gas generator
 - 7.4.4.3 Other methods
 - 7.4.5 List the basic requirements of an IG system
 - 7.4.5.1 To inert empty tanks
 - 7.4.5.2 To provide a controlled atmosphere during cargo operations
 - 7.4.5.3 To purge tanks prior to gas-freeing
 - 7.4.5.4 To top-up pressure when required
 - 7.4.6 Use a block diagram to identify the main components of an IG system
 - 7.4.7 Show the relationship and interaction between the components
 - 7.4.8 Identify the requirements for portable and fixed gas measuring instruments
 - 7.4.9 Describe the use of the inert gas system
 - 7.4.9.1 Inerting from a gas-free condition
 - 7.4.9.2 Venting during loading operations
 - 7.4.9.3 Maintaining an inert condition on load passage
 - 7.4.9.4 Pressurizing before cargo discharge operations
 - 7.4.9.5 Inerting during cargo discharge
 - 7.4.9.6 Inerting during COW
 - 7.4.9.7 Inerting empty tanks on ballast passage
 - 7.4.9.8 Inerting during tank cleaning
 - 7.4.9.9 Purging prior to gas-freeing
 - 7.4.9.10 Gas-freeing using the fresh air intake
 - 7.4.10 Describe precautions to take with the IG system during tank entry
- 7.5 Describe cargo loading and cargo discharging operations**
 - 7.5.1 Discuss loading methods and safe practices
 - 7.5.1.1 Gravity from shore to ship
 - 7.5.1.2 Initial and full pumping rates to ship
 - 7.5.1.3 Frame samples
 - 7.5.1.4 Importance of grade segregation
 - 7.5.1.5 Monitoring tanks during loading
 - 7.5.1.6 Topping off
 - 7.5.1.7 Relaxation periods prior to ullaging and sampling
 - 7.5.2 Discuss discharge methods and safe practices
 - 7.5.2.1 Sequence of valve opening ship to shore
 - 7.5.2.2 Starting and monitoring of cargo pumps

Topics and Learning Objectives

- 7.5.2.3 Shore check valves
- 7.5.2.4 Initial and full pumping rates to shore
- 7.5.2.5 Monitoring tanks during discharge
- 7.5.2.6 Precautions and risks blowing lines
- 7.5.3 Identify checks to be made by the deck watch during loading and discharge
- 7.6 Describe crude oil washing**
 - 7.6.1 Define crude oil washing (COW)
 - 7.6.2 State COW is mandatory for many crude oil tankers
 - 7.6.3 Differentiate water washing and crude oil washing
 - 7.6.4 List advantages and disadvantages of COW
 - 7.6.5 Define commonly used terms and their relationships
 - 7.6.6 Explain the basic principles of crude oil washing
 - 7.6.7 Discuss the characteristics of crude oil as a washing fluid
 - 7.6.8 Describe top washing, bottom washing
 - 7.6.9 Describe multi-stage and single stage washing using fixed deck-mounted and fixed submerged machines
 - 7.6.10 Identify, from a diagram, the location of COW pipelines and machines
 - 7.6.11 Describe portable and fixed drive units and their limitations
 - 7.6.12 Identify checks to be made by the deck watch during COW operations
- 7.7 Explain tank-washing procedures**
 - 7.7.1 List the reasons for tank washing
 - 7.7.2 Describe tank washing line, pump and stripping arrangements
 - 7.7.3 Identify the risks involved with tank washing
 - 7.7.4 List the precautions to be taken during tank washing
 - 7.7.5 State tank washing should be undertaken in an inert atmosphere
 - 7.7.6 Identify precautions to take when washing a non-inert tank
 - 7.7.7 Describe tank washing processes
 - 7.7.7.1 With cold water
 - 7.7.7.2 With hot water
 - 7.7.7.3 Using chemicals
 - 7.7.7.4 Using portable machines
 - 7.7.7.5 Using fixed in place machines
 - 7.7.7.6 Use of programmable and non-programmable machines
 - 7.7.8 State that disposal of tank residues must comply with regulations
 - 7.7.9 Explain the use of the slop tank/s
 - 7.7.10 Identify the risks of over filling slop tanks
 - 7.7.11 Identify safety checks to be made by the deck watch during tank washing
- 7.8 Describe purging and gas-freeing**
 - 7.8.1 Define gas-freeing
 - 7.8.2 Define purging
 - 7.8.3 List the reasons for gas freeing
 - 7.8.4 Describe the safety precautions to take during gas-freeing
 - 7.8.5 Give details of gas-freeing fans arrangements
 - 7.8.5.1 Portable fans
 - 7.8.5.2 Fixed gas freeing equipment
 - 7.8.5.3 Use of the IG air intake
 - 7.8.6 Describe methods of gas-freeing
 - 7.8.7 Define a gas-free tank
 - 7.8.8 Identify how a tank can again become gas dangerous
 - 7.8.9 Discuss the securing arrangements of tank IG lines
 - 7.8.10 Identify safety checks to be made by the deck watch during gas freeing
- 7.9 Describe general procedures for combination carriers**
 - 7.9.1 Prepare holds from dry bulk cargo to oil cargo
 - 7.9.2 Identify additional precautions necessary before loading oil cargo
 - 7.9.3 Identify risks specific to combination carriers when carrying oil cargoes

Topics and Learning Objectives

- 7.9.4 Identify risks specific to combination carriers during load and discharge of oil cargoes
- 7.9.5 Prepare holds from oil cargo for dry bulk cargo

8. Chemical Tanker Operations

8.1 Plan for safe carriage and correct handling of cargo

- 8.1.1 Identify the role and responsibilities of the cargo planner
- 8.1.2 Identify correct technical name and methods to verify this
- 8.1.3 Discuss the importance of tank cleanliness for the loading of cargoes
- 8.1.4 Explain the requirements of heating, padding and blanketing
- 8.1.5 Explain the reasons for not stowing toxic cargoes next to edible cargoes
- 8.1.6 Identify additional stowage requirements for toxic products
- 8.1.7 Identify requirements for inhibited cargoes
- 8.1.8 Explain why tank coatings, fixtures and fittings must be compatible with cargoes to be carried
- 8.1.9 Explain why stainless steel is used in some cargo tanks, cargo piping, valves and pumps

8.2 Describe procedures for loading

- 8.2.1 Describe general tanker precautions to be taken prior to loading
- 8.2.2 Explain lining up for loading
- 8.2.3 Describe different methods of loading and precautions for various cargoes:
 - 8.2.3.1 Over the top
 - 8.2.3.2 Through the drop line
 - 8.2.3.3 Through the deepwell pump and/or drop line
 - 8.2.3.4 Through the pump-room
- 8.2.4 Explain:
 - 8.2.4.1 Inerting
 - 8.2.4.2 Padding
 - 8.2.4.3 Drying
- 8.2.5 Explain the requirements for line and cargo sampling
- 8.2.6 Describe the load sequence
- 8.2.7 Identify checks to be made by the deck watch during loading
- 8.2.8 Describe procedures to take on completion of loading
- 8.2.9 Define:
 - 8.2.9.1 Ullage
 - 8.2.9.2 Innage
 - 8.2.9.3 Sounding

8.3 Care for cargo during transit

- 8.3.1 Explain precautions to take to avoid cargo loss during transit
- 8.3.2 Explain how to maintain cargo temperature according to shipper's instructions
- 8.3.3 Explain cargo care and safety during transit
- 8.3.4 Provide details of the care and transportation requirements for vegetable and animal oils and fats

8.4 Discharge cargo and conduct ballast operations

- 8.4.1 Identify the operational tests required prior to arrival at the discharge port
- 8.4.2 Explain the requirements for line and cargo sampling
- 8.4.3 Describe general tanker safety precautions to be taken prior to discharging
- 8.4.4 Explain techniques and precautions for discharge of high vapour pressure cargoes
- 8.4.5 Discuss general safety precautions during discharge
- 8.4.6 Identify checks to be made by the deck watch during discharge
- 8.4.7 Identify an independent ballast pipeline and pumping arrangement
- 8.4.8 Identify precautions to take before and during ballasting of cargo tanks
- 8.4.9 Describe a ballast/de-ballast sequence

8.5 Conduct tank cleaning procedures and disposal of residues

- 8.5.1 List the reasons for tank cleaning
- 8.5.2 Comply with the requirements of the P&A Manual
- 8.5.3 Describe the water washing process and components of the cleaning system
- 8.5.4 Explain the use of cleaning agents or additives during tank cleaning
- 8.5.5 Explain the use of other liquids for water reactive residues

Topics and Learning Objectives

- 8.5.6 Consult resistance lists for tank coatings
- 8.5.7 Introduce a Tank Cleaning Guide and provide an example for cleaning a cargo tank
- 8.5.8 Identify and describe phases of tank cleaning
 - 8.5.8.1 Prewash
 - 8.5.8.2 Main wash
 - 8.5.8.3 Fresh water rinse
 - 8.5.8.4 Gas-freeing and/or ventilation
 - 8.5.8.5 Drying
 - 8.5.8.6 Inspection/testing
- 8.5.9 Identify checks to be made by the deck watch during tank cleaning

8.6 Gas-free cargo tanks and test for cleanliness

- 8.6.1 Explain the purpose of gas-freeing
- 8.6.2 Describe the equipment used for gas-freeing
- 8.6.3 Explain different ventilation methods with regard to:
 - 8.6.3.1 Type of equipment
 - 8.6.3.2 Weight of cargo vapours
 - 8.6.3.3 Shape of the tank
- 8.6.4 Describe safety precautions to take during gas freeing
- 8.6.5 Identify checks to be made by the deck watch during gas freeing
- 8.6.6 Describe the equipment used for checking for a gas-free tank
- 8.6.7 Explain when a tank is considered to be gas-free
- 8.6.8 Explain the importance of a gas free certificate and entry permits
- 8.6.9 Explain the importance of tank cleanliness
- 8.6.10 Describe the standards expected for tank cleanliness

9. Health, Safety and Emergency Procedures

9.1 Describe health hazards associated with petroleum cargoes

- 9.1.1 List the typical toxic constituents of petroleum gas
- 9.1.2 List the main toxic constituents of inert gas
- 9.1.3 Describe, in general terms, the main exposure hazards to ship personnel
 - 9.1.3.1 Toxicity and the criteria by which it is measured
 - 9.1.3.2 Poisoning – ingestion, inhalation, and absorption
 - 9.1.3.3 Petroleum gas and complications on the person
 - 9.1.3.4 Oxygen deficiency and its effects
 - 9.1.3.5 The effects of various components of flue gases
- 9.1.4 Discuss risks and dangers of hydrogen sulphide
 - 9.1.4.1 Introduce hydrogen sulphide as a dangerous gas
 - 9.1.4.2 List cargoes where hydrogen sulphide may be present
 - 9.1.4.3 Outline its physical properties
 - 9.1.4.4 Describe the physical effects for the human body
 - 9.1.4.5 Describe precautions to take handling hydrogen sulphide rich cargoes
- 9.1.5 Describe the Material Safety Data Sheet (MSDS)
 - 9.1.5.1 Explain the use of the MSDS
 - 9.1.5.2 Explain each section of the MSDS
 - 9.1.5.3 State the periodicity of the MSDS
- 9.1.6 Discuss general first aid procedures

9.2 Describe health hazards associated with chemical cargoes

- 9.2.1 Define ‘health hazard’ as provided in the Code
- 9.2.2 Identify the IMO Medical First Aid Guide for Accidents Involving Dangerous Goods (MFAG)
- 9.2.3 Identify health hazards posed by chemical cargoes;
 - 9.2.3.1 Toxicity
 - 9.2.3.2 Asphyxia
 - 9.2.3.3 Corrosivity
- 9.2.4 Explain how chemicals may enter and affect the human body
- 9.2.5 Describe the general symptoms of poisoning

Topics and Learning Objectives

- 9.2.6 Explain the general symptoms of asphyxia
- 9.2.7 Identify 'health data' from Cargo Data Sheets
- 9.2.8 Show and explain a Material Safety Data Sheet for sample products
- 9.2.9 Differentiate MSDS and Cargo Hazard Sheets
- 9.2.10 Identify 'health data' from MSDS
- 9.2.11 Extract first-aid procedures from Cargo Data Sheets
- 9.2.12 Identify medical first-aid equipment provided onboard including oxygen resuscitation equipment and antidotes for products carried
- 9.3 Identify personal protection and safety equipment**
 - 9.3.1 Identify personnel protection requirements from the Code
 - 9.3.2 List typical protective equipment required onboard
 - 9.3.3 Identify how used and contaminated equipment is segregated from accommodation spaces
 - 9.3.4 List additional safety equipment required for ships carrying toxic products and certain cargoes
 - 9.3.5 Differentiate total protection and partial protection
 - 9.3.6 Demonstrate the use of personal safety and protective equipment
- 9.4 Implement control measures for enclosed space safety**
 - 9.4.1 Define the enclosed space
 - 9.4.2 Identify enclosed spaces
 - 9.4.3 Identify potential hazards
 - 9.4.4 Discuss role and duties of a 'responsible person'
 - 9.4.5 Explain the role of the marine chemist
 - 9.4.6 List commonly used gas indicators and analyzers
 - 9.4.7 Provide details of and the reasons for work permits
 - 9.4.8 Review the requirements of the SMS
 - 9.4.8.1 Permit to Work Systems
 - 9.4.8.2 Work Planning Meetings
 - 9.4.9 Analyze check lists and pre-entry checklists
 - 9.4.10 Assess hazards prior to entry
 - 9.4.11 Recommend procedures and practices for pumproom safety
 - 9.4.11.1 List sources of leakage in the pumproom
 - 9.4.11.2 Describe fire fighting arrangements in the pumproom
 - 9.4.11.3 Review pumproom ventilation requirements
 - 9.4.11.4 List safety equipment located in the pumproom
 - 9.4.11.5 Identify pumproom entry checklists
 - 9.4.12 Recommend procedures and safety practices for tank entry
 - 9.4.12.1 List precautions to take for tank entry
 - 9.4.12.2 Identify tank atmosphere test procedures
 - 9.4.12.3 List equipment required
 - 9.4.12.4 Identify key personnel
 - 9.4.12.5 Analyze tank entry checklists
 - 9.4.13 Explain methods to reduce or eliminate hazards
 - 9.4.14 Re-assess hazards
 - 9.4.15 Simulate emergency tank entry and evacuation procedures using:
 - 9.4.15.1 Tank evacuation equipment
 - 9.4.15.2 Resuscitation equipment
 - 9.4.15.3 Self-contained breathing apparatus
 - 9.4.16 Explain the terms intrinsically safe, flameproof and increased safety equipment
- 9.5 Review fire-fighting principles and control**
 - 9.5.1 Identify the components of the fire triangle
 - 9.5.2 Explain the related chemical reaction
 - 9.5.3 Explain the principles of fire prevention
 - 9.5.4 List sources of emission of flammable cargo vapours
 - 9.5.5 Identify possible ignition sources on oil and chemical tankers
 - 9.5.6 List fire fighting equipment available on board

Topics and Learning Objectives

- 9.5.7 Describe methods of controlling fire with:
 - 9.5.7.1 Water
 - 9.5.7.2 Foam
 - 9.5.7.3 Inert gas
 - 9.5.7.4 Dry chemical
 - 9.5.7.5 Carbon dioxide
 - 9.5.8 Review regulations for the protection of cargo tanks, cargo tank deck area and pumprooms
 - 9.5.9 Identify in Chapter 17 of the IBC Code types of fire protection for chemical tankers
 - 9.5.10 Identify additional fire control problems with certain chemicals
 - 9.5.11 List fire fighting equipment available on board oil and chemical tankers
 - 9.6 Describe terminal emergency procedures**
 - 9.6.1 Identify fire fighting equipment available on the jetty
 - 9.6.2 Identify water-borne fire-fighting equipment available
 - 9.6.3 Describe shore and terminal alarms used in cases of emergency
 - 9.6.4 Identify emergency communications between ship and shore
 - 9.6.5 Specify when emergency cargo operations shut-down is necessary
 - 9.6.6 Identify escape routes from ship to shore and from jetty areas
 - 9.6.7 Describe the general content of a terminal emergency plan
 - 9.6.8 Explain the purpose of the ship-shore safety check list
 - 9.6.9 Describe the general content of the ship-shore safety check list
 - 9.7 Describe shipboard emergency procedures**
 - 9.7.1 Differentiate operational and non-operational emergencies
 - 9.7.2 List the type of emergencies that require written procedures
 - 9.7.3 Discuss the use of emergency plans
 - 9.7.4 Explain the function of an emergency organization
 - 9.7.5 List the main components of an emergency organization
 - 9.7.6 Describe different ship alarms used in cases of emergency
 - 9.7.7 Discuss training for emergencies
 - 9.7.8 Simulate the action required for different emergencies
 - 9.7.9 Discuss, with the use of casualty reports, emergency scenarios and responses
 - 9.8 Give an overview of general safety precautions**
 - 9.8.1 Describe the use, purpose and general content of ISGOTT
 - 9.8.2 Describe the use, purpose and general content of the Tanker Safety Guide Chemicals
 - 9.8.3 Identify other tanker related safety publications for additional information and guidance
 - 9.8.4 Use ISGOTT as a means to discuss general precautions on oil tankers
 - 9.8.5 Use the Tanker Safety Guide Chemicals as a means to discuss general precautions on chemical tankers
- 10. Pollution prevention**
- 10.1 Discuss pollution of the marine environment**
 - 10.1.1 Use statistics to show major worldwide pollution incidents from oil and chemical tankers
 - 10.1.2 Provide examples of how pollution can occur
 - 10.1.2.1 In port
 - 10.1.2.2 At sea
 - 10.1.3 Provide examples of damage to the marine environment due to oil and chemical pollution
 - 10.1.4 State the penalties for pollution of Canadian waters
 - 10.2 Describe operational requirements of oil and chemical tankers**
 - 10.2.1 Identify requirements of oil tankers:
 - 10.2.1.1 Segregated ballast capacity
 - 10.2.1.2 Double hulls and double bottoms
 - 10.2.1.3 Pump-room bottom protection
 - 10.2.1.4 Slop tank capacity
 - 10.2.1.5 Limitation of tank size
 - 10.2.1.6 Overboard piping arrangements
 - 10.2.1.7 Emergency towing arrangements
 - 10.2.2 Explain, briefly, the requirements for an oil discharge control and monitoring system (ODMACS)

Topics and Learning Objectives

- 10.2.3 Explain the use of the portable oil/water interface detector
- 10.2.4 Describe the LOT procedure for crude oil tankers
- 10.2.5 Identify requirements of chemical tankers:
 - 10.2.5.1 Inboard location of cargo tanks
 - 10.2.5.2 Segregated ballast tanks
 - 10.2.5.3 Limitations of Type 3 tankers
 - 10.2.5.4 Ballast pump room
 - 10.2.5.5 Efficient stripping locations
 - 10.2.5.6 Underwater discharge outlet
 - 10.2.5.7 Dedicated slop tank(s), if any
- 10.2.6 Discuss the reason for and requirements of reception facilities

10.3 Respond to marine spills

- 10.3.1 Describe SOPEP and SMPEP requirements
- 10.3.2 Show an example of a SOPEP and a SMPEP
- 10.3.3 Differentiate SOPEP and SEMPEP
- 10.3.4 List pollution prevention equipment required on board
- 10.3.5 Identify periodicity of required pollution drills
- 10.3.6 Describe methods of containment using ship pollution equipment
- 10.3.7 Describe pollution prevention equipment limitations
- 10.3.8 Discuss the use of chemical dispersants and detergents
- 10.3.9 Discuss the importance of timely response to marine spills
- 10.3.10 Evaluate the effects of delayed response to a marine spill
- 10.3.11 Identify parties responsible for:
 - 10.3.11.1 Clean up
 - 10.3.11.2 Resources available
 - 10.3.11.3 Assistance available
 - 10.3.11.4 Supply of pollution prevention equipment
 - 10.3.11.5 Disposal
 - 10.3.11.6 Costs for a marine oil spill
- 10.3.12 List types of pollution equipment available from a shore based pollution response centre

10.4 Conduct safe transfer operations

- 10.4.1 Identify Regulations for the Prevention of Pollution from Ships and for Dangerous Chemicals
 - 10.4.1.1 Identify sections dealing with oil and chemical transfers
 - 10.4.1.2 Discuss each section relating to oil and chemical transfers
- 10.4.2 Identify markings on transfer hoses
- 10.4.3 Differentiate hoses suitable for oil and chemical service
- 10.4.4 Describe the handling and preparation of cargo hoses for oil and chemical transfer
- 10.4.5 State the conditions for authorized discharge of oil and oily mixture in Canadian and International waters
- 10.4.6 State when the discharge of oil and oily mixture is prohibited
- 10.4.7 State the conditions for authorized discharge of NLS in Canadian and International waters
- 10.4.8 State when the discharge of NLS is prohibited
- 10.4.9 Explain the purpose of:
 - 10.4.9.1 Oil Record Book Part I (machinery spaces)
 - 10.4.9.2 Oil Record Book Part II (cargo /ballast operations)
 - 10.4.9.3 Cargo Record Book

LIQUEFIED GAS TANKER FAMILIARIZATION TRAINING

4.1 General

This course applies to officers and ratings who will be assigned specific duties and responsibilities related to cargo and cargo equipment on liquefied gas tankers, taking into account section A-V/1 of the STCW Code.

4.2 Objectives

- 1) Provide the training required under Section 160 of the *Marine Personnel Regulations* in order to obtain a *Liquefied gas Tanker Familiarization* certificate or endorsement.
- 2) Enable the participants to assume the duties and responsibilities relating to the loading, discharging or transfer of cargo and the operation of cargo equipment.

4.3 Duration

55 hours

4.4 Prerequisites

MED with respect to STCW Basic Safety

4.5 Specific instructor qualifications

The main course instructor must hold a master certificate not lower than a Master 3000 Gross tonnage, Near Coastal certificate, or an engineer certificate not lower than Second-class Engineer certificate, with a valid *Liquefied Gas tanker Familiarization* endorsement. If the course is under the supervision of more than one instructor, the assistant instructors must hold qualifications related to the marine industry or have related skills and be approved in accordance with the *Quality Management Manual – Marine Personnel Standards and Pilotage*, referred to in Chapter 2.

4.6 Equipment requirements

- 1) Personnel safety equipment, including breathing apparatus;
- 2) Set of protective equipment, including chemical and gas-tight suits;
- 3) Respiratory protection equipment for emergency escape;
- 4) Portable oxygen meter and oxygen analyser;
- 5) Portable combustible-gas indicator;
- 6) Portable gas detector and sample tubes for vapours and gases;
- 7) IMO medical first aid guide for accidents involving dangerous goods;
- 8) Sample health data and cargo data sheets, emergency plans and casualty reports;
- 9) Latest versions of relevant guidelines for gas tankers;
- 10) Audio-visual presentation equipment.

4.7 Outline

Subject Area	Hours	
	Lecture	Practical
1. The Gas tanker 1.1 Summarize the development of the liquefied gas tanker trade 1.2 Describe types of liquefied gas tankers 1.3 Describe types of cargoes shipped in liquefied gas tankers	6	
2. Rules and Regulations 2.1 Discuss international and national codes and regulations 2.2 Describe the Gas Carrier Codes	4	
3. Ship design and cargo containment 3.1 Establish elements of design 3.2 Describe means of cargo segregation and containment	8	
4. Chemistry of cargo 4.1 Outline physical and chemical properties of cargoes 4.2 Explain the principle of the controlled tank atmosphere	6	
5. Cargo handling systems 5.1 Describe pipeline, pumping and discharge arrangements 5.2 Describe heat exchangers 5.3 Describe reliquefaction plants and boil-off control 5.4 Describe venting arrangements 5.5 Outline instrumentation requirements	8	
6. Liquefied Gas Tanker operations 6.1 Plan for port arrival 6.2 Describe procedures for loading 6.3 Care for cargo during transit 6.4 Discharge cargo and conduct ballast operations 6.5 Conduct cargo change-over procedures and tank cleaning 6.6 Gas-free and ventilate cargo tanks	8	
7. Pollution prevention 7.1 Discuss pollution of the marine environment from liquefied gas tankers 7.2 Describe measures of pollution control	6	
8. Health and Safety 8.1 Describe health hazards associated with liquefied gas cargoes 8.2 Identify personal protection and safety equipment 8.3 Implement control measures for enclosed space safety 8.4 Review fire-fighting principles 8.5 Describe terminal emergency procedures 8.6 Describe shipboard emergency procedures	4	5
	50 hours	5 hours
Total	55 hours	

4.8 Syllabus

Topics and Learning Objectives

1. The Gas tanker

1.1 Summarize the development of the liquefied gas tanker trade

- 1.1.1 Outline the growth of the liquefied gas trade from the late 1950's
- 1.1.2 Describe the evolution of the transportation of liquefied gas in ships
- 1.1.3 Explain the basic principle of gas transport
- 1.1.4 Explain the requirement for standardized international regulations

1.2 Describe types of liquefied gas tankers

- 1.2.1 Identify:
 - 1.2.1.1 LNG carriers
 - 1.2.1.2 Fully refrigerated ships
 - 1.2.1.3 Ethylene carriers
 - 1.2.1.4 Semi-pressurized ships
 - 1.2.1.5 Pressurized ships
- 1.2.2 Differentiate LNG and LPG carriers
- 1.2.3 Explain the difference between liquefied gas tankers and chemical tankers
- 1.2.4 Name the division of gas tankers into the four ship types
- 1.2.5 Explain pressurized carriage
- 1.2.6 Explain refrigerated carriage
- 1.2.7 Identify different gas tankers from general arrangements (GA's)
- 1.2.8 Identify general tank arrangements

1.3 Describe types of cargoes shipped in liquefied gas tankers

- 1.3.1 Differentiate liquefied gas and liquid bulk chemicals
- 1.3.2 Define the terms:
 - 1.3.2.1 LNG
 - 1.3.2.2 NGL
 - 1.3.2.3 LPG
 - 1.3.2.4 LEG
 - 1.3.2.5 Chemical gases
- 1.3.3 Explain the relationship between natural gas, natural gas liquids (NGLs) and Liquefied Petroleum Gases (LPGs)
- 1.3.4 Describe uses for LNG, LPG, NGL and the common chemical gases
- 1.3.5 List the most common cargoes and their conditions of carriage
- 1.3.6 Explain what chemicals can be carried in liquefied gas carriers

2. Rules and Regulations

2.1 Discuss international and national codes and regulations

- 2.1.1 List the most important rules affecting gas tankers as:
 - 2.1.1.1 International conventions
 - 2.1.1.2 National regulations
 - 2.1.1.3 Classification society rules
- 2.1.2 Identify the IMO as the international forum for shipping matters
- 2.1.3 Identify the main IMO conventions affecting tankers
 - 2.1.3.1 Define SOLAS 1974 as the International Convention for the Safety of Life at Sea, 1974
 - 2.1.3.2 Define MARPOL 73/78 as the International Convention for the Prevention of Pollution from Ships, 1973/1978
 - 2.1.3.3 Define STCW 1995 as the International Convention for Standards of Training, Certification and Watchkeeping, 1995
- 2.1.4 Explain how the conventions are incorporated in national legislation
- 2.1.5 Differentiate MARPOL 73/78 Annex I and Annex II
- 2.1.6 Introduce the ISM Code as the International Safety Management Code
- 2.1.7 State a Safety Management System must be in place as required by the ISM Code
- 2.1.8 Identify regulations under the CSA affecting gas tankers

Topics and Learning Objectives

2.2 Describe the Gas Carrier Codes

- 2.2.1 Define 'gas carrier'
- 2.2.2 Identify the Gas Carrier Codes:
 - 2.2.2.1 International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code)
 - 2.2.2.2 Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk
 - 2.2.2.3 Code for Existing Ships Carrying Liquefied Gases in Bulk
- 2.2.3 Explain the purpose of the Gas Carrier Codes
- 2.2.4 Summarize the content of the Gas Carrier Codes
- 2.2.5 Identify the Bulk Chemical Codes
- 2.2.6 Differentiate the Gas Carrier Codes and the Bulk Chemical Codes

3. Ship Design and Cargo Containment

3.1 Establish elements of design

- 3.1.1 Identify general tank and ship arrangements
- 3.1.2 Identify ship types from the Gas Carrier Codes
- 3.1.3 Explain the reason for ship types as defined in the Gas Carrier Codes
- 3.1.4 Identify the hierarchy of ship types from 3G through 1G in relation to greatest overall hazard for products carried
- 3.1.5 Identify the inboard location of cargo tanks for each ship type
- 3.1.6 Describe other safety aspects of design in relation to:
 - 3.1.6.1 Accommodation, service and machinery spaces and control stations
 - 3.1.6.2 Cargo pump rooms and cargo compressor rooms
 - 3.1.6.3 Cargo control rooms
 - 3.1.6.4 Access to spaces in the cargo area
 - 3.1.6.5 Air-locks and alarms
 - 3.1.6.6 Ventilation
 - 3.1.6.6.1 Positive pressure
 - 3.1.6.6.2 Negative pressure
 - 3.1.6.7 Bilge, ballast and fuel oil arrangements
 - 3.1.6.8 Location of cargo tank vents
 - 3.1.6.9 Electrical installations

3.2 Describe means of cargo segregation and containment

- 3.2.1 Identify references from the Gas Carrier Codes dealing with segregation and containment
- 3.2.2 Describe the terms:
 - 3.2.2.1 Gas-dangerous spaces
 - 3.2.2.2 Gas-dangerous zones
- 3.2.3 Differentiate 'gas-safe space' and 'gas-dangerous space'
- 3.2.4 Define:
 - 3.2.4.1 Integral tank
 - 3.2.4.2 Membrane tank
 - 3.2.4.3 Semi-membrane tank
 - 3.2.4.4 Independent tank
 - 3.2.4.5 Internal insulation tank
- 3.2.5 Explain the concept of the cargo containment system:
 - 3.2.5.1 Primary barrier (cargo tank)
 - 3.2.5.2 Secondary barrier (if fitted)
 - 3.2.5.3 Associated thermal insulation
 - 3.2.5.4 Intervening spaces
 - 3.2.5.5 Adjacent support structure
- 3.2.6 Discuss the following terms with regard to the cargo containment system:
 - 3.2.6.1 Thermal stress, expansion and contraction
 - 3.2.6.2 Stress caused by vapour pressure and weight of the liquid
 - 3.2.6.3 Stress caused by sloshing
 - 3.2.6.4 Type and thickness of tank material

Topics and Learning Objectives	
3.2.6.5	Types and thickness of insulation material
3.2.6.6	Method of tank support
3.2.6.7	Location of tank
3.2.6.8	Cargo limitation
3.2.7	Give examples of types of cargo suitable for each of the four ship types
4. Chemistry of Cargo	
4.1 Outline physical and chemical properties of cargoes	
4.1.1	Define liquefied gas
4.1.2	Explain the characteristics of chemical gases
4.1.3	Explain the term 'inhibitor' and the reason for and use of inhibitors
4.1.4	Introduce Cargo Data Sheets
4.1.5	Extract physical data of liquefied gas given in Cargo Data Sheets
4.1.6	Explain 'chemical reactivity'
4.1.7	Explain the terms and provide examples of cargoes which:
4.1.7.1	Self-react
4.1.7.2	React with air
4.1.7.3	React with water
4.1.7.4	React between cargoes
4.1.7.5	Polymerize
4.1.7.6	Require an inhibitor
4.1.8	Identify reactions of cargoes with tank coatings and other materials
4.1.9	Extract reactivity data from Cargo Data Sheets
4.1.10	Describe precautions against reactivity
4.2 Explain the principle of the controlled tank atmosphere	
4.2.1	Define:
4.2.1.1	Flashpoint
4.2.1.2	Auto-ignition temperature
4.2.2	Identify flash point from Cargo Data Sheets
4.2.3	Describe flammable range, lower flammable limit (LFL) and upper flammable limit (UFL)
4.2.4	Identify fire and explosion data from a Cargo Data Sheet
4.2.5	Define inert gas (IG)
4.2.6	Describe methods of production and supply of inert gas
4.2.7	List the general characteristics of composition and temperature of inert gas
4.2.8	Describe the advantages and disadvantages of inert gas from an IG generator
4.2.9	Describe methods of drying inert gas
4.2.10	Explain when nitrogen is used instead of inert gas
4.2.11	Differentiate inert and non-inert tank atmosphere
4.2.12	Explain how and why inert gas is used:
4.2.12.1	In cargo tanks to suppress flammability
4.2.12.2	For interbarrier and hold spaces
4.2.12.3	For some air-reactive cargoes
5. Cargo Handling Systems	
5.1 Describe pipeline, pumping and discharge arrangements	
5.1.1	Describe general cargo piping arrangements on gas tankers
5.1.2	Explain the use of strainers in cargo piping systems
5.1.3	Describe the use of spool-pieces in cargo pipelines
5.1.4	Explain where remote and manually operated shut-off valves are required
5.1.5	Describe the emergency shutdown system
5.1.6	Discuss the care, handling and use of cargo hoses:
5.1.6.1	Types of hose suitable for gas tankers
5.1.6.2	Compatibility and suitability for different cargoes
5.1.6.3	Cargo temperature limitations
5.1.6.4	Inspection and testing procedures

Topics and Learning Objectives

- 5.1.6.5 Certification of hoses
- 5.1.6.6 Maintenance and correct handling
- 5.1.7 Explain basic pumping concepts of centrifugal pumps
- 5.1.8 Discuss the benefits of deepwell pumps and submerged pumps
 - 5.1.8.1 Explain their use on refrigerated gas tankers
 - 5.1.8.2 On deck on pressurized ships
- 5.1.9 Describe alternative discharge methods:
 - 5.1.9.1 By pressurizing the vapour space
 - 5.1.9.2 With or without booster pumps
 - 5.1.9.3 Via booster pump and cargo heater
- 5.1.10 Discuss the benefits and limitations of centrifugal pumps
- 5.1.11 Describe safe handling and operation of
 - 5.1.11.1 A deepwell pump
 - 5.1.11.2 A submerged pump
 - 5.1.11.3 A booster pump
- 5.1.12 Describe stripping and other methods of liquid removal
- 5.2 Describe heat exchangers**
 - 5.2.1 List the purposes of heat exchangers
 - 5.2.2 Describe a cargo heater arrangement
 - 5.2.3 Explain heating of very low temperature cargoes during discharge
 - 5.2.4 Explain the use of vaporizers
 - 5.2.5 Describe heating medium for:
 - 5.2.5.1 Heat exchangers
 - 5.2.5.2 Vaporizers
 - 5.2.6 Describe correct use and handling of heat exchangers
- 5.3 Describe reliquefaction plants and boil-off control**
 - 5.3.1 Define 'boil-off'
 - 5.3.2 Explain methods of controlling vapour pressure in cargo tanks
 - 5.3.3 Describe a system for handling LNG boil-off vapour
 - 5.3.4 List precautions for handling LNG vapour
 - 5.3.5 Explain benefits and drawbacks of different types of reliquefaction systems
- 5.4 Describe venting arrangements**
 - 5.4.1 Describe a cargo tank vent system
 - 5.4.2 Describe where and when:
 - 5.4.2.1 Pressure-relief devices are required
 - 5.4.2.2 Where at least two pressure-relief valves are required
 - 5.4.3 Explain 'set point' of a safety relief valve and its purpose
 - 5.4.4 Explain the vacuum-protection system
 - 5.4.5 Identify safe handling procedures and safety precautions for relief devices, vent masts and piping
- 5.5 Outline instrumentation requirements**
 - 5.5.1 Explain the terms intrinsically safe, flameproof and increased safety equipment
 - 5.5.2 Describe the principles of operation and types of gauging devices for cargo tanks
 - 5.5.3 Identify correct handling procedures and precautions for types of gauges
 - 5.5.4 Identify special requirements for particular cargoes
 - 5.5.5 Outline, using the IGC Code, the requirements for:
 - 5.5.5.1 Pressure gauges
 - 5.5.5.2 Temperature indicating devices
 - 5.5.5.3 Fixed gas-detection systems
 - 5.5.5.4 Emergency shutdown system
 - 5.5.5.5 High level alarms
 - 5.5.5.6 Fixed water-spray system
 - 5.5.6 Explain the use of glycol and glycol-water mixtures
 - 5.5.7 Describe where alcohol is used in the cargo system
 - 5.5.8 Describe, briefly, the test instruments necessary for toxic and flammable cargoes

Topics and Learning Objectives

6. Liquefied Gas Tanker Operations

6.1 Plan for port arrival

- 6.1.1 List information provided to the gas tanker before arrival
- 6.1.2 List information provided to the shore before arrival
- 6.1.3 Assist with pre-arrival checklists
- 6.1.4 Identify any special equipment needed for particular cargoes
- 6.1.5 Discuss the importance of tank cleanliness for the loading of cargoes
- 6.1.6 Explain the requirements of drying, inerting, and cooling down
- 6.1.7 Identify cargo separation requirements for chemically reactive cargoes
- 6.1.8 Inspect and test relevant cargo operation systems
- 6.1.9 Prepare fire equipment for cargo operations
- 6.1.10 Identify personnel for cargo operations

6.2 Describe procedures for loading

- 6.2.1 Identify the ship-shore checklist and pre-transfer procedures
- 6.2.2 Describe general precautions to be taken prior to loading
- 6.2.3 Explain lining up for loading
- 6.2.4 Explain the requirements for cargo sampling
- 6.2.5 Explain cool-down procedures and precautions to take
- 6.2.6 Explain factors affecting load time
- 6.2.7 Describe the load sequence
- 6.2.8 Identify checks to be made by the deck watch during loading
- 6.2.9 Control vapours during loading
- 6.2.10 Identify maximum allowable filling limits
- 6.2.11 Discuss, generally, loading of:
 - 6.2.11.1 Refrigerated ships
 - 6.2.11.2 Pressurized ships
 - 6.2.11.3 Pressurized ships from refrigerated storage
 - 6.2.11.4 Semi-pressurized ships from refrigerated storage
- 6.2.12 Describe procedures to take on completion of loading

6.3 Care for cargo during transit

- 6.3.1 Explain precautions to take to avoid cargo loss during transit
- 6.3.2 Explain how to maintain cargo temperature, pressure and quantity according to shipper's instructions
- 6.3.3 Explain cargo care and safety during transit

6.4 Discharge cargo and conduct ballast operations

- 6.4.1 Identify the functional tests required prior to arrival at the disport
- 6.4.2 Identify the ship-shore checklist
- 6.4.3 Line-up for discharge
- 6.4.4 Describe general precautions before discharge
- 6.4.5 Describe different methods of discharge:
 - 6.4.5.1 Pressure discharge
 - 6.4.5.2 Pressure and booster-pump discharge
 - 6.4.5.3 Centrifugal cargo-pump discharge
 - 6.4.5.4 Centrifugal cargo-pump and booster-pump discharge
- 6.4.6 Explain the requirements for line and cargo sampling
- 6.4.7 Describe a discharge with and without a vapour return
- 6.4.8 Explain cargo discharge with heating
- 6.4.9 Explain reasons to maintain over-pressure during discharge
- 6.4.10 Identify checks to be made by the deck watch during discharge
- 6.4.11 Describe procedures for draining tanks
- 6.4.12 Describe procedures to take on completion of discharge
- 6.4.13 Identify a ballast pipeline and pumping arrangement
- 6.4.14 Describe a ballast/de-ballast sequence

Topics and Learning Objectives

6.5 Conduct cargo change-over procedures and tank cleaning

- 6.5.1 Identify compatibility of next cargo
- 6.5.2 Discuss change over procedures:
 - 6.5.2.1 Removal of remaining liquid
 - 6.5.2.2 Warming-up
 - 6.5.2.3 Inerting
 - 6.5.2.4 Gas freeing
 - 6.5.2.5 Aeration
 - 6.5.2.6 Tank cleaning
 - 6.5.2.7 Visual inspection
- 6.5.3 Explain the procedure for vapourizing cargo residue and warming of the tank shell
- 6.5.4 Explain reasons for and basic methods of inerting
- 6.5.5 Describe methods of tank cleaning

6.6 Gas-free and ventilate cargo tanks

- 6.6.1 Explain the purpose of gas-freeing
- 6.6.2 Describe the equipment used for gas-freeing
- 6.6.3 Explain different ventilation methods with regard to:
 - 6.6.3.1 Type of equipment
 - 6.6.3.2 Weight of cargo vapours
 - 6.6.3.3 Shape of the tank
- 6.6.4 Identify checks to be made by the deck watch during gas freeing
- 6.6.5 List the equipment used for checking for a gas-free tank
- 6.6.6 Explain when a tank is considered to be gas-free

7. Pollution Prevention

7.1 Discuss pollution of the marine environment from liquefied gas tankers

- 7.1.1 Identify worldwide pollution incidents from liquefied gas tankers
- 7.1.2 Describe how pollution can occur from liquefied gas tankers:
 - 7.1.2.1 In port
 - 7.1.2.2 At sea
- 7.1.3 Describe pollution as:
 - 7.1.3.1 Controlled releases of liquid and/or vapours
 - 7.1.3.2 Uncontrolled release liquid and/or vapours
- 7.1.4 Explain why a controlled release of liquid and/or vapours may be necessary
- 7.1.5 Explain when an uncontrolled release of liquid and/or vapours may occur
- 7.1.6 Describe the effects of spillage of liquefied gas
- 7.1.7 Describe the effects of soluble liquefied gases in water
- 7.1.8 Describe pollution from bunker and fuel oil spills and discharges
- 7.1.9 State the penalties for pollution of Canadian waters

7.2 Describe measures of pollution control

- 7.2.1 Evaluate the effects of timely and delayed response to a marine spill
- 7.2.2 List pollution prevention equipment required on board
- 7.2.3 State pollution drills are required
- 7.2.4 Describe methods of containment using ship pollution equipment
- 7.2.5 Describe pollution prevention equipment limitations
- 7.2.6 Discuss the use of chemical dispersants and detergents
- 7.2.7 Identify parties responsible for:
 - 7.2.7.1 Clean up
 - 7.2.7.2 Resources available
 - 7.2.7.3 Assistance available
 - 7.2.7.4 Supply of pollution prevention equipment
 - 7.2.7.5 Disposal
 - 7.2.7.6 Costs for a marine spill
- 7.2.8 List equipment available from a shore based pollution response centre
- 7.2.9 Identify resources for response to pollution

Topics and Learning Objectives

8. Health and Safety

8.1 Describe health hazards associated with liquefied gas cargoes

- 8.1.1 Define 'health hazard'
- 8.1.2 Identify the IMO Medical First Aid Guide for Accidents Involving Dangerous Goods (MFAG)
- 8.1.3 Identify health hazards posed by cargoes:
 - 8.1.3.1 Toxicity
 - 8.1.3.2 Asphyxia
 - 8.1.3.3 Low temperatures
 - 8.1.3.4 Chemical burns
- 8.1.4 Explain how chemicals and gases may enter and affect the human body
- 8.1.5 Describe toxic effects from:
 - 8.1.5.1 Vapours from fires of certain gases and chemicals
 - 8.1.5.2 Inhibitors
 - 8.1.5.3 Inert gas
- 8.1.6 Describe the general symptoms of systemic poisoning and irritants
- 8.1.7 Explain the general symptoms of:
 - 8.1.7.1 Asphyxia
 - 8.1.7.2 Anesthesia
 - 8.1.7.3 Frost bite
- 8.1.8 Identify 'health data' from Cargo Data Sheets
- 8.1.9 Show and explain a Material Safety Data Sheet for sample products
- 8.1.10 Differentiate MSDS and Cargo Hazard Sheets
- 8.1.11 Identify 'health data' from MSDS
- 8.1.12 Extract first-aid procedures from Cargo Data Sheets
- 8.1.13 Identify medical first-aid equipment provided onboard including oxygen resuscitation equipment and antidotes for products carried

8.2 Identify personal protection and safety equipment

- 8.2.1 Identify personnel protection requirements from the Gas Codes and regulations
- 8.2.2 List typical protective equipment required onboard
- 8.2.3 Identify emergency escape equipment and limitations
- 8.2.4 Describe the use, storage and maintenance of safety and protective equipment
- 8.2.5 List additional safety equipment required for ships carrying toxic products and certain cargoes
- 8.2.6 Differentiate total protection and partial protection
- 8.2.7 Demonstrate the use of personal safety and protective equipment

8.3 Implement control measures for enclosed space safety

- 8.3.1 Define the enclosed space
- 8.3.2 Identify enclosed spaces
- 8.3.3 Identify potential hazards
- 8.3.4 Discuss the role and duties of a 'responsible person'
- 8.3.5 List gas measurement procedures for safe entry
- 8.3.6 Explain the role of the marine chemist
- 8.3.7 Describe the content, details and use of work permits
- 8.3.8 Analyze check lists by identifying important elements
- 8.3.9 Assess hazards prior to entry
- 8.3.10 Identify safe practices for tank entry
 - 8.3.10.1 List precautions to take for tank entry
 - 8.3.10.2 Identify tank atmosphere test procedures
 - 8.3.10.3 List equipment required
 - 8.3.10.4 Identify key personnel
 - 8.3.10.5 Analyze tank entry checklists
- 8.3.11 Simulate tank entry and evacuation procedures using:
 - 8.3.11.1 Tank evacuation equipment
 - 8.3.11.2 Self-contained breathing apparatus
- 8.3.12 Describe safety procedures and practices for other enclosed spaces

Topics and Learning Objectives

8.4 Review fire-fighting principles

- 8.4.1 Explain the principles of fire prevention
- 8.4.2 List sources of emission of flammable cargo vapours
- 8.4.3 Identify possible ignition sources on liquefied gas tankers
- 8.4.4 Describe advantages, disadvantages and methods of controlling fires on liquefied gas tankers with:
 - 8.4.4.1 Water
 - 8.4.4.2 Foam
 - 8.4.4.3 Dry chemical powders
 - 8.4.4.4 Carbon dioxide systems
- 8.4.5 Describe specific fire-fighting techniques for liquefied gas cargoes
- 8.4.6 Define the term BLEVE and explain the phenomenon
- 8.4.7 Describe:
 - 8.4.7.1 Water spray system and areas of coverage
 - 8.4.7.2 Fixed dry-powder system
 - 8.4.7.3 'Total flooding' systems
- 8.4.8 Explain the use of the IG system in fire prevention

8.5 Describe terminal emergency procedures

- 8.5.1 Identify fire fighting equipment available on the jetty
- 8.5.2 Identify water-borne fire-fighting equipment available
- 8.5.3 Describe shore and terminal alarms used in cases of emergency
- 8.5.4 Identify emergency communications between ship and shore
- 8.5.5 Specify when emergency cargo operations shut-down is necessary
- 8.5.6 Identify escape routes from ship to shore and from jetty areas
- 8.5.7 Describe the general content of a terminal emergency plan
- 8.5.8 Explain the purpose of the ship-shore safety check list
- 8.5.9 Describe the general content of the ship-shore safety check list

8.6 Describe shipboard emergency procedures

- 8.6.1 Differentiate operational and non-operational emergencies
- 8.6.2 List the type of emergencies that require written procedures
- 8.6.3 Discuss the use of emergency plans
- 8.6.4 Explain the function of an emergency organization
- 8.6.5 List the main components of an emergency organization
- 8.6.6 Describe different ship alarms used in cases of emergency
- 8.6.7 Discuss training for emergencies
- 8.6.8 Simulate the action required for different emergencies
- 8.6.9 Discuss, with the use of casualty reports, emergency scenarios and responses

SPECIALIZED OIL TANKER SAFETY TRAINING

5.1 General

- 1) This chapter describes a course providing specialized Oil Tanker safety training, and training on Crude Oil washing (COW) and Inert gas (IG) systems operation. The first week focuses on tanker safety while the COW/IG training is given in the second week. The whole is a stand-alone course designed to fulfil the requirements of Section A-V/1 of the STCW code, but the COW/IG part may be given separately to applicants who have previously completed the Tanker Safety training.
- 2) The completion of this course is necessary to obtain the *Specialized Oil tanker Training* endorsement on a deck or engineer officer certificate. Refer to Section 228 of the *Marine Personnel Regulations* for details regarding the requirements of this endorsement and training according to personnel responsibilities and position on board.

5.2 Objectives

- 1) Provide the training required under Section 165 of the *Marine Personnel Regulations* in order to obtain a *Specialized Oil Tanker Training* endorsement.
- 2) Enable the participants to take immediate responsibility for the loading, discharging or transfer of cargo and the operation of cargo equipment.

5.3 Duration

55 hours

5.4 Prerequisites

- 1) MED with respect to STCW basic safety
- 2) MED in advanced fire fighting
- 3) Successful completion of an approved training course in Oil and Chemical tanker familiarization or holder of an Oil and Chemical Tanker Familiarization certificate or Endorsement

5.5 Specific instructor qualifications

- 1) The main course instructor must hold a Master Mariner or a First-class engineer certificate with a valid *Specialized Oil Tanker Training* endorsement, but AMSP may consider lower certificates in special circumstances for instructors with additional experience on oil tankers. If the course is under the supervision of more than one instructor, the assistant instructors must hold qualifications related to the marine industry or have related skills and be approved in accordance with the *Quality Management Manual – Marine Personnel Standards and Pilotage*, referred to in Chapter 2.

5.6 Equipment requirements

- 1) Personnel safety equipment, including breathing apparatus;
- 2) Tank evacuation equipment;
- 3) Portable oxygen meter and oxygen analyser;
- 4) Portable combustible-gas indicator;
- 5) Portable interferometer;
- 6) Portable gas detector and sample detector tubes for vapours and gasses;
- 7) Tankscope for detecting and measuring hydrocarbon vapours in inert gas spaces;
- 8) Resuscitator;

- 9) IMO medical first aid guide for accidents involving dangerous goods;
- 10) ISM Code;
- 11) IMO publication “Guidelines for the Development of Shipboard Emergency Response Plans”
- 12) Sample health data and cargo data sheets, emergency plans and casualty reports;
- 13) Audio-visual presentation equipment.

5.7 Outline

	Subject Area	Hours	
		Theory	Practical
1.	The Oil Tanker 1.1 Give a brief overview of oil tanker design and development 1.2 Describe types of oil tanker in current service 1.3 Discuss national and international legislation affecting oil tankers	2	
2.	Basic applied science 2.1 Revise basic physics concepts 2.2 Outline physical and chemical properties of petroleum 2.3 Explain the principle of the controlled tank atmosphere 2.4 Explain the principles of electrostatics	4	
3.	Oil Tanker cargo handling systems 3.1 Describe pipeline, pumping and discharge arrangements 3.2 Identify cargo and ballast measuring devices 3.3 Compare venting arrangements 3.4 Describe cargo heating systems 3.5 Locate bunker systems and bunker transfer equipment	4	
4.	Oil Tanker operations 4.1 Plan for port arrival 4.2 Describe ballasting and de-ballasting operations 4.3 Prepare for loading and discharge operations 4.4 Identify inert gas requirements 4.5 Describe cargo loading and cargo discharging operations 4.6 Identify crude oil washing requirements 4.7 Explain tank washing procedures 4.8 Discuss purging and gas-freeing 4.9 Describe general procedures for combination carriers	4	
5.	Health and Safety 5.1 Describe health hazards associated with petroleum cargoes 5.2 Describe the function and use of gas indicators 5.3 Implement control measures for enclosed space safety 5.4 Review fire-fighting principles	2	5
6.	Emergency procedures 6.1 Discuss the use and requirements of an emergency plan 6.2 Describe ship and shore emergency alarms 6.3 Give an overview of general safety precautions	3	
7.	Safety in terminal operations 7.1 Provide details of oil terminal information exchange 7.2 Describe oil tanker and terminal mooring arrangements 7.3 Describe oil terminal emergency procedures	3	

Subject Area	Hours	
8. Pollution prevention 8.1 Discuss pollution of the marine environment from oil tankers 8.2 Summarize regulatory requirements for pollution prevention 8.3 Describe operational pollution control requirements of oil tankers 8.4 Respond to marine oil spills 8.5 Supervise transfer operations	4	
9. Inert Gas systems 9.1 Describe the Inert Gas System (IG) 9.2 Describe components and design considerations 9.3 Describe the principles of operation of the IG system 9.4 Apply principles of operation to cargo tank operations 9.5 Activate emergency procedures 9.6 Prescribe maintenance, inspection and testing	10	
10. Crude Oil Washing (COW) 10.1 Describe Crude Oil Washing (COW) 10.2 Describe regulatory requirements for COW 10.3 Explain the principles of crude oil washing 10.4 Provide details of COW equipment and design factors 10.5 Apply COW principles 10.6 Determine cold weather techniques 10.7 Complete checklists and prepare COW plans	10	
11. Cargo and Emergency management 11.1 Summarize the International Safety Management System 11.2 Develop criteria for different types of emergency	4	
	50 hours	5 hours
Total	55 hours	

5.8 Syllabus

Topics and Learning Objectives
<p>1. The Oil Tanker</p> <p>1.1 Give a brief overview of oil tanker design and development</p> <p>1.1.6 Introduce the concept of carriage of oil at sea 1.1.7 Discuss the evolution of the oil tanker 1.1.8 Describe a typical oil tanker general arrangement 1.1.9 Identify general tank and ship arrangements 1.1.10 Describe safety aspects of design 1.1.11 Review general stability concepts in relation to design factors: 1.1.11.1 Transverse statical stability 1.1.11.2 Longitudinal stresses 1.1.11.3 Free surface effect 1.1.11.4 Sheer forces 1.1.11.5 Bending moments 1.1.11.6 Hogging and sagging</p> <p>1.2 Describe types of oil tanker in current service</p> <p>1.2.6 Distinguish: – oil tanker – crude oil tanker – product carrier – combination carrier</p> <p>1.2.7 Differentiate single hull and double-hull oil tanker</p>

Topics and Learning Objectives

- 1.2.8 Describe the features of a double-hull oil tanker
- 1.2.9 Explain the term combination carrier
- 1.2.10 Identify an OBO and O/O carrier
- 1.3 Discuss international and national legislation affecting oil tankers**
 - 1.3.1 Differentiate international and national legislation
 - 1.3.2 Identify the IMO as the international forum for shipping matters
 - 1.3.3 Identify the main IMO conventions affecting tankers
 - 1.3.3.1 Define SOLAS 1974 as the International Convention for the Safety of Life at Sea, 1974
 - 1.3.3.2 Define MARPOL 73/78 as the International Convention for the Prevention of Pollution from Ships, 1973/1978
 - 1.3.3.3 Define STCW 1995 as the International Convention for Standards of Training, Certification and Watchkeeping, 1995
 - 1.3.3.4 Explain how amendments affect the IMO conventions
 - 1.3.4 Explain how the conventions are incorporated in national legislation
 - 1.3.5 Link the Cargo Ship Safety Construction Certificate to SOLAS 1974
 - 1.3.6 Link the Cargo Ship Safety Equipment Certificate to SOLAS 1974
 - 1.3.7 Link the International Oil Pollution Prevention Certificate to MARPOL 73/78
 - 1.3.8 Explain the use of the oil tanker supplements to the certificates
 - 1.3.9 State the ISM Code is the International Safety Management Code
 - 1.3.10 State a Safety Management System must be in place as required by the ISM Code
 - 1.3.11 Identify the agencies responsible for the issue of certificates
 - 1.3.11.1 Flag State
 - 1.3.11.2 Delegated agencies
 - 1.3.12 Identify levels of responsibility for the ship and shore
 - 1.3.12.1 State the master is responsible for operational requirements
 - 1.3.12.2 State local regulations may govern oil tanker operations
 - 1.3.13 Differentiate Port State Control and Flag State Control
 - 1.3.14 Explain how Port State Control verifies compliance with the international conventions
 - 1.3.15 Identify regulations under the CSA affecting oil tankers

2. Basic applied science

2.1 Revise basic physics concepts

- 2.1.1 Describe the three states of matter
- 2.1.2 Define:
 - 2.1.2.1 Melting
 - 2.1.2.2 Sublimation
 - 2.1.2.3 Evaporation
 - 2.1.2.4 Melting point
 - 2.1.2.5 Boiling point
- 2.1.3 Describe the following terms as they apply to liquids:
 - 2.1.3.1 Surface tension
 - 2.1.3.2 Adhesion
 - 2.1.3.3 Cohesion
 - 2.1.3.4 Hydrostatic pressure
 - 2.1.3.5 Miscibility
 - 2.1.3.6 Solubility
 - 2.1.3.7 Diffusion
- 2.1.4 Define viscosity and explain viscosity/temperature relationship
- 2.1.5 Define saturated vapour pressure of liquids (SVP)
- 2.1.6 Define True Vapour Pressure (TVP)
- 2.1.7 Define Reid Vapour Pressure (RVP)
- 2.1.8 Describe diffusion, pressure and miscibility as applied to gases/vapour
- 2.1.9 Describe the structure of atoms and molecules
 - 2.1.9.1 Differentiate negative and positive charged electrons
 - 2.1.9.2 Explain attraction and repulsion of charged bodies

Topics and Learning Objectives

- 2.1.9.3 Give examples of positive and negative charged bodies
- 2.1.10 Describe induction of an electrode and charge
 - 2.1.10.1 Describe how a charged electrode may be discharged
 - 2.1.10.2 State a discharge releases energy which may cause a spark
- 2.2 Outline physical and chemical properties of petroleum**
 - 2.2.1 Discuss general characteristics of crude petroleum
 - 2.2.1.1 Stabilized crude
 - 2.2.1.2 Sour crude
 - 2.2.1.3 Spiked crude
 - 2.2.1.4 Light crude
 - 2.2.1.5 Medium crude
 - 2.2.1.6 Heavy crude
 - 2.2.1.7 Pour point
 - 2.2.1.8 Wax content
 - 2.2.1.9 Cloud point
 - 2.2.2 Explain why the composition of crude varies from source
 - 2.2.3 State that crude oil is a mixture of hydrocarbons:
 - 2.2.3.1 Partly gaseous at normal atmospheric conditions
 - 2.2.3.2 Liquid at normal atmospheric conditions
 - 2.2.3.3 Solid at normal atmospheric conditions
 - 2.2.4 Define the following terms:
 - 2.2.4.1 Density
 - 2.2.4.2 Specific gravity
 - 2.2.4.3 API
 - 2.2.5 State conversion tables are used for Density, Specific Gravity and API
 - 2.2.6 Give a brief overview of the refining process
 - 2.2.6.1 Give examples of boiling points of the constituent compounds
 - 2.2.6.2 Explain Distillation
 - 2.2.6.3 Explain Cracking
 - 2.2.6.4 List examples of refined products
 - 2.2.7 Define volatility of petroleum
 - 2.2.7.1 Link volatility to vapour pressure
 - 2.2.7.2 Correlate TVP and RVP
- 2.3 Explain the principle of the controlled tank atmosphere**
 - 2.3.1 Review the components of the fire triangle
 - 2.3.2 Explain the related chemical reaction
 - 2.3.3 Explain how variables in a tank, after discharge, can affect the tank atmosphere:
 - 2.3.3.1 Volatility of the cargo in the tank
 - 2.3.3.2 Ambient temperature
 - 2.3.3.3 Amount of residual oil
 - 2.3.3.4 Distribution of hydrocarbon gases
 - 2.3.3.5 Inert gas
 - 2.3.4 State why it is important to measure the tank concentrations
 - 2.3.5 Describe the process of gas evolution in a tank
 - 2.3.6 Define flashpoint
 - 2.3.7 Describe how flashpoint is determined
 - 2.3.8 Identify the regulatory limits of oxygen content in inert gas
 - 2.3.9 Describe flammable range, lower flammable limit (LFL) and upper flammable limit (UFL)
 - 2.3.10 Identify a flammability composition diagram
 - 2.3.11 Name the critical components of the flammability diagram
 - 2.3.12 Describe, with the aid of a flammability diagram, the effects of:
 - 2.3.12.1 gas freeing
 - 2.3.12.2 purging
 - 2.3.12.3 dilution with air

Topics and Learning Objectives

- 2.3.12.4 critical dilution with air
- 2.3.12.5 dilution with inert gas
- 2.3.13 Differentiate inert and non-inert tank atmosphere
- 2.3.14 Describe pyrophoric iron sulphide formation
- 2.3.15 Ascertain the risk of pyrophoric iron sulphide ignition
- 2.3.16 Describe control measures to avoid pyrophoric iron sulphide ignition
- 2.4 Explain the principles of electrostatics**
 - 2.4.1 Explain what charge separation is and when it occurs
 - 2.4.2 Explain the creation of an electric field using basic principles
 - 2.4.3 Describe charge separation within a conductor in an electrostatic field
 - 2.4.4 Describe the process of charge relaxation
 - 2.4.5 Explain charge retention by insulation
 - 2.4.6 Explain electrical breakdown, discharge and strength of electrostatic fields
 - 2.4.7 Identify a field strength of 3000 kV per metre is sufficient to cause breakdown of air or petroleum gases
 - 2.4.8 Discuss field strength near protrusions and overall field strength
 - 2.4.9 Discuss discharge near protrusions and the space around it or between protrusions and nearby objects
 - 2.4.10 State single-electrode discharges are unlikely to lead to explosions on tankers
 - 2.4.11 Give examples of two-electrode discharges and describe when these may occur
 - 2.4.12 Describe instantaneous release of energy with respect to:
 - 2.4.12.1 Conductors
 - 2.4.12.2 Liquid non-conductors
 - 2.4.12.3 Solid non-conductors
 - 2.4.12.4 Intermediate liquid and solid conductors
 - 2.4.13 Explain when liquids are considered non-conductors
 - 2.4.14 Define a static accumulator oil
 - 2.4.15 List some static accumulator oils
 - 2.4.16 Explain the function and use of anti-static additives
 - 2.4.17 Explain why distillates must be treated as static accumulator oils unless they contain anti-static additives
 - 2.4.18 List the process giving rise to charges with distillates
 - 2.4.19 Summarize the reasons why low load rates are important for some oils
 - 2.4.20 Explain the hazards associated with equipment permanently mounted in the upper part of a tank, and the measures to minimize the hazard
 - 2.4.21 Explain the hazards associated with introducing portable devices and equipment into a tank, and the measures to minimize the hazard
 - 2.4.22 Explain the types of tank operations that can cause a charged mist to develop
 - 2.4.23 Explain the risk of introducing the following into a charged atmosphere:
 - 2.4.23.1 Steam
 - 2.4.23.2 Inert gas
 - 2.4.23.3 Carbon dioxide
 - 2.4.24 Identify the risk of free-fall liquids in a cargo tank
 - 2.4.25 Explain the concept of the ship-to-shore bonding wire and insulating flange

3. Oil Tanker cargo handling systems

3.1 Describe pipeline, pumping and discharge arrangements

- 3.1.1 Describe general pipeline systems including:
 - 3.1.1.1 Hoses and hard-arms
 - 3.1.1.2 Cargo manifold
 - 3.1.1.3 The ship-shore hard-arm operating envelope
 - 3.1.1.4 The difference between a pipeline and free-flow system
 - 3.1.1.5 The types of pipeline system found on a product tanker and a crude oil tanker
 - 3.1.1.6 The types of valve typically found on a pipeline arrangement
 - 3.1.1.7 A typical VLCC ballast pipeline arrangement
 - 3.1.1.8 A stripping system and its uses
 - 3.1.1.9 The MARPOL line
- 3.1.2 Describe a general pump-room pipeline configuration

Topics and Learning Objectives

- 3.1.3 List the main types of cargo pump
 - 3.1.3.1 The centrifugal pump
 - 3.1.3.2 The deepwell pump
 - 3.1.3.3 The reciprocating pump
 - 3.1.3.4 The simplex and duplex pump
- 3.1.4 Give an overview of basic pumping concepts
- 3.1.5 Explain the pressure surge, including risks and dangers
 - 3.1.5.1 Downstream
 - 3.1.5.2 Upstream
 - 3.1.5.3 At the pump
- 3.1.6 Describe the centrifugal pump characteristics, its advantages and disadvantages
- 3.1.7 Explain the function of the deepwell pump including its stripping capability
- 3.1.8 Describe the reciprocating stripping pump
- 3.1.9 Differentiate simplex and duplex pumps
- 3.1.10 Describe the following valves and their uses:
 - 3.1.10.1 Gate or sluice valve
 - 3.1.10.2 Butterfly valve
 - 3.1.10.3 Non-return valve
 - 3.1.10.4 Angle stop valve
 - 3.1.10.5 Pressure-relief valve for positive displacement pumps
- 3.1.11 Describe, with the use of a diagram, an eductor
- 3.1.12 Explain how an eductor is used in the cargo and stripping system
- 3.1.13 Identify the vacuum-strip system and explain its use
- 3.1.14 Locate emergency cargo pump stops
- 3.1.15 Explain the use of the emergency remote cargo pump shutdown
- 3.2 Identify cargo and ballast measuring devices**
 - 3.2.1 Explain the use of the ullage measuring tape
 - 3.2.2 Differentiate innage and ullage
 - 3.2.3 Identify closed system electronic ullage gauges (ie MMC or Hermetic type)
 - 3.2.4 List level gauges found on oil tankers:
 - 3.2.4.1 Mechanically operated float gauge
 - 3.2.4.2 Electrically powered servo-operated gauge
 - 3.2.4.3 Electrical capacitance gauge
 - 3.2.4.4 Bubbler gauge
 - 3.2.4.5 Pneumatic or hydraulic level gauge using a closed cell
 - 3.2.4.6 Other differential-pressure-type gauges
 - 3.2.4.7 Ultrasonic and sonic gauge
 - 3.2.4.8 Surface-sensing-type gauge
 - 3.2.5 Describe, using diagrams, the operating principle of a typical tank radar liquid level gauge
 - 3.2.6 Explain the importance of reliable and accurate measuring devices
 - 3.2.7 Describe control measures to avoid tank overflow:
 - 3.2.7.1 By use of high-level alarms or overflow-control systems
 - 3.2.7.2 By use of gauging devices and tank-filling control procedures
 - 3.2.8 Explain the danger of exceeding the design head of the cargo tank
- 3.3 Compare venting arrangements**
 - 3.3.1 List reasons for venting from cargo and ballast spaces
 - 3.3.2 Discuss the evolution of gases from cargo tanks
 - 3.3.3 Explain the importance of gas dispersion
 - 3.3.4 Describe still air conditions and safety risks
 - 3.3.5 Illustrate typical gas dispersion patterns
 - 3.3.6 Discuss factors affecting gas dispersion
 - 3.3.7 Identify the regulatory requirements for ventilation systems
 - 3.3.8 Describe independent and combined tank venting arrangements
 - 3.3.9 Describe tank isolation arrangements for combined systems

Topics and Learning Objectives

- 3.3.10 Describe the pressure-vacuum valve (P/V)
- 3.3.11 Show, with the aid of a diagram, typical P/V locations
- 3.3.12 Explain the reasons for flame screens in venting systems
- 3.3.13 Describe the use of a high velocity valve
- 3.3.14 Explain the use of the purge pipe

3.4 Describe cargo heating systems

- 3.4.1 List oils which may require heating
- 3.4.2 List examples of oils which should never be heated
- 3.4.3 Describe cold weather conditions affecting oil heating requirements
- 3.4.4 Describe how tank location can affect heating requirements
 - 3.4.4.1 Wing tanks
 - 3.4.4.2 Centre tanks
 - 3.4.4.3 Double hull arrangements
- 3.4.5 Describe a typical steam heating coil arrangement
- 3.4.6 Explain how to detect steam heating coil contamination
- 3.4.7 Compare steam heating to thermal oil heating
- 3.4.8 State the disadvantages of steam heating coils
- 3.4.9 Explain the importance of proper cargo temperature control
- 3.4.10 Explain how pour point, viscosity and cloud point are affected by cargo temperature
- 3.4.11 Describe, briefly, the heating and carriage requirements of bitumen in special ships
- 3.4.12 Explain the importance of not exceeding tank coating design temperature

3.5 Locate bunker systems and bunker transfer equipment

- 3.5.1 Show, with the aid of a diagram, a typical bunker pipeline arrangement
- 3.5.2 Show, with the aid of a plan, a typical bunker tank arrangement
- 3.5.3 Identify bunker transfer pump emergency stops
- 3.5.4 Identify hazards of light hydrocarbons in the tank headspace
- 3.5.5 Explain the use of the explosimeter when measuring flammability of the headspace
- 3.5.6 Describe precautionary measures when handling, storing or carrying residual fuel oils

4. Oil Tanker operations

4.1 Plan for port arrival

- 4.1.1 List information provided to the tanker before arrival
- 4.1.2 List information provided to the shore before arrival
- 4.1.3 Complete pre-arrival checklists
- 4.1.4 Prepare a load, discharge, COW, ballast and de-ballast plan
- 4.1.5 Inspect and test relevant cargo operations systems
- 4.1.6 Prepare fire equipment for cargo operations
- 4.1.7 Identify personnel for cargo operations

4.2 Describe ballasting and de-ballasting operations

- 4.2.1 Describe factors affecting ballast quantity and the tanks to be used
- 4.2.2 Discuss stress forces during ballast operations
- 4.2.3 Discuss draft, minimum draft, and trim requirements
- 4.2.4 Discuss intact stability problems for double hull tankers when ballasting (and working cargo)
- 4.2.5 Describe typical ballast and de-ballast sequence
 - 4.2.5.1 For single hull tanker
 - 4.2.5.2 For double-hull tanker
 - 4.2.5.3 Heavy weather ballast tank
 - 4.2.5.4 CBT
 - 4.2.5.5 SBT
 - 4.2.5.6 Change of ballast at sea
- 4.2.6 Outline the requirements for international ballast water exchange
- 4.2.7 Describe ballast stripping arrangements
- 4.2.8 Outline procedures and restrictions for contaminated ballast
- 4.2.9 Discuss use of the slop tank
- 4.2.10 Explain limitations for ballast discharge at sea and in port

Topics and Learning Objectives

4.3 Prepare for loading and discharge operations

- 4.3.1 Complete ship/shore safety checklist
- 4.3.2 Discuss, using the ship/shore checklist, general safety aspects
- 4.3.3 Calculate cargo capacity
- 4.3.4 Line-up cargo system
- 4.3.5 Describe the precautions, use and connection of cargo hoses
 - 4.3.5.1 Using terminal hoses
 - 4.3.5.2 Using ship hoses
- 4.3.6 Describe the precautions, use and connection of hard-arms
- 4.3.7 Discuss ship and shore cargo sequence
- 4.3.8 Discuss emergency shut-down procedures

4.4 Identify inert gas requirements

- 4.4.1 Identify oil tankers which must be provided with an IG system
- 4.4.2 List the exceptions to this requirement
- 4.4.3 Identify the requirements for an IG system for oil tankers with a COW system
- 4.4.4 Define inert gas
- 4.4.5 Describe, with the aid of a flammability composition diagram, the effect of inert gas
- 4.4.6 List the basic requirements of an IG system
 - 4.4.6.1 To inert empty tanks
 - 4.4.6.2 To provide a controlled atmosphere during cargo operations
 - 4.4.6.3 To purge tanks prior to gas-freeing
 - 4.4.6.4 To top-up pressure when required

4.5 Describe cargo loading and cargo discharging operations

- 4.5.1 Discuss loading methods and safe practices
 - 4.5.1.1 Gravity from shore to ship
 - 4.5.1.2 Initial and full pumping rates to ship
 - 4.5.1.3 Frame samples
 - 4.5.1.4 Monitoring tanks during loading
 - 4.5.1.5 Topping off
 - 4.5.1.6 Relaxation periods prior to ullaging and sampling
- 4.5.2 Discuss discharge methods and safe practices
 - 4.5.2.1 Sequence of valve opening ship to shore
 - 4.5.2.2 Starting and monitoring of cargo pumps
 - 4.5.2.3 Shore check valves
 - 4.5.2.4 Initial and full pumping rates to shore
 - 4.5.2.5 Monitoring tanks during discharge
 - 4.5.2.6 Precautions and risks blowing lines
- 4.5.3 Identify ICS Ship to Ship Transfer Guide (Petroleum)
- 4.5.3 State special procedures for ship-to-ship transfers

4.6 Identify crude oil washing requirements

- 4.6.1 Define crude oil washing (COW)
- 4.6.2 State COW is mandatory for many crude oil tankers
- 4.6.3 Identify international rules requiring COW of cargo tanks (subject to certain operational provisions)
- 4.6.4 Differentiate water washing and crude oil washing
- 4.6.5 Extract minimum COW requirements from MARPOL

4.7 Explain tank washing procedures

- 4.7.1 List the reasons for tank washing
- 4.7.2 Describe tank washing line, pump and stripping arrangements
- 4.7.3 Identify the risks involved with tank washing
- 4.7.4 List the precautions to be taken during tank washing
- 4.7.5 State tank washing should be undertaken in an inert atmosphere
- 4.7.6 Identify precautions to take when washing a non-inert tank

Topics and Learning Objectives

- 4.7.7 Describe tank washing processes
 - 4.7.7.1 With cold water
 - 4.7.7.2 With hot water
 - 4.7.7.3 Using chemicals
 - 4.7.7.4 Using portable machines
 - 4.7.7.5 Using fixed in place machines
 - 4.7.7.6 Use of programmable and non-programmable machines
 - 4.7.8 Describe closed-cycle and open-cycle modes
 - 4.7.9 Plan a typical tank washing sequence
 - 4.7.10 State disposal of tank residues must comply with regulations
 - 4.7.11 Explain the use of the slop tank/s
 - 4.7.12 Identify the risks of over filling slop tanks
 - 4.8 Discuss purging and gas-freeing**
 - 4.8.1 Define gas-freeing
 - 4.8.2 Define purging
 - 4.8.3 List the reasons for gas freeing
 - 4.8.4 Describe the safety precautions to take during gas-freeing
 - 4.8.5 Explain, with the use of a flammability composition diagram, a purging and gas-freeing sequence to avoid the flammable range
 - 4.8.6 Give details of gas-freeing arrangements
 - 4.8.6.1 Portable fans
 - 4.8.6.2 Fixed gas freeing equipment
 - 4.8.6.3 Use of the IG air intake
 - 4.8.7 Describe methods of gas-freeing
 - 4.8.8 Define a gas-free tank
 - 4.8.9 List the equipment used for testing for a gas-free tank
 - 4.8.10 Identify how a tank can again become gas dangerous
 - 4.8.11 Discuss the securing arrangements of tank IG lines
 - 4.9 Describe general procedures for combination carriers**
 - 4.9.1 Prepare holds from dry bulk cargo to oil cargo
 - 4.9.2 Identify additional precautions necessary before loading oil cargo
 - 4.9.3 Identify risks specific to combination carriers when carrying oil cargoes
 - 4.9.4 Identify risks specific to combination carriers during load and discharge of oil cargoes
 - 4.9.5 Prepare holds from oil cargo for dry bulk cargo
 - 4.9.6 Identify the requirements for slops when trading as a dry bulk carrier
 - 4.9.7 Explain the use of cargo change-over check lists
- 5. Health and Safety**
- 5.1 Describe health hazards associated with petroleum cargoes**
 - 5.1.1 List the typical toxic constituents of petroleum gas
 - 5.1.2 List the main toxic constituents of inert gas
 - 5.1.3 Describe, in general terms, the main exposure hazards to ship personnel
 - 5.1.3.1 Toxicity and the criteria by which it is measured
 - 5.1.3.2 Poisoning – ingestion, inhalation, and absorption
 - 5.1.3.3 Petroleum gas and complications on the person
 - 5.1.3.4 Oxygen deficiency and its effects
 - 5.1.3.5 The effects of various components of flue gases
 - 5.1.4 Discuss risks and dangers of hydrogen sulphide
 - 5.1.4.1 Introduce hydrogen sulphide as a dangerous gas
 - 5.1.4.2 List cargoes where hydrogen sulphide may be present
 - 5.1.4.3 Outline its physical properties
 - 5.1.4.4 Describe the physical effects for the human body
 - 5.1.4.5 Describe precautions to take handling hydrogen sulphide rich cargoes

Topics and Learning Objectives

- 5.1.5 Describe the Material Safety Data Sheet
 - 5.1.5.1 Explain the use of the MSDS
 - 5.1.5.2 Explain each section of the MSDS
 - 5.1.5.3 State the periodicity of the MSDS
- 5.1.6 Differentiate MSDS and Cargo Hazard Sheets
- 5.1.7 Discuss general first aid procedures
- 5.2 Describe the function and use of gas indicators**
 - 5.2.1 Describe the operating principle of:
 - 5.2.1.1 A catalytic-filament combustible-gas indicator
 - 5.2.1.2 A non-catalytic heated-filament gas indicator
 - 5.2.1.3 A refractive index meter
 - 5.2.1.4 Chemical indicator tubes
 - 5.2.1.5 An oxygen meter with paramagnetic sensors
 - 5.2.1.6 An oxygen analyzer with electrolytic sensor
 - 5.2.1.7 An oxygen analyzer with selective chemical absorption liquid
 - 5.2.2 Carry-out instrument-check procedures and gas measurements
 - 5.2.3 Determine the suitability of each gas indicator
 - 5.2.4 Explain the role of the marine chemist
 - 5.2.5 Identify and describe the Gas Free Certificate
 - 5.2.6 Provide details of and the reasons for work permits
 - 5.2.7 Explain the terms intrinsically safe, flameproof and increased safety equipment
- 5.3 Implement control measures for enclosed space safety**
 - 5.3.1 Define the enclosed space
 - 5.3.2 Identify enclosed spaces
 - 5.3.3 Identify potential hazards
 - 5.3.4 Discuss role and duties of a 'responsible person'
 - 5.3.5 Review the requirements of the SMS
 - 5.3.5.1 Permit to Work Systems
 - 5.3.5.2 Work Planning Meetings
 - 5.3.6 Analyze check lists
 - 5.3.7 Assess hazards prior to entry
 - 5.3.8 Recommend procedures and practices for pumproom safety
 - 5.3.8.1 List sources of leakage in the pumproom
 - 5.3.8.2 Describe fire fighting arrangements in the pumproom
 - 5.3.8.3 Review ventilation pumproom ventilation requirements
 - 5.3.8.4 List safety equipment located in the pumproom
 - 5.3.8.5 Identify pumproom entry checklists
 - 5.3.9 Recommend procedures and safety practices for tank entry
 - 5.3.9.1 List precautions to take for tank entry
 - 5.3.9.2 Identify tank atmosphere test procedures
 - 5.3.9.3 List equipment required
 - 5.3.9.4 Identify key personnel
 - 5.3.9.5 Analyze tank entry checklists
 - 5.3.10 Explain methods to reduce or eliminate hazards
 - 5.3.11 Re-assess hazards
 - 5.3.12 Simulate emergency tank entry and evacuation procedures
 - 5.3.12.1 Use tank evacuation equipment
 - 5.3.12.2 Resuscitation equipment
 - 5.3.12.3 Self-contained breathing apparatus
- 5.4 Review fire-fighting principles**
 - 5.4.1 Explain the principles of fire prevention
 - 5.4.2 List sources of emission of flammable cargo vapours
 - 5.4.3 Identify possible ignition sources on oil tankers

Topics and Learning Objectives	
5.4.4	List and discuss the methods and measures to control fire
5.4.4.1	Water
5.4.4.2	Foam
5.4.4.3	Inert gas
5.4.4.4	Dry chemical
5.4.4.5	Carbon dioxide
5.4.5	Review regulations for the protection of cargo tanks, cargo tank deck area and pumprooms
6. Emergency procedures	
6.1 Discuss the use and requirements of an emergency plan	
6.1.1	Introduce the oil pollution emergency plan
6.1.2	Describe other oil tanker emergency plans
6.1.3	List information that should be available
6.1.4	Review the components of an emergency organization
6.1.5	Simulate the action required for different emergencies
6.2 Describe ship and shore emergency alarms	
6.2.1	Describe different ship alarms used in cases of emergency, including:
6.2.1.1	General alarm
6.2.1.2	Fire alarm
6.2.1.3	CO ₂ alarm
6.2.2	Describe other important alarms, including
6.2.2.1	Inert gas alarm
6.2.2.2	High-level alarm
6.2.2.3	Engine-room alarms
6.2.2.4	Bridge alarms
6.2.2.5	Accommodation alarms
6.2.2.6	Galley alarms
6.2.3	Describe shore and terminal alarms used in cases of emergency
6.3 Give an overview of general safety precautions	
6.3.1	Describe, briefly, the use and general content of ISGOTT
6.3.2	Identify other tanker related safety publications for additional information and guidance
6.3.3	Use ISGOTT as a means to discuss
6.3.3.1	General precautions on tankers
6.3.3.2	General precautions while a tanker is at a petroleum berth
6.3.3.3	Precautions before and during cargo operations
6.3.4	Use case studies to analyze previous emergency incidents
7. Safety in terminal operations	
7.1 Provide details of oil terminal information exchange	
7.1.1	List information provided from ship to terminal
7.1.1.1	Ship's draft and trim on arrival
7.1.1.2	Maximum draft and trim on completion of cargo/ballast
7.1.1.3	Condition of cargo tanks (inerted, previous cargo, cleaned, COWed etc)
7.1.1.4	Anticipated time for all cargo/ballast operations
7.1.1.5	Repairs that may delay cargo operations
7.1.2	List information provided from terminal to ship
7.1.2.1	Depth of water at berth at low tide
7.1.2.2	Which side alongside, special features of the berth
7.1.2.3	Size of hoses/ hard arms to be connected (reducers available) and operating limits
7.1.2.4	Mooring requirements
7.1.2.5	Maximum angle and speed of approach
7.1.2.6	Relevant cargo handling information and procedures
7.1.2.7	Ship or shore gangway
7.1.2.8	Communications
7.1.2.9	Alarms and emergency procedures

Topics and Learning Objectives

- 7.1.2.10 Restrictions on conducting repairs alongside
- 7.1.3 List check-lists to be completed by ship and shore
- 7.2 Describe oil tanker and terminal mooring arrangements**
 - 7.2.1 Describe general mooring principles
 - 7.2.2 Describe the forces applied to the vessel
 - 7.2.2.1 Wind
 - 7.2.2.2 Waves/ swell/ seiche (tide like fluctuation in lakes)
 - 7.2.2.3 Currents
 - 7.2.2.4 Tides
 - 7.2.2.5 Ice
 - 7.2.2.6 Surges from passing vessels
 - 7.2.3 Determine how applied forces are transferred to moorings
 - 7.2.4 Discuss load distribution
 - 7.2.5 Discuss the optimal configuration for mooring layout
 - 7.2.6 Discuss the risk of mixed moorings
 - 7.2.7 Describe the spilt-drum winch and correct use of wires
 - 7.2.8 Describe S.B.M and S.P.M. mooring arrangements
- 7.3 Describe oil terminal emergency procedures**
 - 7.3.1 Identify fire fighting equipment available on the jetty
 - 7.3.2 Identify water-borne fire-fighting equipment available
 - 7.3.3 Identify typical terminal shore alarms
 - 7.3.4 Identify emergency communications between ship and shore
 - 7.3.5 Specify when emergency cargo operations shut-down is necessary
 - 7.3.6 Identify escape routes from ship to shore and from jetty areas
 - 7.3.7 Describe the general content and components of a terminal emergency plan

8. Pollution prevention

- 8.1 Discuss pollution of the marine environment from oil tankers**
 - 8.1.1 Use statistics to show major worldwide pollution incidents
 - 8.1.2 Provide examples of how pollution can occur from oil tankers
 - 8.1.2.1 In port
 - 8.1.2.2 At sea
 - 8.1.3 Provide examples of damage to the marine environment due to oil pollution
 - 8.1.4 State the penalties for pollution of Canadian waters
 - 8.1.5 Provide examples of fines for pollution of Canadian waters
- 8.2 Summarize regulatory requirements for pollution prevention**
 - 8.2.1 List international conventions and regulations affecting tankers
 - 8.2.2 Identify ships to which MARPOL 73/78 annex I (as amended) applies
 - 8.2.3 Identify the relevant annexes of MARPOL 73/78 affecting oil tankers
 - 8.2.4 Identify the main provisions of MARPOL annex I with regard to:
 - 8.2.4.1 Requirements for machinery spaces
 - 8.2.4.1.1 Tanks for oil residues
 - 8.2.4.1.2 Standard discharge connection
 - 8.2.4.1.3 Oil filtering equipment
 - 8.2.4.1.4 Control of discharge of oil
 - 8.2.4.2 Segregated ballast capacity
 - 8.2.4.3 Double hull and double bottoms
 - 8.2.4.4 Heavy grade oil as cargo
 - 8.2.4.5 Pump-room bottom protection
 - 8.2.4.6 Survival capability in case of damage
 - 8.2.4.7 Limitation of tank size
 - 8.2.4.8 Slop tank capacity
 - 8.2.4.9 Overboard piping arrangements
 - 8.2.5 Describe emergency towing arrangements
 - 8.2.6 Identify pollution prevention regulations under the CSA

Topics and Learning Objectives

- 8.2.7 Comply with pollution prevention regulations under the CSA
- 8.2.8 Describe an IOPP certificate and a COPP certificate and their supplements
- 8.3 Describe operational pollution control requirements of oil tankers**
- 8.3.1 Comply with discharge provisions using the oil discharge control and monitoring system (ODMACS)
- 8.3.2 Describe different principles involved in measuring oil content
 - 8.3.2.1 Ultraviolet fluorescence
 - 8.3.2.2 Turbidity measurement
 - 8.3.2.3 Light absorption
 - 8.3.2.4 Gas measurement
 - 8.3.2.5 Infra-red absorption
- 8.3.3 Describe action in the event of malfunction of the ODMAC's
- 8.3.4 Discuss retention of records
- 8.3.5 Explain, with the aid of a drawing, the operating principle of a portable oil/water interface detector
- 8.3.6 Determine the oil/water interface in a slop tank
- 8.3.7 Describe the LOT procedure for crude oil tankers
- 8.3.8 Discuss the reason for and requirements of reception facilities
- 8.3.9 Format entries for both Oil Record Books
- 8.4 Respond to marine oil spills**
- 8.4.1 Identify mandatory provisions under MARPOL 73/78, as amended, for the shipboard oil pollution emergency plan
- 8.4.2 Identify SOPEP requirements under the International Convention on Oil Pollution Preparedness, Response and Co-operation, 1990
- 8.4.3 Identify Guidelines for the development of Marine Pollution Emergency Plans, as amended
- 8.4.4 Differentiate SOPEP and SMPEP
- 8.4.5 Describe SOPEP requirements
- 8.4.6 Show an example of a SOPEP
- 8.4.7 Analyze the fate of oil spills
 - 8.4.7.1 Weathering
 - 8.4.7.2 Spreading
 - 8.4.7.3 Evaporation
 - 8.4.7.4 Dispersion
 - 8.4.7.5 Emulsification
 - 8.4.7.6 Dissolution
 - 8.4.7.7 Oxidation
 - 8.4.7.8 Sedimentation
 - 8.4.7.9 Biodegradation
 - 8.4.7.10 Combined processes – early and long-term
 - 8.4.7.11 Forecasting slick movement
- 8.4.8 Evaluate the effects of timely and delayed response
- 8.4.9 List pollution prevention equipment required on board
- 8.4.10 Describe methods of containment using ship pollution equipment
- 8.4.11 Describe pollution prevention equipment limitations
- 8.4.12 Discuss the use of chemical dispersants
- 8.4.13 Discuss the importance of timely response to marine oil spills
- 8.4.14 Identify parties responsible for:
 - 8.4.14.1 Clean up
 - 8.4.14.2 Resources available
 - 8.4.14.3 Assistance available
 - 8.4.14.4 Supply of pollution prevention equipment
 - 8.4.14.5 Disposal
 - 8.4.14.6 Costs for a marine oil spill
- 8.4.15 List types of pollution equipment available from a shore based pollution response centre

Topics and Learning Objectives

8.5 Supervise transfer operations

- 8.5.1 Identify sections from the Regulations for the Prevention of Pollution from Ships and for Dangerous Chemicals dealing with oil transfer operations
- 8.5.2 Discuss each section relating to transfer operations
- 8.5.3 Identify test procedures and certification for transfer hoses
- 8.5.4 Identify markings on transfer hoses suitable for oil service
- 8.5.5 Describe the handling and preparation of cargo hoses for oil transfer
- 8.5.6 Describe additional transfer operations requirements
 - 8.5.6.1 Ship and terminal transfers
 - 8.5.6.2 Ship to ship transfers in port and at sea
 - 8.5.6.3 Ship to ship transfers in accordance with *Arctic Waters Oil Transfer Guidelines (TP10783)*
 - 8.5.6.4 Ship to shore transfers in accordance with *Arctic Waters Oil Transfer Guidelines (TP10783)*
 - 8.5.6.5 Ship to barge transfers
 - 8.5.6.6 Identify risks in ship to ship transfers using vapour balancing
 - 8.5.6.7 Vapour returns at terminal facilities

9. Inert Gas System

9.1 Describe the Inert Gas System (IG)

- 9.1.1 Specify the reasons for inerting
- 9.1.2 Specify training requirements and methods
- 9.1.3 Describe regulatory requirements for IG for tankers
 - 9.1.3.1 Identify International conventions and regulations
 - 9.1.3.2 List exceptions to the requirements
- 9.1.4 Define IG
- 9.1.5 Describe the effects of IG using the flammability composition diagram
- 9.1.6 State what the IG system is required to do
 - 9.1.6.1 Inert empty tanks
 - 9.1.6.2 Be operative during cargo and ballast handling
 - 9.1.6.3 Purge tanks prior to gas-freeing
 - 9.1.6.4 Top up pressure in cargo tanks
- 9.1.7 Define general IG terms
 - 9.1.7.1 IG plant
 - 9.1.7.2 IG distribution system
 - 9.1.7.3 IG system
 - 9.1.7.4 Inerting
 - 9.1.7.5 Gas freeing
 - 9.1.7.6 Purging
 - 9.1.7.7 Topping Up
- 9.1.8 Identify sources of inert gas
 - 9.1.8.1 Flue gas system
 - 9.1.8.2 Inert gas generator
 - 9.1.8.3 Other methods
- 9.1.9 List the general characteristics of flue gas

9.2 Describe components and design considerations

- 9.2.1 Identify the main components of an IG system
 - 9.2.1.1 Flue Gas Isolating Valve
 - 9.2.1.2 Scrubber and Demister
 - 9.2.1.3 Blower Inlet Valves
 - 9.2.1.4 Inert Gas Blowers
 - 9.2.1.5 Recirc. and Gas Regulating Valves (Main Control Valve)
 - 9.2.1.6 Inert Gas Vent Valve
 - 9.2.1.7 Fixed Oxygen Analyzer
 - 9.2.1.8 Deck Water Seal
 - 9.2.1.9 Mechanical Non-return Valve

Topics and Learning Objectives

- 9.2.1.10 Liquid P/V Valve
- 9.2.1.11 Mechanical P/V Valve
- 9.2.1.12 Instrumentation and alarms
- 9.2.2 Describe the location and function of each part of the system
- 9.2.3 Discuss design considerations for each component
- 9.2.4 Show the relationship and interaction between the components
- 9.2.5 Identify the requirements for portable and fixed gas measuring instruments
- 9.3 Describe the principles of operation of the IG system**
 - 9.3.1 Start up the system
 - 9.3.2 Monitor the system during normal operations
 - 9.3.3 Shut down the IG system
 - 9.3.4 Perform safety checks when shut down
 - 9.3.5 Identify system failures and action to be taken
- 9.4 Apply principles of operation to cargo tank operations**
 - 9.4.1 Discuss the requirements and use of the instruction manual
 - 9.4.2 Describe dilution and displacement methods of inerting
 - 9.4.3 Describe the use of the inert gas system
 - 9.4.3.1 Inerting from a gas-free condition
 - 9.4.3.2 Re-inerting after breakdown or repair of the IG system
 - 9.4.3.3 Venting during loading operations
 - 9.4.3.4 Maintaining an inert condition on load passage
 - 9.4.3.5 Topping up
 - 9.4.3.6 Pressurizing before cargo discharge operations
 - 9.4.3.7 Inerting during cargo discharge
 - 9.4.3.8 Inerting during COW
 - 9.4.3.9 Ballasting cargo tanks, if applicable
 - 9.4.3.10 Inerting empty tanks on ballast passage
 - 9.4.3.11 Inerting during tank washing
 - 9.4.3.12 Purging prior to gas-freeing
 - 9.4.3.13 Gas-freeing using the fresh air intake
 - 9.4.4 Describe precautions to take with the IG system during tank entry
 - 9.4.5 Apply operational principles of inerting to product carriers
 - 9.4.5.1 Discuss operational and design differences
 - 9.4.5.2 Discuss contamination of cargoes by using IG
 - 9.4.6 Apply operational principles of inerting to combination carriers
 - 9.4.6.1 Discuss operational and design differences
 - 9.4.6.2 Explain problems of slack holds
 - 9.4.6.3 Explain problems of leakage of tank gas
 - 9.4.6.3.1 Through hatch centre-line joints
 - 9.4.6.3.2 Into ballast and void spaces
 - 9.4.7 Describe the precautions to take changing over from oil to cargoes other than oil
- 9.5 Activate emergency procedures**
 - 9.5.1 State action to be taken in the event of total failure of the IG system
 - 9.5.1.1 Tankers carrying crude oil
 - 9.5.1.2 Product tankers
 - 9.5.1.3 During ship to ship transfers
 - 9.5.1.4 During port operations
- 9.6 Prescribe maintenance, inspection and testing**
 - 9.6.1 Describe information available in the operating and maintenance manual
 - 9.6.2 Identify the main system components for inspection
 - 9.6.2.1 For internal inspection during system shut-down
 - 9.6.2.2 For operational inspection with system running
 - 9.6.3 Give specific inspection guidelines for internal inspection of main system components
 - 9.6.4 Give specific guidelines for operational inspections

Topics and Learning Objectives

- 9.6.5 Test functioning of devices and alarms
 - 9.6.5.1 Devices to measure oxygen content
 - 9.6.5.2 IGS pressure and temperature
 - 9.6.5.3 Automatic recording of information
 - 9.6.5.4 All alarm and safety functions
 - 9.6.5.5 Simulation methods for alarm testing
- 9.6.6 Suggest preventative maintenance program
 - 9.6.6.1 Using checklists as a guide
 - 9.6.6.2 Using manufacturers and operations manuals

10. Crude Oil Washing

10.1 Describe Crude Oil Washing (COW)

- 10.1.1 Define crude oil washing (COW)
- 10.1.2 Differentiate COW and conventional tank cleaning
- 10.1.3 Specify training requirements and methods
- 10.1.4 Specify qualification of personnel for COW operations
- 10.1.5 Provide a brief history of the development of COW
- 10.1.6 Specify the types of oil tanker fitted with COW capability

10.2 Describe regulatory requirements for COW

- 10.2.1 Identify International conventions and regulations
- 10.2.2 State the requirements of MARPOL 73/78 and amendments
- 10.2.3 Explain the purpose of the Revised Specifications for the design, operation and control of crude oil washing systems, as amended
- 10.2.4 Give an overview of the content of a COW Operations and Equipment Manual
- 10.2.5 Identify the IOPP and where it indicates COW is mandatory
- 10.2.6 State during COW operations the IG system must be operational
- 10.2.7 Discuss Port State Control actions to ensure effective COW

10.3 Explain the principles of crude oil washing

- 10.3.1 Define commonly used terms and their relationships
- 10.3.2 List advantages and disadvantages of COW
- 10.3.3 Discuss the characteristics of crude oil as a washing fluid
- 10.3.4 Determine the suitability of a crude oil for Crude Oil Washing
- 10.3.5 Define top washing, bottom washing
- 10.3.6 Define multi-stage and single stage washing

10.4 Provide details of COW equipment and design factors

- 10.4.1 Identify, from a diagram, the location of COW machines on a tanker
- 10.4.2 Describe fixed deck-mounted and fixed submerged machines
- 10.4.3 Describe single and multi-nozzle machines
 - 10.4.3.1 Discuss the advantages and disadvantages
- 10.4.4 Explain the reason for shadow diagrams
 - 10.4.4.1 State requirements for horizontal and vertical wash areas
- 10.4.5 Describe portable and fixed drive units and their limitations
- 10.4.6 Describe, using diagrams, a COW pipeline system
- 10.4.7 Describe the stripping system
- 10.4.8 Discuss the use of level gauges, hand dipping and stripping system performance gauges
- 10.4.9 Describe the supply of wash oil using cargo pumps or COW pump

10.5 Apply COW principles

- 10.5.1 Describe the supply and distribution of wash oil
 - 10.5.1.1 Discuss the requirements of 'clean' crude for Crude Oil Washing
 - 10.5.1.2 Discuss backfilling a slop or cargo tank for 'clean' oil
 - 10.5.1.3 Discuss problems associated with 'recycled' wash oil
- 10.5.2 Control wash fluid pressure
 - 10.5.2.1 Identify manufacturers minimum pressure

Topics and Learning Objectives

- 10.5.3 Describe methods of COW
 - 10.5.3.1 Bleed off from cargo discharge
 - 10.5.3.2 Open cycle
 - 10.5.3.3 Closed cycle
 - 10.5.3.4 Limitation of number of machines to use simultaneously
 - 10.5.3.5 Shut off discharge for Crude Oil Washing
 - 10.5.3.6 Describe the use of the eductor
- 10.5.4 Describe Crude Oil Washing with multi-grade cargoes
 - 10.5.4.1 Define multi-grade cargoes
 - 10.5.4.2 Explain washing techniques with the same grade
- 10.5.5 Strip tanks
 - 10.5.5.1 Describe stripping processes
 - 10.5.5.1.1 During bulk discharge
 - 10.5.5.1.2 On completion of discharge
- 10.5.6 Drain cargo and COW lines
 - 10.5.6.1 Connection to a stripping device
 - 10.5.6.2 The MARPOL line
 - 10.5.6.3 Deepwell cargo pump stripping
- 10.5.7 Explain the risk of wet oil in COW operations
 - 10.5.7.1 Define wet crude oil
 - 10.5.7.2 Discuss electrostatic generation during Crude Oil Washing
 - 10.5.7.3 Explain the process of de-bottoming cargo tanks
 - 10.5.7.4 Explain the back filling of the slop tank
- 10.5.8 Explain how to control vapour emissions
- 10.5.9 Describe the limitations of Crude Oil Washing at sea
- 10.6 Determine cold weather techniques**
 - 10.6.1 Review the physical characteristics of crude oil:
 - 10.6.1.1 API (density)
 - 10.6.1.2 Pour Point
 - 10.6.1.3 Cloud Point
 - 10.6.1.4 Viscosity
 - 10.6.1.5 Temperature
 - 10.6.2 Determine heat requirements
 - 10.6.3 Identify COW problems associated with adjacent cold ballast tanks
 - 10.6.4 Explain pour point and IMO recommendations
 - 10.6.5 Explain cloud point and temperature recommendations
 - 10.6.6 Explain the relationship of high wax cargoes and cloud point
 - 10.6.7 Explain how viscosity can cause problems relating to pumping pressures, slow discharge rates and inability to COW
- 10.7 Complete checklists and prepare COW plans**
 - 10.7.1 Identify checklists for use before, during and after crude oil washing
 - 10.7.2 Identify the information to be included in a COW plan
 - 10.7.3 Construct a COW plan from information provided for a proposed COW operation

Topics and Learning Objectives

11. Cargo and Emergency Management

11.1 Summarize the International Safety Management System

- 11.1.1 State the mandatory ISM Code requirements for Safety Management
- 11.1.2 State the objectives of the ISM Code
- 11.1.3 Describe the Document of Compliance (DOC) and the Safety Management Certificate (SMS)
- 11.1.4 State the requirements of a Safety Management Manual (SMM)
- 11.1.5 List the type of emergencies that require written procedures
- 11.1.6 Discuss the use of Contingency Plans

11.2 Develop criteria for different types of emergency

- 11.2.1 Identify the IMO publication 'Guidelines for the Development of Shipboard Emergency Response Plans'
- 11.2.2 Differentiate operational and non-operational emergencies
- 11.2.3 Discuss the content and use of emergency plans
- 11.2.4 Implement and evaluate the effectiveness of emergency plans
- 11.2.5 Develop criteria for monitoring alarms
- 11.2.6 Develop procedures for responding to alarms
- 11.2.7 Discuss training for emergencies

SPECIALIZED CHEMICAL TANKER SAFETY TRAINING

6.1 General

- 1) This chapter describes a course providing specialized Chemical Tanker safety training, designed to fulfil the requirements of Section A-V/1 of the STCW code.
- 2) The completion of the course is necessary to obtain the *Specialized Chemical Tanker Training* endorsement on a deck or engineer officer certificate. Refer to Section 228 of the *Marine Personnel Regulations* for details regarding the requirements of this endorsement and training according to personnel responsibilities and position on board.
- 3) Even though Inert Gas Systems are often found on Chemical tankers, this course does not contain a specific section on such systems. The topics are embedded in the courseware and cover the necessary components required by STCW; they are broadly written so that the instructors have the freedom to adapt as the Chemical industry changes.

6.2 Objectives

- 1) Provide the training required under Section 166 of the *Marine Personnel Regulations* in order to obtain a *Specialized Oil Tanker Training* endorsement.
- 2) Enable the participants to take immediate responsibility for the loading, discharging or transfer of cargo and the operation of cargo equipment.

6.3 Duration

39 hours

6.4 Prerequisites

- 1) MED with respect to STCW basic safety
- 2) MED in advanced fire fighting
- 3) Successful completion of an approved training course in Oil and Chemical tanker familiarization or holder of an Oil and Chemical Tanker Familiarization certificate or Endorsement

6.5 Specific instructor qualifications

The main course instructor must hold a Master Mariner or a First-class engineer certificate with a valid *Specialized Chemical Tanker Training* endorsement, but AMSP may consider lower certificates in special circumstances for instructors with additional experience on oil tankers. If the course is under the supervision of more than one instructor, the assistant instructors must hold qualifications related to the marine industry or have related skills and be approved in accordance with the *Quality Management Manual – Marine Personnel Standards and Pilotage*, referred to in Chapter 2.

6.6 Equipment requirements

- 1) Personnel safety equipment, including breathing apparatus;
- 2) Tank evacuation equipment;
- 3) Portable oxygen meter and oxygen analyser;
- 4) Portable combustible-gas indicator;
- 5) Portable interferometer;
- 6) Portable gas detector and sample detector tubes for vapours and gasses;
- 7) Resuscitator;

- 8) IMO medical first aid guide for accidents involving dangerous goods;
- 9) ISM Code;
- 10) IMO publication “Guidelines for the Development of Shipboard Emergency Response Plans”;
- 11) Chemical Tanker Safety Guide and ISGOTT;
- 12) Sample health data and cargo data sheets, emergency plans and casualty reports;
- 13) Audio-visual presentation equipment.

6.7 Outline

Subject Area	Hours	
	Lecture	Practical
1.0 The Chemical Tanker 1.1 Summarize the development of the chemical tanker trade 1.2 Describe types of cargoes shipped in chemical tankers 1.3 Describe types of chemical tankers	2	
2.0 Rules and regulations 2.1 Discuss international and national codes and regulations 2.2 Identify the general content of MARPOL 73/78 Annex II 2.3 Describe the Bulk Chemical Codes	4	
3.0 Ship Design and Cargo Containment 3.1 Establish elements of design 3.2 Describe means of cargo segregation and containment 3.3 Provide details of tank materials and coatings	4	
4.0 Chemistry of Cargo and Applied Science 4.1 Outline physical and chemical properties of cargoes 4.2 Extract cargo information from chemical data resources 4.3 Explain the principle of the controlled tank atmosphere	4	
5.0 Cargo handling Systems 5.1 Describe pipeline, pumping and discharge arrangements 5.2 Explain arrangements for efficient stripping 5.3 Describe cargo heating systems 5.4 Describe venting arrangements 5.5 Outline instrumentation requirements	4	
6.0 Chemical Tanker Operations 6.1 Plan for safe carriage and correct handling of cargo 6.2 Describe procedures for loading 6.3 Measure and calculate cargo quantities 6.4 Care for cargo during transit 6.5 Preplan for discharge 6.6 Discharge cargo, strip and prewash 6.7 Conduct ballast and de-ballast operations 6.8 Conduct tank cleaning procedures and disposal of residues 6.9 Gas-free and ventilate cargo tanks 6.10 Test for cleanliness and product purity	7	
7.0 Pollution Prevention 7.1 Discuss pollution of the marine environment from chemical ships 7.2 Summarize regulatory requirements for pollution prevention 7.3 Describe measures of pollution control	3	

Subject Area	Hours	
	8.0 Health and safety	4
8.1 Describe health hazards associated with chemical cargoes		
8.2 Identify personal protection and safety equipment		
8.3 Describe the function and use of gas indicators		
8.4 Implement control measures for enclosed space safety		
8.5 Review fire-fighting principles		
9.0 Cargo and Emergency management	3	
9.1 Discuss the requirements of an emergency organization		
9.2 Describe ship and shore emergency alarms		
9.3 Summarize the International Safety Management System		
9.4 Develop criteria for different types of emergency		
	35 hours	4 hours
Total	39 hours	

6.8 Syllabus

Topics and Learning Objectives
<p>1. The Chemical Tanker</p> <p>1.1 Summarize the development of the chemical tanker trade</p> <p>1.1.1 Outline the growth of the chemical trade from the mid-1940's</p> <p>1.1.2 Describe the evolution of the transportation of chemicals in ships</p> <p>1.1.3 Explain the requirement for standardized international regulations</p> <p>1.2 Describe types of cargoes shipped in chemical tankers</p> <p>1.2.1 Differentiate hazardous goods in package form and liquid bulk chemicals</p> <p>1.2.2 Identify types of chemical tanker for the carriage of liquid bulk chemical cargoes</p> <p>1.2.3 Identify a Certificate of Fitness stating what chemicals can be carried for that particular vessel</p> <p>1.2.4 Identify the four main groups of chemical cargoes:</p> <p>1.2.4.1 Petrochemicals</p> <p>1.2.4.2 Alcohols and carbohydrates</p> <p>1.2.4.3 Vegetable and animal oils and fats</p> <p>1.2.4.4 Acids and inorganic chemicals</p> <p>1.2.5 Differentiate organic and inorganic chemicals and bases</p> <p>1.2.6 List examples of industrial products derived from the four main groups of chemical cargoes</p> <p>1.2.7 Identify additional cargoes carried on chemical tankers unrelated to chemicals</p> <p>1.3 Describe types of chemical tankers</p> <p>1.3.1 Identify:</p> <p>1.3.1.1 Parcel/chemical tanker</p> <p>1.3.1.2 Product/chemical tanker</p> <p>1.3.1.3 Specialized chemical tanker</p> <p>1.3.2 Explain the term parcel tanker</p> <p>1.3.3 Explain the difference between product tankers carrying refined product and chemical tankers carrying chemicals</p> <p>1.3.4 Name the division of chemical tankers in categories, Ship Types 1, 2 and 3</p> <p>1.3.5 Describe a modern chemical tanker general arrangement</p> <p>1.3.6 Identify general tank arrangements</p>
<p>2. Rules and regulations</p> <p>2.1 Discuss international and national codes and regulations</p> <p>2.1.1 List the most important rules affecting chemical tankers as:</p> <p>2.1.1.1 International conventions</p> <p>2.1.1.2 National regulations</p> <p>2.1.1.3 Classification society rules</p>

Topics and Learning Objectives

- 2.1.2 Identify the IMO as the international forum for shipping matters
- 2.1.3 Identify the main IMO conventions affecting tankers
 - 2.1.3.1 Define SOLAS 1974 as the International Convention for the Safety of Life at Sea, 1974
 - 2.1.3.2 Define MARPOL 73/78 as the International Convention for the Prevention of Pollution from Ships, 1973/1978
 - 2.1.3.3 Define STCW 1995 as the International Convention for Standards of Training, Certification and Watchkeeping, 1995
- 2.1.4 Explain how amendments affect the IMO conventions
- 2.1.5 Explain how the conventions are incorporated in national legislation
- 2.1.6 Differentiate MARPOL 73/78 Annex I and Annex II
- 2.1.7 Link the Cargo Ship Safety Construction Certificate to SOLAS 1974
- 2.1.8 Link the Cargo Ship Safety Equipment Certificate to SOLAS 1974
- 2.1.9 Link the International Oil Pollution Prevention Certificate to MARPOL 73/78
- 2.1.10 Link the International Pollution Prevention Certificate for the Carriage of Noxious Liquid Substances in Bulk to MARPOL 73/78
- 2.1.11 Link the requirements of the Bulk Chemical Codes to the International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk
- 2.1.12 Explain the use of supplements to the certificates
- 2.1.13 Explain the difference between International Pollution Prevention Certificate for the Carriage of Noxious Liquid Substances in Bulk and the International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk
- 2.1.14 State the ISM Code is the International Safety Management Code
- 2.1.15 State a Safety Management System must be in place as required by the ISM Code
- 2.1.16 Identify the agencies responsible for the issue of certificates
 - 2.1.16.1 Flag State
 - 2.1.16.2 Delegated agencies
- 2.1.17 Identify regulations under the CSA affecting chemical tankers
- 2.2 Identify the general content of MARPOL 73/78 Annex II**
 - 2.2.1 Define 'chemical tanker' from MARPOL Annex II
 - 2.2.2 Determine the application of MARPOL 73/78 Annex II to chemical and oil tankers
 - 2.2.3 Define 'noxious liquid substance' (NLS)
 - 2.2.4 Categorize noxious liquid substances (NLS) according to MARPOL 73/78 Annex II
 - 2.2.5 Identify level of risk for each category
 - 2.2.6 Outline how the discharge of NLS is controlled according to pollution category and location
 - 2.2.7 Outline the procedure for the provisional assessment of an uncategorized liquid substance
 - 2.2.8 Identify carriage requirements of oil-like substances from 1 January 2007
 - 2.2.9 Identify carriage requirements of vegetable oils from 1 January 2007
 - 2.2.10 Describe a Procedures and Arrangements Manual (P&A Manual)
 - 2.2.10.1 State which ships must carry a P&A Manual
 - 2.2.10.2 Describe the arrangements of the P&A manual
 - 2.2.10.3 State the P&A Manual is approved by the Administration only for that ship
 - 2.2.10.4 Explain how the procedures in the P&A Manual ensure compliance with Annex II
 - 2.2.10.5 Link the information provided in the P&A Manual to the Certificate of Fitness
 - 2.2.10.6 Explain the use of the Flow Diagrams of addendum A of Appendix 4
 - 2.2.11 Identify and describe the Cargo Record Book (CRB)
 - 2.2.11.1 Identify, from MARPOL 73/78 Annex II, the requirements for a CRB
 - 2.2.11.2 Explain what entries must be made in the CRB
 - 2.2.11.3 Illustrate correct and complete entries in the CRB
 - 2.2.11.4 Explain the legal implications of the CRB
- 2.3 Describe the Bulk Chemical Codes**
 - 2.3.1 Define IBC Code and BCH Code
 - 2.3.2 State the dates of compliance for the Codes
 - 2.3.3 Link the Codes to SOLAS 74 and MARPOL 73/78
 - 2.3.4 Summarize the content of the Codes

Topics and Learning Objectives

- 2.3.5 Differentiate Chapter IV and Chapter VII of the BCH Code
- 2.3.6 Differentiate Chapter 17 and Chapter 18 of the IBC Code
- 2.3.7 Explain the Pollution Category of NLS in the Codes
- 2.3.8 Identify the Index of Products Carried in Bulk
- 2.3.9 Identify specific and operational requirements listed in the tables of Chapter 17 of the IBC Code

3. Ship Design and Cargo Containment

3.1 Establish elements of design

- 3.1.1 Identify general tank and ship arrangements
- 3.1.2 State the Codes that primarily deal with ship design and equipment
- 3.1.3 Identify ship types from the Bulk Chemical Codes
- 3.1.4 Explain the reason for ship types as defined in the Codes
- 3.1.5 Identify the hierarchy of ship types from 3 through 1 in relation to dangerous and noxious properties of cargoes to be carried
- 3.1.6 Explain how the ship type prescribes the survival capability
- 3.1.7 Explain assumed damage in relation to the ship types
- 3.1.8 Identify the inboard location of cargo tanks for each ship type
- 3.1.9 Describe other safety aspects of design in relation to:
 - 3.1.9.1 Accommodation, service and machinery spaces and control rooms
 - 3.1.9.2 Cargo and/or ballast pump-rooms
 - 3.1.9.3 Ventilation of pump-rooms and/or similar spaces
 - 3.1.9.4 Location of cargo tank vents
 - 3.1.9.5 Electrical installations
- 3.1.10 Describe how tank design assists with:
 - 3.1.10.1 Decreased residues
 - 3.1.10.2 Increased cargo outturn
 - 3.1.10.3 Prevention of cargo contamination

3.2 Describe means of cargo segregation and containment

- 3.2.1 Identify references from the Codes dealing with segregation and containment
- 3.2.2 Define:
 - 3.2.2.1 Independent tank
 - 3.2.2.2 Integral tank
 - 3.2.2.3 Gravity tank
 - 3.2.2.4 Pressure tank
- 3.2.3 Describe the importance of segregation and containment of cargoes and spaces from:
 - 3.2.3.1 Accommodation, service and machinery spaces
 - 3.2.3.2 Drinking water and stores for human consumption
- 3.2.4 Explain how segregation is achieved using:
 - 3.2.4.1 Cofferdams
 - 3.2.4.2 Void spaces
 - 3.2.4.3 Cargo pump-rooms
 - 3.2.4.4 Pump-rooms
 - 3.2.4.5 Empty tanks
 - 3.2.4.6 Oil fuel tanks
 - 3.2.4.7 Other similar spaces

3.3 Provide details of tank materials and coatings

- 3.3.1 Explain why coatings, fixtures and fittings must be compatible with cargoes to be carried
- 3.3.2 Explain the reasons for the use of stainless steel and coatings in cargo tanks
- 3.3.3 Explain the use of stainless steel for cargo piping, valves and pumps
- 3.3.4 Differentiate 'clad' and 'solid' stainless steel
- 3.3.5 Show tank layouts using stainless steel and coatings
- 3.3.6 Describe the limitations and possibilities of specialized tank coatings
 - 3.3.6.1 Zinc silicate
 - 3.3.6.2 Epoxy
 - 3.3.6.3 Phenolics

Topics and Learning Objectives

- 3.3.6.4 Polyurethane
- 3.3.7 Differentiate organic and inorganic coatings
- 3.3.8 Explain the use of rubber linings for highly corrosive cargoes
- 3.3.9 Explain the resistance of coatings to groups of chemicals
 - 3.3.9.1 Identify the manufacturers 'coating resistance list'
- 3.3.10 Describe in general terms maintenance of coatings
- 3.3.11 Explain physical and chemical absorption of coatings and subsequent cargo contamination

4. Chemistry of Cargo and Applied Science

4.1 Outline physical and chemical properties of cargoes

- 4.1.1 Explain the following terms:
 - 4.1.1.1 States of aggregation
 - 4.1.1.2 Melting point
 - 4.1.1.3 Boiling point
 - 4.1.1.4 Partial pressure
 - 4.1.1.5 Vapour pressure
 - 4.1.1.6 Volatility
 - 4.1.1.7 Liquid density, specific gravity, litre weight
 - 4.1.1.8 Vapour density
 - 4.1.1.9 Viscosity, surface tension, adhesion, cohesion
 - 4.1.1.10 Solubility, miscibility
 - 4.1.1.11 Diffusion
- 4.1.2 Introduce Cargo Data Sheets
- 4.1.3 Explain the physical data of liquid chemicals given in Cargo Data Sheets
- 4.1.4 Differentiate organic and inorganic chemistry
- 4.1.5 Explain:
 - 4.1.5.1 The structure of atoms
 - 4.1.5.2 Atomic weight
 - 4.1.5.3 Atomic number
 - 4.1.5.4 The structure of the Periodic Table
- 4.1.6 Explain the structure of:
 - 4.1.6.1 A saturated hydrocarbon molecule
 - 4.1.6.2 An unsaturated hydrocarbon molecule
 - 4.1.6.3 An aromatic hydrocarbon molecule
 - 4.1.6.4 A halogenated hydrocarbon molecule
 - 4.1.6.5 An alcohol molecule
- 4.1.7 Explain:
 - 4.1.7.1 Acid
 - 4.1.7.2 Base
 - 4.1.7.3 PH value
 - 4.1.7.4 Neutralization reaction
- 4.1.8 Explain the following reactions:
 - 4.1.8.1 Chemical reaction
 - 4.1.8.2 Exothermic
 - 4.1.8.3 Endothermic
 - 4.1.8.4 Polymerization
 - 4.1.8.5 Decomposition
- 4.1.9 Explain:
 - 4.1.9.1 Catalyst
 - 4.1.9.2 Inhibitor
- 4.1.10 Name cargoes which:
 - 4.1.10.1 Self-react
 - 4.1.10.2 Polymerize
 - 4.1.10.3 Require an inhibitor
 - 4.1.10.4 React with air

Topics and Learning Objectives

- 4.1.10.5 React with water
- 4.1.10.6 React between cargoes
- 4.1.11 Identify reactions of cargoes with tank coatings and tank materials
- 4.2 Extract cargo information from chemical data resources**
 - 4.2.1 Identify CFR46-150 Cargo Compatibility Charts or other Cargo Compatibility Charts
 - 4.2.2 Describe the use of the Index of Products Carried in Bulk
 - 4.2.3 Explain the importance of correct technical names and synonyms
 - 4.2.4 Explain the term cargo compatibility
 - 4.2.5 Explain the grouping of cargoes using Cargo Compatibility Charts
 - 4.2.6 Use the Charts to identify cargoes which may be incompatible
- 4.3 Explain the principle of the controlled tank atmosphere**
 - 4.3.1 Define:
 - 4.3.1.1 Flashpoint
 - 4.3.1.2 Auto-ignition temperature
 - 4.3.2 Identify flash point of a liquid chemical from data sheets
 - 4.3.3 Describe flammable range, lower flammable limit (LFL) and upper flammable limit (UFL)
 - 4.3.4 Identify a flammability composition diagram
 - 4.3.5 Name the critical components of the flammability diagram
 - 4.3.6 Describe, with the aid of a flammability diagram, the effects of:
 - 4.3.6.1 gas freeing
 - 4.3.6.2 purging
 - 4.3.6.3 dilution with air
 - 4.3.6.4 critical dilution with air
 - 4.3.6.5 dilution with inert gas
 - 4.3.7 Explain flammable range in relation to different chemicals
 - 4.3.8 Differentiate inert and non-inert tank atmosphere
 - 4.3.9 Identify regulations for inert gas systems on chemical tankers
 - 4.3.9.1 Identify IMO Regulations for Inert Gas Systems on Chemical Tankers
 - 4.3.9.1.1 Identify components of IG generator systems contained in the Annex
 - 4.3.9.1.2 Identify requirements for detailed instruction manuals
 - 4.3.9.2 Identify other IMO Resolutions affecting Chemical Tankers
 - 4.3.10 Define 'inert gas'
 - 4.3.11 Explain how inert gas is used in cargo tanks
 - 4.3.11.1 Protection against polymerization, oxidation and humidity
 - 4.3.11.2 Replace air to prevent fire and explosion
 - 4.3.12 Describe methods of production and supply of inert gas
 - 4.3.13 Explain why nitrogen is used instead of inert gas

5. Cargo handling Systems

- 5.1 Describe pipeline, pumping and discharge arrangements**
 - 5.1.1 Describe general cargo piping arrangements on chemical tankers
 - 5.1.2 Identify materials of construction
 - 5.1.3 Identify and describe commonly used types of valve
 - 5.1.3.1 Ball valves
 - 5.1.3.2 Membrane valves
 - 5.1.3.3 Gate valves
 - 5.1.3.4 Butterfly valves
 - 5.1.4 Describe cargo segregation in terms of:
 - 5.1.4.1 Segregation by two valves
 - 5.1.4.2 Spool-pieces
 - 5.1.5 Discuss the care, handling and use of cargo hoses:
 - 5.1.5.1 Compatibility and suitability with chemical cargoes
 - 5.1.5.2 Cargo temperature limitations
 - 5.1.5.3 Inspection and testing procedures
 - 5.1.5.4 Certification of hoses

Topics and Learning Objectives

- 5.1.5.5 Maintenance and correct handling
- 5.1.6 Describe the construction and operation of pumps found on chemical tankers:
 - 5.1.6.1 Centrifugal
 - 5.1.6.2 Piston
 - 5.1.6.3 Screw
 - 5.1.6.4 Eductors
- 5.1.7 Explain basic pumping concepts
- 5.1.8 Describe deepwell pumps and submerged pumps
- 5.1.9 Discuss the benefits of the deepwell and submerged pump
- 5.1.10 Discuss the limitations of deepwell and submerged pumps
- 5.1.11 Explain the pump graph with regard to:
 - 5.1.11.1 Performance curve
 - 5.1.11.2 Efficiency
 - 5.1.11.3 Power consumption
 - 5.1.11.4 NPSH
- 5.1.12 Explain the terms:
 - 5.1.12.1 Total head
 - 5.1.12.2 Design point
 - 5.1.12.3 NPSH
 - 5.1.12.4 Cavitation
- 5.1.13 Explain the characteristics and dangers of running two or more pumps in parallel
- 5.1.14 Explain how discharge rate is affected by:
 - 5.1.14.1 Pressure in shore-tank
 - 5.1.14.2 Static back-pressure
 - 5.1.14.3 Dynamic back-pressure
- 5.1.15 Describe stripping using an eductor
- 5.1.16 Describe stripping arrangements using a deepwell pump
- 5.2 Explain arrangements for efficient stripping**
 - 5.2.1 Use the Code and identify examples of:
 - 5.2.1.1 Pollution Category X substances
 - 5.2.1.2 Pollution Category Y substances
 - 5.2.1.3 Pollution Category Z substances
 - 5.2.1.4 Pollution Category OS substances
 - 5.2.2 Describe the importance of efficient stripping with regard to the Categories
 - 5.2.3 Describe the stripping test and efficiency parameters
 - 5.2.4 Explain effects of viscosity and melting point during stripping
 - 5.2.5 Explain efficient stripping with regard to:
 - 5.2.5.1 Using compressed gas
 - 5.2.5.2 Not using compressed gas
 - 5.2.6 Use MARPOL 73/78 Regulation 12 to discuss the maximum quantities of residues permitted
- 5.3 Describe cargo heating systems**
 - 5.3.1 Explain the importance of heating for some cargoes
 - 5.3.2 Describe different heating medium
 - 5.3.3 Describe heating systems using:
 - 5.3.3.1 Heating coils
 - 5.3.3.2 Deck mounted heat exchanger
 - 5.3.4 Explain the risks associated with overheating cargo
 - 5.3.5 Explain the risks and dangers associated with poor maintenance of heating systems
 - 5.3.6 Identify problems associated with heated cargoes adjacent to polymerizable or inhibited cargoes
 - 5.3.7 Identify dangers associated with heated cargoes adjacent to highly volatile cargoes
- 5.4 Describe venting arrangements**
 - 5.4.1 Use the IBC Code to define open and controlled ventilation systems
 - 5.4.2 Discuss load rates and ventilation capacity
 - 5.4.3 Explain the design of safe ventilation to minimize cargo vapours in areas open to access by personnel

Topics and Learning Objectives

- 5.4.4 Explain the limitations and risks of open-venting
- 5.4.5 Explain when controlled venting is required
- 5.4.6 Describe the reason for and use of the vapour return
- 5.4.7 Describe safety aspects of vent design, including:
 - 5.4.7.1 Flame arrestors
 - 5.4.7.2 Flame screens
 - 5.4.7.3 High-velocity vents
- 5.4.8 Explain the mode of operation and precautions of:
 - 5.4.8.1 High-velocity valve
 - 5.4.8.2 Flame arrestor
- 5.4.9 Explain the purpose and operation of a pressure/vacuum valve (P/V's)
- 5.4.10 Discuss general precautions and maintenance of P/V's
- 5.5 Outline instrumentation requirements**
 - 5.5.1 Explain the terms intrinsically safe, flameproof and increased safety equipment
 - 5.5.2 Describe the principles of operation and types of gauging devices for cargo tanks
 - 5.5.3 Explain the terms:
 - 5.5.3.1 Open gauging
 - 5.5.3.2 Restricted gauging
 - 5.5.3.3 Closed gauging
 - 5.5.4 Describe the limitations of open and restricted gauging with regard to open venting
 - 5.5.5 Explain the use and purpose of high-alarm systems for cargoes
 - 5.5.6 Explain the tank overflow control system
 - 5.5.7 Describe the test instruments necessary for toxic and flammable cargoes
 - 5.5.8 Discuss fixed and portable vapour-detection instruments

6. Chemical Tanker Operations

6.1 Plan for safe carriage and correct handling of cargo

- 6.1.1 Identify the role and responsibilities of the cargo planner
- 6.1.2 Describe the key elements of cargo planning, including:
 - 6.1.2.1 Cargo requirements
 - 6.1.2.2 Stowage and segregation
 - 6.1.2.3 Cargo compatibility and reactivity
 - 6.1.2.4 Tank coatings
 - 6.1.2.5 Tank preparation, cleanliness and product purity
 - 6.1.2.6 Trading pattern and load and discharge rotation
 - 6.1.2.7 Nitrogen supply
 - 6.1.2.8 Slop disposal
- 6.1.3 Identify minimum requirements from Chapter 17 of the Code
- 6.1.4 Use Chemical data Sheets and CFR46-150 to identify physical and chemical properties of some sample cargoes
- 6.1.5 Identify correct technical name and methods to verify the above
- 6.1.6 Use a cargo compatibility chart to determine suitability of cargoes adjacent to each other
- 6.1.7 Use a Tank Lining Guide to ascertain suitability of cargo coatings for different cargoes
- 6.1.8 Discuss the importance of tank cleanliness for the loading of cargoes
- 6.1.9 Explain the requirements of heating, padding and blanketing
- 6.1.10 Explain the reasons for not stowing toxic cargoes next to edible cargoes
- 6.1.11 Identify additional stowage requirements for toxic products
- 6.1.12 Identify requirements for inhibited cargoes

6.2 Describe procedures for loading

- 6.2.1 Identify the cargo information and shipping documents required for safe loading of cargoes
- 6.2.2 Explain the important operational requirements from the Codes
- 6.2.3 Describe the stowage plan and its role in preplanning
- 6.2.4 Describe general tanker precautions to be taken prior to loading
- 6.2.5 Explain lining up for loading

Topics and Learning Objectives

- 6.2.6 Describe different methods of loading and precautions to be taken:
 - 6.2.6.1 Over the top
 - 6.2.6.2 Through the drop line
 - 6.2.6.3 Through the deepwell pump and/or drop line
 - 6.2.6.4 Through the pump-room
- 6.2.7 Explain:
 - 6.2.7.1 Inerting
 - 6.2.7.2 Padding
 - 6.2.7.3 Drying
- 6.2.8 Explain the requirements for line and cargo sampling
- 6.2.9 Describe the load sequence
- 6.2.10 Describe procedures to take on completion of loading
- 6.2.11 List general precautions during lightering operations
- 6.3 Measure and calculate cargo quantities**
 - 6.3.1 Explain why cargo quantities are limited for Type 1 and Type 2 tankers
 - 6.3.2 Predict expansion of cargo due to high-temperatures
 - 6.3.3 Identify from the Code special requirements for maximum tank filling limits
 - 6.3.4 Define:
 - 6.3.4.1 Ullage
 - 6.3.4.2 Innage
 - 6.3.4.3 Sounding
 - 6.3.5 Identify units of measurement used in cargo calculations
 - 6.3.6 Use ullage tables to calculate tank quantities, allow for corrections and correct for temperature
 - 6.3.7 Show a cargo report
- 6.4 Care for cargo during transit**
 - 6.4.1 Explain precautions to take to avoid cargo loss during transit
 - 6.4.2 Explain how to maintain cargo temperature according to shipper's instructions
 - 6.4.3 Explain cargo care and safety during transit
 - 6.4.4 Outline the requirements for care and transportation of vegetable and animal oils and fats
 - 6.4.5 Identify requirements for inhibitors and where this information is obtained
 - 6.4.6 Identify the Certificate of Inhibition
- 6.5 Preplan for discharge**
 - 6.5.1 Identify the cargo information and shipping documents required for safe discharge of cargoes
 - 6.5.2 Identify the operational tests required prior to arrival at the disport
 - 6.5.3 Identify inerting and drying requirements, if applicable
 - 6.5.4 Explain the requirements for line and cargo sampling
 - 6.5.5 Describe general tanker precautions to be taken prior to discharging
 - 6.5.6 Identify trim requirements for efficient stripping
 - 6.5.7 Explain techniques and precautions for discharge of high vapour pressure cargoes
- 6.6 Discharge cargo, strip and prewash**
 - 6.6.1 Identify maximum allowed stripping quantity left after discharge for Categories X, Y and Z substances
 - 6.6.2 Discuss measures of control for Category X substances
 - 6.6.2.1 Required washing on completion of discharge
 - 6.6.2.2 Exemptions from washing requirements
 - 6.6.2.3 Reception facilities and concentration of substance in the effluent discharge to shore
 - 6.6.2.4 Action to take when unable to measure concentration of residues after discharge
 - 6.6.2.5 Limitations on subsequent discharge of wash water or ballast into the sea
 - 6.6.3 Discuss measures of control for Categories Y and Z substances
 - 6.6.3.1 Conditions for pre-wash on completion of discharge
 - 6.6.3.2 Exemptions from washing requirements
 - 6.6.3.3 Procedures for solidifying and non-solidifying substances
 - 6.6.3.4 Procedures for high-viscosity and low-viscosity substances
 - 6.6.3.5 Operational requirements for ballasting and de-ballasting
 - 6.6.3.6 Prohibition of discharges in the Antarctic Area

Topics and Learning Objectives

- 6.6.4 Discuss slop tank discharge restrictions and requirements
- 6.6.5 Describe procedures to take on completion of discharge
- 6.6.6 Make entries in the Cargo Record Book
- 6.7 Conduct ballast and de-ballast operations**
 - 6.7.1 Identify an independent ballast pipeline and pumping arrangement
 - 6.7.2 Comply with the requirements of the P&A Manual
 - 6.7.3 Describe a ballast/de-ballast sequence identifying:
 - 6.7.3.1 General stability and trim requirements
 - 6.7.3.2 Stability problems with different ballast tank configurations
 - 6.7.3.3 Ballasting during cargo operations using segregated ballast tanks (SBT)
 - 6.7.3.4 Precautions to take before and during ballasting of cargo tanks
 - 6.7.3.5 Free surface effect
- 6.8 Conduct tank cleaning procedures and disposal of residues**
 - 6.8.1 List the reasons for tank cleaning
 - 6.8.2 Comply with the requirements of the P&A Manual
 - 6.8.3 Describe the use of tank cleaning guides such as Verwey's Tank Cleaning Guide
 - 6.8.4 Describe the water washing process and components of the cleaning system
 - 6.8.5 Explain the use of cleaning agents or additives during tank cleaning
 - 6.8.6 Explain the use of other liquids for water reactive residues
 - 6.8.7 Consult resistance lists for tank coatings
 - 6.8.8 Use a Tank Cleaning Guide and provide an example for cleaning a cargo tank
 - 6.8.9 Identify and describe phases of tank cleaning
 - 6.8.9.1 Prewash
 - 6.8.9.2 Main wash
 - 6.8.9.3 Fresh water rinse
 - 6.8.9.4 Gas-freeing and/or ventilation
 - 6.8.9.5 Drying
 - 6.8.9.6 Inspection/testing
 - 6.8.10 Explain the use of a Cleaning and Disposal Procedure (CDP) flow diagram
- 6.9 Gas-free and ventilate cargo tanks**
 - 6.9.1 Explain the purpose of gas-freeing
 - 6.9.2 Describe the equipment used for gas-freeing
 - 6.9.3 Explain different ventilation methods with regard to:
 - 6.9.3.1 Type of equipment
 - 6.9.3.2 Weight of cargo vapours
 - 6.9.3.3 Shape of the tank
 - 6.9.4 Describe safety precautions to take during gas freeing
 - 6.9.5 Describe the equipment used for checking for a gas-free tank
 - 6.9.6 Describe, with the aid of a flammability diagram, a gas-freeing operation by ventilation with air of a tank containing a mixture of:
 - 6.9.6.1 Cargo vapour and air
 - 6.9.6.2 Cargo vapour and inert gas
 - 6.9.7 Explain when a tank is considered to be gas-free
- 6.10 Test for cleanliness and product purity**
 - 6.10.1 Explain the importance of tank cleanliness
 - 6.10.2 Describe the standards expected for tank cleanliness
 - 6.10.3 Discuss the role of the independent surveyor and the issue of the 'Clean Certificate'
 - 6.10.4 Demonstrate a test for contamination by hydrocarbons
 - 6.10.5 Demonstrate a test for contamination by chloride
 - 6.10.6 Describe the permanganate time test
 - 6.10.7 Demonstrate an 'acid wash' test
 - 6.10.8 Demonstrate the use of a colour scale

Topics and Learning Objectives

7. Pollution Prevention

7.1 Discuss pollution of the marine environment from chemical ships

- 7.1.1 Identify major worldwide pollution incidents
- 7.1.2 Describe how pollution can occur from chemical tankers:
 - 7.1.2.1 In port
 - 7.1.2.2 At sea
- 7.1.3 Describe damage to the marine environment from chemical tankers
- 7.1.4 State the penalties for pollution of Canadian waters

7.2 Summarize regulatory requirements for pollution prevention

- 7.2.1 Identify ships to which MARPOL 73/78 Annex II (as amended) applies
- 7.2.2 Identify the categorization of chemicals and the guidelines for categorization
- 7.2.3 Explain, briefly, how chemicals are categorized
- 7.2.4 Define GESAMP
- 7.2.5 Explain the GESAMP hazard profiles with regard to ship types
- 7.2.6 Explain the practical execution of Annex II of MARPOL 73/78 based on:
 - 7.2.6.1 Efficient stripping
 - 7.2.6.2 Mandatory pre-wash
 - 7.2.6.3 Control in port
- 7.2.7 Explain the discharge into the sea of NLS based on:
 - 7.2.7.1 Category of NLS
 - 7.2.7.2 Control of discharges
- 7.2.8 Identify the stripping test to assess residue quantities left in tanks
- 7.2.9 Explain the main purpose of the P&A manual with regard to pollution
- 7.2.10 Identify CSA 'Regulations for the Prevention of Pollution from Ships and for Dangerous Chemicals'
 - 7.2.10.1 Identify what sections apply to chemical tankers
 - 7.2.10.2 Explain the provisions, prohibition and exceptions for discharge in waters under Canadian jurisdiction
 - 7.2.10.3 Identify the main requirements dealing with Transfer Operations
- 7.2.11 Explain when the following certificates are issued:
 - 7.2.11.1 Canadian Noxious Liquid Substances Certificate
 - 7.2.11.2 International Pollution Prevention Certificate for the Carriage of Noxious Liquid Substances in bulk
 - 7.2.11.3 Canadian Certificate of Fitness for the carriage of Dangerous Chemicals in Bulk
 - 7.2.11.4 International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk
 - 7.2.11.5 Certificate of Compliance
- 7.2.12 Identify the requirements for a shipboard marine pollution emergency plan for noxious liquid substances in MARPOL 73/78 Annex II (SMPEP)

7.3 Describe measures of pollution control

- 7.3.1 Summarize the content of a SMPEP
- 7.3.2 Discuss the importance of timely response to marine spills
- 7.3.3 Evaluate the effects of timely and delayed response to a marine spill
- 7.3.4 List pollution prevention equipment required on board
- 7.3.5 Describe methods of containment using ship pollution equipment
- 7.3.6 Describe pollution prevention equipment limitations
- 7.3.7 Discuss the use of chemical dispersants and detergents
- 7.3.8 Identify parties responsible for:
 - 7.3.8.1 Clean up
 - 7.3.8.2 Resources available
 - 7.3.8.3 Assistance available
 - 7.3.8.4 Supply of pollution prevention equipment
 - 7.3.8.5 Disposal
 - 7.3.8.6 Costs for a marine spill
- 7.3.9 List equipment available from a shore based pollution response centre
- 7.3.10 Identify resources for response to chemical pollutions

Topics and Learning Objectives

8. Health and Safety

8.1 Describe health hazards associated with chemical cargoes

- 8.1.1 Define 'health hazard' as provided in the Code
- 8.1.2 Identify the IMO Medical First Aid Guide for Accidents Involving Dangerous Goods (MFAG)
- 8.1.3 Identify health hazards posed by cargoes:
 - 8.1.3.1 Toxicity
 - 8.1.3.2 Asphyxia
 - 8.1.3.3 Corrosivity
- 8.1.4 Explain how chemicals may enter and affect the human body
- 8.1.5 Explain the synergistic effect of some chemicals
- 8.1.6 Describe toxic effects from:
 - 8.1.6.1 Vapours from fires of certain chemicals
 - 8.1.6.2 Inhibitors
 - 8.1.6.3 Inert gas
- 8.1.7 Describe the general symptoms of poisoning
- 8.1.8 Explain the general symptoms of asphyxia
- 8.1.9 Identify 'health data' from Cargo Data Sheets or CFR 46-150
- 8.1.10 Identify health hazard criteria from the Code
- 8.1.11 Show and explain a Material Safety Data Sheet for sample products
- 8.1.12 Differentiate MSDS and Cargo Hazard Sheets
- 8.1.13 Identify 'health data' from MSDS
- 8.1.14 Extract first-aid procedures from Cargo Data Sheets
- 8.1.15 Identify medical first-aid equipment provided onboard including oxygen resuscitation equipment and antidotes for products carried
- 8.1.16 Explain when professional medical treatment and advice should be sought
- 8.1.17 Extract information from the MFAG for sample products

8.2 Identify personal protection and safety equipment

- 8.2.1 Identify personnel protection requirements from the Code
- 8.2.2 List typical protective equipment required onboard
- 8.2.3 Identify how used and contaminated equipment is segregated from accommodation spaces
- 8.2.4 List additional safety equipment required for ships carrying toxic products and certain cargoes
- 8.2.5 Differentiate total protection and partial protection
- 8.2.6 Demonstrate the use of personal safety and protective equipment

8.3 Describe the function and use of gas indicators

- 8.3.1 Describe the operating principle of:
 - 8.3.1.1 A catalytic-filament combustible-gas indicator
 - 8.3.1.2 A non-catalytic heated-filament gas indicator
 - 8.3.1.3 A refractive index meter
 - 8.3.1.4 Chemical indicator tubes
 - 8.3.1.5 An oxygen meter with paramagnetic sensors
 - 8.3.1.6 An oxygen analyzer with electrolytic sensor
 - 8.3.1.7 An oxygen analyzer with selective chemical absorption liquid
- 8.3.2 Carry-out instrument-check procedures and gas measurements
- 8.3.3 Determine the suitability of each gas indicator
- 8.3.4 Explain the role of the marine chemist
- 8.3.5 Identify and describe the Gas Free Certificate
- 8.3.6 Describe the content, details and use of work permits
- 8.3.7 Explain the terms intrinsically safe, flameproof and increased safety equipment

8.4 Implement control measures for enclosed space safety

- 8.4.1 Define the enclosed space
- 8.4.2 Identify enclosed spaces
- 8.4.3 Identify potential hazards
- 8.4.4 Discuss role and duties of a 'responsible person'
- 8.4.5 Review the requirements of the SMS

Topics and Learning Objectives

- 8.4.6 Discuss Permit to Work Systems
- 8.4.7 Discuss Work Planning Meetings
- 8.4.8 Analyze check lists by identifying important elements
- 8.4.9 Assess hazards prior to entry
- 8.4.10 Recommend procedures and practices for pump-room safety
- 8.4.11 Recommend procedures and safety practices for tank entry
 - 8.4.11.1 List precautions to take for tank entry
 - 8.4.11.2 Identify tank atmosphere test procedures
 - 8.4.11.3 List equipment required
 - 8.4.11.4 Identify key personnel
 - 8.4.11.5 Analyze tank entry checklists
- 8.4.12 Simulate tank entry and evacuation procedures
 - 8.4.12.1 Use tank evacuation equipment
 - 8.4.12.2 Resuscitation equipment
 - 8.4.12.3 Self-contained breathing apparatus
- 8.5 Review fire-fighting principles**
 - 8.5.1 Explain the principles of fire prevention
 - 8.5.2 List sources of emission of flammable cargo vapours
 - 8.5.3 Identify possible ignition sources on chemical tankers
 - 8.5.4 Identify fire safety measures for tankers from SOLAS 74, exceptions and additional requirements from the Code
 - 8.5.5 List methods of controlling fire
 - 8.5.6 Describe advantages, disadvantages and methods of controlling fires on chemical tankers with:
 - 8.5.6.1 Water
 - 8.5.6.2 Foam
 - 8.5.6.3 Inert gas
 - 8.5.6.4 Carbon dioxide
 - 8.5.6.5 Dry chemical
 - 8.5.7 Identify in Chapter 17 of the Code fire protection requirements
 - 8.5.8 Identify additional fire control problems with certain chemicals

9. Cargo and Emergency Management

9.1 Discuss the requirements of an emergency organization

- 9.1.1 List the main components of an emergency organization
- 9.1.2 Explain the function of an emergency organization
- 9.1.3 List information that should be available to the emergency organization
- 9.1.4 Give an overview of general emergency procedures
- 9.1.5 Simulate the action required for different emergencies

9.2 Describe ship and shore emergency alarms

- 9.2.1 Describe different ship alarms used in cases of emergency
- 9.2.2 Describe shore and terminal alarms used in cases of emergency

9.3 Summarize the International Safety Management System

- 9.3.1 State the mandatory ISM Code requirements for Safety Management
- 9.3.2 State the objectives of the ISM Code
- 9.3.3 Describe the Document of Compliance (DOC) and the Safety Management Certificate (SMS)
- 9.3.4 State the requirements of a Safety Management Manual (SMM)
- 9.3.5 List the type of emergencies that require written procedures
- 9.3.6 Discuss the use of Contingency Plans

Topics and Learning Objectives

9.4 Develop criteria for different types of emergency

- 9.4.1 Identify the IMO publication 'Guidelines for the Development of Shipboard Emergency Response Plans'
- 9.4.2 Differentiate operational and non-operational emergencies
- 9.4.3 Discuss the use of emergency plans
- 9.4.4 Implement and evaluate the effectiveness of emergency plans
- 9.4.5 Develop criteria for monitoring alarms
- 9.4.6 Develop procedures for responding to alarms
- 9.4.7 Discuss training for emergencies
- 9.4.8 Discuss, with the use of casualty reports, emergency scenarios and responses

SPECIALIZED LIQUEFIED GAS TANKER SAFETY TRAINING

7.1 General

- 1) This chapter describes a course providing specialized Liquefied Gas Tanker safety training.
- 2) The completion of this course is necessary to obtain the *Specialized Liquefied gas tanker Training* endorsement on a deck or engineer officer certificate. Refer to Section 228 of the *Marine Personnel Regulations* for details regarding the requirements of this endorsement and training according to personnel responsibilities and position on board.

7.2 Objectives

- 1) Provide the training required under Section 167 of the *Marine Personnel Regulations* in order to obtain a *Specialized Oil Tanker Training* endorsement.
- 2) Enable the participants to take immediate responsibility for the loading, discharging or transfer of cargo and the operation of cargo equipment.

7.3 Duration

39 hours

7.4 Prerequisites

- 1) MED with respect to STCW basic safety
- 2) MED in advanced fire fighting
- 3) Successful completion of an approved training course in Liquefied gas tanker familiarization or holder of a Liquefied Gas Tanker Familiarization certificate or Endorsement

7.5 Specific instructor qualifications

The main course instructor must hold a Master Mariner or a First-class engineer certificate with a valid *Specialized Liquefied Gas Tanker Training* endorsement, but AMSP may consider lower certificates in special circumstances for instructors with additional experience on oil tankers. If the course is under the supervision of more than one instructor, the assistant instructors must hold qualifications related to the marine industry or have related skills and be approved in accordance with the *Quality Management Manual – Marine Personnel Standards and Pilotage*, referred to in Chapter 2.

7.6 Equipment requirements

- 1) Personnel safety equipment, including breathing apparatus;
- 2) Tank evacuation equipment;
- 3) Portable oxygen meter and oxygen analyser;
- 4) Portable combustible-gas indicator;
- 5) Portable interferometer;
- 6) Portable gas detector and sample detector tubes for vapours and gasses;
- 7) Resuscitator;
- 8) IMO medical first aid guide for accidents involving dangerous goods;
- 9) ISM Code;
- 10) IMO publication “Guidelines for the Development of Shipboard Emergency Response Plans”;
- 11) ISGOTT Liquefied Gas Handling Principles on ships and in terminals;

- 12) Chemical Tanker Safety Guide;
- 13) Sample health data and cargo data sheets, emergency plans and casualty reports;
- 14) Audio-visual presentation equipment.

7.7 Outline

Subject Area	Hours	
	Lecture	Practical
1.0 The Liquefied Gas Tanker 1.1 Summarize the development of the liquefied gas tanker trade 1.2 Describe types of liquefied gas tankers 1.3 Describe types of cargoes shipped in liquefied gas tankers	2	
2.0 Rules and Regulations 2.1 Discuss international and national codes and regulations 2.2 Describe the Gas Carrier Codes 2.3 Apply MARPOL 73/78 requirements for gas tankers	4	
3.0 Ship Design and Cargo Containment 3.1 Establish elements of design 3.2 Describe means of cargo segregation and containment	4	
4.0 Chemistry of Cargo and Applied Science 4.1 Outline physical and chemical properties of cargoes 4.2 Explain basic thermodynamic theory 4.3 Explain the principle of the controlled tank atmosphere	4	
5.0 Cargo Handling Systems 5.1 Describe pipeline, pumping and discharge arrangements 5.2 Describe heat exchangers 5.3 Describe reliquefaction plants and boil-off control 5.4 Describe venting arrangements 5.5 Outline instrumentation requirements	4	
6.0 Liquefied Gas Tanker Operations 6.1 Plan for port arrival 6.2 Describe procedures for loading 6.3 Measure and calculate cargo quantities 6.4 Care for cargo during transit 6.5 Preplan for discharge 6.6 Discharge cargo 6.7 Conduct ballast and de-ballast operations 6.8 Conduct cargo change-over procedures and tank cleaning 6.9 Gas-free and ventilate cargo tanks	7	
7.0 Pollution Prevention 7.1 Discuss pollution of the marine environment from liquefied gas tankers 7.2 Summarize regulatory requirements for pollution prevention 7.3 Describe measures of pollution control	3	
8.0 Health and Safety 8.1 Describe health hazards associated with liquefied gas cargoes 8.2 Identify personal protection and safety equipment 8.3 Describe the function and use of gas indicators 8.4 Implement control measures for enclosed space safety 8.5 Review fire-fighting principles	4	4

Subject Area	Hours	
9.0 Cargo and Emergency Management	3	
9.1 Discuss the requirements of an emergency organization		
9.2 Describe ship and shore emergency alarms		
9.3 Summarize the International Safety Management System		
9.4 Develop criteria for different types of emergency		
	35 hours	4 hours
Total	39 hours	

7.8 Syllabus

Topics and Learning Objectives
<p>1. The Liquefied Gas Tanker</p> <p>1.1 Summarize the development of the liquefied gas tanker trade</p> <p>1.1.1 Outline the growth of the liquefied gas trade from the late 1950's</p> <p>1.1.2 Describe the evolution of the transportation of liquefied gas in ships</p> <p>1.1.3 Explain the basic principle of gas transport</p> <p>1.1.4 Explain the requirement for standardized international regulations</p> <p>1.2 Describe types of liquefied gas tankers</p> <p>1.2.1 Identify:</p> <p>1.2.1.1 LNG carriers</p> <p>1.2.1.2 Fully refrigerated ships</p> <p>1.2.1.3 Ethylene carriers</p> <p>1.2.1.4 Semi-pressurized ships</p> <p>1.2.1.5 Pressurized ships</p> <p>1.2.2 Differentiate LNG and LPG carriers</p> <p>1.2.3 Explain the difference between liquefied gas tankers and chemical tankers</p> <p>1.2.4 Name the division of gas tankers into the four ship types</p> <p>1.2.5 Explain pressurized carriage</p> <p>1.2.6 Explain refrigerated carriage</p> <p>1.2.7 Identify different gas tankers from general arrangements (GA's)</p> <p>1.2.8 Identify general tank arrangements</p> <p>1.3 Describe types of cargoes shipped in liquefied gas tankers</p> <p>1.3.1 Differentiate liquefied gas and liquid bulk chemicals</p> <p>1.3.2 Define the terms:</p> <p>1.3.2.1 LNG</p> <p>1.3.2.2 NGL</p> <p>1.3.2.3 LPG</p> <p>1.3.2.4 LEG</p> <p>1.3.2.5 Chemical gases</p> <p>1.3.3 Identify sources of LNG, LPG and NGL</p> <p>1.3.4 Explain the relationship between natural gas, natural gas liquids (NGLs) and Liquefied Petroleum Gases (LPGs)</p> <p>1.3.5 Describe uses for LNG, LPG, NGL and the common chemical gases</p> <p>1.3.6 List the most common cargoes and their conditions of carriage</p> <p>1.3.7 Identify an International Certificate of Fitness for the Carriage of Liquefied Gases in Bulk stating what products can be carried in bulk for that particular vessel</p> <p>1.3.8 Explain what chemicals can be carried in liquefied gas carriers and the additional requirements</p>

Topics and Learning Objectives

2. Rules and Regulations

2.1 Discuss international and national codes and regulations

- 2.1.1 List the most important rules affecting gas tankers as:
 - 2.1.1.1 International conventions
 - 2.1.1.2 National regulations
 - 2.1.1.3 Classification society rules
- 2.1.2 Identify the IMO as the international forum for shipping matters
- 2.1.3 Identify the main IMO conventions affecting tankers
 - 2.1.3.1 Define SOLAS 1974 as the International Convention for the Safety of Life at Sea, 1974
 - 2.1.3.2 Define MARPOL 73/78 as the International Convention for the Prevention of Pollution from Ships, 1973/1978
 - 2.1.3.3 Define STCW 1995 as the International Convention for Standards of Training, Certification and Watchkeeping, 1995
- 2.1.4 Explain how amendments affect the IMO conventions
- 2.1.5 Explain how the conventions are incorporated in national legislation
- 2.1.6 Differentiate MARPOL 73/78 Annex I and Annex II
- 2.1.7 Link the Cargo Ship Safety Construction Certificate to SOLAS 1974
- 2.1.8 Link the Cargo Ship Safety Equipment Certificate to SOLAS 1974
- 2.1.9 Link the International Oil Pollution Prevention Certificate to MARPOL 73/78
- 2.1.10 Link the International Pollution Prevention Certificate for the Carriage of Noxious Liquid Substances in Bulk to MARPOL 73/78
- 2.1.11 Link the requirements of the Gas Carrier Codes to the International Certificate of Fitness for the Carriage of Liquefied Gases in Bulk
- 2.1.12 Explain when and why gas tankers may be issued with a Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk
- 2.1.13 Explain the use of supplements to the certificates
- 2.1.14 Explain the difference between International Pollution Prevention Certificate for the Carriage of Noxious Liquid Substances in Bulk and the International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk
- 2.1.15 State the ISM Code is the International Safety Management Code
- 2.1.16 State a Safety Management System must be in place as required by the ISM Code
- 2.1.17 Identify the agencies responsible for the issue of certificates
 - 2.1.17.1 Flag State
 - 2.1.17.2 Delegated agencies
- 2.1.18 Identify regulations under the CSA affecting gas tankers

2.2 Describe the Gas Carrier Codes

- 2.2.1 Define 'gas carrier'
- 2.2.2 Identify the Gas Carrier Codes:
 - 2.2.2.1 International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code)
 - 2.2.2.2 Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk
 - 2.2.2.3 Code for Existing Ships Carrying Liquefied Gases in Bulk
- 2.2.3 State the dates of compliance for the Gas Carrier Codes
- 2.2.4 Link the Gas Carrier Codes to SOLAS 74 and MARPOL 73/78
- 2.2.5 Explain the purpose of the Gas Carrier Codes
- 2.2.6 Summarize the content of the Gas Carrier Codes
- 2.2.7 List the content of Chapter 19 of the Gas Carrier Codes
- 2.2.8 Identify the Summary of Minimum Requirements from the Gas Carrier Codes, Chapter 19
- 2.2.9 Identify special requirements listed in the tables of the Gas Carrier Codes, Chapter 19
- 2.2.10 Identify the products in Chapter 19 of the Gas Carrier Codes, which are also covered by the Bulk Chemical Codes
- 2.2.11 Identify the Bulk Chemical Codes

Topics and Learning Objectives

- 2.2.12 Explain when a gas tanker must comply with both Gas Carrier Codes and Bulk Chemical Codes
- 2.2.13 Explain when the Gas Carrier Codes takes precedence over the Bulk Chemical Codes
- 2.2.14 Explain when a gas tanker must comply only with the Bulk Chemical Codes

2.3 Apply MARPOL 73/78 requirements for gas tankers

- 2.3.1 Determine the application of MARPOL 73/78 Annex II to gas tankers
- 2.3.2 Define 'noxious liquid substance' (NLS)
- 2.3.3 Categorize noxious liquid substances (NLS) according to MARPOL 73/78 Annex II
- 2.3.4 Identify level of risk for each category
- 2.3.5 Outline how the discharge of NLS is controlled according to pollution category and areas
- 2.3.6 Outline the procedure for the provisional assessment of an uncategorized liquid substance
- 2.3.7 Identify carriage requirements of oil-like substances from 1 January 2007
- 2.3.8 Describe a Procedures and Arrangements Manual (P&A Manual)
 - 2.3.8.1 Explain when a gas tanker must carry a P&A Manual
 - 2.3.8.2 State which ships must carry a P&A Manual
 - 2.3.8.3 Describe the arrangements of the P&A manual
 - 2.3.8.4 State the P&A Manual is approved by the Administration only for that ship
 - 2.3.8.5 Explain how the procedures in the P&A Manual ensure compliance with Annex II
 - 2.3.8.6 Link the information provided in the P&A Manual to the Certificate of Fitness
- 2.3.9 Identify and describe the Cargo Record Book (CRB)
 - 2.3.9.1 Identify the requirements for a CRB
 - 2.3.9.2 Explain what entries must be made in the CRB
 - 2.3.9.3 Illustrate correct and complete entries in the CRB
 - 2.3.9.4 Explain the legal implications of the CRB

3. Ship Design and Cargo Containment

3.1 Establish elements of design

- 3.1.1 Identify general tank and ship arrangements
- 3.1.2 State the primary purpose of the IMO Gas Carrier Codes
- 3.1.3 Identify ship types from the Gas Carrier Codes
- 3.1.4 Explain the reason for ship types as defined in the Gas Carrier Codes
- 3.1.5 Identify the hierarchy of ship types from 3G through 1G in relation to greatest overall hazard for products carried
- 3.1.6 Explain how the ship type prescribes the survival capability
- 3.1.7 Explain assumed damage in relation to the ship types
- 3.1.8 Identify the inboard location of cargo tanks for each ship type
- 3.1.9 Describe other safety aspects of design in relation to:
 - 3.1.9.1 Accommodation, service and machinery spaces and control stations
 - 3.1.9.2 Cargo pump rooms and cargo compressor rooms
 - 3.1.9.3 Cargo control rooms
 - 3.1.9.4 Access to spaces in the cargo area
 - 3.1.9.5 Air-locks and alarms
 - 3.1.9.6 Ventilation
 - 3.1.9.6.1 Positive pressure
 - 3.1.9.6.2 Negative pressure
 - 3.1.9.7 Bilge, ballast and fuel oil arrangements
 - 3.1.9.8 Location of cargo tank vents
 - 3.1.9.9 Electrical installations

3.2 Describe means of cargo segregation and containment

- 3.2.1 Identify references from the Gas Carrier Codes dealing with segregation and containment
- 3.2.2 Describe the terms:
 - 3.2.2.1 Gas-dangerous spaces
 - 3.2.2.2 Gas-dangerous zones
- 3.2.3 Differentiate 'gas-safe space' and 'gas-dangerous space'

Topics and Learning Objectives

- 3.2.4 Define:
 - 3.2.4.1 Integral tank
 - 3.2.4.2 Membrane tank
 - 3.2.4.3 Semi-membrane tank
 - 3.2.4.4 Independent tank
 - 3.2.4.5 Internal insulation tank
- 3.2.5 Explain the concept of the cargo containment system:
 - 3.2.5.1 Primary barrier (cargo tank)
 - 3.2.5.2 Secondary barrier (if fitted)
 - 3.2.5.3 Associated thermal insulation
 - 3.2.5.4 Intervening spaces
 - 3.2.5.5 Adjacent support structure
- 3.2.6 Discuss the following terms with regard to the cargo containment system:
 - 3.2.6.1 Thermal stress, expansion and contraction
 - 3.2.6.2 Stress caused by vapour pressure and weight of the liquid
 - 3.2.6.3 Stress caused by sloshing
 - 3.2.6.4 Type and thickness of tank material
 - 3.2.6.5 Types and thickness of insulation material
 - 3.2.6.6 Method of tank support
 - 3.2.6.7 Location of tank
 - 3.2.6.8 Cargo limitation
- 3.2.7 Explain each item of section 3.2.6 in relation to:
 - 3.2.7.1 Integral tanks
 - 3.2.7.2 Gaz Transport membrane tanks
 - 3.2.7.3 Technigaz membrane tanks
 - 3.2.7.4 Independent tanks of type A (LPG)
 - 3.2.7.5 Independent tanks of type A (Conch)
 - 3.2.7.6 Independent tanks of type B (Kvaerner-Moss/Moss Rosenberg)
 - 3.2.7.7 Independent tanks of type C
 - 3.2.7.8 Internal insulation tanks
- 3.2.8 Give examples of types of cargo suitable for each of the four ship types

4. Chemistry of Cargo and Applied Science

4.1 Outline physical and chemical properties of cargoes

- 4.1.1 Define liquefied gas
- 4.1.2 Explain the relationship between liquefied gas cargoes and hydrocarbons
- 4.1.3 Describe the characteristics of the hydrocarbon atom in various arrangements:
 - 4.1.3.1 Up to four carbon atoms
 - 4.1.3.2 5 to 20 carbon atoms
 - 4.1.3.3 More than 20 carbon atoms
- 4.1.4 Explain, with the aid of a molecular structure diagram:
 - 4.1.4.1 A saturated hydrocarbon molecule
 - 4.1.4.2 An unsaturated hydrocarbon molecule
 - 4.1.4.3 A typical chemical gas molecule
- 4.1.5 Describe the characteristics of chemical gases
- 4.1.6 Explain dewpoint
- 4.1.7 Give examples of typical liquefied gas cargoes that are:
 - 4.1.7.1 Saturated hydrocarbons
 - 4.1.7.2 Unsaturated hydrocarbons
 - 4.1.7.3 Chemical gases
- 4.1.8 Explain 'stenching' and how and why it is necessary
- 4.1.9 Explain the term 'inhibitor' and the general characteristics of inhibitors
- 4.1.10 Explain the reason for and use of inhibitors for 'unstable' and reactive cargoes
- 4.1.11 Identify and describe a Certificate of Inhibition
- 4.1.12 Describe the conditions for transportation of some reactive cargoes, which do not require an inhibitor

Topics and Learning Objectives

- 4.1.13 Explain the following and the density temperature relationship:
 - 4.1.13.1 Density of liquids
 - 4.1.13.2 Density of gases
 - 4.1.13.3 Density of vapours
- 4.1.14 Explain vapour pressure and how it varies with temperature
- 4.1.15 Explain saturated vapour pressure
- 4.1.16 Define boiling point
- 4.1.17 Identify a pressure-temperature-density diagram and explain its use
- 4.1.18 Introduce Cargo Data Sheets
- 4.1.19 Extract physical data of liquefied gas given in Cargo Data Sheets
- 4.1.20 Explain the following terms:
 - 4.1.20.1 Diffusion and mixing of gases
 - 4.1.20.2 Solubility of gases in liquids
 - 4.1.20.3 Miscibility between liquids and effects of temperature on miscibility
 - 4.1.20.4 Vapour pressure of solutions
 - 4.1.20.5 Densities of solutions
 - 4.1.20.6 Variation in dewpoints and effect of low temperatures
 - 4.1.20.7 The phenomenon of rollover
 - 4.1.20.8 The LPG-mix
 - 4.1.20.9 The equilibrium diagram for LPG mixture
- 4.1.21 Explain 'chemical reactivity'
- 4.1.22 Explain the terms and provide examples of cargoes which:
 - 4.1.22.1 Self-react
 - 4.1.22.2 React with air
 - 4.1.22.3 React with water
 - 4.1.22.4 React between cargoes
 - 4.1.22.5 Polymerize
 - 4.1.22.6 Require an inhibitor
- 4.1.23 Identify reactions of cargoes with tank coatings and other materials
- 4.1.24 Extract reactivity data from Cargo Data Sheets
- 4.1.25 Describe precautions against reactivity
- 4.2 Explain basic thermodynamic theory**
 - 4.2.1 Define:
 - 4.2.1.1 Absolute temperature
 - 4.2.1.2 Absolute pressure
 - 4.2.1.3 Enthalpy
 - 4.2.1.4 Latent heat of vaporization
 - 4.2.2 Describe the three states of aggregation
 - 4.2.3 Explain the relationship between pressure and boiling point
 - 4.2.4 Define:
 - 4.2.4.1 Critical temperature of a gas
 - 4.2.4.2 Critical pressure of a gas
 - 4.2.4.3 Critical point of a gas
 - 4.2.5 Explain the relationship between temperature and enthalpy for the various states of aggregation
 - 4.2.6 Identify a Mollier diagram, explain its purpose and use
 - 4.2.7 Explain the first and second laws of thermodynamics
 - 4.2.8 Explain the gas laws and state their limitations in practical use
 - 4.2.9 Define the general gas equation and state its limitation in practical use
 - 4.2.10 Explain:
 - 4.2.10.1 Dalton's law
 - 4.2.10.2 Joule's law
 - 4.2.10.3 Avogadro's law

Topics and Learning Objectives

4.3 Explain the principle of the controlled tank atmosphere

- 4.3.1 Define:
 - 4.3.1.1 Flashpoint
 - 4.3.1.2 Auto-ignition temperature
- 4.3.2 Identify flash point from Cargo Data Sheets
- 4.3.3 Describe flammable range, lower flammable limit (LFL) and upper flammable limit (UFL)
- 4.3.4 Identify and explain the flammability chart
- 4.3.5 Identify fire and explosion data from a Cargo Data Sheet
- 4.3.6 Define inert gas (IG)
- 4.3.7 Identify regulations for inert gas systems on gas tankers
- 4.3.8 Describe methods of production and supply of inert gas
- 4.3.9 List the general characteristics of composition and temperature of inert gas
- 4.3.10 Describe the advantages and disadvantages of inert gas from an IG generator
- 4.3.11 Describe methods of drying inert gas
- 4.3.12 Explain when nitrogen is used instead of inert gas
- 4.3.13 Differentiate inert and non-inert tank atmosphere
- 4.3.14 Explain how and why inert gas is used:
 - 4.3.14.1 In cargo tanks to suppress flammability
 - 4.3.14.2 For interbarrier and hold spaces
 - 4.3.14.3 For some air-reactive cargoes

5. Cargo Handling Systems

5.1 Describe pipeline, pumping and discharge arrangements

- 5.1.1 Describe general cargo piping arrangements on gas tankers
- 5.1.2 Identify materials of construction
- 5.1.3 Explain the use of strainers in cargo piping systems
- 5.1.4 Identify and describe commonly used types of valve
 - 5.1.4.1 Ball valves
 - 5.1.4.2 Globe valves
 - 5.1.4.3 Gate valves
 - 5.1.4.4 Butterfly valves
- 5.1.5 Describe the use of spool-pieces in cargo pipelines
- 5.1.6 Explain where remote and manually operated shut-off valves are required
- 5.1.7 Describe the emergency shutdown system
- 5.1.8 Discuss the care, handling and use of cargo hoses:
 - 5.1.8.1 Types of hose suitable for gas tankers
 - 5.1.8.2 Compatibility and suitability for different cargoes
 - 5.1.8.3 Cargo temperature limitations
 - 5.1.8.4 Inspection and testing procedures
 - 5.1.8.5 Certification of hoses
 - 5.1.8.6 Maintenance and correct handling
- 5.1.9 Explain basic pumping concepts of centrifugal pumps
- 5.1.10 Describe deepwell pumps and submerged pumps
 - 5.1.10.1 Explain their use on refrigerated gas tankers
 - 5.1.10.2 On deck on pressurized ships
- 5.1.11 Describe alternative discharge methods:
 - 5.1.11.1 By pressurizing the vapour space
 - 5.1.11.2 With or without booster pumps
 - 5.1.11.3 Via booster pump and cargo heater
- 5.1.12 Discuss the benefits and limitations of centrifugal pumps
- 5.1.13 Explain cavitation
- 5.1.14 Explain the pump graph with regard to:
 - 5.1.14.1 Performance curve
 - 5.1.14.2 Efficiency
 - 5.1.14.3 Power consumption

Topics and Learning Objectives

- 5.1.14.4 NPSH
- 5.1.15 Explain the terms:
 - 5.1.15.1 Total head
 - 5.1.15.2 Design point
 - 5.1.15.3 NPSH
 - 5.1.15.4 Cavitation
- 5.1.16 Explain the factors that influence a pump's suction condition
- 5.1.17 Explain the use and characteristics of running:
 - 5.1.17.1 Two or more pumps in parallel
 - 5.1.17.2 Two or more pumps in series
 - 5.1.17.3 Pumps in series with a booster pump
- 5.1.18 Explain:
 - 5.1.18.1 Static back-pressure
 - 5.1.18.2 Dynamic back-pressure
 - 5.1.18.3 Factors influencing dynamic back-pressure
- 5.1.19 Explain how discharge rate is affected by:
 - 5.1.19.1 Pressure in shore-tank
 - 5.1.19.2 Static back-pressure
 - 5.1.19.3 Dynamic back-pressure
- 5.1.20 Explain the $Q-H$ curve and a system head curve
- 5.1.21 Describe safe handling and operation of
 - 5.1.21.1 A deepwell pump
 - 5.1.21.2 A submerged pump
 - 5.1.21.3 A booster pump
- 5.1.22 Describe stripping and other methods of liquid removal
- 5.2 Describe heat exchangers**
 - 5.2.1 List the purposes of heat exchangers
 - 5.2.2 Describe a cargo heater arrangement
 - 5.2.3 Explain heating of very low temperature cargoes during discharge
 - 5.2.4 Explain the use of vaporizers
 - 5.2.5 Describe heating medium for:
 - 5.2.5.1 Heat exchangers
 - 5.2.5.2 Vaporizers
 - 5.2.6 Describe correct use and handling of heat exchangers
- 5.3 Describe reliquefaction plants and boil-off control**
 - 5.3.1 Define 'boil-off'
 - 5.3.2 Explain methods of controlling vapour pressure in cargo tanks
 - 5.3.3 Describe a system for handling LNG boil-off vapour
 - 5.3.4 List precautions for handling LNG vapour
 - 5.3.5 Describe:
 - 5.3.5.1 A single-stage direct reliquefaction system and its limitations
 - 5.3.5.2 A two-stage direct system and its limitations
 - 5.3.5.3 A cascade system
 - 5.3.6 Use a Mollier diagram to explain:
 - 5.3.6.1 The single-stage direct reliquefaction cycle
 - 5.3.6.2 The two-stage direct reliquefaction cycle
 - 5.3.6.3 The stages in a cascade cycle
 - 5.3.7 Describe an indirect system:
 - 5.3.7.1 Different types of indirect system
 - 5.3.7.2 Limitations of the indirect system
 - 5.3.8 Identify, from the Gas Codes, cargoes requiring an indirect system
 - 5.3.9 Explain benefits and drawbacks of different types of reliquefaction systems

Topics and Learning Objectives

5.4 Describe venting arrangements

- 5.4.1 Describe a cargo tank vent system
- 5.4.2 Describe where and when:
 - 5.4.2.1 Pressure-relief devices are required
 - 5.4.2.2 Where at least two pressure-relief valves are required
- 5.4.3 Describe the operating principle of:
 - 5.4.3.1 A pilot-operated safety-relief valve
 - 5.4.3.2 A spring-loaded safety-relief valve
- 5.4.4 Explain 'set point' of a safety relief valve and its purpose
- 5.4.5 Explain the procedures to follow for changing the settings of relief valves
- 5.4.6 Identify additional requirements for certain cargoes
- 5.4.7 Explain the vacuum-protection system
- 5.4.8 Identify safe handling procedures and safety precautions for relief devices, vent masts and piping

5.5 Outline instrumentation requirements

- 5.5.1 Explain the terms intrinsically safe, flameproof and increased safety equipment
- 5.5.2 Describe the principles of operation and types of gauging devices for cargo tanks
 - 5.5.2.1 Indirect type
 - 5.5.2.2 Closed device, not penetrating the tank
 - 5.5.2.3 Closed device, penetrating the tank
 - 5.5.2.4 Restricted devices, such as fixed tube and slip tube
- 5.5.3 Identify correct handling procedures and precautions for types of gauges
- 5.5.4 Identify special requirements for particular cargoes
- 5.5.5 Outline, using the IGC Code, the requirements for:
 - 5.5.5.1 Pressure gauges
 - 5.5.5.2 Temperature indicating devices
 - 5.5.5.3 Fixed gas-detection systems
 - 5.5.5.4 Emergency shutdown system
 - 5.5.5.5 High level alarms
 - 5.5.5.6 Fixed water-spray system
- 5.5.6 Describe with the aid of a drawing:
 - 5.5.6.1 The function of a fixed gas-detection system
 - 5.5.6.2 The procedure to calibrate a fixed gas detector
 - 5.5.6.3 The function of an emergency shutdown system
 - 5.5.6.4 A fixed water-spray system
 - 5.5.6.5 A glycol system
 - 5.5.6.6 An alcohol-injection system
- 5.5.7 Explain the use of glycol and glycol-water mixtures
- 5.5.8 Explain how to measure the freezing point of a glycol-water mixture
- 5.5.9 Describe where alcohol is used in the cargo system

6. Liquefied Gas Tanker Operations

6.1 Plan for port arrival

- 6.1.1 List information provided to the gas tanker before arrival
- 6.1.2 List information provided to the shore before arrival
- 6.1.3 Complete pre-arrival checklists
- 6.1.4 Prepare a load, discharge, ballast and de-ballast plan
- 6.1.5 Perform pre-arrival stress and stability calculations
- 6.1.6 Identify any special equipment needed for particular cargoes
- 6.1.7 Ascertain minimum allowable inner hull steel temperatures
- 6.1.8 Identify requirements for inhibited cargoes
- 6.1.9 Identify other requirements for cargo compatibility
- 6.1.10 Identify requirements for inerting before loading
- 6.1.11 Discuss the importance of tank cleanliness for the loading of cargoes
- 6.1.12 Explain the requirements of drying, inerting, and cooling down
- 6.1.13 Identify cargo separation requirements for chemically reactive cargoes

Topics and Learning Objectives

- 6.1.14 Inspect and test relevant cargo operation systems
- 6.1.15 Prepare fire equipment for cargo operations
- 6.1.16 Identify personnel for cargo operations
- 6.2 Describe procedures for loading**
 - 6.2.1 Identify the cargo information and shipping documents required for safe loading of cargoes
 - 6.2.2 Identify the ship-shore checklist and pre-transfer procedures
 - 6.2.3 Identify special requirements from the Gas Codes
 - 6.2.4 Verify the load plan against cargo to load
 - 6.2.5 Describe general precautions to be taken prior to loading
 - 6.2.6 Explain lining up for loading
 - 6.2.7 Co-relate the setting of the safety relief valve and the filling limit of the cargo tank
 - 6.2.8 Explain the requirements for cargo sampling
 - 6.2.9 Explain cool-down procedures and precautions to take
 - 6.2.10 Obtain cool-down time by calculation or estimate from a diagram
 - 6.2.11 Explain factors affecting load time
 - 6.2.12 Describe the load sequence
 - 6.2.13 Control vapours during loading
 - 6.2.14 Identify maximum allowable filling limits
 - 6.2.15 Discuss, generally, loading of:
 - 6.2.15.1 Refrigerated ships
 - 6.2.15.2 Pressurized ships
 - 6.2.15.3 Pressurized ships from refrigerated storage
 - 6.2.15.4 Semi-pressurized ships from refrigerated storage
 - 6.2.16 Describe procedures to take on completion of loading
- 6.3 Measure and calculate cargo quantities**
 - 6.3.1 Explain the reasons for tank filling limits
 - 6.3.2 Identify a list or diagram showing maximum allowable filling limits
 - 6.3.3 Define:
 - 6.3.3.1 Ullage
 - 6.3.3.2 Innage
 - 6.3.3.3 Sounding
 - 6.3.4 Calculate, given sample data, the maximum allowable filling volume of cargo tanks
 - 6.3.5 Identify units of measurement used in cargo calculations
 - 6.3.6 Identify calculation of the liquid phase and vapour phase for cargo quantities
 - 6.3.7 Calculate tank quantities, allow for corrections and correct for temperature and pressure
 - 6.3.8 Show a cargo report
- 6.4 Care for cargo during transit**
 - 6.4.1 Explain precautions to take to avoid cargo loss during transit
 - 6.4.2 Explain how to maintain cargo temperature, pressure and quantity according to shipper's instructions
 - 6.4.3 Explain cargo care and safety during transit
 - 6.4.4 Explain how boil-off is used as fuel on LNG ships
 - 6.4.5 Describe, with a diagram, reliquefaction of cargo vapour and precautions to take
 - 6.4.6 Use the Gas Codes to discuss special cargo condition requirements for:
 - 6.4.6.1 Chlorine
 - 6.4.6.2 Ethylene oxide
 - 6.4.6.3 Methylacetylene-propadiene mixtures (MAP-gas)
 - 6.4.6.4 Propylene oxide and mixtures of ethylene oxide – propylene oxide with ethylene oxide content not more than 30% by weight
 - 6.4.7 Ascertain refrigeration efficiency and factors that reduce efficiency
- 6.5 Preplan for discharge**
 - 6.5.1 Identify the cargo information and shipping documents required for safe discharge of cargoes
 - 6.5.2 Identify the functional tests required prior to arrival at the disport
 - 6.5.3 Identify terminal requirements for cargo tank pressures and temperatures

Topics and Learning Objectives

- 6.5.4 Identify method of discharge:
 - 6.5.4.1 Pressure discharge
 - 6.5.4.2 Pressure and booster-pump discharge
 - 6.5.4.3 Centrifugal cargo-pump discharge
 - 6.5.4.4 Centrifugal cargo-pump and booster-pump discharge
- 6.5.5 Explain the requirements for line and cargo sampling
- 6.5.6 Describe general precautions to be taken prior to discharging
- 6.5.7 Identify trim and stability requirements
- 6.6 Discharge cargo**
 - 6.6.1 Perform cargo calculations
 - 6.6.2 Complete ship-shore checklist
 - 6.6.3 Line-up for discharge
 - 6.6.4 Describe general precautions before discharge
 - 6.6.5 Describe different methods of discharge
 - 6.6.6 Describe a discharge with and without a vapour return
 - 6.6.7 Explain cargo discharge with heating
 - 6.6.8 Explain reasons to maintain over-pressure during discharge
 - 6.6.9 Describe procedures for draining tanks
 - 6.6.10 Describe procedures to take on completion of discharge
 - 6.6.11 Make entries in the Cargo Record Book
 - 6.6.12 Explain ship-to-ship transfer
- 6.7 Conduct ballast and de-ballast operations**
 - 6.7.1 Identify a ballast pipeline and pumping arrangement
 - 6.7.2 Describe a ballast/de-ballast sequence identifying:
 - 6.7.2.1 General stability and trim requirements
 - 6.7.2.2 Stability problems with different ballast tank configurations
 - 6.7.2.3 Ballasting during cargo operations
 - 6.7.2.4 Precautions to take before and during ballasting of cargo tanks
 - 6.7.2.5 Free surface effect
- 6.8 Conduct cargo change-over procedures and tank cleaning**
 - 6.8.1 Identify compatibility of next cargo
 - 6.8.2 Use tables as a guide to cargo and construction material compatibility
 - 6.8.3 Discuss change over procedures:
 - 6.8.3.1 Removal of remaining liquid
 - 6.8.3.2 Warming-up
 - 6.8.3.3 Inerting
 - 6.8.3.4 Gas freeing
 - 6.8.3.5 Aeration
 - 6.8.3.6 Tank cleaning
 - 6.8.3.7 Visual inspection
 - 6.8.4 Explain the procedure for vapourizing cargo residue and warming of the tank shell
 - 6.8.5 Explain:
 - 6.8.5.1 Reasons for inerting
 - 6.8.5.2 Basic methods of inerting
 - 6.8.5.3 Methods of tank cleaning
 - 6.8.6 Describe, with the aid of a flammability diagram, the effects of:
 - 6.8.6.1 Dilution with inert gas
 - 6.8.6.2 Aeration
 - 6.8.6.3 Critical dilution with air
 - 6.8.6.4 Flammability hazard

Topics and Learning Objectives

6.9 Gas-free and ventilate cargo tanks

- 6.9.1 Explain the purpose of gas-freeing
- 6.9.2 Describe the equipment used for gas-freeing
- 6.9.3 Explain different ventilation methods with regard to:
 - 6.9.3.1 Type of equipment
 - 6.9.3.2 Weight of cargo vapours
 - 6.9.3.3 Shape of the tank
- 6.9.4 Describe safety precautions to take during gas freeing
- 6.9.5 Describe the equipment used for checking for a gas-free tank
- 6.9.6 Explain when a tank is considered to be gas-free

7. Pollution Prevention

7.1 Discuss pollution of the marine environment from liquefied gas tankers

- 7.1.1 Identify worldwide pollution incidents from liquefied gas tankers
- 7.1.2 Describe how pollution can occur from liquefied gas tankers:
 - 7.1.2.1 In port
 - 7.1.2.2 At sea
- 7.1.3 Describe pollution as:
 - 7.1.3.1 Controlled releases of liquid and/or vapours
 - 7.1.3.2 Uncontrolled release liquid and/or vapours
- 7.1.4 Explain why a controlled release of liquid and/or vapours may be necessary
- 7.1.5 Explain when an uncontrolled release of liquid and/or vapours may occur
- 7.1.6 Describe the effects of spillage of liquefied gas
- 7.1.7 Describe the effects of soluble liquefied gases in water
- 7.1.8 Describe pollution from bunker and fuel oil spills and discharges
- 7.1.9 State the penalties for pollution of Canadian waters

7.2 Summarize regulatory requirements for pollution prevention

- 7.2.1 Identify the relevant annexes of MARPOL 73/78 (amended) affecting liquefied gas tankers
- 7.2.2 Determine when Annex II of MARPOL 73/78 (amended) applies to liquefied gas tankers
- 7.2.3 Identify CSA 'Regulations for the Prevention of Pollution from Ships and for Dangerous Chemicals'
 - 7.2.3.1 Explain when they apply to liquefied gas tankers
 - 7.2.3.2 Explain the provisions, prohibition and exceptions for discharge in waters under Canadian jurisdiction
 - 7.2.3.3 Identify the main requirements dealing with Transfer Operations
- 7.2.4 Explain when the following certificates are issued:
 - 7.2.4.1 Canadian Noxious Liquid Substances Certificate
 - 7.2.4.2 International Pollution Prevention Certificate for the Carriage of NLS in bulk
 - 7.2.4.3 Certificate of Compliance (NLS)
 - 7.2.4.4 International Certificate of Fitness for the carriage of Liquefied Gases in Bulk
- 7.2.5 Identify the requirements for a shipboard oil pollution emergency plan in MARPOL 73/78 Annex I (SOPEP)
- 7.2.6 Identify the requirements for a shipboard marine pollution emergency plan for noxious liquid substances in MARPOL 73/78 Annex II (SMPEP)

7.3 Describe measures of pollution control

- 7.3.1 Summarize the content of a SOPEP
- 7.3.2 Link the SOPEP to the SMPEP
- 7.3.3 Explain how a SMPEP can incorporate provisions of a SOPEP
- 7.3.4 Discuss the importance of timely response to marine spills
- 7.3.5 Evaluate the effects of timely and delayed response to a marine spill
- 7.3.6 List pollution prevention equipment required on board
- 7.3.7 Describe methods of containment using ship pollution equipment
- 7.3.8 Describe pollution prevention equipment limitations
- 7.3.9 Discuss the use of chemical dispersants and detergents

Topics and Learning Objectives

- 7.3.10 Identify parties responsible for:
 - 7.3.10.1 Clean up
 - 7.3.10.2 Resources available
 - 7.3.10.3 Assistance available
 - 7.3.10.4 Supply of pollution prevention equipment
 - 7.3.10.5 Disposal
 - 7.3.10.6 Costs for a marine spill
- 7.3.11 List equipment available from a shore based pollution response centre
- 7.3.12 Identify resources for response to pollution

8. Health and Safety

8.1 Describe health hazards associated with liquefied gas cargoes

- 8.1.1 Define 'health hazard'
- 8.1.2 Identify the IMO Medical First Aid Guide for Accidents Involving Dangerous Goods (MFAG)
- 8.1.3 Identify health hazards posed by cargoes:
 - 8.1.3.1 Toxicity
 - 8.1.3.2 Asphyxia
 - 8.1.3.3 Low temperatures
 - 8.1.3.4 Chemical burns
- 8.1.4 Explain how chemicals and gases may enter and affect the human body
- 8.1.5 Explain the synergistic effect of some chemicals
- 8.1.6 Describe toxic effects from:
 - 8.1.6.1 Vapours from fires of certain gases and chemicals
 - 8.1.6.2 Inhibitors
 - 8.1.6.3 Inert gas
- 8.1.7 Describe the general symptoms of systemic poisoning and irritants
- 8.1.8 Explain the general symptoms of:
 - 8.1.8.1 Asphyxia
 - 8.1.8.2 Anesthesia
 - 8.1.8.3 Frost bite
- 8.1.9 Explain 'toxicity', how it is measured and expressed
- 8.1.10 Identify 'health data' from Cargo Data Sheets
- 8.1.11 Show and explain a Material Safety Data Sheet for sample products
- 8.1.12 Differentiate MSDS and Cargo Hazard Sheets
- 8.1.13 Identify 'health data' from MSDS
- 8.1.14 Extract first-aid procedures from Cargo Data Sheets
- 8.1.15 Identify medical first-aid equipment provided onboard including oxygen resuscitation equipment and antidotes for products carried
- 8.1.16 Explain when professional medical treatment and advice should be sought
- 8.1.17 Extract information from the MFAG for sample products

8.2 Identify personal protection and safety equipment

- 8.2.1 Identify personnel protection requirements from the Gas Codes and regulations
- 8.2.2 List typical protective equipment required onboard
- 8.2.3 Identify emergency escape equipment and limitations
- 8.2.4 Describe the use, storage and maintenance of safety and protective equipment
- 8.2.5 List additional safety equipment required for ships carrying toxic products and certain cargoes
- 8.2.6 Differentiate total protection and partial protection
- 8.2.7 Demonstrate the use of personal safety and protective equipment

8.3 Describe the function and use of gas indicators

- 8.3.1 Describe the operating principle of:
 - 8.3.1.1 A catalytic-filament combustible-gas indicator
 - 8.3.1.2 A non-catalytic heated-filament gas indicator
 - 8.3.1.3 A refractive index meter
 - 8.3.1.4 Chemical indicator tubes
 - 8.3.1.5 An oxygen meter with paramagnetic sensors

Topics and Learning Objectives

- 8.3.1.6 An oxygen analyzer with electrolytic sensor
- 8.3.2 Carry-out instrument-check procedures and gas measurements
- 8.3.3 Explain the role of the marine chemist
- 8.3.4 Describe the content, details and use of work permits
- 8.3.5 Explain the suitability and limitations of each gas indicator
- 8.4 Implement control measures for enclosed space safety**
 - 8.4.1 Define the enclosed space
 - 8.4.2 Identify enclosed spaces
 - 8.4.3 Identify potential hazards
 - 8.4.4 Discuss the role and duties of a ‘responsible person’
 - 8.4.5 Review the requirements of the SMS
 - 8.4.6 Analyze check lists by identifying important elements
 - 8.4.7 Assess hazards prior to entry
 - 8.4.8 Recommend procedures and safety practices for tank entry
 - 8.4.8.1 List precautions to take for tank entry
 - 8.4.8.2 Identify tank atmosphere test procedures
 - 8.4.8.3 List equipment required
 - 8.4.8.4 Identify key personnel
 - 8.4.8.5 Analyze tank entry checklists
 - 8.4.9 Simulate tank entry and evacuation procedures using:
 - 8.4.9.1 Tank evacuation equipment
 - 8.4.9.2 Resuscitation equipment
 - 8.4.9.3 Self-contained breathing apparatus
 - 8.4.10 Recommend safety procedures and practices for other enclosed spaces
- 8.5 Review fire-fighting principles**
 - 8.5.1 Explain the principles of fire prevention
 - 8.5.2 List sources of emission of flammable cargo vapours
 - 8.5.3 Identify possible ignition sources on liquefied gas tankers
 - 8.5.4 Extract auto-ignition temperatures for sample cargoes from Cargo Data Sheets
 - 8.5.5 Identify fire safety measures for tankers from SOLAS 74, exceptions and additional requirements from the Gas Codes
 - 8.5.6 List methods of controlling fire
 - 8.5.7 Describe advantages, disadvantages and methods of controlling fires on liquefied gas tankers with:
 - 8.5.7.1 Water
 - 8.5.7.2 Foam
 - 8.5.7.3 Dry chemical powders
 - 8.5.7.4 Carbon dioxide systems
 - 8.5.8 Describe specific fire-fighting techniques for liquefied gas cargoes
 - 8.5.9 Define the term BLEVE
 - 8.5.10 Explain the phenomenon of the BLEVE
 - 8.5.11 Describe:
 - 8.5.11.1 Water spray system and areas of coverage
 - 8.5.11.2 Fixed dry-powder system
 - 8.5.11.3 ‘Total flooding’ systems
 - 8.5.12 Explain the use of the IG system in fire prevention

Topics and Learning Objectives

9. Cargo and Emergency management

9.1 Discuss the requirements of an emergency organization

- 9.1.1 List the main components of an emergency organization
- 9.1.2 Explain the function of an emergency organization
- 9.1.3 List information that should be available to the emergency organization
- 9.1.4 Give an overview of general emergency procedures
- 9.1.5 Simulate the action required for different emergencies

9.2 Describe ship and shore emergency alarms

- 9.2.1 Describe different ship alarms used in cases of emergency
- 9.2.2 Describe shore and terminal alarms used in cases of emergency
- 9.2.3 Identify emergency shut-down (ESD) systems
- 9.2.4 Identify emergency release (ERS) systems

9.3 Summarize the International Safety Management System

- 9.3.1 State the mandatory ISM Code requirements for Safety Management
- 9.3.2 State the objectives of the ISM Code
- 9.3.3 Describe the Document of Compliance (DOC) and the Safety Management Certificate (SMS)
- 9.3.4 State the requirements of a Safety Management Manual (SMM)
- 9.3.5 List the type of emergencies that require written procedures
- 9.3.6 Discuss the use of Contingency Plans

9.4 Develop criteria for different types of emergency

- 9.4.1 Identify the IMO publication 'Guidelines for the Development of Shipboard Emergency Response Plans'
- 9.4.2 Differentiate operational and non-operational emergencies
- 9.4.3 Discuss the use of emergency plans
- 9.4.4 Implement and evaluate the effectiveness of emergency plans
- 9.4.5 Develop criteria for monitoring alarms
- 9.4.6 Develop procedures for responding to alarms
- 9.4.7 Discuss training for emergencies
- 9.4.8 Discuss, with the use of casualty reports, emergency scenarios and responses

SUPERVISION OF AN OIL TRANSFER OPERATION COURSE

8.1 General

The Supervision of an Oil Transfer Operation (SOTO) course is divided in three modules and applicants must complete all parts within a period of thirty months prior to issue of the Supervisor of an Oil transfer Operation certificate.

8.2 Part A – Basic

This part must have been completed prior to the completion of Part C; it is designed for “new entrants” to the industry. The following items of the syllabus as outlined in subsection 8.10 will be specifically covered in this module: 1(d), 1(f), 2(b), 2(c), 2(e), 2(f), 3(c), 3(d), 3(e), 4(a), 4(b), 4(h), 5(c), 6(a), 6(b), 6(c), 6(f), 8(a), 8(b), 11(a), 11(b), 11(c), 12(a), 12(b), 12(c), 12(d), 12(e) and 12(f). The students will be issued a training certificate of completion at the conclusion of this part. The certificate will be generated by the Recognized Institution and must not be confused with the SOTO certificate, which is issued by Marine safety. This certificate will remain valid for a period of 30 months. Total duration is approximately 30 hours.

8.3 Part B – Industry experience

This part consists of three months operational and supervised industry experience. The experience must be recorded in an approved “record book”, which will be the responsibility of the applicant to maintain.

8.4 Part C – Advanced

This part is designed for existing certificated personnel serving in the industry and new personnel who have successfully completed Parts A and B. The following items of the syllabus as outlined in subsection 8.10 will be specifically covered in this module: 3(a), 3(b), 3(f), 3(g), 4(c), 4(d), 4(e), 4(f), 4(g), 4(i), 4(j), 4(k), 5(b), 6(d), 6(e), 6(g), 7(a), 7(b), 7(c), 7(d), 7(e), 7(f), 7(g), 7(h), 7(i), 7(j), 8(c), 9(a), 9(b), 9(c), 9(d), 9(e), 10(b) and 13 (examination). Total duration is approximately 30 hours.

8.5 Duration

60 hours

8.6 Prerequisites

- 1) MED A₁ and B₂ or MED with respect to STCW Basic Safety
- 2) Completion of Restricted Radio Operator examination
- 3) Proof of medical fitness

8.7 Specific instructor qualifications

The main course instructor must hold qualifications or experience related to the marine industry and have completed MED A₁ and B₂ or MED with respect to STCW Basic Safety. If the course is under the supervision of more than one instructor, the assistant instructors must hold qualifications related to the marine industry or have related skills and be approved in accordance with the *Quality Management Manual – Marine Personnel Standards and Pilotage* referred to in Chapter 2.

8.8 Goals

At the completion of this course the students will have gained the knowledge to safely supervise the transfer of crude and refined oils from:

- a) a barge to a shore facility, and
- b) a barge to another barge or vessel.

8.9 Outline

Subject Area	Hours	
	Lecture	Practical
1. Personal safety and health hazards (clothing and equipment)	1.25	
2. Properties of hydrocarbons and fire hazards	3.5	
3. Pipeline layouts and theory	6	
4. Pumps and pump theory	6.5	
5. General vessel maintenance	2	
6. Cargo planning and calculations	8.5	
7. General paperwork and operations	7	
8. Tank Barge to Tank Barge and Tank Barge to Ship transfers when not alongside a facility	7.5	
9. Pollution prevention regulations and environmental response	7	
10. Communications	1.25	
11. General seamanship	2.5	
12. Practical barge session		4
13. Examination		2
	53 hours	6 hours
Total	59 hours	

8.10 Syllabus

Topics and Learning Objectives	Compliance through	
	Knowledge	Application
<p>1. Personal safety and health hazards (clothing and equipment) At the completion of this session the student will be able to discuss the personal safety and health hazards associated with working on an unmanned barge</p> <p style="text-align: center;">Learning Objectives</p> <p>(a) Respirators, safety shoes, coveralls, gloves, safety glasses</p> <p>(b) Breathing apparatus</p> <p>(c) Basic measurements such as:</p> <p style="margin-left: 20px;">1) Definition of air</p> <p style="margin-left: 20px;">2) Definition of TLV</p> <p style="margin-left: 20px;">3) Definition of PPM</p> <p>(d) Identify substances found in crude and refined products such as:</p> <p style="margin-left: 20px;">1) Hydrocarbons</p> <p style="margin-left: 20px;">2) Aromatics</p> <p style="margin-left: 20px;">3) Hydrogen sulfide</p> <p style="margin-left: 20px;">4) Other gases</p> <p>(e) Define volatile and non-volatile hydrocarbons</p>	0.5 hour	Prerequisite MED Prerequisite Prerequisite

Topics and Learning Objectives	Compliance through	
	Knowledge	Application
(f) Identify internal and external health hazards such as the dangers associated with: 1) Inhalation 2) Ingestion 3) Absorption 4) Gas freeing 5) Methods and procedures for safe entry into enclosed compartments	0.5 hour 0.25 hour	
2. Properties of hydrocarbons and fire hazards At the completion of this session the student will be able to discuss the fire hazards associated with hydrocarbons (and their prevention) whilst working on an unmanned barge Learning Objectives		
(a) Understand the fire triangle and tetrahedon		MED
(b) Understand flammable vapors with reference to: 1) Definition of flammable limits 2) Definition of flammable range 3) Displayed typical flammable ranges	0.5 hour	
(c) Understand ignition sources such as: 1) Definition of auto ignition temperature 2) Displayed examples of auto ignition 3) Displayed ignition sources from hand tools 4) Understand flash point 5) Understand fire point 6) Understand the difference between flame proof and intrinsically safe	1.0 hour	
(d) Be aware of heat sources such as: 1) Naked lights 2) Wet rags (oil and water) 3) Smoking, lighters and matches 4) Friction 5) Non-intrinsically safe switches	1.5 hours	MED
(e) Be aware of static charges such as: 1) Static accumulators 2) Bonding 3) Water vapor (including oil/water mixes) 4) Gas expansion 5) Free falling water or oil 6) Understand ullaging dangers 7) Understand tank cleaning dangers		
(f) Understand the operation and maintenance of fire fighting equipment, that is: 1) Foam (fixed and portable) 2) CO ₂ and dry chemical extinguishers 3) Steam smothering 4) Inert gas 5) Water hoses and nozzles	0.5 hour	MED MED MED MED

Topics and Learning Objectives	Compliance through	
	Knowledge	Application
<p>3. Pipeline layouts and theory At the completion of this session the student will be able to discuss various pipeline configurations commonly found on an unmanned barge</p> <p style="text-align: center;">Learning Objectives</p> <p>(a) Sketch, describe and set cargo pipelines for loading, discharging and cleaning:</p> <ol style="list-style-type: none"> 1) Ring main systems 2) Direct systems 3) Hatch lids and closing devices <p>(b) Sketch, describe and set cargo pumphooms for loading, discharging and cleaning (giving special emphasis to pipeline flushing and cleaning)</p> <p>(c) Understand the need as to:</p> <ol style="list-style-type: none"> 1) Cargo segregation and separation 2) Closed loading and vapor recovery <p>(d) Understand the compatibility of cargo</p> <p>(e) Understand the need for double valve separation</p> <p>(f) Sketch and describe the construction and operation of:</p> <ol style="list-style-type: none"> 1) Gate valves 2) Globe valves 3) Butterfly valves 4) Non return valves 5) Screw down non return valves 6) Pressure/vacuum valves 7) Extended spindles 8) Spill valves 9) Pressure/vacuum vents 10) Rockwell valves <p>(g) Understand basic pipeline theory in relation to:</p> <ol style="list-style-type: none"> 1) Cavitation and erosion damage 2) Friction losses 3) Insulated flanges 4) Tank suction 5) Water hammer 6) Cargo “plugs” 7) Pipeline “pigging” 	<p>0.5 hour</p> <p>1.0 hour</p> <p>1.0 hour</p> <p>0.5 hour</p> <p>0.5 hour</p> <p>1.5 hours</p> <p>1.0 hour</p>	
<p>4. Pumps and pump theory At the completion of this session the student will be able to discuss various pumping arrangements and configurations commonly found on an unmanned barge</p> <p style="text-align: center;">Learning Objectives</p> <p>(a) Sketch and describe the construction and operating procedures (start-up, running, stopping and emergency stopping) of:</p> <ol style="list-style-type: none"> 1) Centrifugal pumps 2) Gear pumps 3) Rotary vane pumps 4) Deep well pumps 5) Eductors <p>(b) Understand the hazards of operating positive displacement pumps</p>	<p>2.5 hours</p> <p>0.5 hour</p>	

Topics and Learning Objectives	Compliance through	
	Knowledge	Application
<ul style="list-style-type: none"> (c) Understand the meaning of NPSH (d) Understand why decreasing pump speed will affect tank suction (e) Understand the meaning of design point (f) Understand why low vapor pressure will improve tank suction (g) Understand why actual discharge rates are affected by static and dynamic back pressures from shore installations (h) Understand why pump cavitation occurs (i) Sketch and describe a graph showing the characteristics of a centrifugal pump (j) Understand the meaning of <i>shore installation curve</i> (k) Sketch and describe a typical <i>Q-H</i> curve for: <ul style="list-style-type: none"> 1) Single pump use 2) Double pump in parallel use 	<ul style="list-style-type: none"> 0.25 hour 0.25 hour 0.25 hour 0.25 hour 0.5 hour 0.5 hour 0.5 hour 0.5 hour 	
<p>5. General vessel maintenance At the completion of this session the student will be able to demonstrate proficiency with respect to operational maintenance on an unmanned barge</p> <p style="text-align: center;">Learning Objectives</p> <ul style="list-style-type: none"> (a) Demonstrate the ability to: <ul style="list-style-type: none"> 1) Perform the execution of line pressure testing 2) Perform the execution of flexible cargo hose pressure testing 3) Understand the importance of hose clamps 4) Understand hose construction details 5) Repair pipe work from damage caused by cavitation, corrosion, mechanical action, etc. 6) Repack valve glands 7) Repack pump glands and change mechanical seals 8) Replace pipe and hose gaskets (b) Demonstrate the ability to perform routine maintenance checks related to: <ul style="list-style-type: none"> 1) Pump motive power units 2) Portable pumps 3) Generating equipment 4) Batteries 5) Deck lighting systems 6) Cargo heating equipment 7) Cargo sampling equipment 8) Cargo calibration equipment (tapes, rods, floats) 9) Hydraulic pumps and pipe work (c) Demonstrate knowledge with respect to the maintenance of: <ul style="list-style-type: none"> 1) Scupper plugs 2) Drip trays 3) Tank lid covers 4) Ullage cap covers 	<ul style="list-style-type: none"> 2 hours 	<ul style="list-style-type: none"> Industry Industry Industry

Topics and Learning Objectives	Compliance through	
	Knowledge	Application
<p>6. Cargo planning and calculations At the completion of this session the student will be able to demonstrate proficiency with respect to planning cargo disposition and quantifying the cargo on an unmanned barge</p> <p style="text-align: center;">Learning Objectives</p> <p>(a) Understand the meaning of general terms and abbreviations such as:</p> <ol style="list-style-type: none"> 1) OBQ, ROB, TOV, GSV, Gross bbl 2) Net bbl, M³, Litres, Gallons (US and Imp) 3) API, SG, RD, FW 4) Long ton and metric tonne, B/L, LEL, UEL, BS&W <p>(b) Understand the usage of:</p> <ol style="list-style-type: none"> 1) Ullage/sounding systems (hand, mechanical and electronic) 2) O₂ analyzers, explosimeters and Dragear Tubes 3) Water pastes and gas pastes 4) Sample techniques and standards (ASTM) 5) Temperature measurements (hand and electronic) 6) Hydrometers 7) Flash test apparatus <p>(c) Understand and interpret ASTM tables (A & B)</p> <p>(d) Understand the problem associated with heated cargo</p> <p>(e) Understand the importance of pre planning a cargo with respect to:</p> <ol style="list-style-type: none"> 1) Segregation and parcels 2) compatibility of parcels 3) Loading/discharging sequences and pump usage 4) Color coding 5) Weight distribution 6) Pump usage 7) Final sailing drafts 8) Tank innages <p>(f) Quantify a given multi-parcel cargo in:</p> <ol style="list-style-type: none"> 1) Long tons, metric tonnes, pounds 2) Net bbl's, litres, gallons (US and Imp) <p>(g) Using a given worked example, prepare an ullage report for a multi-parcel load</p> <p>(h) Discuss special requirements related to cargo planning for voyages in Arctic waters</p>	<p>1.5 hours</p> <p>1.5 hours</p> <p>0.5 hour</p> <p>0.5 hour</p> <p>1.5 hours</p> <p>1.5 hours</p> <p>1.0 hour</p> <p>0.5 hour</p>	
<p>7. General paperwork and operations At the end of this session the student will be able to demonstrate proficiency with respect to completing regulatory and company paperwork on an unmanned barge</p> <p style="text-align: center;">Learning Objectives</p> <p>(a) List the information to be provided by the shore facility for loading and discharging</p> <p>(b) List the information to be provided by the unmanned tank barge for loading and discharging</p> <p>(c) State that an operational agreement should be made in writing before commencing loading or discharging</p> <p>(d) Explain the subjects to be covered in the loading plan</p> <p>(e) List the subjects to be covered in the discharging plan</p>	<p>0.5 hour</p> <p>0.5 hour</p> <p>0.5 hour</p> <p>0.5 hour</p> <p>0.5 hour</p>	

Topics and Learning Objectives	Compliance through	
	Knowledge	Application
(f) Describe the pre-loading tank inspection, and the limitations when surveyors cannot enter a tank	1.0 hour	
(g) Understand that when different oils are handled, their names and descriptions should be clearly understood by both parties in writing	1.0 hour	
(h) Understand that the ship/shore checklist should be completed jointly by both tank barge/vessel staff and shore facility staff	0.5 hour	
(i) Understand the relevance of the check list and understand the importance of the items contained within the checklist	0.5 hour	
(j) Using a work example, complete the <i>Oil Record Book</i> for: 1) Loading 2) Discharging 3) Ballast and deballast of cargo tanks 4) Cleaning	1.5 hours	
<p>8. Tank Barge to Tank Barge and Tank Barge to Ship transfers when not alongside a facility At the end of this session the student will be able to demonstrate proficiency of knowledge with respect to tank barge to tank barge and tank barge to ship transfers when not alongside</p> <p style="text-align: center;">Learning Objectives</p> <p>(a) Understand the special considerations necessary when not alongside with respect to:</p> <ol style="list-style-type: none"> 1) Life saving 2) Life rafts 3) Fire fighting 4) Lifejackets 5) Immersion suits 6) PFD's 7) rescue boats 8) Safety contingency plans 9) Weather (including ice conditions) 10) Lighting 11) Communications and control 12) Emergency stop procedures 13) Oil spill contingency planning 14) Transfer check lists <p>(b) Understand special requirements in relation to general seamanship, i.e.:</p> <ol style="list-style-type: none"> 1) Fendering 2) Mooring 3) Anchoring 4) Hose handling, emphasizing stress and chaffing problems 5) Action after transfer completion <p>(c) Discuss the special requirements related to offshore and shore transfers within the <i>Arctic Waters Oil Transfer Guidelines</i> (TP 10783)</p>	<p>1.0 hour</p> <p>1.0 hour</p> <p>0.5 hour</p> <p>0.5 hour</p> <p>0.5 hour</p> <p>1.0 hour</p> <p>0.5 hour</p> <p>1.5 hours</p> <p>1.0 hour</p>	<p>MED</p> <p>MED</p> <p>MED</p> <p>MED</p> <p>MED</p> <p>MED</p> <p>MED</p>

Topics and Learning Objectives	Compliance through	
	Knowledge	Application
<p>9. Pollution prevention regulations and environmental response At the completion of this session the student will be able to demonstrate proficiency of knowledge with respect to pollution prevention regulations and environmental response</p> <p style="text-align: center;">Learning Objectives</p> <p>(a) Demonstrate knowledge relating to regulations with respect to:</p> <ol style="list-style-type: none"> 1) <i>Canada Shipping Act</i> 2) MARPOL 73/78 Annex 1 3) OPA 90 4) ASPPR <p>(b) Understand the effects of timely response to oil spills, emphasizing:</p> <ol style="list-style-type: none"> 1) Preparation of response 2) Responsibilities 3) Communications 4) Equipment 5) Reporting methods and obligations 6) Requesting assistance 7) Preventative measures <p>(c) Describe initial action:</p> <ol style="list-style-type: none"> 1) Methods of first aid action 2) Methods of containment 3) Methods of first aid clean up 4) Reporting information and contents 5) Sample reports <p>(d) Describe clean up action:</p> <ol style="list-style-type: none"> 1) Responsibility 2) Costs 3) Available resources 4) Methods of operation <p>(e) Complete by example the <i>Oil Record Book</i> section dealing with accidental overboard discharges of oil</p> <p>(f) Provide a 'Hands on' component for emergency environmental response</p>	<p>1.5 hours</p> <p>2.5 hours</p> <p>1.5 hours</p> <p>1.0 hour</p> <p>0.5 hour</p>	<p>Industry</p>
<p>10. Communications At the end of this session the student will be able to demonstrate proficiency of knowledge with respect to radio communications between unmanned tank barge and shore facility and between unmanned tank barge and proper authorities</p> <p style="text-align: center;">Learning Objectives</p> <p>(a) External communications</p> <ol style="list-style-type: none"> 1) Read and understand the Marine Restricted Radio Certificate 2) Examination to Industry Canada standards to allow student to hold Marine Restricted Radio Certificate <p>(b) Operational communications</p> <ol style="list-style-type: none"> 1) Understand that reliable communications between unmanned tank barge and shore facility require primary and back-up communication mediums 	<p>1.0 hour</p>	<p>Prerequisite</p>

Topics and Learning Objectives	Compliance through	
	Knowledge	Application
<ul style="list-style-type: none"> 2) Understand that all parties should establish, and agree in writing, all communications related to starting, slowing down, stopping and emergency stopping of all cargo operations 3) Understand that ‘slang terms’ must be avoided when dealing with oil products as ambiguity is often caused 4) Understand that profanity during radio communications is illegal and unwarranted 		
<p>11. General Seamanship At the completion of this session the student will be able to demonstrate proficiency of knowledge with respect to unmanned tank barge seamanship details</p> <p style="text-align: center;">Learning Objectives</p> <ul style="list-style-type: none"> (a) Mooring <ul style="list-style-type: none"> 1) Understand forces acting on moorings 2) Mooring optimizing 3) Mooring layout 4) Mooring equipment 5) Mooring management (b) Derricks and cranes <ul style="list-style-type: none"> 1) SWL 2) Rigging 3) Preventive maintenance 4) Record keeping (c) Flexible hoses <ul style="list-style-type: none"> 1) Inspections before use 2) Test certificates 3) Connecting 4) Disconnecting 5) Cleaning, stowage and handling 6) Flange and joint inspection to match product requirements (d) Rope and Wire work – Understand and demonstrate: <ul style="list-style-type: none"> 1) Bowline 2) Reef knot 3) Rolling hitch 4) Clove hitch 5) Eye splice 6) Back splice 7) Common whipping (e) Understand that good general housekeeping improves efficiency 	<p>0.5 hour</p> <p>1.0 hour</p> <p>1.0 hour</p>	<p>Industry</p> <p>Industry</p>

Topics and Learning Objectives	Compliance through	
	Knowledge	Application
<p>12. Practical barge session At the completion of this session the student will gain a practical insight as to the operations carried out on board a suitably equipped unmanned tank barge</p> <p style="text-align: center;">Learning Objectives</p> <p>(a) During a normal working day the student will observe and record all pertinent facts related to the transfer of oil products</p> <p>(b) Sketch and describe the pipeline layout of the unmanned tank barge</p> <p>(c) Sketch and describe the pump room layout of the unmanned tank barge</p> <p>(d) Record and describe the color coding system used for cargo transfer</p> <p>(e) Record and understand:</p> <ol style="list-style-type: none"> 1) Tank capacities 2) Deadweight 3) Maximum draft 4) Minimum freeboard 5) Maximum cargo grades able to segregate 6) Ballast capacity (if applicable) <p>(f) Observe and describe:</p> <ol style="list-style-type: none"> 1) Pollution prevention equipment 2) Oil spill equipment 3) Radio equipment and procedures 4) Checklists 5) Contingency plans 6) Oil record Book 		<p>Barge visit</p> <p>Barge visit</p> <p>Barge visit</p> <p>Barge visit</p> <p>Barge visit</p> <p>Barge visit</p>
<p>13. Examinations At the completion of part C the student will be able to demonstrate proficiency of knowledge by written examination all aspects related to supervising oil transfer operations on board an unmanned tank barge</p> <p>(a) Students will be required to have all course assignments completed at times specified and will be to the instructors' satisfaction</p> <p>(b) An examination containing a mixture of 100 multiple choice and written questions will be given at the completion of the course</p> <p>(c) Pass mark for examination will be set at 70%</p> <p>(d) Examination re-writes will be allowed after one week from the date of failure</p> <p>(e) Failure to pass the examination after the second attempt will require the candidate to re-take course components A and C</p>		

8.11 References

- 1) *Canada Shipping Act, 2001*
- 2) MARPOL 73/78 Convention as amended (IMO)
- 3) I.S.G.O.T.T. (Witherby & Co.)
- 4) *Tanker Handbook for Deck Officers* (Brown Son & Ferguson)
- 5) *Ship to Ship Transfer Guide* (Witherby & Co.)
- 6) ASTM Measurement Tables (ASTM)

- 7) *Manual on Oil Pollution* (Section II) Contingency Plan (IMO)
- 8) *Manual on Oil Pollution* (Section IV) Combating Oil Spills (IMO)
- 9) *Oil Record Book*, Parts 1 and 2 (Marine Safety)
- 10) TP 10783 – *Arctic Waters Oil Transfer Guidelines* (Marine Safety)
- 11) TP 11663 – *Guidelines for the Operation of Tankers and Barges in Canadian Arctic Waters* (Marine Safety)
- 12) TP 11960 – *Standards and Guidelines for the Construction, Inspection and Operation of Barges that Carry Oil in Bulk* (Marine Safety)

SUPERVISION OF A CHEMICAL TRANSFER OPERATION COURSE

9.1 General

- 1) This course is in many ways similar to the SOTO course and is based on the same syllabus; it may be dispensed independently from that course or combined with it. For applicants who already hold the SOTO certificate, A “bridging” course is available.
- 2) To avoid repetition, this chapter deals only with the “bridging” course and the differences between the chemical and the oil transfer courses.

9.2 Duration

- 1) Chemical Transfer Operation Course: 60 hours
- 2) Combined Oil and Chemical Transfer Operation Course: 76 hours
- 3) Bridging from Oil to Chemical Transfer course: 16 hours

9.3 Prerequisites

- 1) MED A₁ and B₂ or MED with respect to STCW Basic Safety
- 2) Completion of Restricted Radio Operator examination
- 3) Proof of medical fitness

9.4 Specific instructor qualifications

The main course instructor must hold qualifications or experience related to the marine industry and have completed MED A₁ and B₂ or MED with respect to STCW Basic Safety. If the course is under the supervision of more than one instructor, the assistant instructors must hold qualifications related to the marine industry or have related skills and be approved in accordance with the *Quality Management Manual – Marine Personnel Standards and Pilotage* referred to in Chapter 2.

9.5 Goals

At the completion of this course the students will have gained the knowledge to safely supervise the transfer of chemical products from:

- a) a barge to a shore facility, and
- b) a barge to another barge or vessel.

9.6 Outline

The following topics are to be added to the SOTO course syllabus, while the corresponding subjects that are specific to the Oil transfer course are to be removed from the SOTO course to give the *Supervision of a Chemical Transfer Operation Course*. These topics make up the bridging course to SCTO for applicants already holding the SOTO certificate.

Subject Area	Hours	
	Lecture	Practical
1. Properties of chemicals	3	
2. Flammability and safety hazards	3	
3. Product handling systems	3	
4. Planning, care and control of product	3	
5. Spill prevention and response	2	
6. Differences between oil and chemical tankers	1	
7. Examination		1
	15 hours	1 hour
Total	16 hours	

9.7 Syllabus

Topics and Learning Objectives	Compliance through	
	Knowledge	Application
1. Properties of Chemicals Learning Objectives (a) Health and safety (b) Chemical hazards (c) Personal protective equipment (d) Decontamination	X	
2. Flammability and safety hazards Learning Objectives (a) Safety hazards of chemicals (b) North American Emergency Response Guide (NAERG) (c) Material Safety Data Sheet (MSDS)	X	
3. Product handling systems Learning Objectives (a) Refreshing information on: 1) pipeline theory 2) pipeline systems and tank hatches 3) valve types 4) Pumps, suction, static and dynamic back pressures, cavitation	X	

Topics and Learning Objectives	Compliance through	
	Knowledge	Application
<p>4. Planning, care and control of product</p> <p style="text-align: center;">Learning Objectives</p> <p>(a) Chemical-specific topics:</p> <ol style="list-style-type: none"> 1) Segregation and safety planning 2) Cargo record book 3) Dangerous Goods declaration 	X	
<p>5. Spill prevention and response</p> <p style="text-align: center;">Learning Objectives</p> <p>(a) General refreshing information, particularly with regard to:</p> <ol style="list-style-type: none"> 1) Incident Command System (ICS) 2) Zoning 3) Emergency response 	X	

9.8 References

- 1) MARPOL Convention as amended (IMO)
- 2) *International Maritime Dangerous Goods* (IMDG) code
- 3) SOLAS Convention as amended (IMO)
- 4) *Safe Stowage* (International Affairs and International Trade Canada)
- 5) BCH Code (IMO)
- 6) IBC Code (IMO)
- 7) *Marine Fire Fighting* (Oklahoma State University)
- 8) *Fire Protection Handbook* (NFPA)