

**TRAINING STANDARDS FOR  
TANKER SAFETY, INERT GAS AND  
CRUDE OIL WASHING, AND  
SUPERVISOR OF OIL TRANSFER OPERATIONS  
PERSONNEL**

AUGUST 1997



## **Introduction**

On September 1, 1982, Marine Safety commenced issuing endorsements to Masters and Mates certificates for service in oil tankers and chemical tankers. Transport Publication (TP) 8129, the original document for these courses was developed in 1986 with assistance from Industry.

In 1992, the TP was amended to incorporate approved changes which included training requirements for selected Engineer Officers and engine room ratings and a Ship Safety Bulletin outlining the changes was issued in July of that year.

In June 1996, Industry was notified that in order to comply with Marpol and SOLAS regulations, Marine Safety intended to introduce a training programme for selected crew members of crude oil tankers fitted with Inert Gas (IG) and Crude Oil Washing (COW) equipment. A draft training course was sent out to Industry for comment in October 1996 and the course was subsequently finalized.

It has been decided to incorporate the new course in TP 8129 rather than publish a separate TP.

Companies which were consulted, and to which were sent copies of the IG and COW training course for comment were;

Canadian Shipowners Association, Ottawa  
Kent Line Ltd., St. John, N.B.  
Rigel Shipping Canada Inc., Shediac, N.B.  
Groupe Desagnes Inc., Quebec  
Socanav Inc., Montreal, Quebec  
Enerchem Transport Inc., Montreal, Quebec  
Imperial oil Ltd., Toronto, Ontario  
Shell Canada Products Ltd., Calgary, Alberta  
Nordic Canadian Tankers, Halifax, N.S.

### **SUPERVISOR OF OIL TRANSFER OPERATIONS (SOTO)**

It has been decided also, to include the Supervisor of Oil Transfer Operations training course in this TP in order to ensure that all training courses related to oil or chemical tankers are included in the one publication.

It will be noted that the SOTO training programme is presented in the form of Training Standards rather than as a syllabus. The reason is that the course format was generated by joint effort of Marine Carriers Association and Marine Safety.

## **OBJECTIVES**

1. Compliance with the International Maritime Organisation (IMO) requirement under regulations V/1 and V/2 as contained in the Standards of Training, Certification and Watchkeeping (1978).
2. Compliance with the International Maritime Organisation (IMO) under regulation 13 as contained in the Regulations for the Prevention of Pollution by Oil (MARPOL) 1973/78 and under regulation 60 as contained in the International Convention for the Safety of Life at Sea (SOLAS) 1974/78

## **GOALS**

1. To provide awareness of the hazards and a standard of basic and advanced training to officers and certificated ratings involved in the handling and carriage of petroleum and chemical products on Canadian tankers.
2. To provide knowledge of the crude oil washing process and programmes, the associated dangers, and safe operating procedures, and the use, operation and maintenance of inert gas systems, to officers and ratings involved in the operations.

## **COURSES**

The basic tanker safety course is intended for ratings, while the advance course is intended for certificated officers who require a Level 1 or Level 2 Endorsement.

The Crude Oil Washing and Inert Gas course and the Supervisor of Oil Transfer course are intended for all personnel who have responsibilities in connection with either operation.

The course titles are as follows:

- Basic Petroleum Tanker Safety Course
- Advanced Petroleum Tanker Safety Course
- Basic Chemical Tanker Safety Course
- Advanced Chemical Tanker Safety Course
- Inert Gas and Crude Oil Washing Course
- Supervisor of Oil Transfer Operations

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## **COURSE SYLLABI**

## **BASIC PETROLEUM TANKER SAFETY COURSE**

### **1. APPLIED SCIENCE**

- 1.1 Different cargoes.  
Flammability.  
Behaviour of different products.  
Differences between crudes/products.  
Temperature/viscosity relationships.
- 1.2 Principle of controlled cargo tank atmosphere. Flammable and combustible liquids. Fire and explosion.
- 1.3 Sources of ignition. Smoking. Electrical equipment. Spontaneous combustion. Auto ignition temperature. Pyrophoric iron sulphides.  
The above to include practical day-to-day examples, such as, the use of non-intrinsically safe equipment in hazardous areas, etc.
- 1.4 Static electricity during loading, discharging, tank washing, gas freeing, clearing lines, electrical storms, helicopter operations and synthetic clothing. Initial loading rates. Bonding of tank washing hoses. Bonding of cargo hoses. Types of ullage tapes. Free falling samples. Cathodic protection on ship/jetty. Ship/shore bonding wire vs. insulating flange.
- 1.5 Flammability and explosion hazards. Gas atmospheres in cargo tanks during loading, discharging, ballasting and tank washing, for typical high, medium and low vapour pressure products. Effect of cargo contamination on flash point.
- 1.6 Gas concentrations at deck level. Dispersion. Danger from vapour cloud drift. Effect of weather conditions.
- 1.7 Overview of characteristics and hazards of petrochemicals and solvents with reference to toxicity - low flash point - compatibility with cargo handling equipment - existence of chem tasco - importance of MSDS.

## 2. **PETROLEUM TANKER DESIGN AND CONSTRUCTION**

- 2.1 General description on ship design and the differences in design between product tankers, OBOS', crude carriers, etc.
- 2.2 General tank and deck arrangement.
- 2.3 Accommodation ventilation system. Significance of location of accommodation openings and cargo venting systems.

## 3. **CARGO HANDLING SYSTEMS**

### 3.1 **Equipment**

- 3.2 General description of piping arrangements, including direct, ring main and free flow systems. The principle of operation and practical aspects of cargo pumps, including maintenance, over heating and thermal trips. Pump characteristics. Ancillary and main equipment. Drop line. Eductors. Control equipment for draining (e.g. vacuum strip).

Purge pipes - gassing up of pumps, valves - operation, types, characteristics, inspection procedures, line and valve testing procedures.

- 3.3 Bunker systems and bunker transfer equipment.

Top/bottom cargo tank venting systems.

- 3.5 Standpipes, P/V valves. High velocity vent valves.

- 3.6 Flame screens. Flame arresters.

- 3.7 Liquid level gauges. Remote cargo pump shutdown system.

- 3.8 Pumproom/bilge level alarms. Fixed hydrocarbon/air monitoring systems.

- 3.9 Intrinsically safe, flameproof and increased safety equipment, including lighting, electric motors, radios/walkie-talkies, I.S. barriers.

- 3.10 Cargo heating systems - cargo contamination
  - cargo retention in coils
  - correct testing procedures
  - drain returns

#### 4. **OPERATING PROCEDURES**

- 4.1 Preplanned loading/discharging procedures. Interruption of operations - safety considerations. Segregation of grades. Compatibility, heating requirements - effects on adjacent tanks. Checklists. Ship/shore liaison. Communication. General precautions. The proper supervision of personnel. Loading and discharging procedures.
- 4.2 Tank cleaning and gas freeing for changing products. Inspection, cool and hot work permits. Preparation for repair and maintenance.
- 4.3 Ballasting and de-ballasting procedures.
  - including Clean Ballast Tank made of operation.
- 4.4 operation of venting systems. Closed and open transfer operations.
- 4.5 Handling of heated cargoes - summer
  - winter
  - distribution
  - May temp.
- 4.6 Cold weather handling precautions and techniques.

#### 5. **INERT GAS SYSTEMS**

- 5.1 Reasons for inerting.
- 5.2 Description of inert gas system.
- 5.3 General overview of procedures to be followed during loading and discharging.
- 5.4 Safety precautions and procedures for inert gas systems.

## 6. SAFETY IN TANK WASHING

- 6.1 Tank conditions. Controllable atmosphere, lean and rich. Explosive range. Inert atmosphere. Tank equipment. Fixed equipment. Coverage of tank surfaces. Shadow areas. Delivery capacity. Range and angle of location. Portable equipment. Range, delivery capacity, operation mode. Hoses.
- 6.2 Static generation when tank cleaning. Steaming, the water plug theory.
- 6.3 Tank cleaning in controllable atmospheres. Difficulty in monitoring and keeping the atmosphere under control. Vapour pockets. Precautions to be taken - introducing machines, probing tanks, etc.
- 6.4 Procedures to be followed - water temperature below 60°C, gas freeing, hot water if required, gas freeing.
- 6.5 Tank cleaning in inerted atmospheres. Action to be taken in case of inert gas system failure. Fixed tank cleaning systems.

## 7. OIL POLLUTION (SEA AND AIR)

- 7.1 Effects on human and marine life from release of oil at sea. Effect of density, solubility, vapour pressure and atmospheric conditions on the dispersal of released oil.
- 7.2 Chemical dispersing agents and their use. Chemical barriers. Mechanical removal - skimmers, oil spill booms.
- 7.3 Air pollution and vapour emission control. Emission prevention when ballasting after crude oil washing.
- 7.4 Interface detectors.
- 7.5 Bilges, rules and regulations.

**8. FIRE FIGHTING**

8.1 Specialized fire extinguishing, prevention and detection equipment on ship and jetty. Fire fighting procedures. Equipment maintenance.

**9. EMERGENCY PROCEDURES**

9.1 Preplanning of emergencies. The emergency plan. Remote controls for pumping equipment. Ship/jetty liaison. General alarm: emergency team; back-up team; engineer's group.

9.2 Action in the event of fire, collision, grounding, spillages and failure of services essential to cargo.

9.3 Particular case studies. Specific emergency procedures as outlined in I.C.S./O.C.I.M.F. International Safety Guide for Oil Tankers and Terminals. Specific jetty emergency plan.

**10. REGULATIONS AND CODES OF PRACTICE**

10.1 General overview of national and international rules, regulations and codes of practice for petroleum tankers.

10.2 Canada Labour Code.

**11. SAFETY PRACTICES AND EQUIPMENT**

11.1 Use of portable and fixed measuring instruments. The function, interpretation and calibration of combustible gas indicators and oxygen analyzers. Toxic gas determination. Procedures for entry into pumphooms, tanks and hazardous spaces. Enclosed space entry permits and checklists. Breathing apparatus and tank rescue equipment. Rescue techniques and supervision. Protective clothing and equipment. Oxygen/air resuscitation equipment.

11.2 Workplace Hazardous Materials Information System.

## 12. **HEALTH**

- 12.1 Toxicity. Threshold limit values. Acute and chronic effects of toxicity. Systemic poisons and irritants.
- 12.2 Health hazards. Dangers of skin contact, inhalation and ingestion. Effects of crude oil, distillates, hydrogen sulphide, aromatics and leaded fuels.
- 12.3 Material safety data sheets.
- 12.4 First Aid procedures.

## 13. **SAFETY IN TERMINAL OPERATIONS**

### 13.1 **Mooring**

- 13.2 General principles. Forces acting on mooring. Mooring optimization principles. Mooring layout. Mooring equipment standards for V.L.C.C.'s. Mooring management. All wires mooring. Load distributions (monitoring). Use of fibre tails in conjunction with wires. Mooring winches - split drum - method of coiling wires. Brake holding capacity. Mooring requirements at S.P.M./S.B.M. and multi-point.

only a brief overview of the above is intended, the thrust will be to enlighten the student that there is a right and wrong way, and the consequences that could result.

### 13.3 **Operations**

- 13.4 Pre-arrival information exchange. Ship/shore pre-operation meeting. operating limits applicable to the ship. Operation particulars. Stoppages due to shore operating requirements Flow rate variations. Ship/shore communications. Cargo transfer procedures. Sequence of different grades. Requirements between grades transfer.
- 13.5 Ship/shore safety checklist.
- 13.6 Pollution prevention checklist. Fire fighting equipment. On board containment features/procedures.

14. **ENVIRONMENTAL RESPONSE**

Theoretical

- 14.1 Effects of timely response. Examples of timely and delayed responses and their effects.
- 14.2 Preparation of response. Responsibilities. Communications. Equipment. Reporting methods and obligations. Requesting assistance. Preventative measures.
- 14.3 Initial action. First aid action. Methods of first aid action. Methods of containment. Methods of first aid cleanup. Reporting information and contents including sample reports and timing.
- 14.4 Clean up action. Responsibility. Costs. Resources available for assistance. Equipment available. Methods of operation.

Practical

- 14.5 Environmental response equipment. Hands-on display of first aid equipment. Display of clean-up equipment. Care and storage of first aid equipment.
- 14.6 Participate in first aid action. Select equipment. Deploy/use equipment. Recover equipment.

## ADVANCED PETROLEUM TANKER SAFETY COURSE

### 15. APPLIED SCIENCE

- 15.1 An outline of the important physical and chemical properties of crude oil and distillates carried in bulk, including aspects of production and principal applications. Saturated vapour pressure. Saturated vapour pressure/temperature relationship. Boiling point. Influence of pressure on boiling point temperature. Reid vapour pressure. Flash point. Flammable range. Upper and lower flammable limit. Relationship between flashpoint and lower flammable limit. These properties in relation to distillation products of crude oil from gasoline to fuel oils. Stabilized crudes, sour crudes and spiked crudes. Uses of different qualities of crude.
- 15.2 Diffusion. Partial pressure. Viscosity and viscosity/temperature relationship. Liquid density and relative liquid density. Vapour travel.
- 15.3 Principle of controlled cargo tank atmosphere. Flammable and combustible liquids. Fire and explosion.
- 15.4 Sources of ignition. Smoking. Electrical equipment. Spontaneous combustion. Auto ignition temperature. Pyrophoric iron sulphides.
- 15.5 Static electricity during loading, discharging, tank washing, gas freeing, clearing lines, electrical storms, helicopter operations and synthetic clothing. Initial loading rates. Bonding of tank washing hoses. Bonding of cargo hoses. Types of ullage tapes. Free falling samples. Cathodic protection on ship/jetty. Ship/shore bonding wire vs. insulating flange.
- 15.6 Flammability and explosion hazards. Gas atmospheres in cargo tanks during loading, discharging, ballasting and tank washing, for typical high, medium and low vapour pressure products. Effect, of cargo contamination on flash point. Pyrophoric ignition.
- 15.7 Gas concentrations at deck level. Dispersion. Danger from vapour cloud drift. Effect of weather conditions.
- 15.8 Tank coatings in relation to gas retention.

**16. PETROLEUM TANKER DESIGN AND CONSTRUCTION**

- 16.1 General ship design considerations, as applied to crude carriers, product carriers and O.B.O./O.O. Safety aspects of design including potentially hazardous and gas free zones, the safety barrier principle and the citadel concept.
- 16.2 Loadline regulations. Stresses and shear forces. Hogging and sagging. Draft calculations according to zone lines.
- 16.3 General tank and deck arrangement.
- 16.4 Accommodation ventilation system.

**17. DEVELOPMENT OF PETROLEUM TANKER**

- 17.1 Introduction to and evolution of the petroleum tanker. The petroleum tanker and the ship/jetty interface. Identification of the interface to include personnel on ship and jetty and operational procedures on ship and jetty. The safety record of the petroleum tankers in relation to other vessel types, in terms of previous statistical evidence.
- 17.2 The position of crude oil and distillates in the oil and chemical industries. Commercial aspects. The spot market. Flags of convenience. World scale.

## 18. **CARGO HANDLING SYSTEMS**

### 18.1 **Equipment**

18.2 General description of piping arrangements, including direct, ring main and free flow systems. The principle of operation and practical aspects of cargo pumps, including maintenance, over heating and thermal trips. Pump characteristics. Ancillary and main equipment. Drop line. Eductors. Control equipment for draining (e.g. vacuum strip).

18.3 Bunker systems and bunker transfer equipment.

18.4 Top/bottom cargo tank venting systems. Gassing up in pumps.

18.5 Standpipes. P/V valves. High velocity vent valves.

18.6 Flame screens. Flame arresters.

18.7 Instrumentation.

18.8 Liquid level gauges. Remote cargo pump shutdown system.

18.9 Pumproom/bilge level alarms.

18.10 Intrinsically safe, flameproof and increased safety equipment.

## 19. **OPERATING PROCEDURES**

19.1 Preplanned loading/discharging procedures. Interruption of operations - safety considerations. Checklists. Ship/shore liaison. Communication. General precautions. The proper supervision of personnel. Loading and discharging procedures. Inerting and purging operations.

19.2 Tank cleaning and gas freeing for changing products. Inspection, cool and hot work permits.

19.3 Ballasting and de-ballasting procedures.  
- Clean Ballast Tank mode of operation.

19.4 Loadicators and their application to cargo handling.

19.5 Operation of venting systems.

19.6 Combination carriers - preparation before loading petroleum after carrying dry bulk cargo, and before loading any dry bulk cargo after carrying petroleum.

## 20. **INERT GAS SYSTEMS**

- 20.1 Reasons for inerting.
- 20.2 Operation, maintenance and monitoring of inert flue gas systems. Inert gas generators.
- 20.3 Quality of exhaust gas, scrubbing, fans and cargo intake, construction and general principles of operation.
- 20.4 Inert gas warning systems. Safety considerations; water seal; non-return valve; exhaust gas composition; oxygen, pyrophoric generation.
- 20.5 Use of inert gas in loading, discharging, ballasting and tank cleaning, including loaded and ballast passage.
- 20.6 Cargo measurements on inerted ships.

## 21. **SAFETY IN TANK CLEANING**

- 21.1 Tank conditions. Controllable atmosphere, lean and rich. Explosive range. Inert atmosphere. Tank equipment. Fixed equipment.. Coverage of tank surfaces. Shadow areas. Delivery capacity. Range and angle of location. Portable equipment. Range, delivery capacity, operation mode. Hoses.
- 21.2 Static generation when tank cleaning. Steaming, the water plug theory.
- 21.3 Tank cleaning in controllable atmospheres. Difficulty in monitoring and keeping the atmosphere under control. Vapour pockets. Precautions to be taken -introducing machines, probing tanks, etc.
- 21.4 Procedures to be followed - water temperature below 64°C, gas freeing, hot water if required, gas freeing.
- 21.5 Tank cleaning in inerted atmospheres. Action to be taken in case of inert gas system failure. Fixed tank cleaning systems.

**22. CRUDE OIL WASHING**

- 22.1 Crude oil washing systems.
- 22.2 The need for crude oil washing.
- 22.3 Cargo pump eductors. Lines to washing machines.
- 22.4 Machine setting requirements.
- 22.5 Checks required before starting crude oil washing. Checks during crude oil washing.
- 22.6 Aborting crude oil washing.

**23. OIL POLLUTION (SEA AND AIR)**

- 23.1 Effects on human and marine life from release of oil at sea. Effect of density, solubility, vapour pressure and atmospheric conditions on the dispersal of released oil.
- 23.2 Chemical dispersing agents and their use. Chemical barriers. Mechanical removal - skimmers, oil spill booms.
- 23.3 Air pollution and vapour emission control.  
Emission prevention when ballasting after crude oil washing.
- 23.4 I.M.O. Convention 1954 as amended, 1961, 1969, 1971, and M.A.R.P.O.L. 1973.  
1979 Convention of Liability.  
1971 Convention of Fund Creation.  
1978 Protocols, Part, 1. Clean Sea Code.  
Tank size limitation. Load-on-top and crude oil washing.
- 23.5 Interface detectors.
- 23.6 Ballasting after crude oil washing.
- 23.7 Tank inspection after crude oil washing.

**24. FIRE FIGHTING**

- 24.1 Specialized fire extinguishing, prevention and detection equipment on ship and jetty. Fire fighting procedures. Equipment maintenance.

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## 25. **EMERGENCY PROCEDURES**

- 25.1 Preplanning of emergencies. The typical ship's emergency plan. Remote controls for pumping equipment. Ship/jetty liaison. General alarm: emergency team; back-up team; engineer's group.
- 25.2 Action in the event of fire, collision, grounding, spillages and failure of services essential to cargo.
- 25.3 Particular case studies. Specific emergency procedures as outlined in I.C.S./O.C.I.M.F. International Safety Guide for Oil Tankers and Terminals. Specific jetty emergency plan.

## 26. **REGULATIONS AND CODES OF PRACTICE**

- 26.1 Safety regulations ship and shore. Local, national and relevant international codes and regulations. Health and Safety Executive and Department of Trade requirements. I.C.S./O.C.I.M.F. International Safety Guide for Oil Tankers and Terminals. S.O.L.A.S. '69/74. 1979 Convention of Liability. 1971 Convention of Fund Creation. 1978 Protocols (I.M.O.). I.C.S. Guide to Helicopter/Ship Operations.
- 26.2 Canada Labour Code.

## 27. **SAFETY PRACTICES AND EQUIPMENT**

- 27.1 Use of portable and fixed measuring instruments. The function, interpretation and calibration of combustible gas indicators and oxygen analyzers. Toxic gas determination. Procedures for entry into pumprooms, tanks and gas dangerous spaces. Enclosed space entry permits and checklists. Breathing apparatus and tank rescue equipment. Rescue techniques and supervision. Protective clothing and equipment. Oxygen/air resuscitation equipment.

## 28. **HEALTH**

- 28.1 Toxicity. Threshold limit values. Acute and chronic effects of toxicity. Systemic poisons and irritants.
- 28.2 Health hazards. Dangers of skin contact, inhalation of ingestion. Effects of crude oil, distillates, hydrogen sulphide, aromatics and leaded fuels.
- 28.3 Cargo hazard sheets.

28.4 First aid procedures.

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## 29. SAFETY IN TERMINAL OPERATIONS

### 29.1 Mooring

29.2 General principles. Forces acting on mooring. Mooring optimization principles. Mooring layout. Mooring equipment standards for V.L.C.C.'s. Mooring management. All wires mooring. Load distributions (monitoring). Use of fibre tails in conjunction with wires. Mooring winches split drum - method of coiling wires. Brake holding capacity. Mooring requirements at S.P.M./ S.B.M. and multi-point.

### 29.3 Operations

29.4 Pre-arrival information exchange. Ship/shore pre-operation meeting. operating limits applicable to the ship. operation particulars. Stoppages due to shore operating requirements. Flow rate variations. Ship/shore communications. Cargo transfer procedures. Sequence of different grades. Requirements between grades transfer.

29.5 Tank inspection. Ballasting/de-ballasting. Cargo transfer equipment (limits, conditions, maintenance).

29.6 Ship/shore safety checklist.

29.7 Pollution prevention checklist.

**30. ENVIRONMENTAL RESPONSE**

Theoretical

- 30.1 Effects of timely response. Examples of timely and delayed responses and their effects.
- 30.2 Preparation of response. Responsibilities. Communications. Equipment. Reporting methods and obligations. Requesting assistance. Preventative measures.
- 30.3 Initial action. First aid action. Methods of first aid action. Methods of containment. Methods of first aid cleanup. Reporting information and contents including sample reports and timing.
- 30.4 Clean up action. Responsibility. Costs. Resources available for assistance. Equipment available. Methods of operation.

Practical

- 30.5 Environmental response equipment. Hands-on display of first aid equipment. Display of clean-up equipment. Care and storage of first aid equipment.
- 30.6 Participate in first aid action. Select equipment. Deploy/use equipment. Recover equipment.

**31. TRANSFERS OF CARGO WHEN NOT ALONGSIDE**

- 31.1 Lifesaving and safety considerations, firefighting and emergency equipment, contingency procedures, weather and local ice conditions, lighting, communications and control.
- 31.2 Hose preparation and handling, transfer process and check list, emergency stop of transfer, action after transfer is completed.
- 31.3 Ship to ship transfer process in accordance with TP 10783 Arctic Water Oil Transfer Guidelines.
- 31.4 Ship to shore transfer process in accordance with TP 10783 Arctic Water Oil Transfer Guidelines.

**SECTION 32 IS ADDITIONAL FOR LEVEL 2 CERTIFICATION.**

**32. CARGO AND EMERGENCY MANAGEMENT**

- 32.1 Develop criteria for monitoring, and procedures for responding to, all types of alarms.
- 32.2 Develop procedures for responding to emergencies. Grounding of the vessel. Hole in tank at waterline. Leak below waterline. Fire when working cargo while alongside.
- 32.3 Develop procedures to prevent contamination of cargo. Cargo compatibility.
- 32.4 Develop procedures for responding to pollution.

## **BASIC CHEMICAL TANKER SAFETY COURSE**

### **33. APPLIED SCIENCE**

#### **33.1 Physical properties**

- Density
- Specific Gravity
- Boiling Point
- Freezing (melting) Point
- Solubility in Water
- viscosity

#### **33.2 Vapour**

- Vapour pressure (Partial, saturated)
- Vapour Density
- Variation of vapour pressure with temperature

#### **33.3 Flammability**

- Flash Point
- Auto Ignition Temperature
- Electrostatic Charge Generation
- Flammable Range

#### **33.4 Reactivity**

- Self-Reactivity
- With Other Chemicals and Air and Water
- With Tank Coating

34. **INSTRUMENTATION**

34.1 **Cargo Instrumentation**

Hazard Area Designation  
Ventilation of Cargo Control Room and Accommodation certified Safe Electrical  
Equipment

- Intrinsically safe
- Flame Proof

34.2 **Control Systems**

Liquid Level Gauges

- Float Type
- Slip Tube and Fixed Tube - Ultrasonic
- Radioactive

Level Alarms

- Pressure Indicators
- Direct
- Differential

Temperature Indicators

- Monitoring
- Control

Vapour Detection Equipment

35. **POTENTIAL HAZARDS**

35.1 **Flammability and Explosion**

Flammable Atmosphere  
Enclosed Spaces  
Open Spaces

35.2 **Sources of Ignition**

Smoking Materials  
Electric Appliances and Equipment  
Lightning  
Static Electricity  
Power Tools

35.3 **Environmental Hazards**

#### 35.4 **Reactivity and Corrosion Hazard**

Self-Reaction  
Reaction with other chemicals  
Reaction with Tanks

### 36. **CHEMICAL FIRE FIGHTING TECHNIQUES AND EQUIPMENT**

#### 36.1 **Fire Fighting**

Chemistry of Fire  
Class of Fire  
Fire Prevention

#### 36.2 **Fire Extinguishment**

Extinguishing Methods  
Extinguishing Agents  
Extinguishing Equipment  
- Portable  
- Fixed  
- Hose reel

### 37. **SAFETY PRACTICES AND EQUIPMENT**

#### 37.1 **Monitoring Equipment**

Vapour Measuring Equipment  
Oxygen  
- Testing  
- Upkeep  
- Calibration

#### 37.2 **Safety Procedures and Precautions**

Hazard warning Notices  
Entry into Enclosed Spaces including Canada Labour Code  
Safety Procedure during Repair  
and Maintenance

**37.3 Rescue**

Rescue Techniques from Enclosed Spaces

**37.4 Personal Safety Equipment**

Protective Clothing  
Breathing Apparatus  
Rescue Equipment

**37.5 Use of Personal Safety Equipment**

Wearing of clothing  
Donning of B.A.  
Precautions

**37.6 WHMIS**

**38. HEALTH**

**38.1 Chemical Effect of Exposure to the:**

- Skin
- Eye
- Inhalation
- Ingestion

**38.2 First Aid**

**38.3 Resuscitation**

**39. CHEMICAL CARRIERS - DESIGN AND EQUIPMENT**

**39.1 General Design Description**

Shapes, Materials and Coatings Void spaces, cofferdams, pumprooms and cargo control rooms

I.M.O. classification (Types 1, 2 and 3)

40. **TERMINAL OPERATIONS**

40.1 **Safety Practices at Terminals**

Safety Precautions  
Emergency Procedures

40.2 **Arrival in Port**

Preparation for Arrival  
Entering/Leaving Port  
Mooring

40.3 **Ship/shore Liaison**

Ship/shore safety check list

40.4 **Cargo Operations**

Ship Shore Cargo Connections  
Cargo Hoses

41. **CARGO HANDLING SYSTEMS**

41.1 **Cargo Handling Equipment**

Piping  
Expansion Joints  
Valves  
Blanking Devices  
Bonding of Flanges

41.2 **Practical Operations of Cargo Pumps**

Deep-well  
Submerged

41.3 **Venting and closed loading systems**

41.4 **Inert and Nitrogen Gas System**

Principle  
Description  
Monitoring

41.5 **Cargo Tank Lining**

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42. **CHEMICAL CARRIER - OPERATING PROCEDURE**

42.1 **Loading/Discharging procedure**

42.2 **Segregation of cargoes to avoid Hazards**

Reactivity  
Corrosion

42.3 **Maintenance against corrosion of:**

Piping system  
Structure  
Equipment

42.4 **Tank cleaning and Gas Freeing**

Procedures  
Precautions

42.5 **Gauging, sampling and heating of cargoes**

42.6 **Ballasting and De-ballasting procedure**

42.7 **Monitoring of Tank Atmosphere**

42.8 **Correct operational procedure to avoid Hazards**

Fire  
Explosion  
Health  
Environment

43. **REGULATIONS**

43.1 **General overview of National and International Regulations**

**44. CHEMICAL CARRIER - EMERGENCY PROCEDURE**

**44.1 Ship's Emergency Plan**

**44.2 Port Emergency Plan**

**44.3 Shut Down-Cargo Operation Failure**

**44.4 Cargo Leakage or Spillage**

**44.5 Presence of Toxic Vapours**

45. **ENVIRONMENTAL RESPONSE**

Theoretical

- 45.1 Effects of timely response. Examples of timely and delayed responses and their effects.
- 45.2 Preparation of response. Responsibilities. Communications. Equipment. Reporting methods and obligations. Requesting assistance. Preventative measures.
- 45.3 Initial action. First aid action. Methods of first aid action. Methods of containment. Methods of first aid cleanup. Reporting information and contents including sample reports and timing.
- 45.4 Clean up action. Responsibility. Costs. Resources available for assistance. Equipment available. Methods of operation.

Practical

- 45.5 Environmental response equipment. Hands-on display of first aid equipment. Display of clean-up equipment. Care and storage of first aid equipment.
- 45.6 Participate in first aid action. Select equipment. Deploy/use equipment. Recover equipment.

## ADVANCED CHEMICAL TANKER SAFETY COURSE

### 46. APPLIED SCIENCE - PHYSICS

#### 46.1 Physical Properties

Density

Specific Gravity

Boiling Point - Influence of Temperature Freezing

(Melting) Point -

Influence of Temperature

Latent Heat of Vaporization

Expansion - Co-efficient of Cubic Expansion Solubility in Water

Viscosity

#### 46.2 Vapour

Vapour Pressure

Saturated Vapour Pressure

Partial Vapour Pressure

Diffusion

Variation of Vapour Pressure with Temperature

Reid Vapour Pressure (RVP)

Vapour Density

#### 46.3 Flammability

Upper and Lower Flammable Limits

Flammable Range

Flash Point

Auto Ignition Temperature

Electrostatic Charge Generation

47. **APPLIED SCIENCE - CHEMISTRY**

47.1 **Atomic Theory**

Atoms and Molecules  
Elements and Compounds  
Symbols and Formulas  
Atomic and Molecular Weight  
Structure of the Atom  
Atomic Number  
Periodic Table - Families of Elements  
Chemical Bonding

47.2 **Inorganic Chemistry**

Acids and Bases  
Properties of Acids and Bases  
Common Acids and Bases

47.3 **Organic Chemistry**

Classification of Organic Compounds  
in Families  
Formulas  
Functional Groups

47.4 **Reactivity**

Self-Reactivity  
- Polymerization  
- Inhibition  
With Other Chemicals and Air and Water  
- Binary Compatibility  
With Tank Coating  
- Corrosion

## 48. INSTRUMENTATION

### 48.1 Cargo Instrumentation

- Hazardous Area Designation
- Ventilation of Cargo Control Room and Accommodation
- Certified Safe Electrical Equipment
  - Types and principles
  - Intrinsically Safe
  - Flame Proof
  - Specialized Safety Equipment

### 48.2 Control Systems

- Liquid Level Gauges
  - Float Type
  - Slip Tube and Fixed Tube
  - Ultrasonic
  - Radioactive
- Level Alarms
- Overflow Control
- Pressure Indicators
  - Direct
  - Differential
- Temperature Indicators
  - Monitoring
  - Control
- Vapour Detection Equipment

## 49. **POTENTIAL HAZARDS**

### 49.1 **Flammability and Explosion**

Potential Flammable Atmospheres

Enclosed Spaces

- Void Spaces
- Cofferdams
- Others

Open Spaces

- Decks
- Jetties

### 49.2 **Sources of Ignition**

Smoking Materials

Personal Electric Equipment

Electric Appliances

Power Tools

Static Electricity

Lightning

### 49.3 **Environmental Hazards**

Influence of Density and Solubility  
in Dispersion

Vapour Cloud Drift

Jettisoning of Toxic/Flammable Liquids

### 49.4 **Reactivity and Corrosion Hazards**

Self-reaction

- Polymerization
- Temperature Effect
- Impurities as Catalysts

Reaction with Other Chemicals

- Reaction with Air
- Reaction with Water

Reaction with Tanks

- Concentration Effect
- Corrosion
- Evolution of Hydrogen

50. **CHEMICAL FIRE FIGHTING TECHNIQUES AND EQUIPMENT**

50.1 **Fire Fighting**

Chemistry of Fire  
Classes of Fire  
Fire Prevention

50.2 **Fire Extinguishment**

Extinguishing Methods  
Extinguishing Agents  
Extinguishing Equipment  
- Portable  
- Fixed  
- Hose Lines

## 51. SAFETY PRACTICES AND EQUIPMENT

### 51.1 Monitoring Equipment

Vapour Measuring Equipment Oxygen

- Testing
- Upkeep
- Calibration

### 51.2 Safety Procedures and Precautions

Hazard Warning Notices

Cargo Data Sheets

Entry into Enclosed Spaces including Canada Labour Code

Proper Supervision during Hazardous Operations

Safety Procedures during Repair and  
Maintenance

### 51.3 Rescue

Rescue Techniques from Enclosed Spaces

### 51.4 Personal Safety Equipment

Protective Clothing

Breathing Apparatus

- Self-Contained
- Air Line
- Filter Masks

Rescue Equipment

### 51.5 Use of Personal Safety Equipment

Wearing of Clothing

Donning and Use of B.A.

Storage and Maintenance of Safety

Equipment

Precautions

### 51.6 Workplace Hazardous Materials Information System

52. **HEALTH**

52.1 The course will include chemical effects of acute exposure to the:

- skin
- eye
- inhalation
- ingestion

52.2 **First Aid - Procedures and Demonstrations**

52.3 **Resuscitation**

52.4 **Visual Aids**

53. **CHEMICAL CARRIERS - DESIGN AND EQUIPMENT**

53.1 **Development**

Introduction to the Chemical/Parcel Tanker  
Evolution of Design  
Position of Common Chemicals in Relation  
to the oil and Chemical Industries  
Commercial Background

53.2 **Design and Construction**

Description

- Shapes, Materials and Coatings
- Void Spaces, Cofferdams, Pumphooms and Cargo Control Rooms

I.M.C.O. Classifications

- Type 1, II and III Ships

I.M.C.O. Code for Construction and equipment

- Stability and Survival Capabilities
- Certificate of Fitness

**54. TERMINAL OPERATIONS**

**54.1 Safety Practices at Terminals**

Safety Precautions and Emergency Procedures  
Personnel Safety

**54.2 Arrival in Port**

Preparation for Arrival  
Entering or Leaving Port  
Mooring

**54.3 Ship/Shore Liaison and Communications**

Terminal Advice to Tanker  
Tanker Advice to Terminal  
Pre-Plan Cargo Operation  
Ship/Shore Safety Check List

**54.4 Cargo Operations**

Inspections of Cargo Tanks  
Ship and Shore Cargo Connections  
Cargo Hoses

**54.5 Areas of Responsibility**

**55. CARGO HANDLING SYSTEMS**

55.1 Description of cargo-handling equipment found on chemical carriers; piping; expansion joints; valves; blanking devices; bonding of flanges.

55.2 Principles of operation and practical aspects of cargo pumps, both deep-well and submerged.

55.3 Description of valves and cargo heaters, venting and closed loading systems.

55.4 Compatibility of materials of construction, including cargo tank linings, piping systems, valves and pumps.

55.5 Principle and description of Inert Gas and Nitrogen systems, including pipework and associated equipment; operation, maintenance and monitoring of system.

55.6 General aspects of cargo handling with reference to different ships and cargoes.

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## 56. **CHEMICAL CARRIERS - OPERATING PROCEDURES**

- 56.1 Correct operational procedures designed to control the potential hazards of fire and explosion and to health and the environment; compliance with local, national and international regulations. The importance of preplanning in loading/discharge procedures, the ship/shore check list, shipboard/ shore communications; the proper supervision of personnel; the ship's operation manual.
- 56.2 General design of vessel from a safety aspect.
- 56.3 Segregation of chemicals to avoid possible reactivity and corrosion hazards. Inerting, water padding, drying agents; cargo inhibition.
- 56.4 Control of tank atmosphere without the use of inert gas or nitrogen systems; principles of methods available; hydrocarbon gas detectors required to monitor tank atmospheres; recommended operation procedures.
- 56.5 Control of tank atmospheres by the use of inert gas or nitrogen systems; description of cargo tank cleaning operations involving the use of inert gas or nitrogen
- 56.6 Importance of proper maintenance and inspection to avoid hazards arising from corrosion of piping systems, structure and equipment.
- 56.7 Control of sources of ignition, including static electricity; regulations governing construction and equipment and industry codes of operating practice; general precautions; importance of good housekeeping.
- 56.8 Complete cycle of loading, discharging, tank cleaning and gas freeing; cargo planning with reference to binary compatibility, adjacent stowage, segregation, compatibility with tank coatings and hoses, suitability of tank type - integral or independent, open or closed gauging requirements; compatibility of cargo vapours - vent arrangements, previous cargo compatibility, proximity of polymersible cargo and highly volatile cargoes to heated cargoes; cargo condition during passage, sampling of cargoes; heating of cargoes; cargo calculations; stability considerations; ballasting and de-ballasting.

57. **REGULATIONS**

57.1 **Inspection Procedures (C.C.G.)**

- Submission of Plans
- Checking against Approved Plans
- Identification - Controls and Systems
- Fire Protection
- Personnel Protection
- Cargo Hoses
- Warning Notices
- Certificate of Fitness - Validity

57.2 **Operational Requirements (Regulatory)**

- Advance Reporting
- Entering Tanks and Void Spaces
- Personnel Training
- Cargo Information
- Supervision
- Communication
- Securing and Towing off Arrangements
- Emergency Situation
- Casualty or Dangerous Occurrence
- Spot Inspections

57.3 **Special Requirements (Regulatory)**

- General Overview

57.4 **International Maritime Organization**

- Code - Amendments 1-7
- Code - Amendment 8
- Code - Amendment 9
- International Application - Code and Amendment

58. **CHEMICAL CARRIERS - EMERGENCY PROCEDURES**

- 58.1 Typical ship's emergency plans; shipboard emergency organization, training and planning.
- 58.2 Ship/shore and ship/ship liaison; typical port emergency plan and organization, ship emergencies; emergency shutdown of cargo operations; action in the event of failure of systems or services essential to cargo; collisions, strandings or spillage; envelopment of ship in toxic or flammable vapour; cargo leakage to adjacent void spaces or cofferdams.
- 58.3 Personnel emergencies; abandoning ship in the presence of toxic vapours.
- 58.4 Particular emergency case studies.
- 58.5 Chemical cargo stowage exercise.

59. **BREATHING APPARATUS SYSTEMS**

59.1 **Self-contained Breathing Apparatus**

- Description
- Operation
- Emergency Procedures
- Wearing
- Servicing

59.2 **Air Line**

- Description
- Operation

59.3 **Filter Mask**

- Description

60. **ENVIRONMENTAL RESPONSE**

Theoretical

- 60.1 Effects of timely response. Examples of timely and delayed responses and their effects.
- 60.2 Preparation of response. Responsibilities. Communications. Equipment. Reporting methods and obligations. Requesting assistance. Preventative measures.
- 60.3 Initial action. First aid action. Methods of first aid action. Methods of containment. Methods of first aid cleanup. Reporting information and contents including sample reports and timing.
- 60.4 Clean up action. Responsibility. Costs. Resources available for assistance. Equipment available. Methods of operation.

Practical

- 60.5 Environmental response equipment. Hands-on display of first aid equipment. Display of clean-up equipment. Care and storage of first aid equipment.
- 60.6 Participate in first aid action. Select equipment. Deploy/use equipment. Recover equipment.

61 **TRANSFERS OF CARGO WHEN NOT ALONGSIDE**

- 61.1 Lifesaving and safety considerations, firefighting and emergency equipment, contingency procedures, weather and local ice conditions, lighting, communications and control.
- 61.2 Hose preparation and handling, transfer process and check list, emergency stop of transfer, action after transfer is completed.
- 61.3 Ship to ship transfer process in accordance with TP 10783 Arctic Water Oil Transfer Guidelines.
- 61.1 Ship to shore transfer process in accordance with TP 10783 Arctic Water Oil Transfer Guidelines.

**SECTION 62 IS ADDITIONAL FOR LEVEL 2 CERTIFICATION.**

62. **CARGO AND EMERGENCY MANAGEMENT**

- 62.1 Develop criteria for monitoring, and procedures for responding to, all types of alarms.
- 62.2 Develop procedures for responding to emergencies. Grounding of the vessel. Hole in tank at waterline. Leak below waterline. Fire when working cargo while alongside.
- 62.3 Develop procedures to prevent contamination of cargo. Cargo compatibility.
- 62.4 Develop procedures for responding to pollution.

**63. CONDITIONS FOR APPROVAL OF TANKER COURSES**

- 63.1 Location of Training Centre must be easily accessible.
- 63.2 Training Centre must be located close to a M.E.D. Centre.
- 63.3 Course content as detailed in this document must be closely followed for the appropriate course. Changes to the course will require prior Marine Safety approval.
- 63.4 Instruction time for the basic course must be not less than 18 hours total of which the Sections 14 or 45, as appropriate, must comprise at least 6 hours.
- 63.5 Instruction time for the advanced course for the Level 1 certificate or Supervisor Oil Transfer must be at least 39 hours of which Sections 30 or 60, as appropriate, must comprise at least 6 hours. In addition, for the Level 2 certificate, Section 32 or 62, as appropriate, must comprise a further additional 6 hours.
- 63.6 Training Centre must have laboratory facilities for practical experiments and demonstrations with volatile and non-volatile products.
- 63.7 Course may be offered in English or French.
- 63.8 Course instructions must be conducted in a well ventilated and lighted room provided with a blackboard and audio visual equipment.
- 63.9 Instructions relating to Health Hazards must be conducted by a medic with involvement in the Industry and should be accredited by the Province in which such course is offered.
- 63.10 It is desirable that the Training Centre be located close to a Tanker Terminal, in the absence of which Training in Ship/Jetty Operation must be substituted with Marine Safety approved video demonstrations.
- 63.11 The number of trainees on a course not to exceed 24.
- 63.12 For continual Marine Safety approval of the appropriate course at least one such course must have been offered in the preceding year.
- 63.13 Marine Safety may monitor any course without prior notification.
- 63.14 Following Safety Equipment to be available for demonstration.
  - Combustible Gas Indicator
  - Oxygen Analyzer/Indicator
  - Inert Gas Monitoring Instrument
  - Toxic Gas determining instrument
  - Instrument Calibration Equipment
  - Vapour measuring Equipment
  - Self contained breathing apparatus
  - Tank Rescue Equipment
  - Oxygen/Air Resuscitation Equipment
  - Protective Clothing
  - Ullage Measuring Tape

- Filter Mask
- Applicators
- Totally enclosed fireman's suit

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#### 64.0 **CONDITIONS FOR APPROVAL OF MAIN COURSE INSTRUCTOR**

- 64.1 Master Mariner or equivalent certificate of competency as determined by the Marine Safety.
- 64.2 Hold a Level 2 Endorsement as applicable to the Course.
- 64.3 Must have completed an approved Fire Fighting Course.
- 64.4 For Tanker Safety Courses, C.O.W. and Inert Gas experience is desirable, (but mandatory for Inert Gas and Crude Oil Course Instructors) alternatively the completion of an approved course is acceptable.
- 64.5 Must be accredited as an instructor by the province in which the course is conducted.

#### 65. **CONDITIONS FOR APPROVAL OF ASSISTANT INSTRUCTORS**

- 65.1 ON I, Second Engineer or equivalent  
Certificate of Competency as determined by the Marine Safety.
- 65.2 Hold a Level 2 Endorsement as applicable to the course.
- 65.3 Must have completed an approved Fire Fighting course.
- 65.4 C.O.W. and Inert Gas experience desirable alternatively the completion of an approved course.
- 65.5 Must be accredited as an instructor by the Province in which the course is conducted.

66. **ADDITIONAL FIREFIGHTING TRAINING FORMING PART OF BASIC OR ADVANCED**

**THEORETICAL DURATION 2 HOURS**

66.1 TYPES OF FOAM.

66.2 Mechanical, chemical and their characteristic differences. Methods of producing them, their advantages and disadvantages.

66.3 PUMPROOM FIRES

66.4 Firefighting procedure using foam, halon, steam or CO<sub>2</sub> fixed systems. Steps to include remote stop, battening down and special procedure for release of the medium using fixed system.

66.5 CARGO TANK FIRES

66.6 Procedure to include completely shutting off supply of air, if tank is ruptured opening may be plugged and fixed system using steam, foam or CO<sub>2</sub> be used. If a fixed steam smothering system is used valves on branch lines leading to pumprooms, cofferdams or tanks not on fire and which are not adjacent to such tanks which are on fire should be closed. Water in the form of a solid stream or high and/or Low velocity water fog should be used to cool the surrounding decks, bulkheads and other structural members.

66.7 Hands-on drill in foam making.

66.8 Testing procedure of foams.

66.9 Deterioration time of foams.

## INERT GAS AND CRUDE OIL WASHING COURSE

### INERT GAS SECTION (I.G.)

- 1.0 **Conventions & Regulations**
- 1.1 Oil Pollution Prevention Regulations
- 1.2 Marpol 78 and Amendments
- 1.3 SOLAS 74 and Amendments
- 1.4 IOPP Certificate
- 1.5 STCW(95) Code, Chapter V
  
- 2.0 **Applied Science**
- 2.1 Physical and Chemical Properties of Crude Oil
- 2.2 Flammability, Upper and Lower Limits
- 2.3 Effect of Inert Gas on Flammability
- 2.4 Explosion Hazards
- 2.5 Sources of Ignition
- 2.6 Static Electricity
  
- 3.0 **Inert Gas Systems**
- 3.1 Reasons for Inerting Sources of Inert Gas
- 3.2 a) Uptake Gas from Ships Main or Auxiliary Boilers  
b) Independent Inert Gas Generator  
c) A Gas Turbine with Afterburner
  
- 4.0 **Inert Gas Plant Components**
- 4.1 Function of Inert Gas Scrubber
- 4.2 Inert Gas Blowers
- 4.3 Deck Water Seal and Nonreturn Devices
- 4.4 Inert Gas Valve
- 4.5 Venting Arrangements
- 4.6 System Maintenance and Testing
  
- 5.0 **Gas Monitoring Equipment**
- 5.1 Oxygen Analyzers
- 5.2 Combustible Gas Indicator and Sensors
- 5.3 Calibration
- 5.4 Alarms and Procedures
  
- 6.0 **Inert Gas Distribution System and Procedures**
- 6.1 Operating Instructions
- 6.2 Gas supply Line and Branch Lines
- 6.3 Inerting, Purging and Gas Freeing
- 6.4 Tank Protection from Excessive Pressure or Vacuum  
Venting Arrangements

**7.0 Operations**

7.1 Primary Inerting, Dilution and Displacement Methods Inerting Procedures for:

- 7.2 a) Empty Gas Free Tanks  
b) Loading Cargo or Ballast  
c) Loaded or Ballast Passage  
d) Cargo or Ballast Discharge  
e) Crude Oil Washing  
f) Tank Cleaning with Water  
g) Purging, Gas Freeing, Topping up  
Static Electricity Precautions

7.3

Record and Check Lists

7.4

**8.0 Tank and Enclosed Space Entry**

8.1 Entry Procedures and Atmospheric Testing

8.2 Instrumentation Usage and Analysis

8.3 Gas Free Certificates

**9.0 Special Inerting Requirements Combination Carriers**

- 9.1 a) Design Problems  
b) Slack Holds  
c) Leakage, Hatches and Ballast and Void Spaces  
d) Application When Carrying Oil  
e) Application When Cargoes Other Than Oil  
f) Inert Gas distribution

9.2 Product Carriers

- a) Flash Point Limitations  
b) Product contamination  
c) Cargo Contamination  
d) Additional Purging and Gas Freeing

**10.0 Emergency Procedures**

10.1 Warning Systems

10.2 Inert Gas System Failure During Discharge

10.3 Maintaining Positive Pressure

10.4 Procedures During system Repair

10.5 Shore Supply Connection

**11.0 Health and Safety**

11.1 Oxygen Deficiency

11.2 Toxic Effects

11.3 Electrostatic Hazards

11.4 Hydrogen Sulphide

11.5 Pyrophoric Iron Sulphide

11.6 General Safety Considerations

## **CRUDE OIL WASHING (COW)**

- 1.0 **Regulatory Requirements**
- 1.1 Oil Pollution Prevention Regulations
- 1.2 MARPOL 78 and Amendments
- 1.3 SOLAS 74 and Amendments
- 1.4 IOPP Certificate
- 1.5 Oil Record Book
- 1.6 Operations and Equipment Manuals
  
- 2.0 **Principles of Crude Oil Washing**
- 2.1 Characteristics of Crude Oil as a Washing Fluid
- 2.2 Tanks to be Crude Oil Washed
- 2.3 Ballasting After Crude Oil Washing
- 2.4 Crude Oil Washing at Sea
  
- 3.0 **Equipment**
- 3.1 Washing Machines, Deck Mounted and Submerged
  - a) Types
  - b) Characteristics
  - c) Construction
  - d) Operating Parameters
- 3.2 Location of Washing Machines
- 3.3 Top Washing, Bottom Washing and Wash Cycle
- 3.4 Trim Requirements
- 3.5 Means of Sounding Tanks
  
- 4.0 **Fluid Supply and Distribution**
- 4.1 Source of Washing Fluid
- 4.2 Distribution Systems
- 4.3 Pumps and Eductors
  
- 5.0 **Stripping Systems**
- 5.1 Types of Pumps Used for Stripping
- 5.2 Stripping of Cargo Tanks
- 5.3 Draining and Stripping of Cargo Lines
- 5.4 Means of Checking Cargo Tanks Are Dry After Stripping
  
- 6.0 **Operational Procedures**
- 6.1 Operation and Equipment Manuals
- 6.2 Check Lists
- 6.3 Testing of Crude Oil Washing Equipment
- 6.4 Washing Schedules for Traditional Pipeline Ship, Free Flow Ship and Partial Free Flow Ship
- 6.5 Crude Oil Washing with Multi-Grade Cargoes

- 6.6 Procedure to Minimize Berth Time
- 6.7 Water Rinsing of Ballast Tanks
- 6.8 Ballasting for Departure
- 6.9 Washing Operations at Sea Between Discharge Ports
  
- 7.0 Safety**
  - 7.1 Inert Gas Procedure
  - 7.2 Maintenance and Monitoring of Inert Gas Quality and Pressure
  - 7.3 Procedure in Event of Failure or Quality of Inert Gas
  - 7.4 Precautions to Avoid Generation of Static Electricity
  - 7.5 Check of Toxicity Levels of Inert Gas
  
- 8.0 Maintenance of Plant and Equipment**
  - 8.1 Plant and Equipment to be Maintained in Accordance with Manufacturers' Instructions
  - 8.2 Maintenance of Testing Procedures in Accordance with Operations and Equipment Manuals

## 1.0 SOTO - GENERAL INFORMATION

- 1.1 Course Goal:** At the termination of this course the students will have gained the *knowledge* to safely supervise the transfer of crude and refined oils from (a) between barge & facility and (b) barge to barge/other vessel.
- 1.2 Course Duration:** Total course is to be covered in 59 hours of instruction. During this period the student will receive approximately 50% classroom theory and 50% practical experience. At the termination of the course the student will be required to complete a written examination. The pass mark for this examination will be 70%
- 1.3 Course Location:** Courses may be given at either (a) Marine Safety/TC Approved Institutes or (b) Approved Company sites. (TP 8129 E)
- 1.4 Course Delivery:** Courses shall only be given by instructors who are approved by the administration. (TP 8129 E)
- 1.5 Industry Participation:** Industry shall be encouraged to participate in the following areas:  
(a) Classroom theory  
(b) Company policies  
(c) Practical demonstrations  
(d) Program review committees
- 1.6 Coast Guard Participation:** Coast Guard shall be encouraged to participate in the following areas:  
(a) Course monitoring  
(b) Course examination procedures  
(c) Legislation updating  
(d) Program review committees
- 1.7 Pre Requisites:** Before entry to the course, students will demonstrate (by written evidence where required):  
(a) Completion of MED A1 & B2 courses  
(b) Proof of medical fitness  
(c) Completion of DOC Restricted Radio examination  
(d) Completion of an aptitude test  
(e) If required, show a statement of previous related service

- 1.8 Student Supplies:** At the commencement of the course the student will be required to bring the following:
- (a) Swim wear & towel
  - (b) Suitable writing material (pens, pencils, colored pencils, paper, rulers etc.)
  - (c) A simple calculator
  - (d) Work wear including safety shoes/boots

## 2.0 SOTO - COURSE CONTENT

TOPIC	EXPLANATION OF TOPIC ITEM	Covered by:
<b>2.1 Personal safety (clothing and equipment) &amp; health hazards:</b>	<p>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 tank barge.</p> <p>Learning Tasks:</p> <ul style="list-style-type: none"><li>(a) Respirators, safety shoes / boots, coveralls, gloves, safety glasses etc.</li><li>(b) Breathing apparatus.</li><li>(c) Basic measurements such as:<ul style="list-style-type: none"><li>- definition of air.</li><li>- definition of TLV.</li><li>- definition of PPM.</li></ul></li><li>(d) Identify substances found in crude and refined products, such as:<ul style="list-style-type: none"><li>- Hydrocarbons.</li><li>- Aromatics.</li><li>- Hydrogen sulfide.</li><li>- Other gasses.</li></ul></li><li>(e) Define volatile and non-volatile hydrocarbons.</li><li>(f) Identify internal &amp; external health hazards such as the dangers associated with:<ul style="list-style-type: none"><li>- Inhalation.</li><li>- Ingestion.</li><li>- Absorption.</li><li>- Gas Freeing.</li><li>- Methods &amp; procedures for safe entry into enclosed compartments.</li></ul></li></ul>	<p>Pre Requisite</p> <p>MED B2 Pre Requisite</p> <p>0.5 Hours</p> <p>Pre Requisite</p> <p>0.5 Hours</p>

TOPIC	EXPLANATION OF TOPIC ITEM	Covered by:
<b>2.2 Properties of hydrocarbons and fire hazards:</b>	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 tank barge.	
	Learning Tasks:	
	(a) Understand the fire triangle & tetrahedron.	MED B2
	(b) Understand flammable vapors with reference to: - Definition of flammable limits. - Definition of flammable range. - Displayed typical flammable ranges.	0.5 Hours
	(c) Understand ignition sources such as: - Definition of auto ignition temperature - Displayed examples of auto ignition. - Displayed ignition sources from hand tools. - Understand flash point. - Understand fire point. - Understand the difference between flame proof & intrinsically safe.	1.0 Hours
	(d) Be aware of heat sources such as: - Naked lights. - Wet rags. (Oil[Nat./Org.] & water) - Smoking, lighters & matches. - Friction. - Non intrinsically safe switches.	MED B2
	(e) Be aware of static charges such as: - Static accumulators. - Bonding. - Water vapor. (inc. oil/water mixes) - Gas expansion. - Free falling water or oil. - Understand ullaging dangers. - Understand tank cleaning dangers.	1.5 Hours
	(f) Understand the operation & maintenance of fire fighting equipment, that is: - Foam. (fixed & portable) - CO2 & Dry Chemical extinguishers. - Steam Smothering. - Inert Gas. - Water hoses & nozzles.	MED B2
		MED B2
		MED B2
		0.5 Hours
		MED B2

TOPIC	EXPLANATION OF TOPIC ITEM	Covered by:
<b>2.3 Pipeline layouts and theory:</b>	At the completion of this session the student will be able to discuss various pipeline configurations commonly found on an unmanned tank barge.	
	Learning Tasks:	
	(a) Sketch, describe and set cargo pipelines for loading, discharging and cleaning: - Ring main systems. - Direct systems. - Hatch lids & closing devices	0.5 Hours
	(b) Sketch, describe and set cargo pumprooms for loading, discharging and cleaning. (giving special emphasis to pipeline flushing/cleaning.)	1.0 Hours
	(c) Understand the needs as to: - Cargo segregation and separation. - Closed loading & vapor recovery.	1.0 Hours
	(d) Understand the compatibility of cargo.	0.5 Hours
	(e) Understand the need for double valve separation.	0.5 Hours
	(f) Sketch & describe the construction and operation of: - Gate valves. - Globe valves. - Butterfly valves. - Non return valves. - Screw down non return valves. - Pressure/Vacuum valves. - Extended spindles. - Spill Valves. - P/V vents. - Rockwell valves	1.5 Hours
	(g) Understand basic pipeline theory in relation to: - Cavitation & Erosion damage. - Friction losses. - Insulated flanges. - Tank suction. - Water hammer. - Cargo "plugs". - Pipeline "pigging".	1.0 Hours

TOPIC	EXPLANATION OF TOPIC ITEM	Covered by:
<b>2.4 Pumps and pump theory:</b>	At the completion of this session the student will be able to discuss various pumping arrangements and configurations commonly found on an unmanned tank barge.	
	Learning Tasks:	
	(a) Sketch & describe the construction and operating procedures (start up, running, stopping & emergency stopping) of: - Centrifugal pumps. - Gear pumps. - Rotary Vane pumps. - Deep well pumps. - Eductors.	2.5 Hours
	(b) Understands the hazards of operating positive displacement pumps.	0.5 Hours
	(c) Understands the meaning of NPSH.	0.25 Hours
	(d) Understands why decreasing pump speed will affect tank suction.	0.25 Hours
	(e) Understands the meaning of design point.	0.25 Hours
	(f) Understands why low vapor pressure will improve tank suction.	0.25 Hours
	(g) Understands why actual discharge rates are affected by static and dynamic back pressures from shore installations.	0.5 Hours
	(h) Understands why pump cavitation occurs.	0.5 Hours
	(i) Sketch & describe a graph showing the characteristics of a centrifugal pump.	0.5 Hours
	(j) Understands the meaning of <i>shore installation curves</i> .	0.25 Hours
	(k) Sketch & describe a typical Q-H curve for: - Single pump use. - Double pump in parallel use.	0.5 Hours

TOPIC	EXPLANATION OF TOPIC ITEM	Covered by:
<b>2.5 General vessel maintenance:</b>	At the completion of this session the student will be able to demonstrate proficiency with respect to operational maintenance on an unmanned tank barge.  Learning Tasks:	
	(a) Demonstrate the ability to: - Perform the execution of line pressure testing. - Perform the execution of flexible cargo hose pressure testing. - Understand the importance of hose clamps. - Understand hose construction details. - Repair pipe work from damage caused by cavitation, corrosion, mechanical action etc. - Re pack valve glands. - Re pack pump glands/change mechanical seals. - Replace pipe/hose gaskets.	Industry
	(b) Demonstrate the ability to perform routine maintenance checks related to: - Pump motive power units. - Portable pumps. - Generating equipment. - Batteries. - Deck lighting systems. - Cargo heating equipment. - Cargo sampling equipment. - Cargo calibration equipment (tapes, rods, floats etc.) - Hydraulic pumps & pipe work.	Industry Industry 0.5 Hours 0.5 Hours Industry 1.0 Hours Industry Industry
	(c) Demonstrate knowledge with respect to the maintenance of: Scupper plugs. Drip trays. Tank lid covers. Ullage cap covers.	Industry Industry

**TOPIC**

**EXPLANATION OF TOPIC ITEM**

**Covered by:**

**2.6 Cargo planning and calculations:**

At the completion of this session the student will be able to demonstrate proficiency with respect to planning cargo disposition & quantifying the cargo on an unmanned tank barge.

Learning Tasks:

- (a) Understand the meaning of general terms and abbreviations such as:
    - OBQ - ROB - TOV - GSV- Gross Bbl 1.5 Hours
    - Net Bbl - M<sup>3</sup> - Litres- Gallons (US)
    - Gallons (Imp.) - API - SG- RD - FW
    - Long Ton - Metric Tonne- B/L - LEL
    - UEL - BS&W
  - (b) Understand the usage of:
    - Ullage/sounding systems (hand, mechanical & electronic) 1.5 Hours
    - O<sub>2</sub> Analyzers, Explosimeters and Dragear Tubes
    - Water pastes - Gas pastes.
    - Sample Techniques & Standards (ASTM)
    - Temperature measurements (hand & electronic)
    - Hydrometers.
    - Flash Test apparatus.
  - (c) Understand & interpret ASTM tables (A&B)
  - (d) Understand the problems associated with heated cargo. 0.5 Hours
  - (e) Understand the importance of pre planning a cargo with respect to:
    - Segregation of parcels.
    - Compatibility of parcels. 1.5 Hours
    - Loading/discharging sequences & pump usage
    - Color coding.
    - Weight distribution.
    - Pump usage.
    - Final sailing drafts.
    - Tank innages.
  - (f) Quantify a given multi parcel cargo in:
    - Long Tons - Metric Tonnes - Pounds
    - Net Bbl's - Litres - Gallons (Imp & US) 1.5 Hours
  - (g) Using a given worked example, prepare an ullage report for a multi parcel load. 1.5 Hours
  - (h) Discuss special requirements related to cargo planning for voyages in Arctic Waters 1.0 Hours
- 0.5 Hours

TOPIC	EXPLANATION OF TOPIC ITEM	Covered by:
<b>2.7 General paperwork &amp; Operations:</b>	At the completion of this session the student will be able to demonstrate proficiency with respect to completing regulatory and company paperwork on an unmanned tank barge.	
	Learning Tasks:	
	(a) Lists the information to be provided by the shore facility for loading & discharging.	0.5 Hours
	(b) Lists the information to be provided by the unmanned tank barge for loading & discharging.	0.5 Hours
	(c) States that an operational agreement should be made in writing before commencing loading or discharging.	0.25 Hours
	(d) Explains the subjects to be covered by the loading plan.	0.5 Hours
	(e) Lists the subjects to be covered by the discharging plan.	0.5 Hours
	(f) Describes the pre-loading tank inspection, and the limitations when surveyors cannot enter a tank.	1.0 Hours
	(g) Understands that, when different oils are handled, their names and descriptions should be clearly understood by both parties in writing.	1.0 Hours
	(h) Understands that the ship/shore checklist should be completed jointly by both tank barge/vessel staff and shore facility staff.	0.5 Hours
	(i) Understands the relevance of the check list and understands the importance of the items contained within the checklist.	0.5 Hours
	(j) Using a worked example, complete the OIL RECORD BOOK for: - Loading. - Discharging. - Ballast & De-Ballast of cargo tanks. - Cleaning.	1.5 Hours

TOPIC	EXPLANATION OF TOPIC ITEM	Covered by:
<b>2.8 Tank Barge to Tank Barge and Tank Barge to Ship transfers when not alongside a facility:</b>	At the completion of this session the student will be able to demonstrate proficiency of knowledge with respect to tank barge to tank barge & tank barge to ship transfers when not alongside.	
	Learning Tasks:	
	(a) Understand the special considerations necessary when not alongside with respect to:	
	- Life saving.	MED A1
	- Life rafts.	MED A1
	- Fire fighting.	MED B2
	- Lifejackets.	MED A1
	- Immersion suits.	MED A1
	- PFD's.	MED A1
	- Rescue Boats.	MED A1
	- Safety contingency plans.	MED A1
	- Weather. (inc. ice conditions)	1.0 Hours
	- Lighting.	1.0 Hours
	- Communications and control.	0.5 Hours
	- Emergency stop procedures.	0.5 Hours
	- Oil spill contingency planning.	0.5 Hours
	- Transfer check lists.	1.0 Hours
	(b) Understand special requirements in relation to general seamanship, i.e.	0.5 Hours
	- Fendering.	1.5 Hours
	- Mooring.	
	- Anchoring.	
	- Hose handling, emphasizing stress & chaffing problems	
	- Action after transfer completion.	
	(c) Discuss the special requirements related to offshore and shore transfers within the Arctic Water Oil Transfer Guidelines (TP 10783)	1.0 Hours

TOPIC	EXPLANATION OF TOPIC ITEM	Covered by:
<b>2.9 Pollution Prevention Regulations and Environmental response:</b>	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	
	Learning Tasks:	
	(a) Demonstrate knowledge relating to regulations with respect to: - Canada Shipping Act. - MARPOL 73/78 - Annex I - O.P.A. 90 - A.S.P.P.R	1.5 Hours
note: include theory with practical session +	(b) Understand the effects of timely response to oil spills, emphasizing: - Preparation of response. - Responsibilities. - Communications. - Equipment. - Reporting methods & obligations. - Requesting assistance. - Preventative measures.	2.5 Hours
note: include theory with practical session +	(c) Describe initial action: - Methods of first aid action. - Methods of containment. - Methods of first aid clean up. - Reporting information & contents. - Sample reports.	1.5 Hours
	(d) Describe clean up action: - Responsibility. - Costs. - Available resources. - Methods of operation.	1.0 Hours
	(e) Complete by example the OIL RECORD BOOK section dealing with accidental overboard discharges of oil.	0.5 Hours
	(f) Provide a 'Hands On' component for emergency environmental response.	Industry

TOPIC	EXPLANATION OF TOPIC ITEM	Covered by:
<b>2.10 Communications:</b>	At the completion of this session the student will be able to demonstrate proficiency of knowledge with respect radio communications between unmanned tank barge and shore facility and between unmanned tank barge and proper authorities.  Learning Tasks:	
	(a) External communications: - Read and understand the DOC Marine Restricted Radio Certificate. - Examination to DOC standards to allow student to hold Marine Restricted Radio Certificate.	Pre Requisite
	(b) Operational communications: - Understands that reliable communications between unmanned tank barge and shore facility require primary and back up communication mediums. - 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. - Understand that 'slang terms' must be avoided when dealing with oil products as ambiguity is often caused. Understand that profanity during radio communications is illegal and unwarranted.	1.0 Hours

TOPIC	EXPLANATION OF TOPIC ITEM	Covered by:
<b>2.11 General seamanship:</b>	At the completion of this session the student will be able to demonstrate proficiency of knowledge with respect to unmanned tank barge seamanship details.	
	Learning Tasks:	
	(a) Mooring: - Understands forces acting on moorings. - Mooring optimizing. - Mooring layout. - Mooring equipment. - Mooring management.	0.5 Hours
	(b) Derricks/Cranes: - SWL. - Rigging. - Preventive maintenance. - Record keeping.	1.0 Hours
	(c) Flexible Hoses: - Inspections before use. - Test certificates. - Connecting. - Disconnecting. - Cleaning, stowage & hose handling. - Flange & joint inspection to match product requirements	1.0 Hours
	(d) Rope & Wire work - Understand and demonstrate: - Bowline. - Reef knot. - Rolling hitch. - Clove hitch. - Eye splice. - Back splice. - Common whipping	Industry
	(e) Understand that good general housekeeping improves efficiency.	Industry

TOPIC	EXPLANATION OF TOPIC ITEM	Covered by:
<b>2.12 Practical Barge session:</b>	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.	
	Learning Tasks:	
	(a) During a normal working day the student will observe and record all pertinent facts related to the transfer of oil products.	Barge Visit
	(b) Sketch and describe the pipeline layout of the unmanned tank barge.	Barge Visit
	(c) Sketch and describe the pumproom layout of the unmanned tank barge.	Barge Visit
	(d) Record and describe the color coding system used for cargo transfer.	Barge Visit
	(e) Record and understand: - Tank capacities. - Deadweight. - Maximum draft. - Minimum freeboard. - Maximum cargo grades able to segregate. - Ballast capacity. (if applicable)	Barge Visit
	(f) Observe and describe: - Pollution prevention equipment. - Oil Spill equipment. - Radio equipment & procedures. - Checklists. - Contingency plans. - OIL RECORD BOOK	Barge Visit

4.0 Hours Total

TOPIC	EXPLANATION OF TOPIC ITEM	Covered by:
<b>2.13 Examinations:</b>	<p>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 a unmanned tank barge.</p> <ul style="list-style-type: none"><li>(a) Students will be required to have all course assignments completed at times specified and will be to the instructors satisfaction.</li><li>(b) An examination containing a mixture of 100 multiple choice and written questions will be given at the termination of the course.</li><li>(c) Pass mark for examination will be set at minimum 70%</li><li>(d) Examination re-writes will be allowed after one week from the date of failure.</li><li>(e) Failure to pass the examination after the second attempt will require the candidate to re take course components A and C.</li></ul>	2.0 Hours

## APPENDIX I

### 3.1 Explanation of training terms & requirements:

- (a) Where a learning task is suffixed " Pre Requisite", this is to indicate that the student is expected to have completed the content of that task either via industry specific training, acceptable related training elsewhere or by pre course reading.  
It is emphasized that the content of this learning task will not be instructed through the normal duration of class contact, but knowledge of that subject may be tested for during the examination at the conclusion of the SOTO course.
- (b) Where a learning task is suffixed " Industry ", this is to indicate that the student is expected to have completed the content of that task either via industry specific training or acceptable related training elsewhere.  
It is emphasized that the content of this learning task will not be instructed through the normal duration of class contact, but knowledge of that subject may be tested for during the examination at the conclusion of the SOTO course.
- (c) Where a learning task is suffixed by time (e.g. 1.0 Hours), this is to indicate that the student is expected to have completed the content of that task via acceptable training standard at an approved training establishment.  
It is emphasized that the content of this learning task will be instructed through the normal duration of class contact, and knowledge of that subject will be tested for during the examination at the conclusion of the SOTO course.

## APPENDIX II

### 3.2 Industry / Institute recommendations & participation:

- (a) Entry to SOTO courses should not be automatic. Candidates will be required to successfully complete the aptitude test as given in stated in 1.7 of this standard.
- (b) The SOTO course shall be divided into three modules and candidates must complete all Parts within a period of thirty (30) months prior to the issue of Marine Safety/TC Certification. Part A must have been completed prior to the completion of Part C.

#### **Part A - Basic**

Approx. 30 hours instruction at an approved training facility. (see Appendix III)

#### **Part B - Industry Experience**

3 months operational and supervised industry experience. This experience to be recorded in an approved "Record Book", which will be the responsibility of the Candidate to maintain

#### **Part C - Advanced**

Approx. 30 hours instruction at an approved training facility. (see Appendix IV)

- (c) Industry will be consulted by the approved training facilities to determine acceptable candidate performance during Part B of this course.
- (d) Candidates will not be eligible for Marine Safety/TC Certification until success completion of Part C has been achieved.
- (e) Training Facility modules should be monitored at regular intervals by relevant industry concerns.
- (f) Training Facility modules should be monitored at regular intervals by Marine Safety/TC.

## APPENDIX III

### 3.3 Part A Requirements:

It shall be understood that Part A of the SOTO course is specifically designed for 'New Entrants' to the industry.

The following item numbers (time suffixes only) will be included in approved facilities offering instruction to Part A of the SOTO course.

2.1(d), 2.1(f), 2.2(b), 2.2(c), 2.2(e), 2.2(f), 2.3(c), 2.3(d), 2.3(e), 2.4(a), 2.4(b), 2.4(h), 2.5(c), 2.6(a), 2.6(b), 2.6(c), 2.6(f), 2.8(a), 2.8(b), 2.11(a), 2.11(b), 2.11(c), 2.12(a), 2.12(b), 2.12(c), 2.12(d), 2.12(e), 2.12(f)

(Approx. 30 Hours Instruction)

#### **Note:**

The student will be issued a training certificate of completion at the conclusion of Part A. This certificate will be generated by the approved training facility and must not be confused with the full Marine Safety/TC SOTO certificate of competency.

The training certificate as described above will remain valid for a period of 30 months.

## APPENDIX IV

### 3.4 Part C Requirements:

It shall be understood that Part C of the SOTO course is specifically designed for existing certificated personnel presently serving in the industry and new personnel who have successfully completed Parts A & B. It is anticipated that Part C will be used primarily for CPE requirements.

The following item numbers (time suffixes only) will be included in approved facilities offering instruction to Part C of the SOTO course.

2.3(a), 2.3(b), 2.3(f), 2.3(g), 2.4(c), 2.4(d), 2.4(e), 2.4(f), 2.4(g), 2.4(i), 2.4(j), 2.4(k), 2.5(b), 2.6(d), 2.6(e), 2.6(g), 2.7(a), 2.7(b), 2.7(c), 2.7(d), 2.7(e), 2.7(f), 2.7(g), 2.7(h), 2.7(i), 2.7(j), 2.8(c), 2.9(a), 2.9(b), 2.9(c), 2.9(d), 2.9(e), 2.10(b), 2.13(exam)

(Approx. 30 Hours Instruction)

#### Notes:

At the termination of Part C of the student will be expected to pass the examination as outlined in 2.13 of this standard.

A student who successfully achieves all of the requirements of Part's A, B & C will be eligible for a full Marine Safety/TC SOTO certificate of competency.

## APPENDIX V

### 3.5 References:

<b>Publication</b>	<b>Published By:</b>
1 Tanker Safety Courses (TP 8129 E)	Marine Safety/TC
2 Canada Shipping Act CRCc 1454	Supply & Services Canada
3 MARPOL 73/78 (1992 ed.)	I.M.O.
4 I.S.G.O.T.T.	Witherby & Co.
5 Tanker Handbook For Deck Officers	Brown Son, & Ferguson
6 Ship to Ship Transfer Guide	Witherby & Co.
7 ASTM Measurement Tables	ASTM
8 Manual On Oil Pollution (Sect II) Contingency Planning	I.M.O.
9 Manual On Oil Pollution (Sect IV) Combating Oil Spills	I.M.O.
10 Oil Record Book (Parts 1&2)	Marine Safety/TC
11 Arctic Water Oil Transfer Guidelines (TP 10783)	Marine Safety/TC
12 Guidelines for the Operation of Tankers and Barges in Canadian Arctic Waters (Interim) (TP 11663E)	Marine Safety/TC
13 Ship Safety Standards & Guidelines for the Construction, Inspection & Operation of Barges that Carry Oil in Bulk (TP N/A rev 4A)	Marine Safety/TC