MARPOL Annex II

Regulations for the Control of Pollution by Liquid Noxious Substances in Bulk

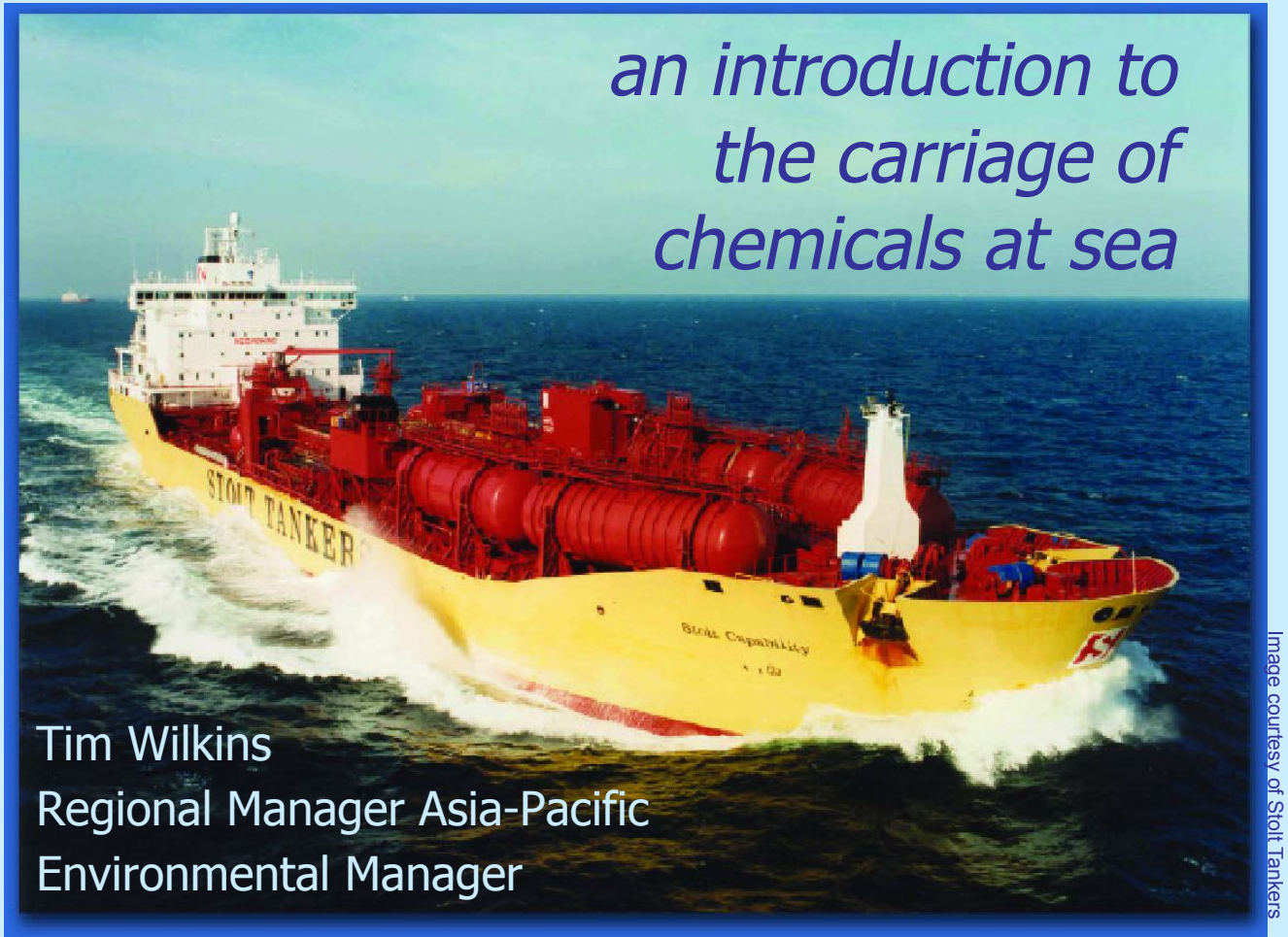

Image courtesy of Stolt Tankers

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1. Overview: the carriage of chemicals at sea
   i. Market analysis
   ii. Chemical tanker industry

2. An overview of MARPOL Annex II
   i. Pollution Categorization
   ii. Ship Types
   iii. Operational requirements

1. Overview

- Chemical transportation technically and logistically different from oil transportation

Cargoes

- extensive range from noxious or hazardous chemicals to edible oils and fats
- every chemical cargo carried requires careful consideration during the planning process and loading
  - relative temperature sensitivity
  - semi-gases
  - possible need to be inhibited
  - relative sensitivity to water
  - potential to react with each other

1. Overview

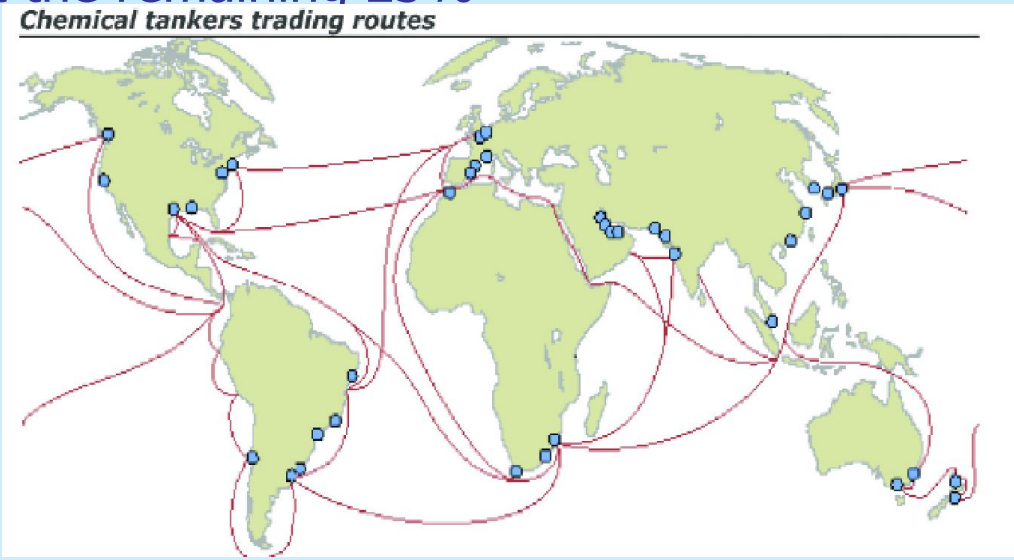
- Chemical transportation technically and logistically different from oil transportation

  Ships

  - 50 plus tanks means complex and advanced **construction**
    - tank construction type for containment
    - pumping requirements
    - tank coating compatibility
    - venting requirements
    - gauging equipment
    - vapour detection
    - fire protection medium
  - 50 plus tanks means complex and advanced **operation**
    - cross compatibility with other cargoes carried
    - heating requirements
    - environmental controls if required e.g. inerting
    - inhibition requirements
    - density limitations of the product in relation to the cargo tank construction

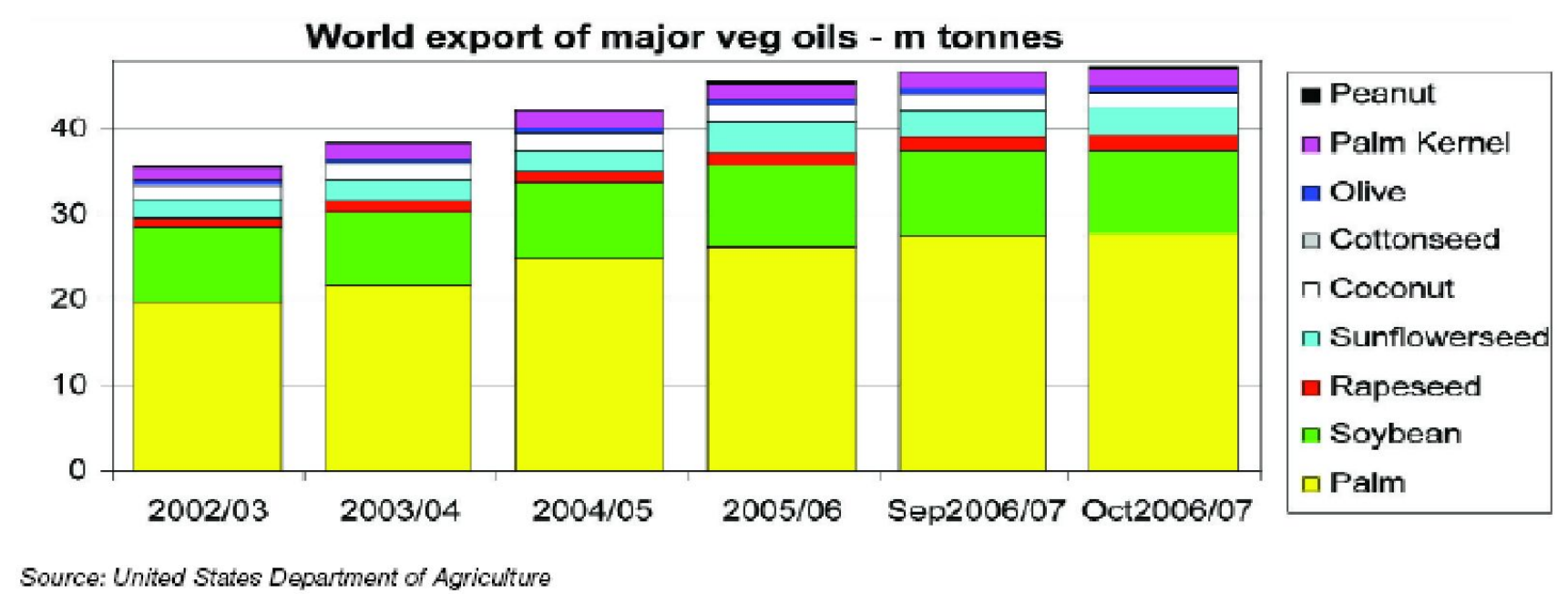
1. Overview: market analysis

- The vegetable oil trade represents close to 50 million tonnes
  - palm oil trade 60%
  - soybean oil some 20%
  - sunflower seed 7%
  - palm kernel oil, peanut oil, olive oil, cottonseed oil and coconut oil represent the remaining 23%



1. Overview: market analysis

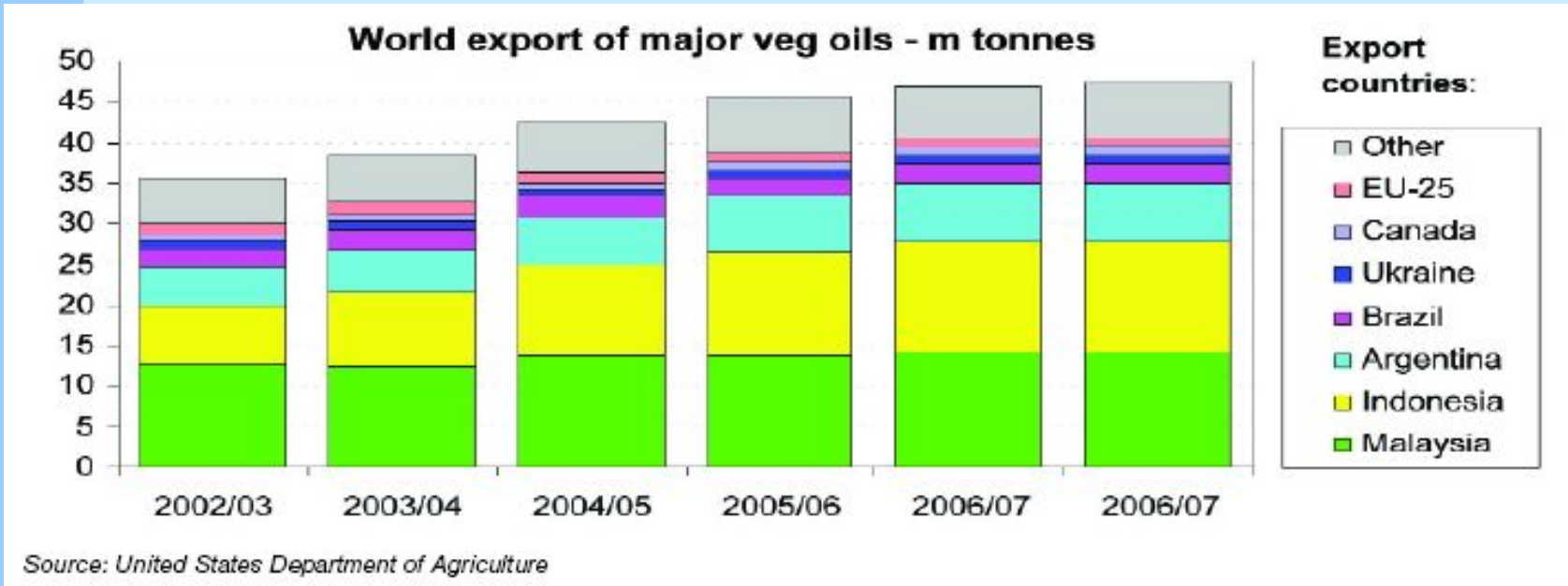
World export of major veg oils – oil types



Source: United States Department of Agriculture

1. Overview: market analysis

World export of major veg oils – export countries



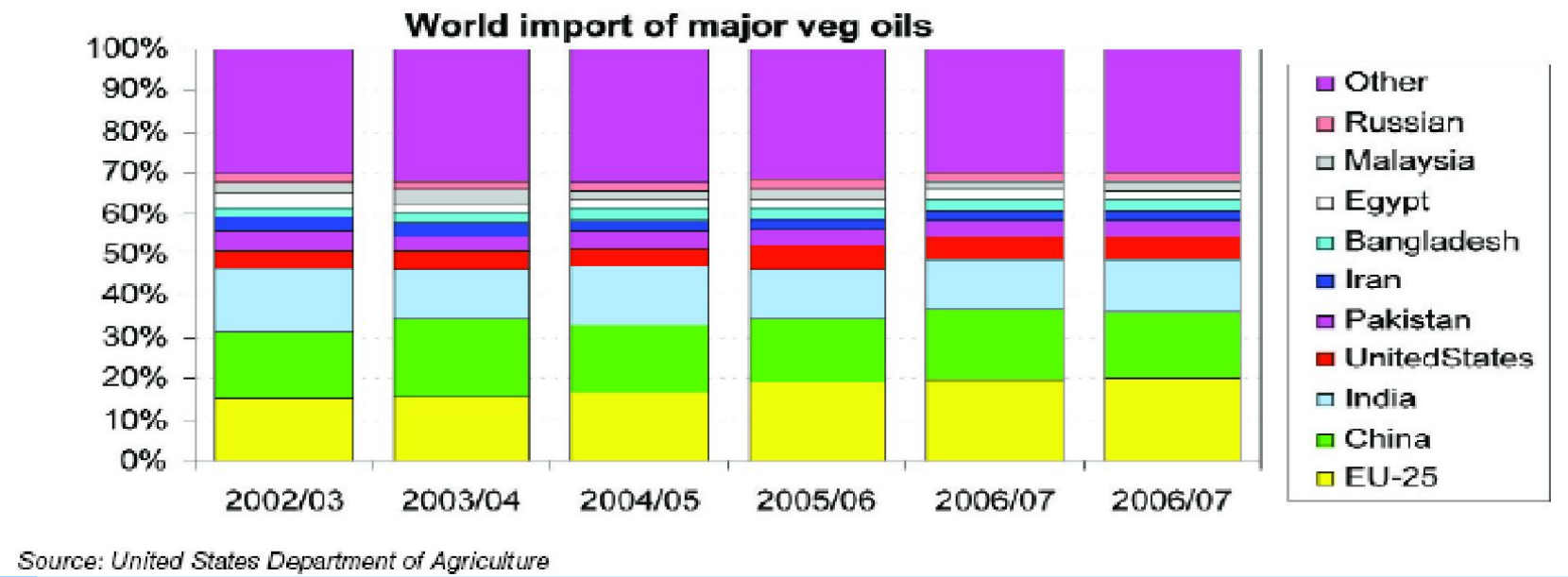
Source: United States Department of Agriculture

Veg oil exports per year

- Indonesia 30%
- Malaysia 30%
- Argentina 15%
- Brazil 5%

1. Overview: market analysis

World import of major veg oils



Source: United States Department of Agriculture

The biggest importing areas are:

- Europe (9 m tonnes)
- China (7.5 m tonnes)
- India (6 m tonnes)

1. Overview: market analysis

Chinese Vegetable Oil Consumption Continues to Grow

- 7 years of growth in China's vegetable oil consumption
  - 9.5 kg per person per year in 1999/00
  - 17.1 kg in 2006/07 (forecast)
- If China's per capita oil consumption were to reach that of the Taiwan, China would consume 52% more vegetable oil, or 35 million tons in 2006/07 instead of the 23 million tons estimated
  - Apparently, due to growing middle class eating more restaurant meals!

Source: United States Department of Agriculture

1. Overview: market analysis

Transportation of vegoils

Malaysia & Indonesia export trade:

2005	27.5 million tonnes
2006	29.4 million tonnes

Malaysian export of palm oil:

2004/05	12,634 million tonnes
2005/06	13,770 million tonnes
2006/07	13,840 million tonnes

Double Hull tankers increasing dominance:

2005	53%
2006	60%

Source: Malaysian Palm Oil Board

1. Overview: market analysis

Transportation of vegoils

Malaysia/Indonesian palm oil trade by hull type

Hull type	2005 - 27.5 m ts		2006 - 29.4 m ts	
	m tonnes	Share	m tonnes	Share
SH	3.6	13%	4.1	14%
DB	8.8	32%	7.1	24%
DH	14.6	53%	17.6	60%
Unknown	0.5	2%	0.6	2%
Total	**27.5**	**100%**	**29.4**	**100%**

The shares were estimated based on reported spot fixtures only - approximately 5 million tonnes of the trade.

Source: Inge Steensland AS

1. Overview: market analysis

Major consideration going into 2007; the re-categorisation of vegetable oils and the need to carry these cargoes in double hull chemical tankers

Chemical tanker fleet by hull – number

DWT cat	DB	DH	DS	SH	No info	Total
5,000-10,000	174	360	4	37	47	622
10,000-19,999	94	369	3	40		506
20,000-29,999	41	101	1	23	2	168
30,000-39,999	46	313	10	20	1	390
40,000 +	35	271	10	11		327
Total	**390**	**1,414**	**28**	**131**	**50**	**2,013**

Chemical tanker fleet by hull – dwt

DWT segment	DB	DH	DS	SH	No info.	Grand Total
5,000-10,000	1,245,535	2,656,408	29,556	258,679	318,488	4,508,667
10,000-19,999	1,399,329	5,452,673	39,070	592,957		7,484,029
20,000-29,999	1,058,239	2,573,600	29,900	668,084	59,996	4,389,819
30,000-39,999	1,636,298	11,159,267	391,355	690,802	37,314	13,915,036
40,000 +	1,525,061	12,511,339	447,058	518,147		15,001,605
Grand Total	**6,864,462**	**34,353,287**	**936,939**	**2,728,669**	**415,798**	**45,299,155**

NB includes tankers with IMO type that may not trade in Annex II products

Source: Chemindex (Inge Steensland)

2. MARPOL Annex II

For ease of understanding Annex II can be divided into two clear sections:

i. Pollution categories
ii. Ship type requirements

Additionally there are also the:

iii. Operational requirements
(for the actual/physical carriage of chemicals in bulk)

2. MARPOL Annex II: Pollution categorization

Early 1990's IMO commenced review of

- MARPOL Annex II regulations
- International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (IBC Code)

Why?

- Editorial improvements
- Adaptation to the revised GESAMP procedure
- Reduce the number of categories
- Simplification of operational requirements
- Fewer non-regulated substances
- Reduction of legal discharges
- Keeping up with technical development
- Adaptation to the Global Harmonized System (GHS)

2. MARPOL Annex II: Pollution categorization

Previously there were 5 pollution categories within Annex II:

- categories A, B, C, D and an Appendix III
- Appendix III listed products to which the IBC Code did not apply

As of 1st January 2007 we have 3+1 pollution category system:

- X, Y, Z and OS
- OS or Other Substances - includes apple juice, clay slurry, coal slurry, dextrose solution, glucose solution, kaoline slurry, molasses and water
- Vegetable oils now upgraded from Appendix III (of the IBC Code) to Pollution Category Y
- Oil like substances no longer exist (xylene, toluene, pentanes now require CoF and can no longer be carried on product tankers)

2. MARPOL Annex II: Pollution categorization

Summarising the extent of the changes in volume terms

Type of change	Reclassified from to	Products and volumes	
Re-categorisation of vegoils, soft oils and fats	D to IMO type 2 (or IMO type 3 with DH meeting operational requirements)	Palm oil	27 m ts
		Soybean oil	10 m ts
		Sunflowerseed	3 m ts+
		Other veg oils	6 m ts+
		Tallow	2 m ts+
		Fatty acids, paraffin wax	
		Total	appox. 50m ts)
Other products with no previous requirement to IMO ship type	IBC ch18 to IMO type IMO 3	Methanol	17 m ts
		MTBE	5.5 m ts
		UAN	5 m ts
		MEG/TEG/DEG	5 m ts
		Ethyl acetate, Methyl ethyl ketone	1 m ts
Change of ship type requirements	IMO type 3 to 2	Xylenes	> 5 m ts
No requirements	No change	Molasses	6 m ts
		Ethanol	3 m ts

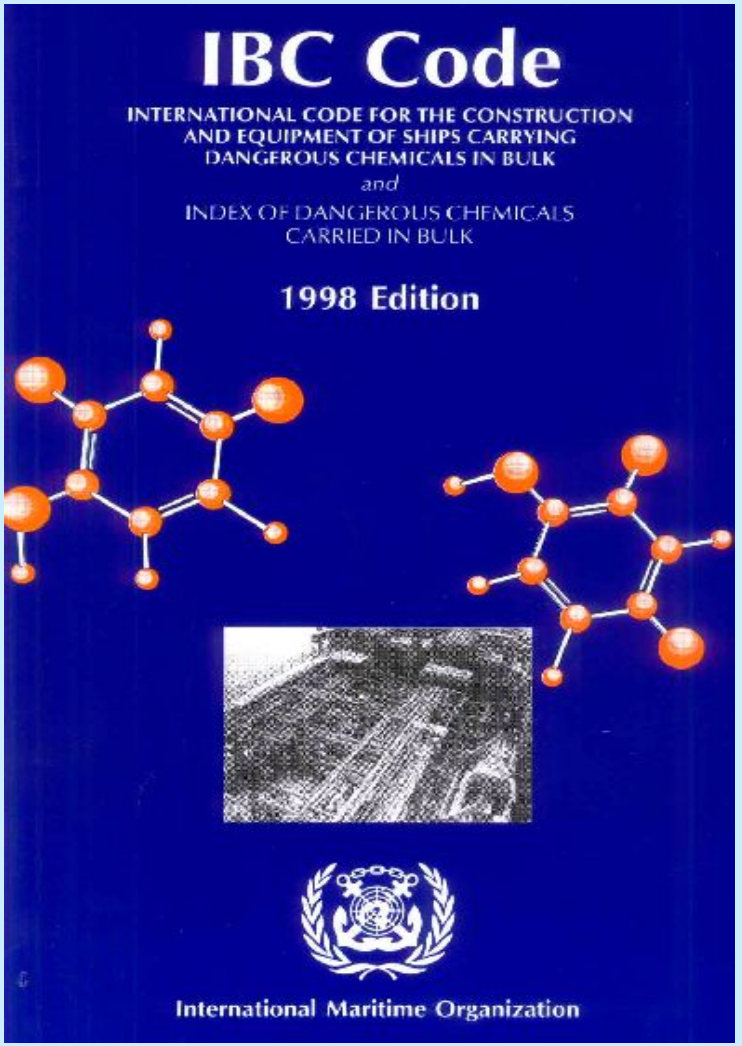
Source: Inge Steensland AS

2. MARPOL Annex II: Ship types

What is an IMO Ship Type?

- The International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk IBC Code provides detailed standards for the construction and equipment of three types of chemical tankers (Types 1, 2 and 3)

- The bulk carriage of any liquid product other than those defined as oil (subject to MARPOL Annex I) is prohibited unless the product has been evaluated and categorised for inclusion in Chapter 17 or 18 of the IBC Code



2. MARPOL Annex II: Ship types

IMO Ship Type 1
is a chemical tanker intended for the transportation of products considered to present the greatest overall hazard. The quantity of cargo required to be carried in a Type 1 ship should not exceed 1,250 m3 in any one tank

IMO Ship Type 2
is intended to transport products with appreciably severe environmental and safety hazards which require significant preventive measures to preclude escape of such cargo. The quantity of cargo required to be carried in a Type 2 ship should not exceed 3000 m3 in any one tank

IMO Ship Type 3
is a chemical tanker intended to transport products with sufficiently severe environmental and safety hazards. These products require a moderate degree of containment to increase survival capability in a damaged condition. There is no filling restriction for chemicals assigned to Ship Type 3

2. MARPOL Annex II: Ship types

Cargo Tank Location

2.6.1 Cargo tanks shall be located at the following distances inboard:

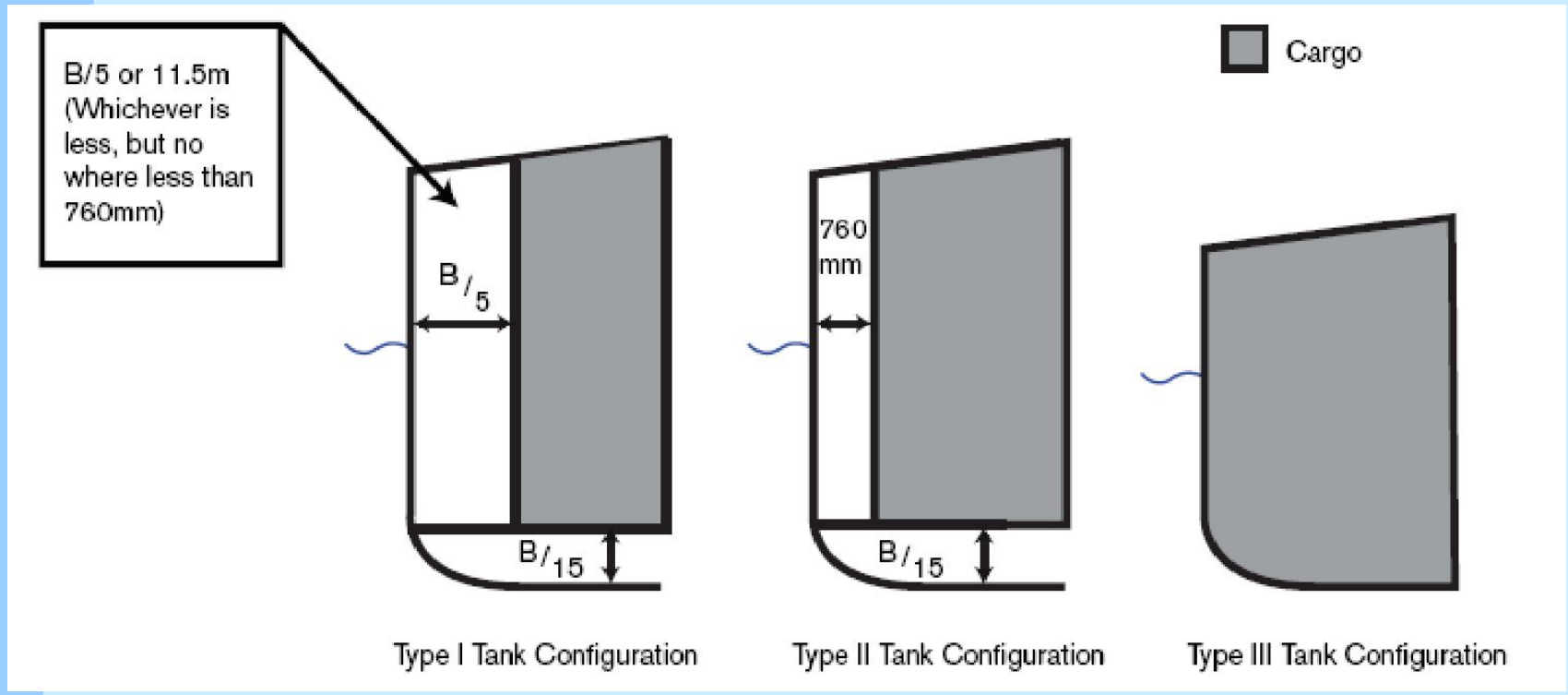
.1 Type 1 ships: from the side shell plating, not less than the transverse extent of damage specified in 2.5.1.1.2, (B/5 or 11.5m whichever is less), and from the moulded line of the bottom shell plating at centreline, not less than the vertical extent of damage specified in 2.5.1.2.3, (B/15 or 6 m whichever is less), and nowhere less than 760 mm from the shell plating. This requirement does not apply to the tanks for diluted slops arising from tank washing.

.2 Type 2 ships: from the moulded line of the bottom shell plating at centreline, not less than the vertical extent of damage specified in 2.5.1.2.3, (B/15 or 6 m which ever is less), and nowhere less than 760 mm from the shell plating. This requirement does not apply to the tanks for diluted slops arising from tank washing.

.3 Type 3 ships: no requirement"

2. MARPOL Annex II: Ship types

Cargo Tank Location and Configuration



2. MARPOL Annex II: Ship types

Pollution Category and Ship Type - Combined

Table 1

Product	New Poll Cat	New ship type	Old poll cat	Old ship Type
Acetic acid	Z	3	D	3
Acetic anhydride	Z	2	D	2
Acetochlor	X	2	A	2
Acetone cyanohydrin	Y	2	A	2
Acetonitrile	Z	2	III	2
Acetonitrile (low purity grade)	Y	3	D	2
Acid oil mixture from soyabean, corn (maize) and sunflower oil refining	Y	2	D	n/a
Acrylamide solution (50% or less)	Y	2	D	2
Acrylic acid	Y	2	D	3
Acrylonitrile	Y	2	B	2
Citric acid (70% or less)	Z	3	D	n/a
Coal tar	X	2	A	2
Coal tar pitch (molten)	X	2	D	3
Coal tar naphtha solvent	Y	2	B	3
Cocoa Butter	Y	2 (k)	D	n/a
Coconut oil	Y	2 (k)	D	n/a
Coconut oil fatty acid	Y	2	C	3
Coconut oil fatty acid methyl ester	Y	2	D	n/a
Copper salt of long chain (C17+) alkanoic acid	Y	2	D	N/a
Corn Oil	Y	2 (k)	D	N/a
Cotton seed oil	Y	2 (k)	D	N/a

2. MARPOL Annex II: Operational requirements

Stripping requirements (1)

The revised stripping limits will greatly reduce the amount of residues that vessels will be allowed to discharge into the marine environment

Ships constructed before 1 July 1986 shall be provided with a pumping and piping arrangement to ensure that each tank certified for the carriage of substances in Category X or Y does not retain a quantity of residue in excess of 300 litres in the tank and its associated piping and that each tank certified for the carriage of substances in Category Z does not retain a quantity of residue in excess of 900 litres in the tank and its associated piping. A performance test shall be required to be carried out.

Every ship constructed on or after 1 July 1986 but before 1 January 2007 shall be provided with a pumping and piping arrangement to ensure that each tank certified for the carriage of substances in Category X or Y does not retain a quantity of residue in excess of 100 litres in the tank and its associated piping and that each tank certified for the carriage of substances in Category Z does not retain a quantity of residue in excess of 300 litres in the tank and its associated piping.

2. MARPOL Annex II: Operational requirements

Stripping requirements (2)

Every ship constructed on or after 1 January 2007 shall be provided with a pumping and piping arrangement to ensure that each tank certified for the carriage of substances in Category X, Y or Z does not retain a quantity of residue in excess of 75 litres in the tank and its associated piping.

After 1 January 2007, the stripping performance requirements will apply to all tankers holding a Certificate of Fitness (CoF).

2. MARPOL Annex II: Operational requirements

Underwater discharge requirements

The underwater discharge arrangement for tank washing water is required for pollution categories X and Y for ships keel laid before 1 January 2007.

New buildings will require such for all pollution categories X, Y and Z.

Category Z products will be exempted from the underwater discharge requirement, although new vessels will be required to comply.

2. MARPOL Annex II: Operational requirements

Stripping and Discharge requirements Summarised

Category	BCH Ships Constructed before 31/7/1986	Existing IBC Constructed from 31/7/1986 but before 1/1/2007	New Buildings Constructed from 1/1/2007	Ships Other than Chemical Tankers constructed before 1/1/2007
X	Pre Wash Strip to 350 Litres 12 mile 25m water depth 7 knots, en-route	Pre Wash Strip to 150 Litres 12 mile 25m water depth 7 knots, en-route	Pre Wash Strip to 75 Litres 12 mile 25m water depth 7 knots, en-route	Carriage Prohibited
Y	Pre Wash for solidifying for high viscosity substances Strip to 350 Litres 12 mile 25m water depth 7 knots, en-route	Pre Wash for solidifying for high viscosity substances Strip to 150 Litres 12 mile 25m water depth 7 knots, en-route	Pre Wash for solidifying for high viscosity substances Strip to 75 Litres 12 mile 25m water depth 7 knots, en-route	Carriage Prohibited
Z	Strip to 950 Litres 12 mile 25m water depth 7 knots, en-route	Strip to 350 Litres 12 mile 25m water depth 7 knots, en-route	Strip to 75 Litres 12 mile 25m water depth 7 knots, en-route	Strip to Maximum Extent 12 mile 25m water depth 7 knots, en-route
OS	No carriage Requirements	No Carriage Requirements	No Carriage Requirements	
Underwater Discharge Required	Only X and Y cargoes	Only X and Y cargoes	X,Y and Z cargoes	

2. MARPOL Annex II: Operational requirements

Certification of Cargoes

All non-oil cargoes carried in bulk are classified by the IMO and/or the vessel's flag state/administration

The carriage requirements for a product are then determined by these entities using the guidelines set forth by GESAMP* and IMO

If regulated by the IBC Code those cargoes must be authorised for carriage on that particular ship and listed on the ship's Certificate of Fitness (CoF)

Every chemical tanker is required to have a Certificate of Fitness (CoF) – indicating that it is certified to carry certain products

The issuance of a CoF will also require a Procedures and Arrangements (P&A) Manual

*GESAMP – Group of Experts on Scientific Aspects related to Marine Pollution

2. MARPOL Annex II: Further considerations

Ship Conversions – example 1

Conversion of a product tanker to a Ship Type 3 chemical tanker

For the purpose of converting an oil product tanker to an IMO Ship Type 3 chemical tanker complying with the IBC Code, the following major differences in regulatory regimes would need to be considered:

- damage stability criteria
- cargo tank & venting requirements
- environmental control
- fire-extinguishing systems
- personnel protection
- gauging and high level alarms
- welded pipe
- underwater discharge outlet
- stripping limits
- officer/crew training

2. MARPOL Annex II: Further considerations

Ship Conversions – example 2

Conversion of a Ship Type 3 chemical tanker with double hull complying with MARPOL Annex I Regulation 19, to a full IMO Ship Type 2

The double bottom height must meet the B/15 at the centreline, as required by IBC Code paragraph 2.6.1.2.

Verified as complying with the requirements of Type 2:

- damage stability
- safety requirements as per example '1' enabling the vessel to carry IMO ST2 chemicals

2. MARPOL Annex II: Further considerations

1. Tripartite Agreement

Categorizing new products needs to be considered:

- If cargo is not in IBC Code, provisional classification is given using a;
- Tripartite Agreement initiated between
  1. the port state of the shipper
  2. the flag state of the carrier
  3. the port state receiving the cargo

2. Provisional Categorization of Liquid Substances

Three year deadline by initiator for full details of product for classification (not acceptable for repeated Tripartite Agreements)

So, when there is a need to transport a bulk liquid cargo that has not been classified, the shippers have to go to their administration and request that a tripartite agreement be established between the shipping country, the receiving country, and the ship's flag state (Regulation 3(4))

2. MARPOL Annex II: Further considerations

3. Shortage of Tanker Tonnage for Veg Oils

Regulatory development raised concern over possible shortage of Ship Type 2 tonnage after 1/1/2007

The result was regulation 4.1.3:

"An administration may exempt ships from the carriage requirements under Regulation 11 for ships certified to carry individually identified vegetable oils identified by the relevant footnote in Chapter 17 of the IBC Code, provided the ship complies with…..":

Regulation 4.1.3 offers an exemption for a double hull products tanker (complying with Regulation 19 of MARPOL Annex 1 or an IMO Ship Type 3 that complies with all the requirements of an IMO Ship Type 2 (except cargo tank location) to carry vegetable oils.

2. MARPOL Annex II: Further considerations

Some final thoughts (figures)

- In early 2007, the chemical tanker fleet was 26.2 m dwt with just over 1,400 tankers
- This fleet included both dedicated chemical tankers and swing tonnage tankers that are also trading in petroleum products
- deliveries are projected to be some 2.175 m dwt or 133-167 ships annually in the years 2007 and 2008
- Already the order book for 2009 is 70 tankers or two million dwt
- The chemical tanker fleet is modern with an average age of some 11.5 years
- Some 66% of the fleet is below 15 years and just under 8% more than 25 years old
- The confirmed orders represent some 37% of the current fleet

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The Revisions to MARPOL Annex II – A Practical Guide

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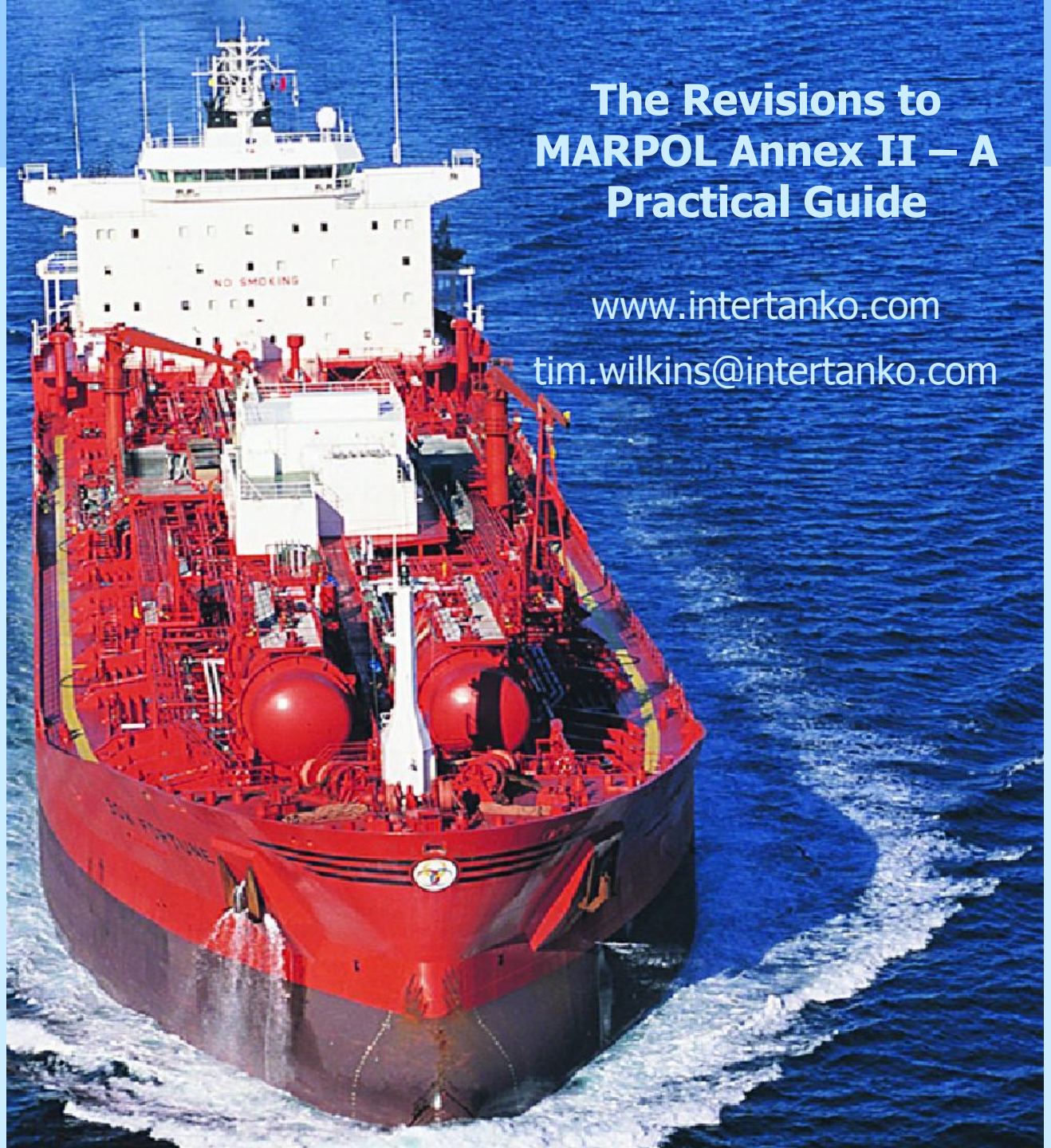

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