Session 1

Overview of Hazardous and Noxious Substances

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Contents



I. The Role of ITOPF

II. What are HNS

III. Risks

IV. Case Studies






I Role of ITOPF – Introduction of ITOPF

- Not-for-profit organisation established in 1968
- Primarily funded by shipping industry (via P&I Clubs)
- Main role: advice on marine oil & HNS spills
- Based in London but provides a global service

I Role of ITOPF – members and associates

~ 95% world tankers

- 6,300 tanker owners & bareboat charterers
- 10,900 tankers, barges & OBOs - 340 million GT

> 90% world fleet

- Owners of other types of ship (since 1999)
- 658 million GT of non-tanker shipping

I Role of ITOPF – spill attendance

Background Source: US National Park Service

- Attendance ~ 700 spills in 99 countries and regions
- Provide technical advice to promote effective response & cooperation
- Advise and monitor spill response, investigate damages via joint assessment
- Worldwide network of contacts, technical databases & library

I Role of ITOPF – Drills & Exercises

- Multi-national co-operation exercises within Regional Seas;
- Joint Exercises between 2 or more countries;
- Industrial, company drills and exercises

I Role of ITOPF – Training, workshop & Contingency Planning

- IMO Regional OPRC Workshops and Training Programmes
- National & local Authorities
- Contingency planning for industry and government

II What are Hazardous and Noxious Substances

In 2010 HNS Convention

to ensure maritime safety and prevention of pollution

(a) Carried on board a ship as cargo:

(i) **Oils** in bulk, **MARPOL 73/78 Annex I**;

(ii) **Noxious liquid** in bulk, **MARPOL 73/78 Annex II**;

(iii) **Dangerous liquid** in bulk, **IBC Code**;

(iv) **Packaged goods** listed in **IMDG Code**;

(v) **Liquefied gases** in **IGC Code**;

(vi) **Liquid** carried in bulk with a **flashpoint ≤ 60°C**;

(vii) **Solid bulk materials** possessing chemical hazards covered by **IMSBC**;

(b) Residues from the previous carriage in bulk

II What are HNS

include

- <u>all liquefied gases</u> in bulk;
- <u>bulk liquids</u> if there are potential safety, pollution or explosion hazards:

  organic chemicals, e.g. methanol, styrene;

  inorganic chemicals, e.g. acids, caustic soda;

  persistent and non-persistent oils of petroleum origin;

  vegetable and animal oils and fats
- <u>bulk solids</u> such as fertilizers, sodium and potassium nitrates, sulphur, some types of fishmeal;

NOT include

- most inert bulk solids, e.g. iron ore, grain, alumina, cement, etc.
- radioactive materials
- oil damages already covered under CLC, FUND conventions

III. Risks associated with Hazardous and Noxious Substances

1. Physical properties of HNS
2. Hazardous profiles of HNS
3. Risk assessment

ITOPF

III Risks of HNS

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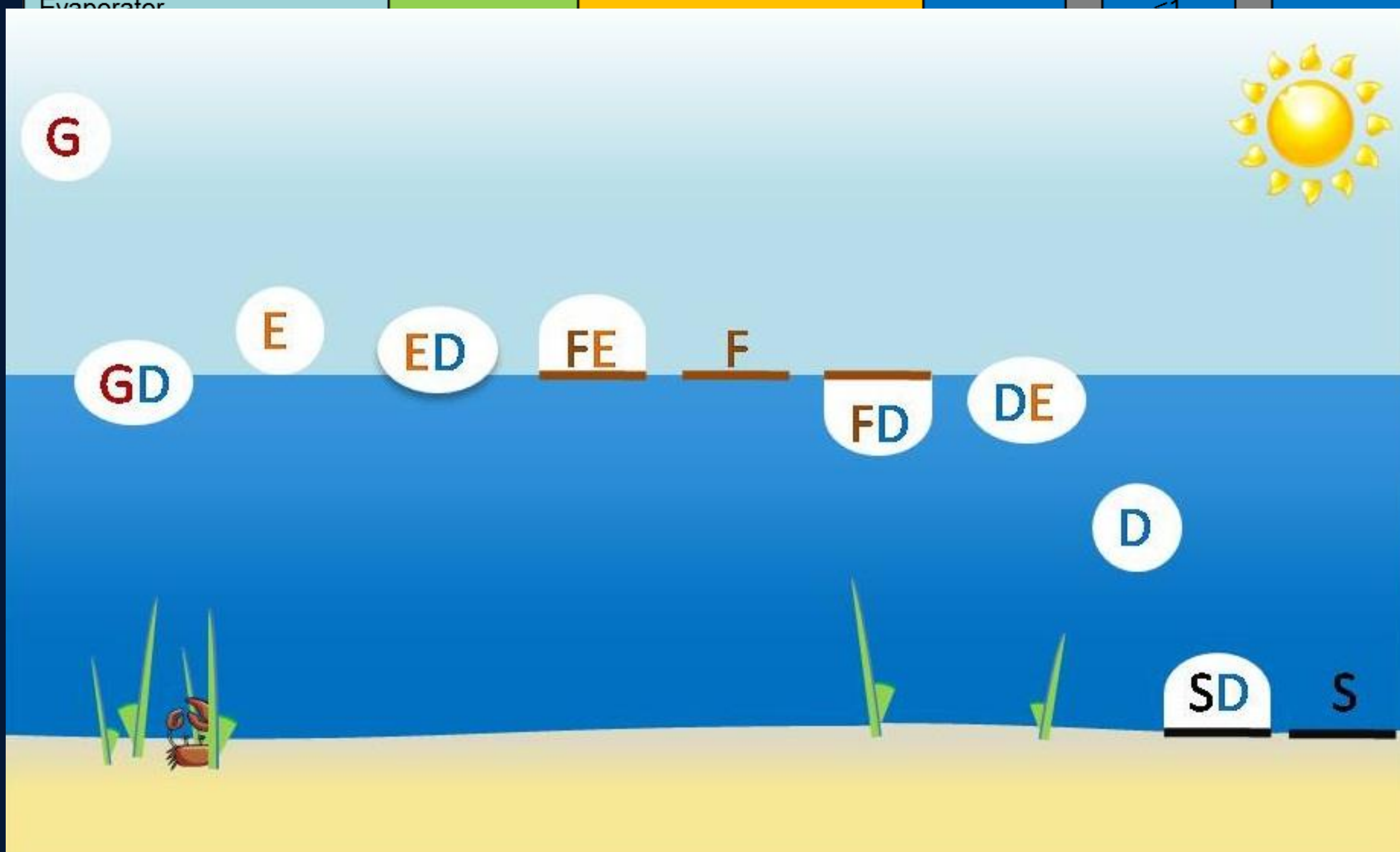
1. Physical properties of HNS

Behaviour class	Density (kg/m^3)	Vapour Pressure (Pa)	Solubility % Gas	Solubility % Liquid	Solubility % Solid
Gas	<1030	>3000	<10	-	-
Gas/Dissolver			>10		
Evaporator			-	<1	-
Evaporator/Dissolver				>1	
Floater		<300		<0.1	<10
Floater/Evaporator		300-3000			-
Floater/Evaporator/Dissolver				0.1-5	
Floater/Dissolver					10-100
Dissolver		<10,000		>5	100
Dissolver/Evaporator		>10,000			
Sinker	>1023	-		-	<10
Sinker/Dissolver					10-100

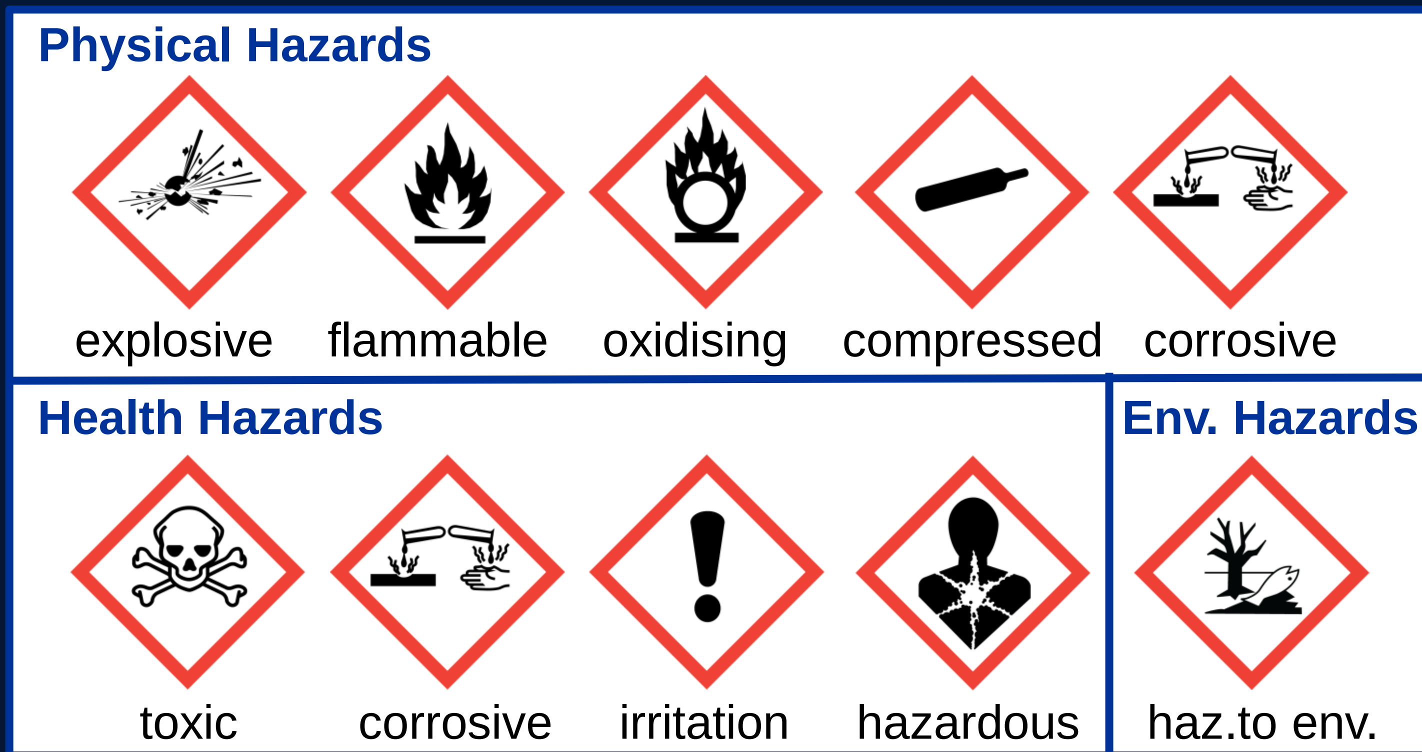
1. Physical properties of HNS

Behaviour class	Density	Vapour Pressure	Solubility %		
	(kg/m^3)	(Pa)	Gas	Liquid	Solid
Gas		>3000	<10	-	-
Gas/Dissolver			>10		



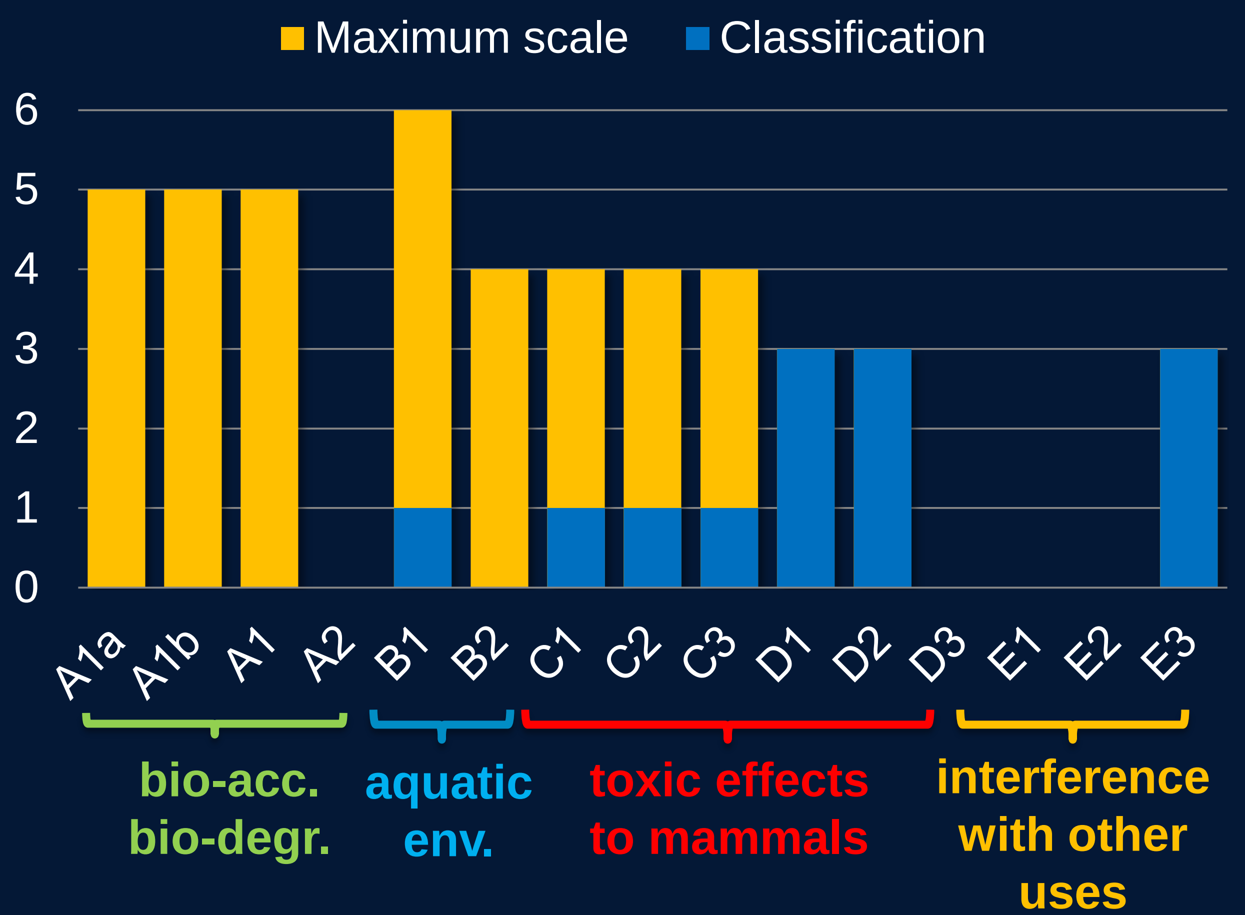
2. Hazardous profile of HNS

- UN Globally Harmonized System (GHS) of Classification



2. Hazardous profile of HNS

- UN Globally Harmonized System (GHS) of Classification
- GESAMP Hazard Evaluation (OECD, UN) (for Chemical Substances Carried by Ship)



Acetic Acid

- Dissolver
- Severely corrosive
- Readily biodegradable

3. Risk assessment

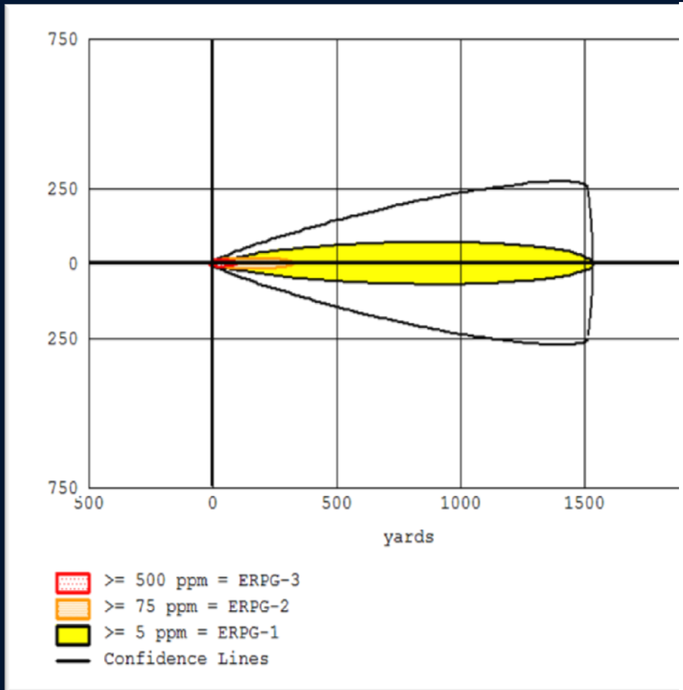
- Risk and safety issues

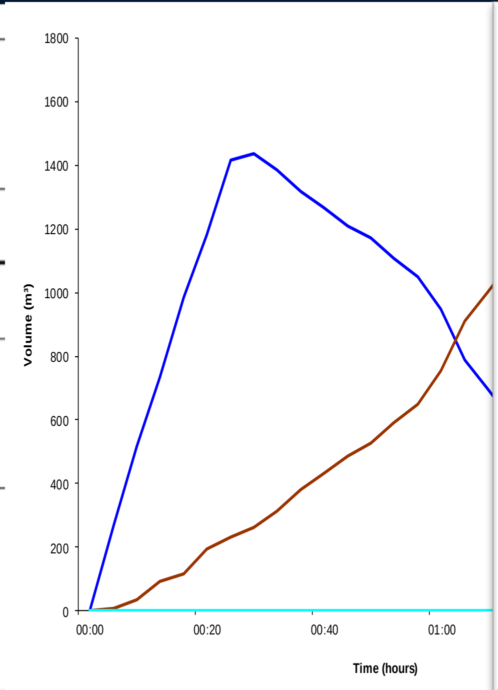
  Emergency response planning, exposure guidelines, evacuation

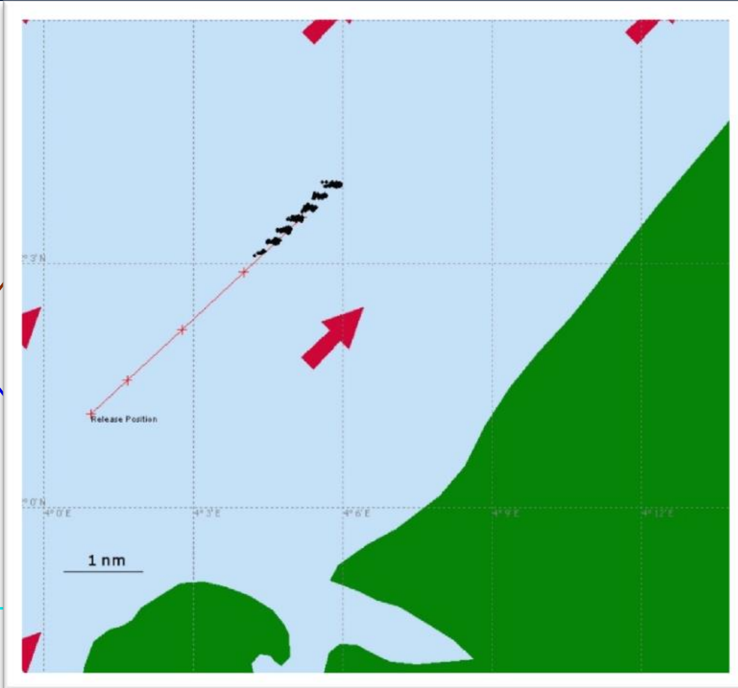
- Fate modelling

  Likely fate and behaviour of the HNS;

  Likely impacts on air and aquatic environment;







III Risks of HNS

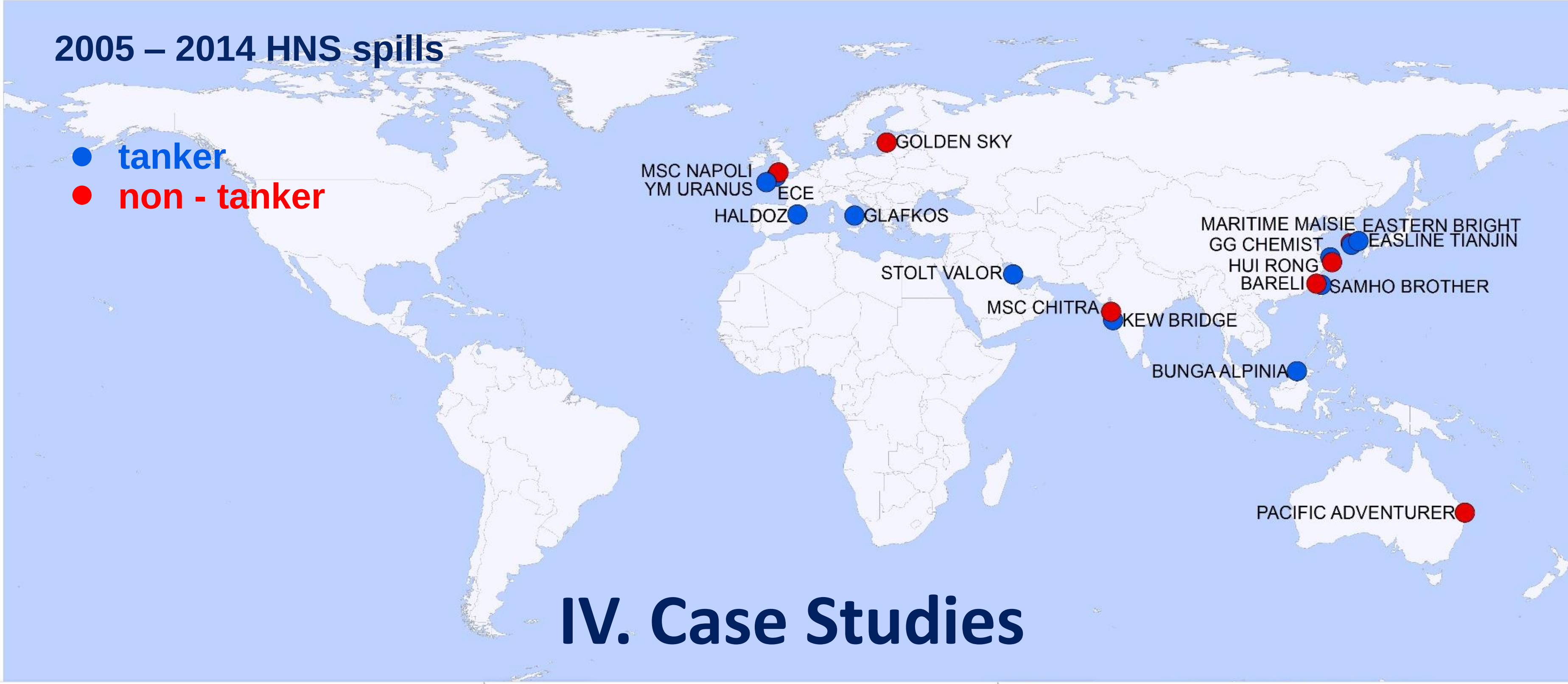
Rank	Chemical	Rank	Chemical
1	Sulphuric acid	11	Styrene
2	Hydrochloric acid	12	Methanol
3	Sodium hydroxide / caustic soda	13	Ethylene glycol
4	Phosphoric acid	14	Chlorine
5	Nitric acid	15	Acetone
6	LPG/LNG	16	Ammonium nitrate
7	Ammonia	17	Urea
8	Benzene	18	Toluene
9	Xylene	19	Acrylonitrile
10	Phenol	20	Vinyl acetate

20 chemicals most likely to be involved in HNS incidents

Source: IMO OPRC-HNS/TG

165 million tonnes of chemicals (including petrochemicals) were transported, but ***20*** pose **highest risk**

IV. Case Studies

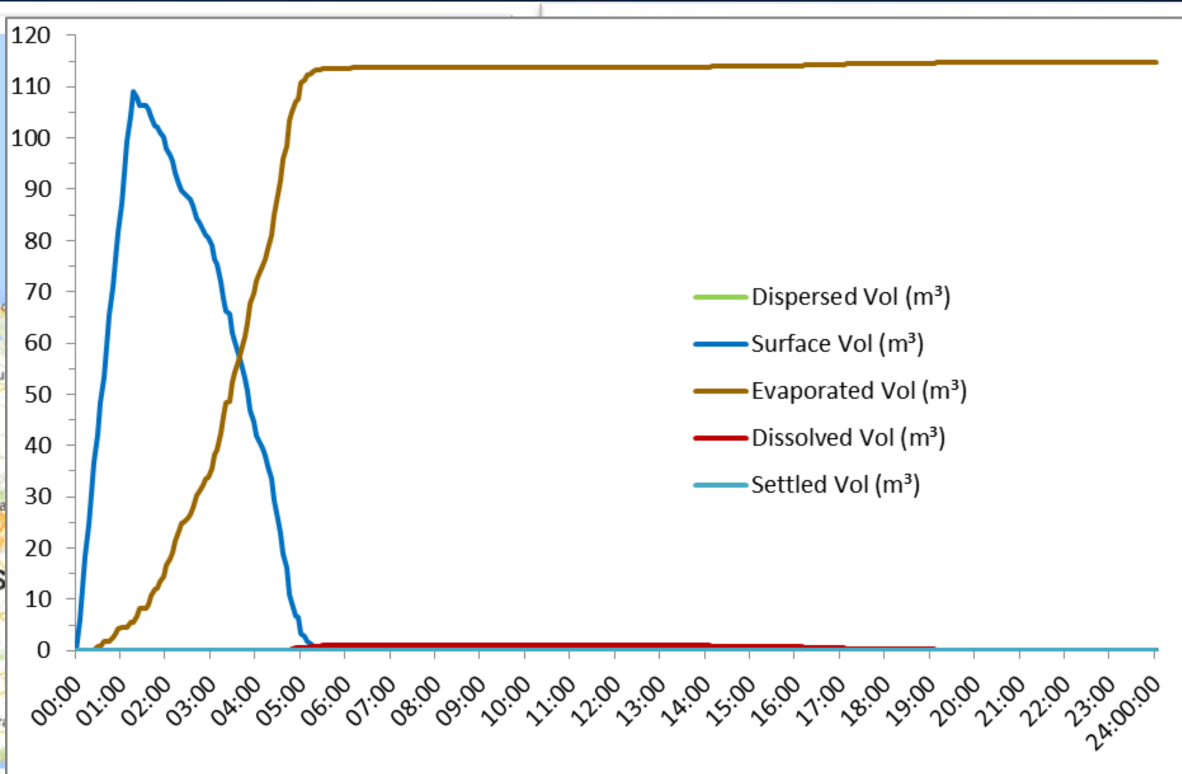


HALDOZ, Spain, 2012

KEW BRIDGE, India, 2006

BARELI, China, 2012

IV Case Studies - HALDOZ, chemical tanker



1. Situation

- Chemical tanker HALDOZ (2,593 GT, 2007) spilled ≈ 104 MT styrene monomer within the port of Tarragona, Spain during loading on 3rd Feb. 2012
- Light polymerisation occurred on the hull of the vessel when styrene was in contact with water

2. Risk assessment

- ChemSIS model confirmed that 99% of the product will evaporate within hours after release; 1 % is expected to dissolve but will eventually evaporate within 1 day.

3. Response

- 200 m boom for containment;
- Removal of the polymerised product in water

IV Case Studies - KEW BRIDGE, LPG tanker

1. Situation

- LPG tanker KEW BRIDGE (12,240 GT, 1983) ran aground on soft mud during monsoon rough seas, 14 Sept 2006.
- 8,798 tonnes of Butane cargo onboard;
- Each of the tanks were about 98% full, very little headspace for expansion;
- Salvage attempts affected by the monsoon;

2. Risk assessment

- Butane boils at ≈ -1°C;
- Temperature of the tank = -5°C, but increases 0.5 °C per day;
- Increased pressure in tank, Boiling Liquid Expanding Vapour Explosion;
- Cooling system was not functional;
- Close to local village

IV Case Studies - KEW BRIDGE, LPG tanker

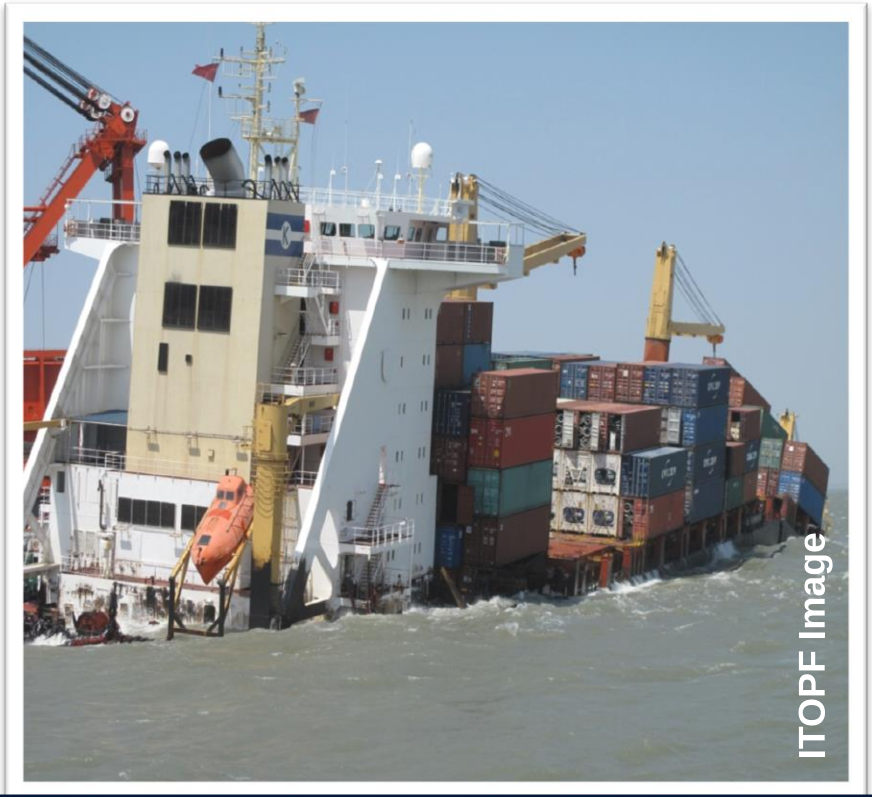
1st stage response

- Modelling of temperature & pressure within tanks showed no uncontrolled release of gas from valves until Butane reached 15˚C (≈ 30 days)
- Install secondary cooling system
- Implementation of a safety zone
- 146 MT of bunkers removed

2nd stage response

- Modelling showed removing ≈ 2000 tonnes of LPG would give enough headspace within tanks to allow gas to remain safe even if temperature reached ambient temp (35˚C)
- Lightering operation: 2000 MT of butane removed by second LPG tanker
- Refloated during spring tide on 9th Oct. 2006

IV Case Studies - BARELI, container ship



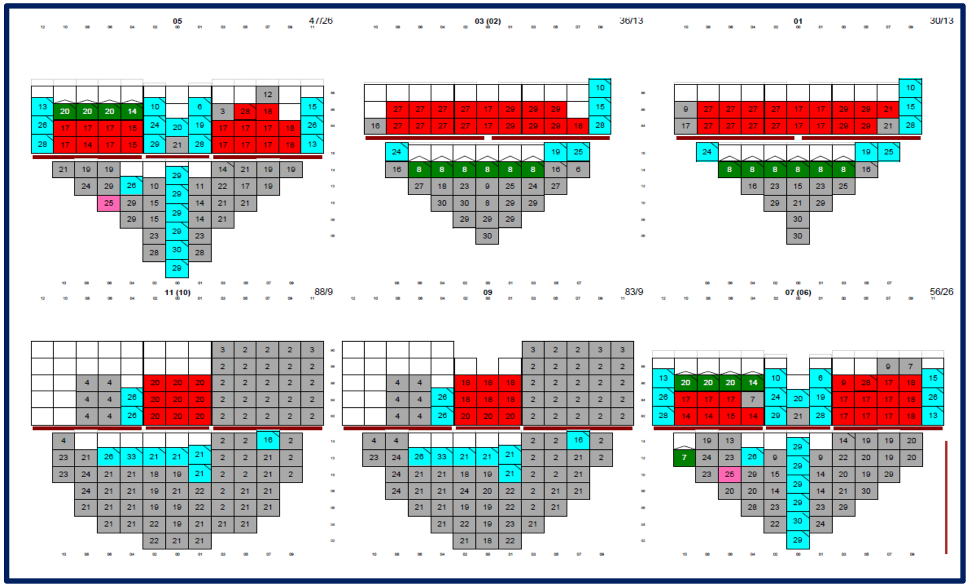
1. Situation

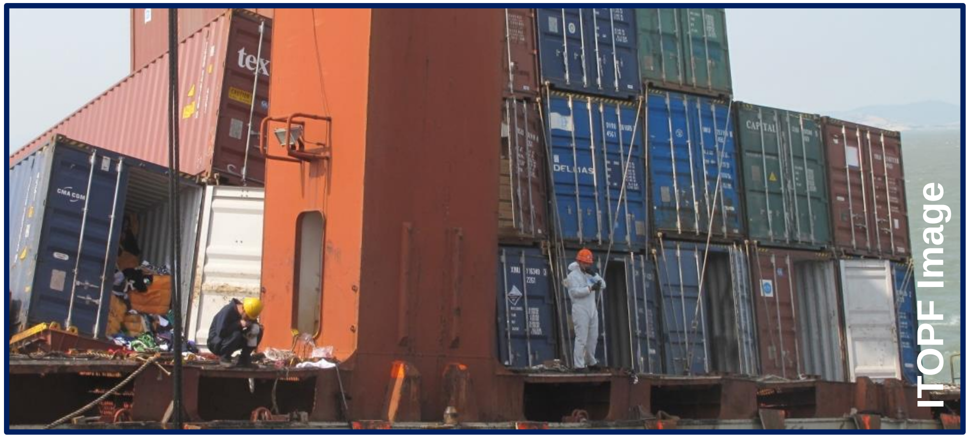
- Container ship BARELI (35,881 GT, 2004) ran aground 6nm off Nan Ri Island when approaching Fu Zhou Container Terminal, on 15th March 2012;
- Vessel back broken amidship, resulting in the release of ~ 100 MT HFO and the loss of 165 containers (80 with Dangerous Goods) overboard;

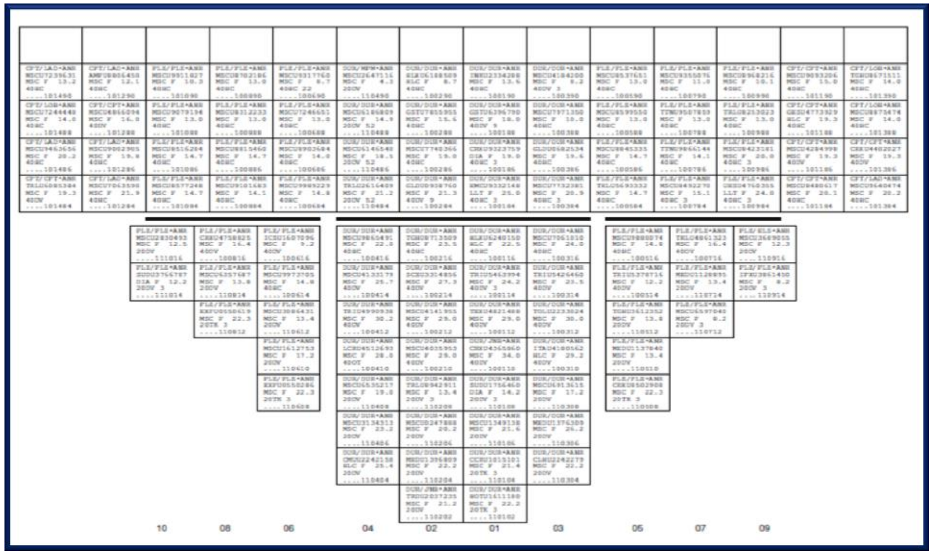
2. Risk assessment

- Lost cargo included highly toxic herbicides, insecticides and sodium hydroxide;
- Loose packages mixed with HFO, difficult to identify the nature of the product;
- Lost goods stranded in nearby villages, ransacked by villagers, difficult to set up exclusion zone;

IV Case Studies - BARELI: identifying dangerous goods







Response: Assess and prioritise the dangerous goods

- Manifest needs to be cross-referenced with Bay Plan to locate containers
- Information on hazards & handling procedures should be provided to salvors

IV Case Study - BARELI: container processing

Response: Recovery

- Retrieving floating and stranded cargos;
- Transport to designated area in terminal for temporary storage;
- External cleaning
- Customs clearance;

Response: Processing – should have coordinated by fully trained HAZMAT team

*correct PPE, e.g. liquid tight suits, SCBAs, etc. should be worn at all times

- Repacking of intact cargo;
- Disposal of damaged cargo to appropriate facilities

Summary

- **Definition** of HNS within 2010 Convention
- What's covered and what's NOT

- **Risks**
- Physical properties
- Hazardous profiles
- risk assessment using modelling

- **Case studies**
- Chemical tanker;
- LPG tanker
- Container vessel

Any Questions?

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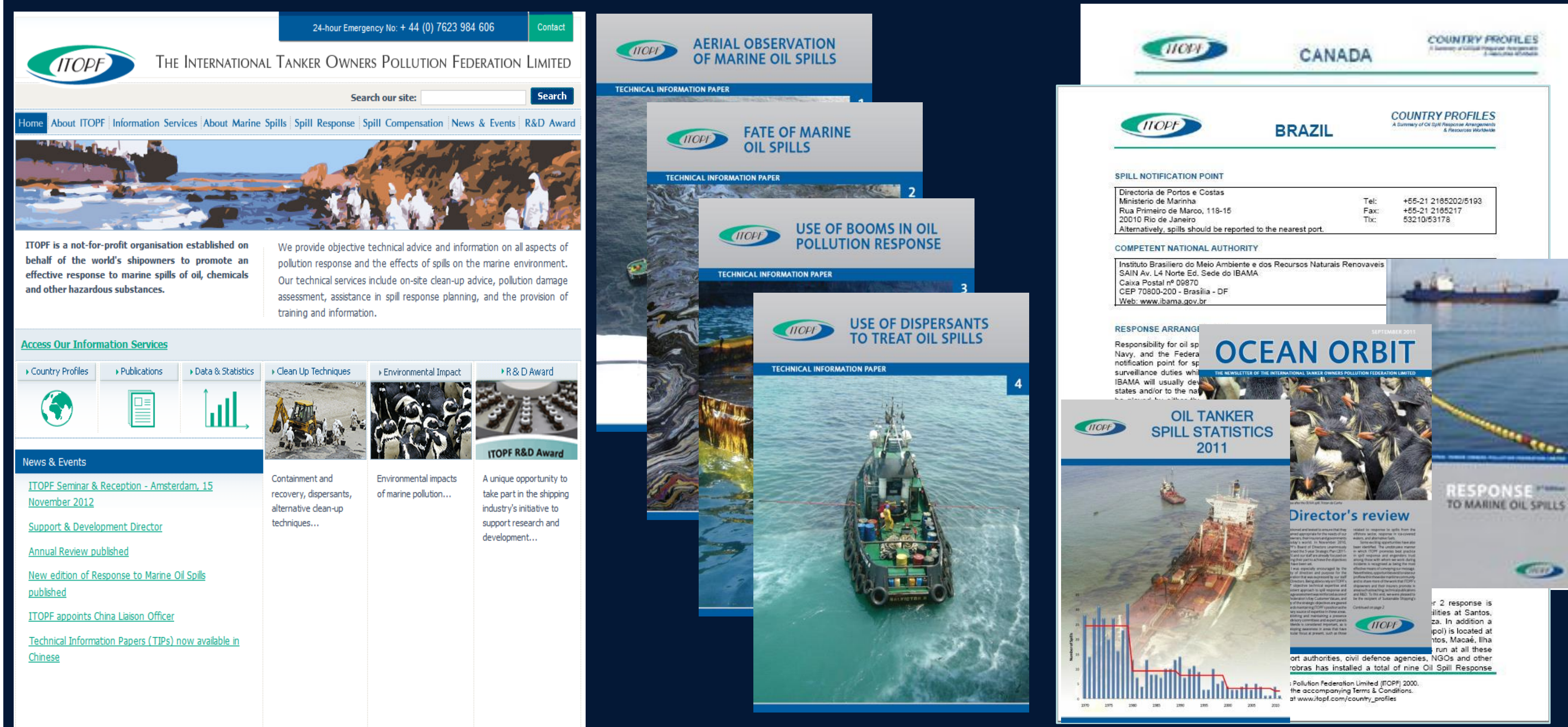

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- ITOPF publications – Response Handbooks, TIPS Series 17 Topics published in English, French, Russian, Chinese and Spanish;
- Databases with spill statistics;
- ITOPF film series to download and watch on App;
- Country Profiles – 160 maritime nations and regions;