International regulatory trends & potential for enhanced contribution from the education sector

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MARPOL

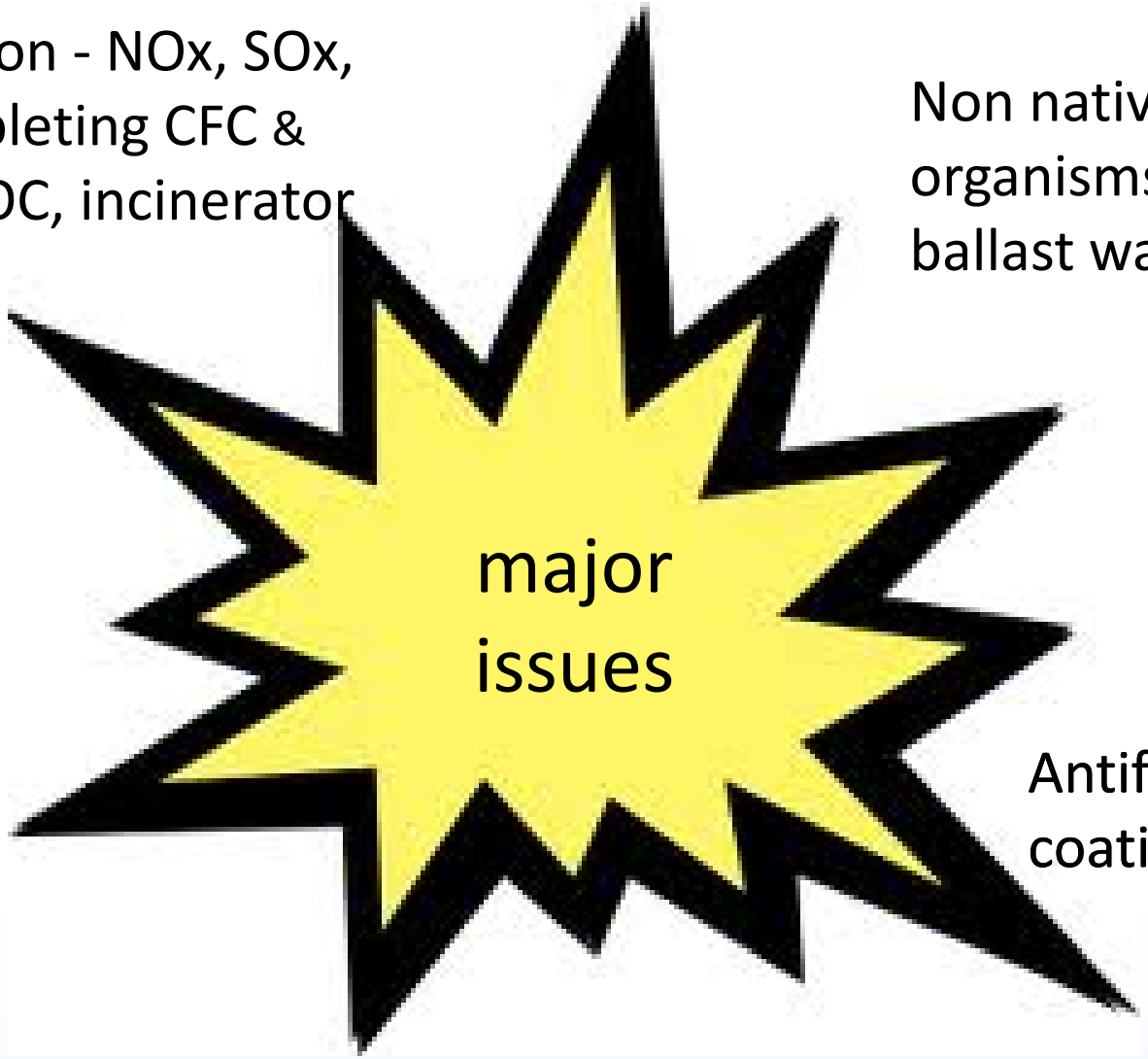
the starting point

International Convention for the Prevention of Pollution from Ships - MARPOL

Annex I – oil
Annex II - noxious liquid substances
Annex III - harmful substances in packaged form
Annex IV - sewage
Annex V - garbage

1990s

Air pollution - NOx, SOx, ozone depleting CFC & halons, VOC, incinerator emissions



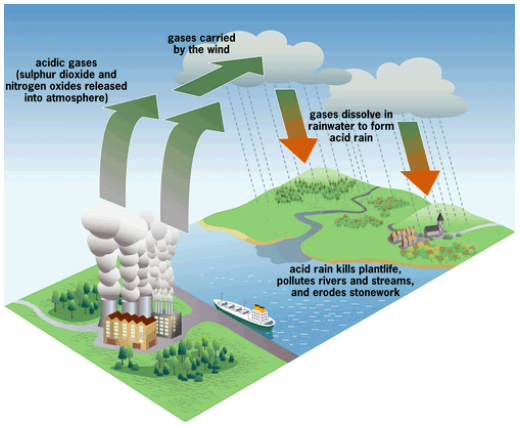
Non native organisms in ballast water

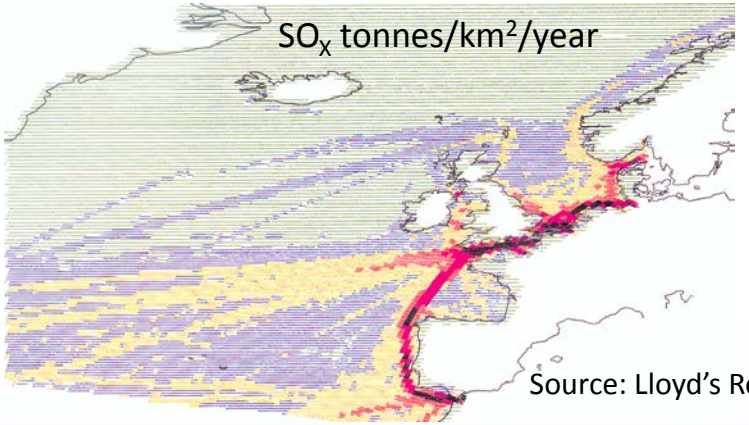
Antifouling coatings

Air pollution (NOx & SOx)

developing understanding and expertise

- Health & environmental impacts – acid rain, human health and more
- Quantifying ship emissions/onboard measurement campaigns
- Development of generic emission factors
- Inventories, geographical disaggregation
- Dispersal of emissions & modelling





Source: Lloyd's Register, 1995

in parallel

- Regulatory options under discussion 1990 -1997
- Air pollution regulations adopted 1997 as Annex VI to MARPOL (entered into force 2005)
- Included
  - NOx, SOx - not CO_2
  - VOC
  - Halons & CFC
  - Shipboard incinerators

similar processes…

- Similar pattern of developing understanding and expertise and exploration of regulatory control options throughout 1990s led to adoption of:
- International Convention on the Control of Harmful Anti-fouling Systems on Ships, 5 October 2001*
- International Convention for the Control and Management of Ships' Ballast Water and Sediments, 13 February 2004

* entered into force 2008

The next phase

Early 2000's – present day

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- Major environmental issues well established
- Technologies for compliance moving to fore
  - Range of options & compliance strategies emerging (ballast water treatment, SOx emissions compliance…
- More environmental issues emerging….

Ship recycling

Environmental and safety concerns..

Marine Mammals

Collisions, underwater noise….

GHG emissions

CO_2, refrigerant gases, CH_4 ….

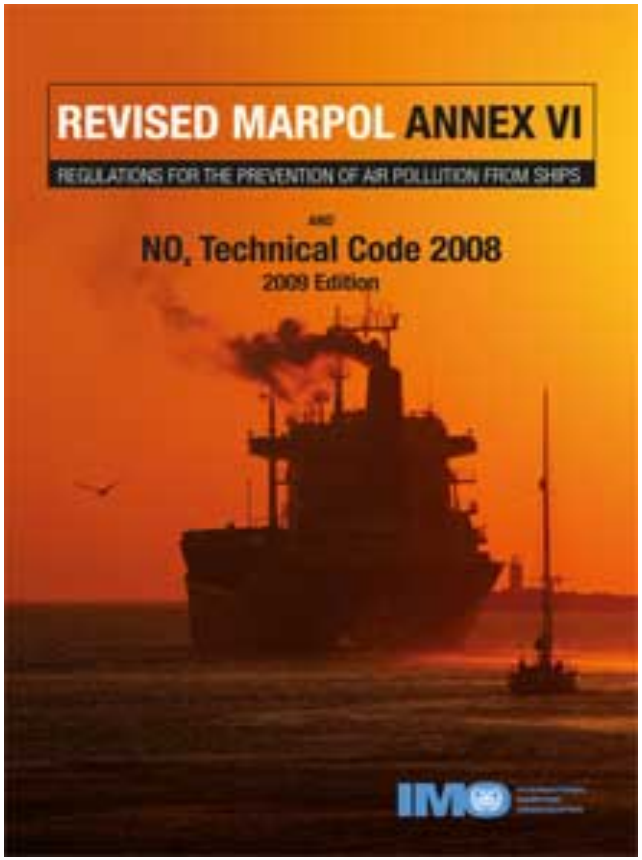
Black carbon

strongly light absorbing particles

reduce reflectivity & add to regional warming in Arctic

Re- examination of MARPOL Annex VI provisions

NOx, SOx, ozone depleting substances, VOC ….



Present day regulatory landscape

- Updated MARPOL Annex VI – more stringent requirements for control air emissions & introduction new Emission Control Areas (ECA) covering NO_X, SO_X and/or PM
- Additional chapter (4) in MARPOL Annex VI covering Regulations on Energy Efficiency for Ships - adopted July 2011
- Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships - adopted May 2009
- Guidance for minimizing the risk of ship strikes with cetaceans, 2009
- Voluntary Guidelines for the Reduction of Underwater Noise from Commercial Shipping - finalised March 2013

What’s next?

Climate change related issues

Overall control of CO_2 emissions

- Current focus on:
  - development of performance standard for fuel consumption measurement for ships
  - accurate monitoring, reporting and verification of fuel use onboard ship
- Potentially leading to
  - (market based) measures to stabilise or control overall emissions from shipping

Other emissions linked to global climate change

Black carbon, HFC refrigerant gases, VOC

ODP = 0
GWP = 3,748

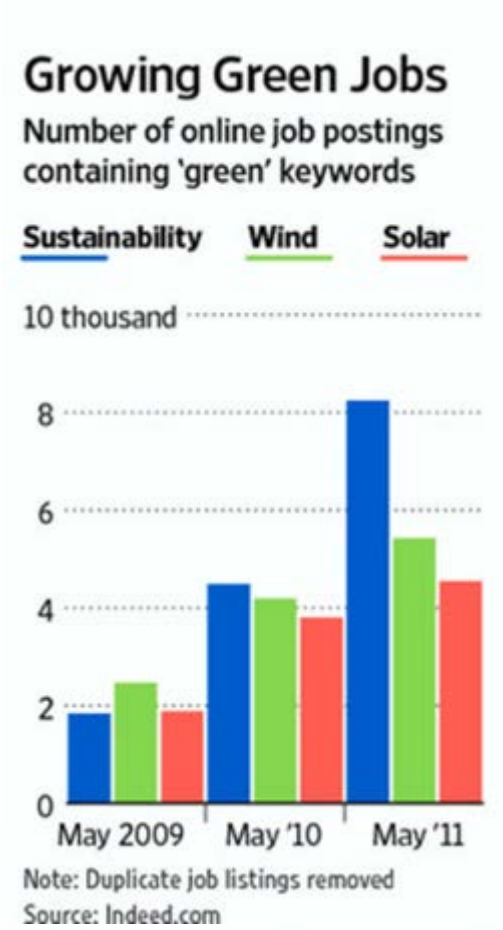
Adaption to harsher operating conditions

Ships, ports, terminals & other offshore structures

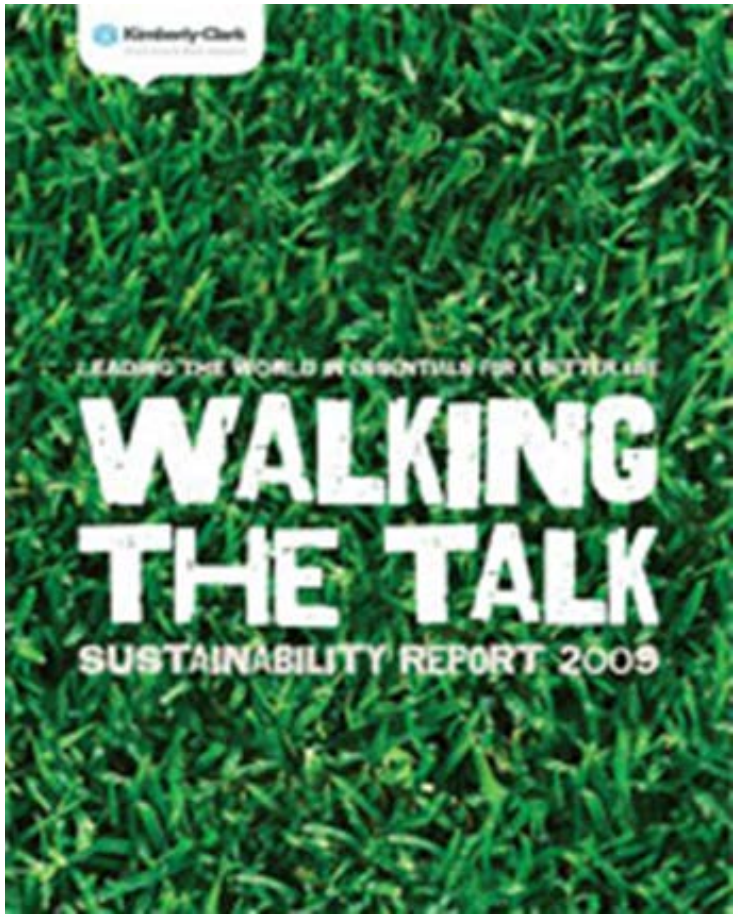
Sustainability

Sustainability jobs

Sustainability coordinator, manager, director…



Sustainability reports



Industry initiatives

IMO

World Maritime Day 2013: Sustainable Development: IMO's contribution beyond Rio+20

Sustainability

What does it mean?

potential for enhanced contribution

from the education sector

Fundamental need

Students with knowledge, understanding & confidence to address environment & sustainability issues

……..working across disciplines

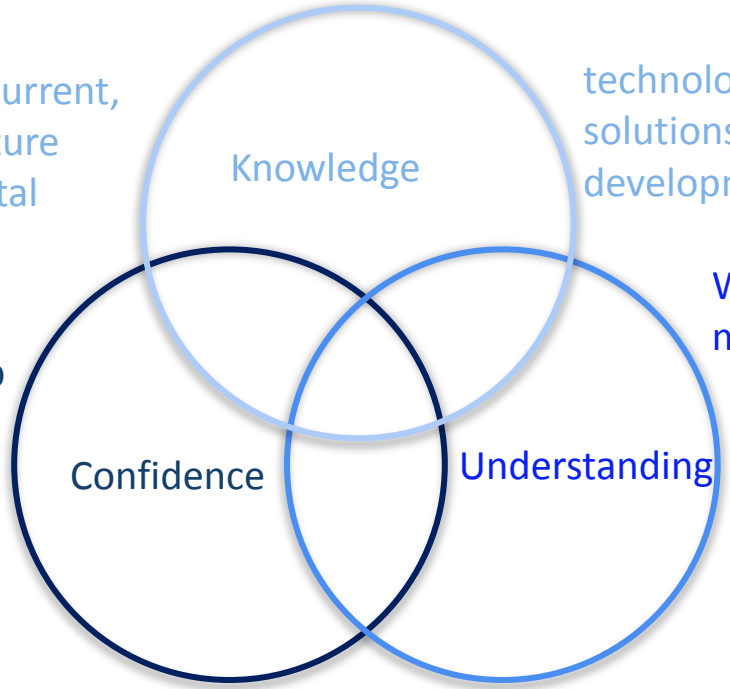
What's required?

Base: sound education engineering/science /naval architecture …

regulations – in place/under development/under consideration

concerns – current, potential future environmental concerns

technologies and operational solutions available or under development



Why the issue is or might be of concern

provide leadership

independence of thought

how technology or operational control measures work; why they don't work or provide an adequate solution

develop novel, sustainable solutions

importance of bigger picture & not focusing on solving a problem in isolation

Beyond educational system

- a mechanism to for educational establishments to foster knowledge, understanding & confidence in those outside educational system
- to work with industry & others to provide sustainable solutions
- significant short term potential for assisting industry & regulators with independent assessment of abatement technologies. Choices are becoming increasingly complex

meeting MARPOL Annex VI SOx emissions requirements

Low sulphur fuel vs exhaust gas treatment – a simple choice?

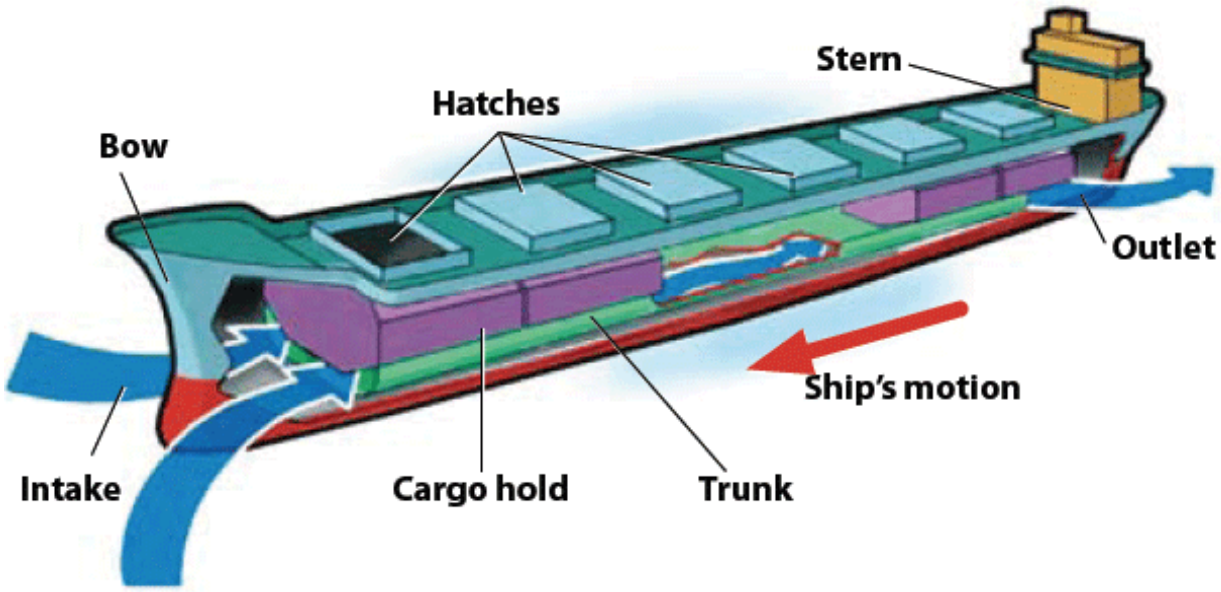
- Low sulphur residual fuels? distillate fuels? LNG?
- Relative fuel costs & availability?
- Capital costs of treatment system?
- Any additional costs eg wash water treatment? discharge of sludge ashore? Training of crew? Maintenance costs?
- Impact on fuel consumption & energy efficiency?
- Impacts on ease of compliance with other pollution control measures/regulations? – NOx, PM, black carbon, CO_2
- Overall impact on global CO_2 emissions?
- Overall life cycle costs/benefits?

Ballast water

- Many different ballast water treatment systems; different approaches to controlling organisms - uv, chemical biocides, filtration etc; differing power, piping & pumping requirements, different treatment locations – and physical space requirements
- Does the system work?
- Impact on energy efficiency & CO_2 emissions?
- Potential for use of alternative, lower risk, sources of ballast water? Can “Smart ballasting” minimise uptake of organisms and sediments & reduce demands on the treatment system? Use of fresh water? Recycled (treated) grey water?

Ballast water free ships?

Impact on energy efficiency, CO_2 emissions and other pollution issues eg biofouling? Implications for ship safety?



Significant potential to assist

- Increasingly complex choices; more knowledge required to assess options
  - Is technology effective?
  - What are the impacts on energy efficiency and other pollutants?
  - Could doing things differently reduce/eliminate problem?
  - Hidden issues within life cycle?
  - Disposal problems?

- Substantial potential short & longer term for educational sector to assist industry make effective choices

For more information or to discuss how GL Reynolds could assist your business, please contact:

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