Oil in Water Measurement Associated with the Shipping Industry

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Research and Development

Deckma Hamburg GmbH

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- Selling and manufacturing oil-in-water monitors since more than 35 years for marine and industrial applications: more than 55.000
- On-line-instruments for bilge water separators, cooling water, boiler feedwater, surface runoff waters, effluent water and produced water
- For marine applications, certified as 15-ppm Bilge-Alarm according to IMO-Resolution MEPC.107(49)

Topics

- IMO, MARPOL 73/78
- Bilge water
- Resolutions, MEPC.107(49)
- Instrumentation
- Technology
- Light scattering: Measuring principle

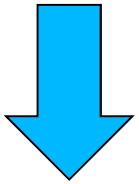
IMO = International Maritime Organization

- International Convention for the Prevention of Pollution Form Ships, MARPOL 73/78 administered by the IMO

- Annex I prevention of pollution by oil & oily water, 2 October 1983
- Annex II control of pollution by noxious liquid substances in bulk, 6 April 1987
- Annex III prevention of pollution by harmful substances carried by sea in packaged form, 1 July 1992
- Annex IV pollution by sewage from ships, 27 September 2003
- Annex V pollution by garbage from ships, 31 December 1988
- Annex VI Prevention of air pollution from ships, 19 May 2005

IMO, MARPOL

- International Convention for the Prevention of Pollution Form Ships, MARPOL 73/78 administered by the IMO
- **Annex I prevention of pollution by oil & oily water, 2 October 1983**



Oil Tanker deballasting:

Oil discharge control system

ODME

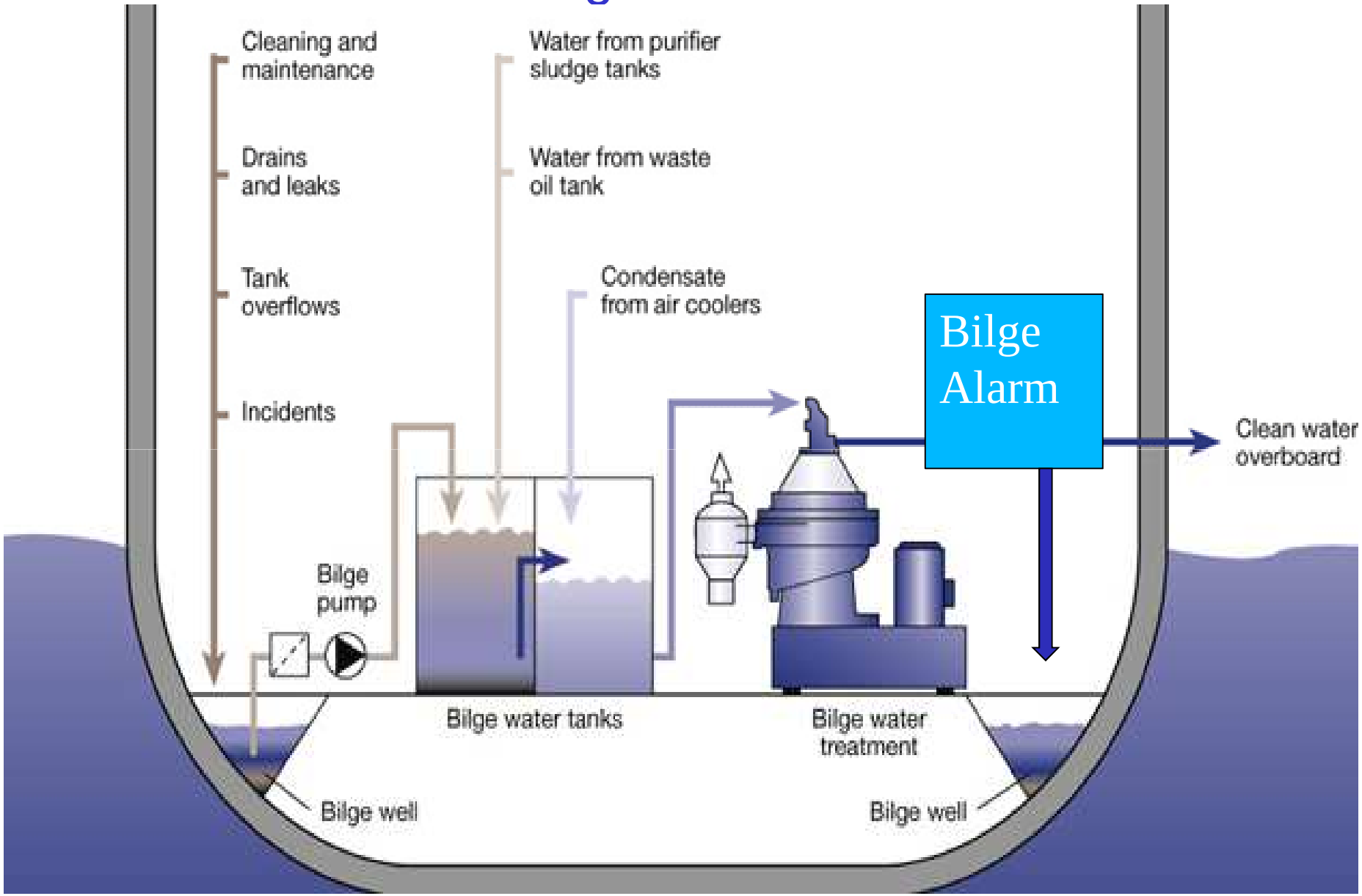
(Oil Discharge Monitoring Equipment)

Bilge water treatment:

Separator

Bilge-Alarm

Bilge Water


Cleaning and maintenance
Drains and leaks
Tank overflows
Incidents
Water from purifier sludge tanks
Water from waste oil tank
Condensate from air coolers
Bilge Alarm
Clean water overboard
Bilge pump
Bilge water tanks
Bilge water treatment
Bilge well
Bilge well

IMO-Resolutions by MEPC

(= Marine Environment Protection Committee)

Tanker deballasting

(Tanker > 150 GT)

- A.586(14),
  2 October 1986
- MEPC. 108(49),
  1 January 2005

Bilge water treatment

(all > 400GT)

- A.393(X),
  14 November 1978
- MEPC. 60(33),
  30 April 1994
- MEPC.107(49),
  1 January 2005

<u>Measurement:</u>

Oil litres per nautical mile

Oil concentration

Bilge water resolutions, basic points

- A.393(X):

100ppm(+/-10ppm or 20%) / 15ppm(+/-5ppm)
Arabian light crude
0 / 6% salt
100ppm solids (air cleaner test dust) @100ppm oil
20s response time
Reference: differential IR-Absorption

- MEPC. 60(33):

15ppm(+/-5ppm),
light destillate fuel oil
0 / 6% salt
10ppm solids (air cleaner test dust) @ 10ppm oil
20s response time
Reference: differential IR-Absorption

MEPC.107(49), basic points

- 15ppm (+/- 5ppm)
- Test Fluid „A“ Marine residual fuel oil RMG 35
- Test Fluid „B“ Marine distillate fuel oil DMA
- Test Fluid „C“ Emulsion Mixture of A + B and Surfactant + Iron Oxide
- 0 / 6% salt
- 10, 50, 100ppm solids (iron oxide) @ 10ppm oil
- 5s response time
- Data logging system: should record date, time, alarm status and operating status of separator
- Reference: GC-FID, ISO 9377-2

MEPC.107(49)

- Environmental test including vibration, temperature, humidity and inclination
- Avoid wilful manipulation (breaking of seal)
- Alarm activated whenever clean water is used
- Accuracy check at IOPP certificate renewal
- Calibration certificate should be retained on board for inspection purposes
- Accuracy check only by manufacturer or persons authorized by manufacturer

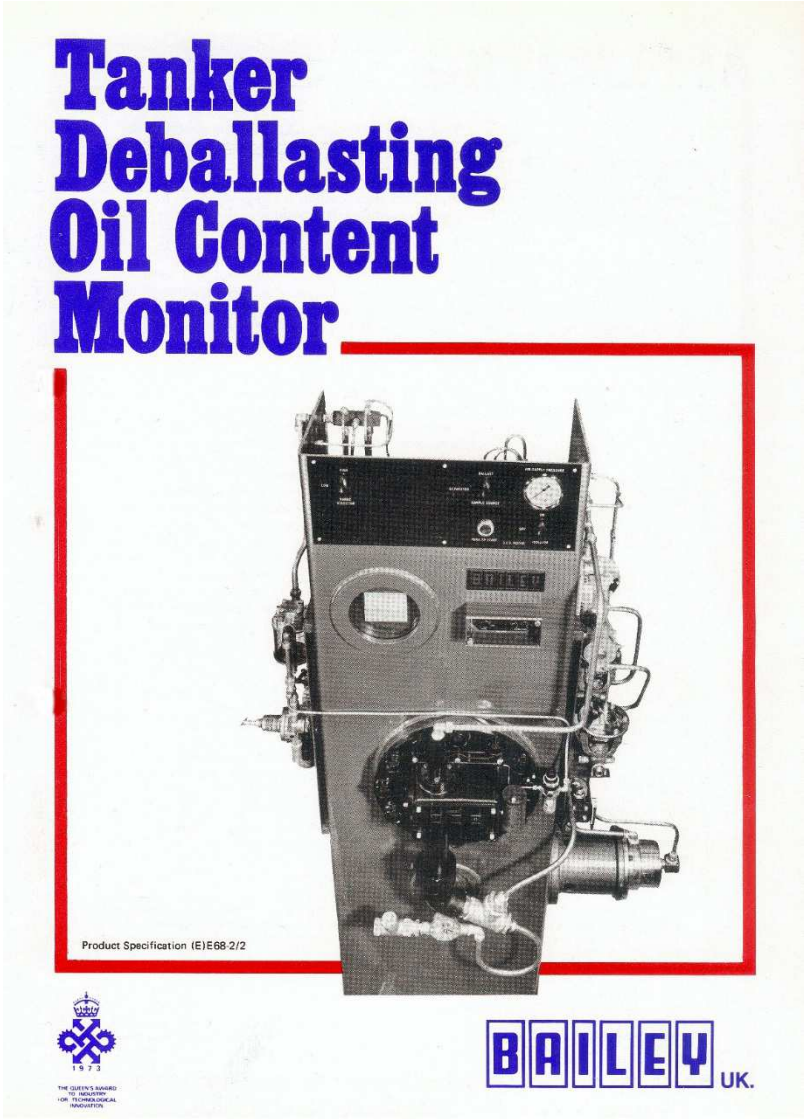
Future regulations / trends

- 5ppm(+/-3ppm) oil content => Canada
- 5ppm(+/-2ppm) oil content => DNV-GL
- tamper-proof design => „white box“

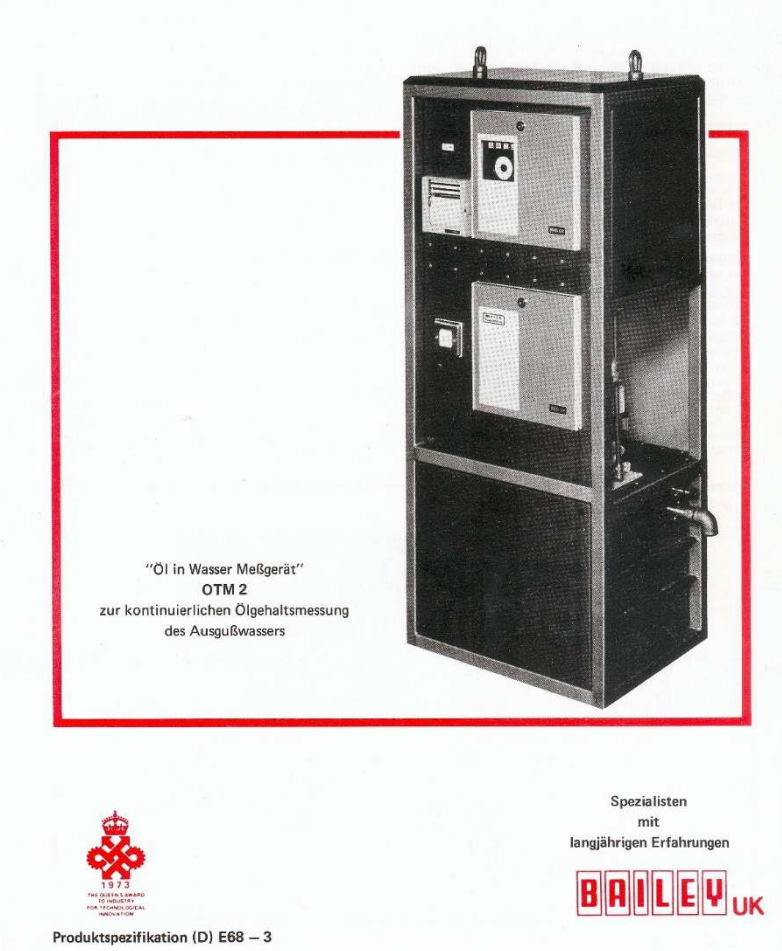
- automatic discharge control by concatenation with ship position data and electronic map

Instrumentation

First instruments from Bailey UK 1973 / 1976
(UV-fluorescence)



Bilge Water Monitor



15ppm Bilge Alarm OCA, Year 1979
(white light attenuation, Photos Feburary 2010)

Technological Progress

235 kg **70 kg** **17 kg** **3,5 kg** **1,5 kg**

UV-fluorescence / light scattering

Development 1970 – 2010

15ppm Bilge Alarm: OMD-24

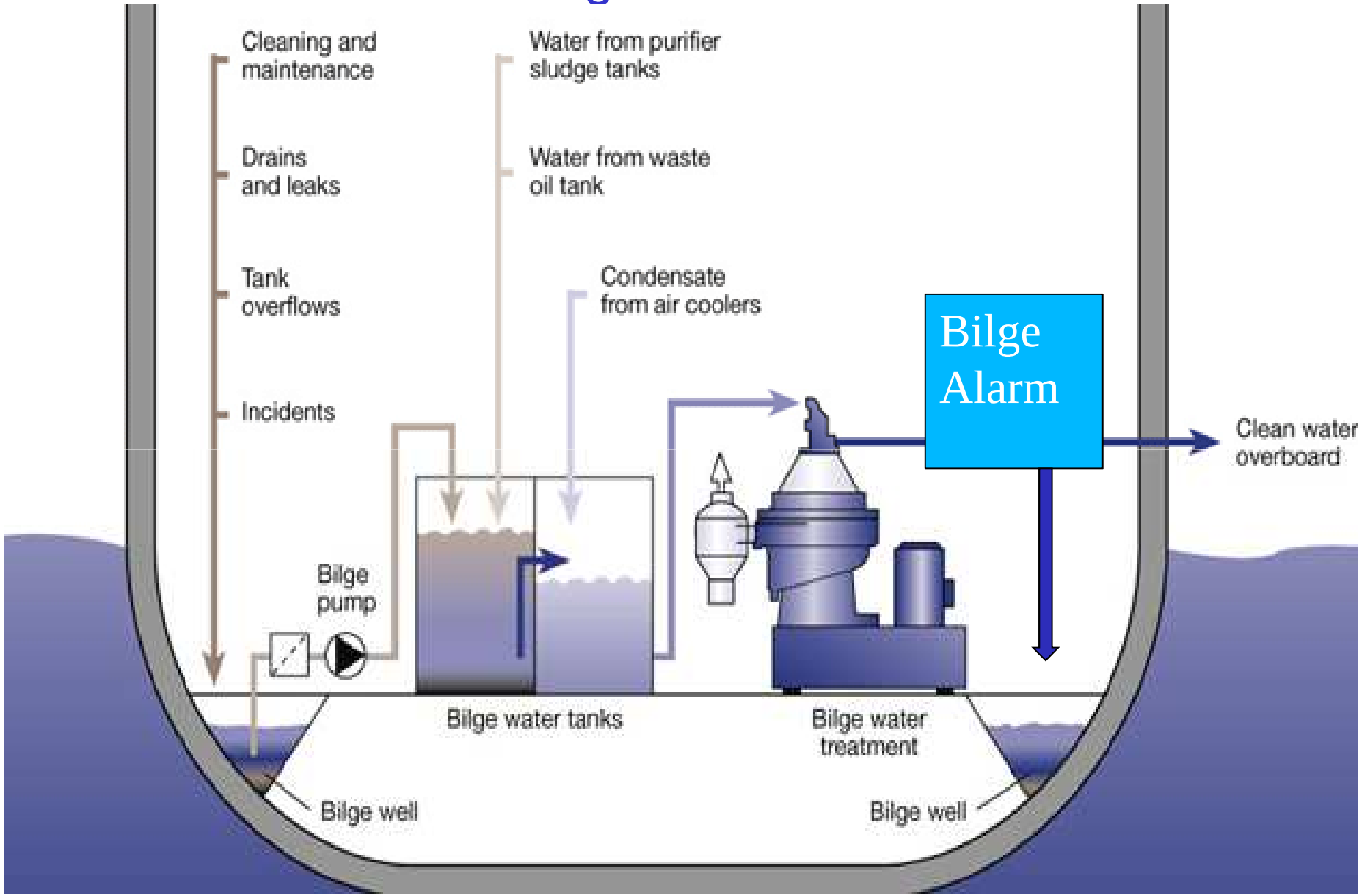
Powersupply,
Visualization
Alarming

Measuring Cell
(light scattering)

OMD-24
mounted on a
centrifugal
separator

Technology

Bilge Water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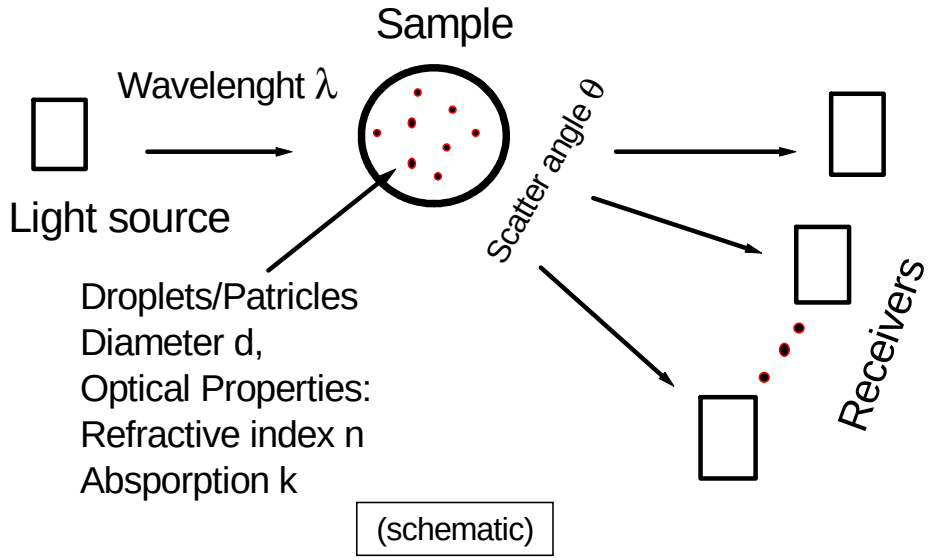
What to measure in bilge water

- Different oiltypes: light, crude, lubricant etc.
- Varying composition: different timescale
- Several chemicals: e.g. cleaning agents, tensides
- Varying salt content
- Solids: iron oxide, calcium carbonate etc.
- Biological load
- Gas/Air load

Bilge Alarms - Technology

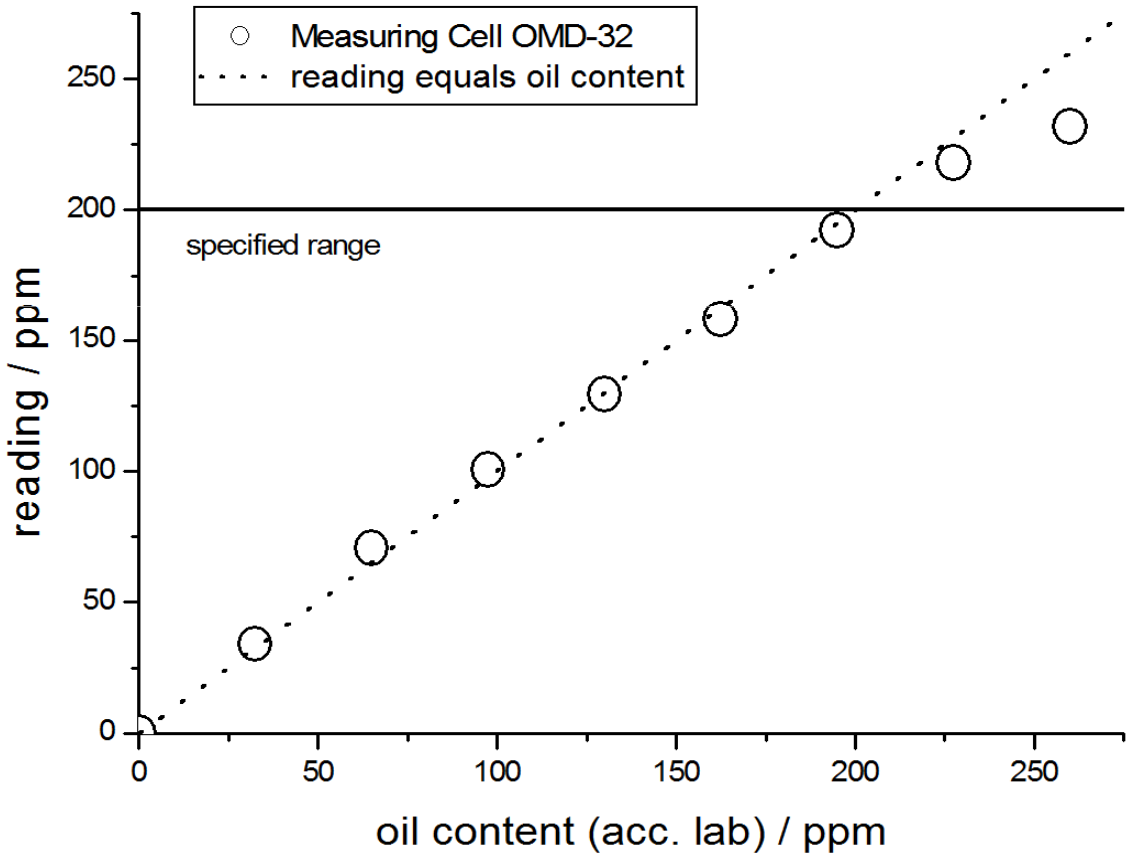
- Commonly used: Light scattering
- UV-fluorescence:
  e.g. FPSO´s, special application
- Other: Camera systems
  e.g. special application

Light scattering

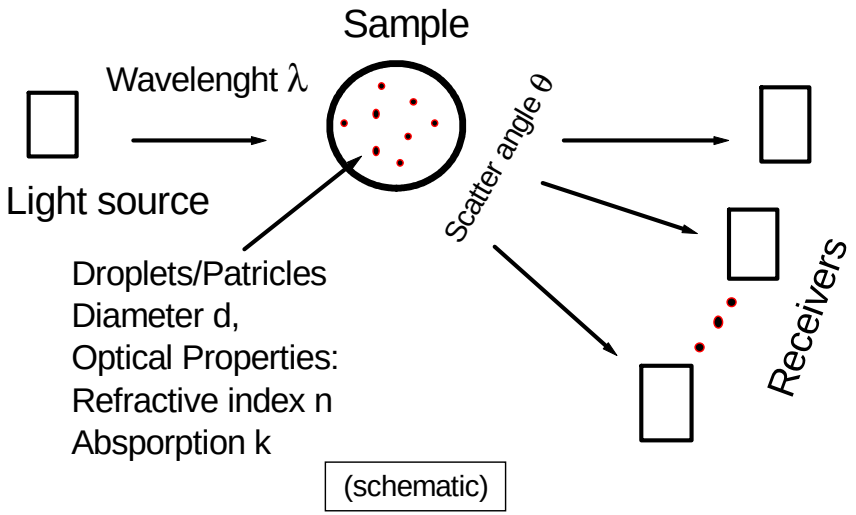


- Intensity of scattered light depends on particle size and shape, optical properties, and incident wavelength
- Intrinsically linear at low concentrations

Light scattering - Linearity



Light scattering



- Intensity of scattered light depends on particle size and shape, optical properties, and incident wavelength ⇨ compensate for varying parameter
- Intrinsically linear at low concentrations
- Price

Summary

Oil in water measurement in the shipping industry is regulated by IMO: up to now 15ppm oil content

Actual regulation MEPC.107(49) try to simulate the situation on board with different oiltypes and chemicals/solids

Scattered light measurement is accurate and reliable in terms of IMO regulation

Now / in near future, regulations will tighten the measurement: 5ppm +/- 2ppm oil content

Gross Tonnage

Gross Tons	Volume (m3)
2	10
24	100
260	1,000
2,800	10,000
30,000	100,000
320,000	1,000,000