Efficiency assessment. modifications on the “IFP test”

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What is the Effectiveness of dispersion

- The ability for a given situation to change the surface oil in a suspension of oil droplets in the water column which can be assessed by measuring :
  - *–quantity of the oil changed into droplets,*
  - *–the stability of the suspension*
  - *–% of water remove from the water surface,*

Ways to assess the effectiveness of dispersion

spill of opportunity

field trials

pilot scale tests

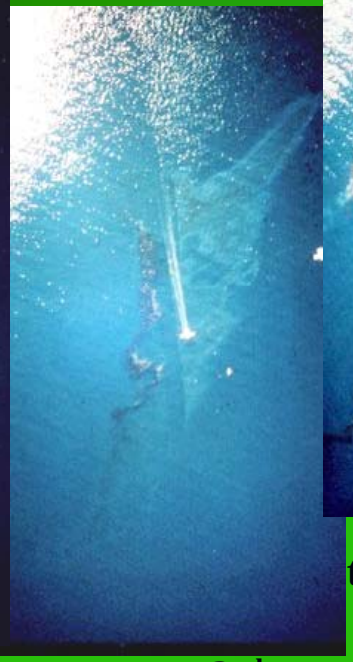
laboratory tests

Field trials

Example of dispersion

treatment 1st run

T:0



treatment 2nd run

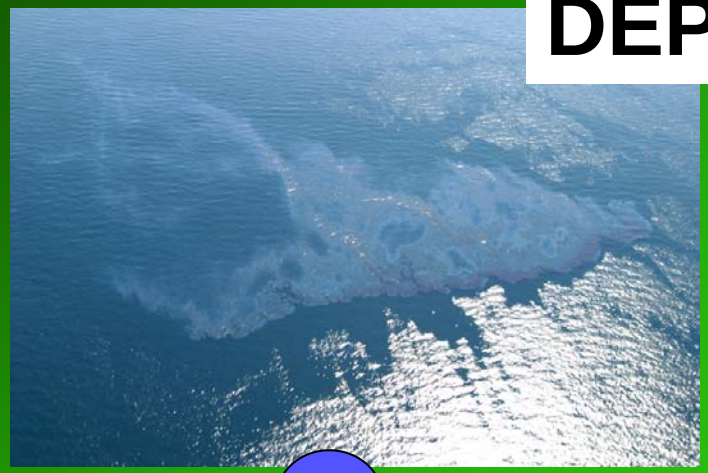
treatment completed

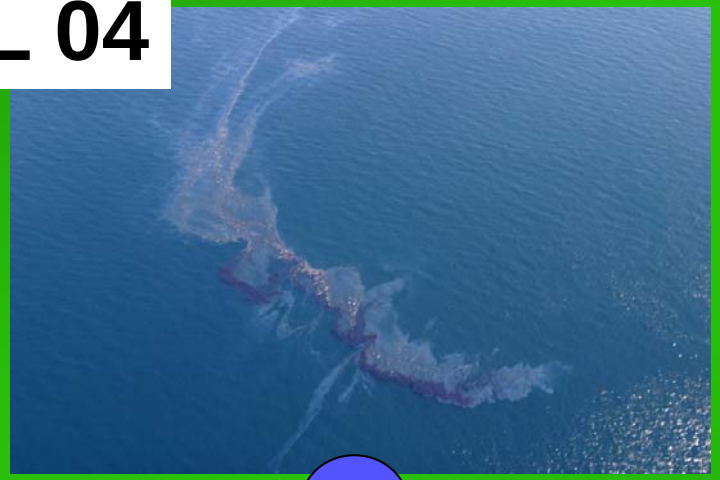
T:1h30

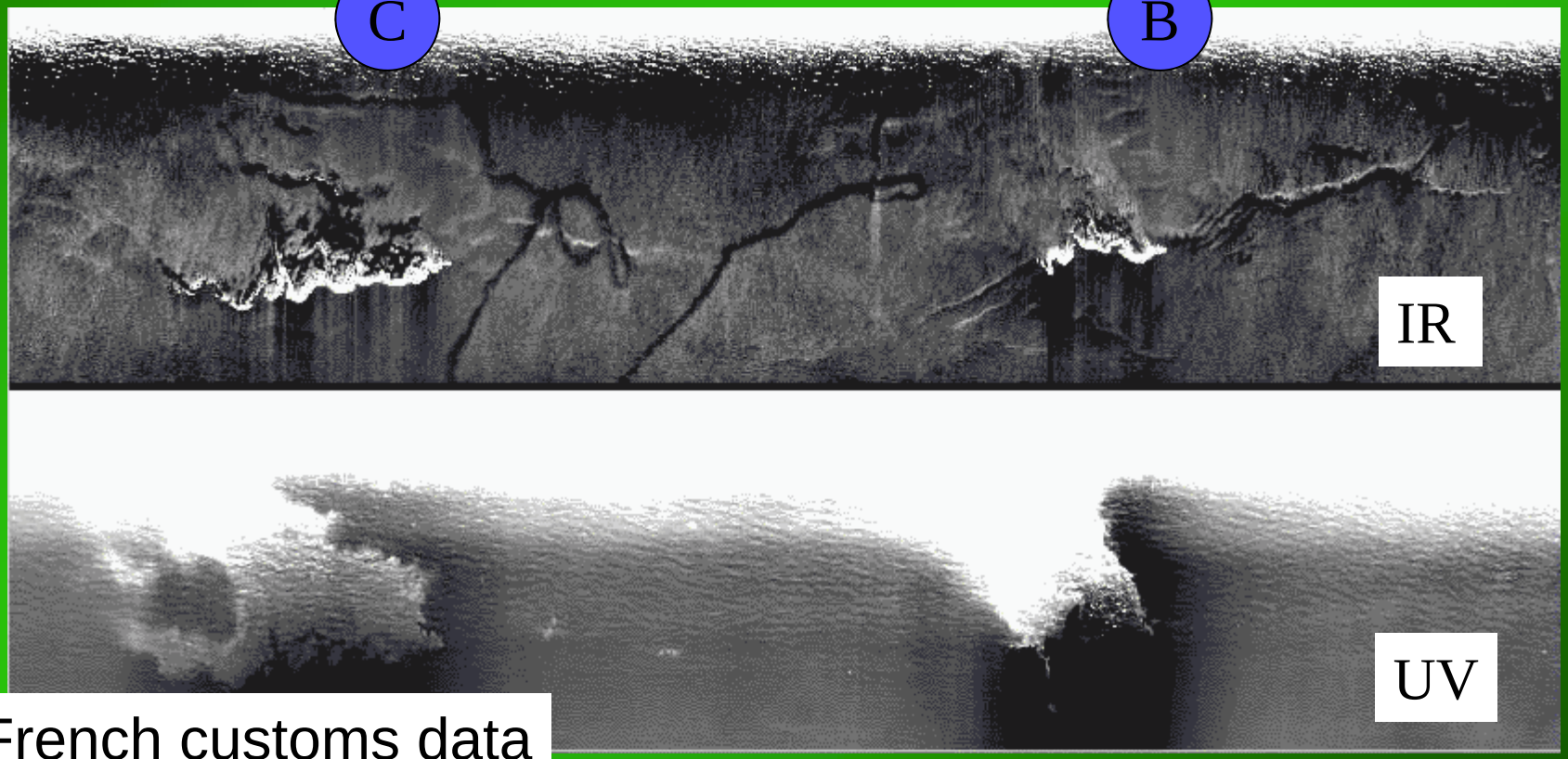
T:4h

next day

DEPOL 04







French customs data

Repetitive small scale sea trials:
an alternative to large pilot scale tests

in the eighties : => WSL
=> Cedre IFP test

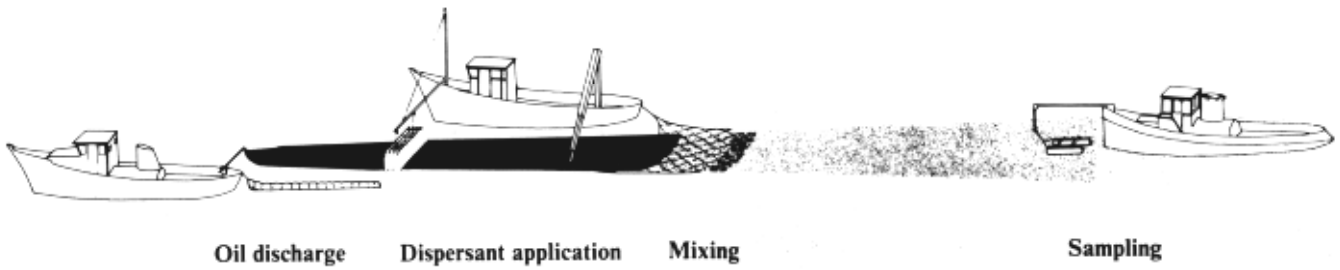


Figure 6. Medium scale field test—General procedure

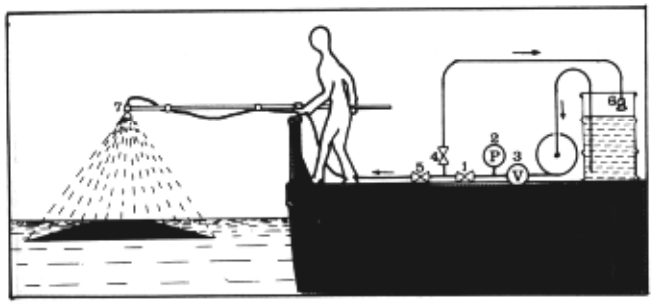


Figure 7. Field test—Oil discharge system

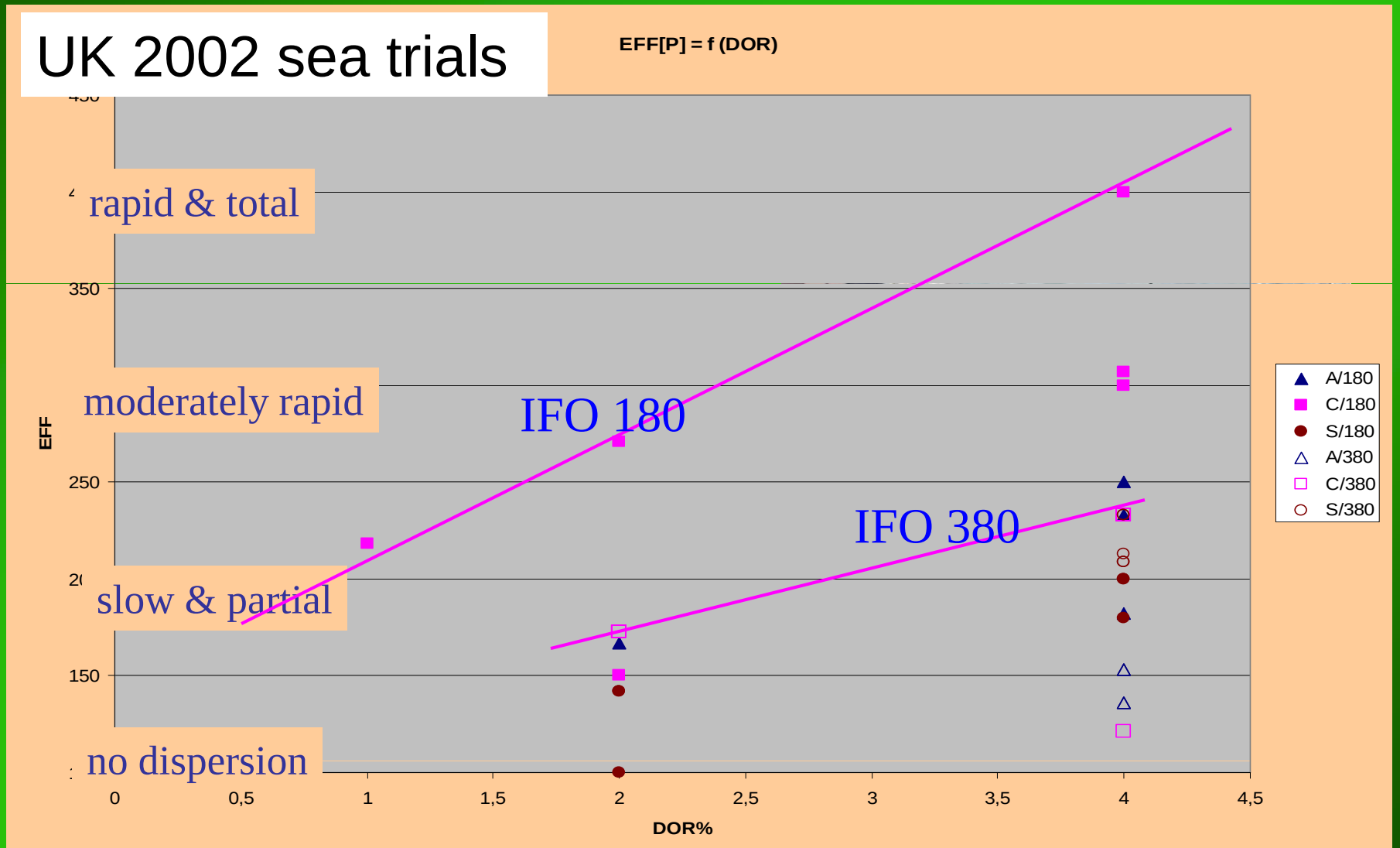
Figure 8. Field test—Discharge of oil and dispersant spraying boat

Repetitive small scale sea trials:
an alternative to large pilot scale tests

WSL in the eighties
UK 2002 sea trials
DEPOL 05

Repetitive small scale sea trials:
an alternative to large pilot scale tests

UK 2002 sea trials



Repetitive small scale sea trials

DEPOL 05

Similar concept :
Smalls slicks (150l)
4 oils (from 2000 to 10 000 cSt)
3 dispersants
3 DOR (5, 10, 15%)

visual assessment
- Global note
- + 4 criteria :
  - brown oil plume
  - spreading
  - resurfacing
  - white dispersant plume

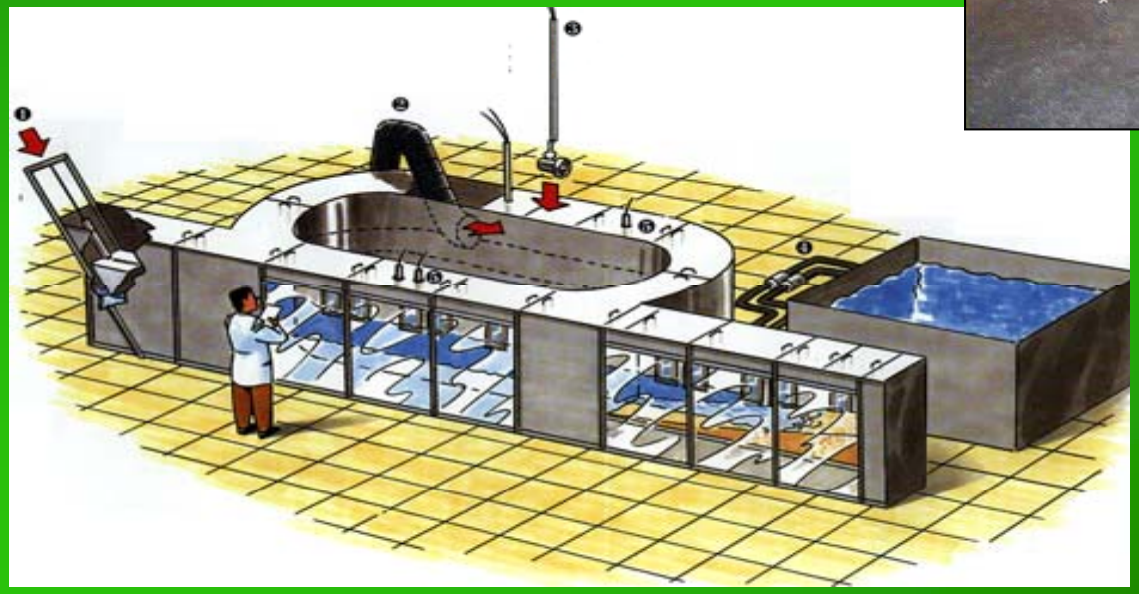
Control of the oil & dispersant application

pilot scale tests: floating cells

Piece of water column trapped inside curtains, open on the bottom:
- wave transparent
- natural dilution process

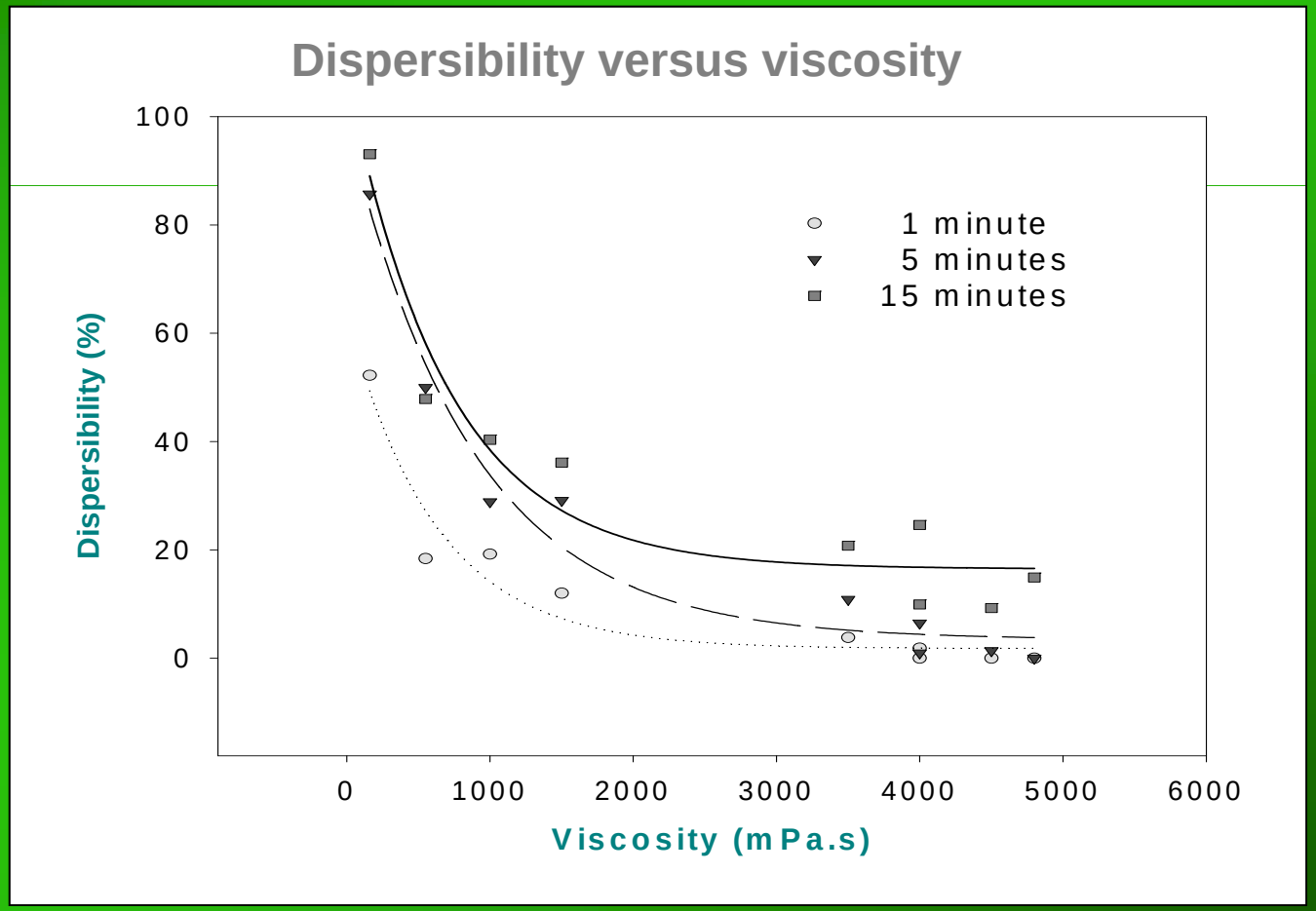
pilot scale tests: floating cells

pilot scale tests: flume test



pilot scale tests: flume test

Dispersibility versus weathering



window of opportunity for dispersion

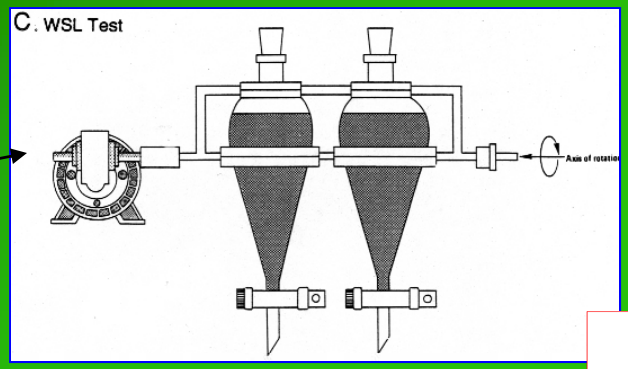
laboratory tests

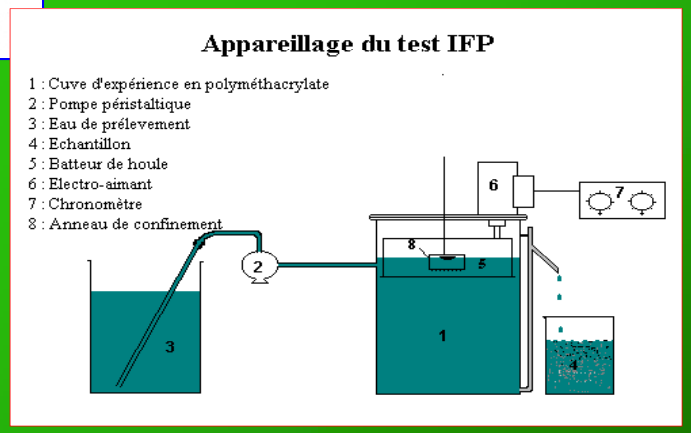
WSL (UK)

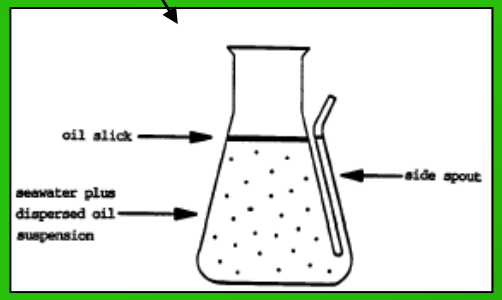
IFP test (F)

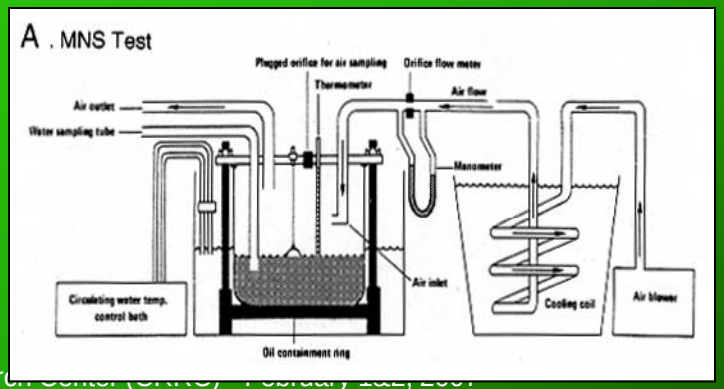
Mackay test

Swirling test (US)





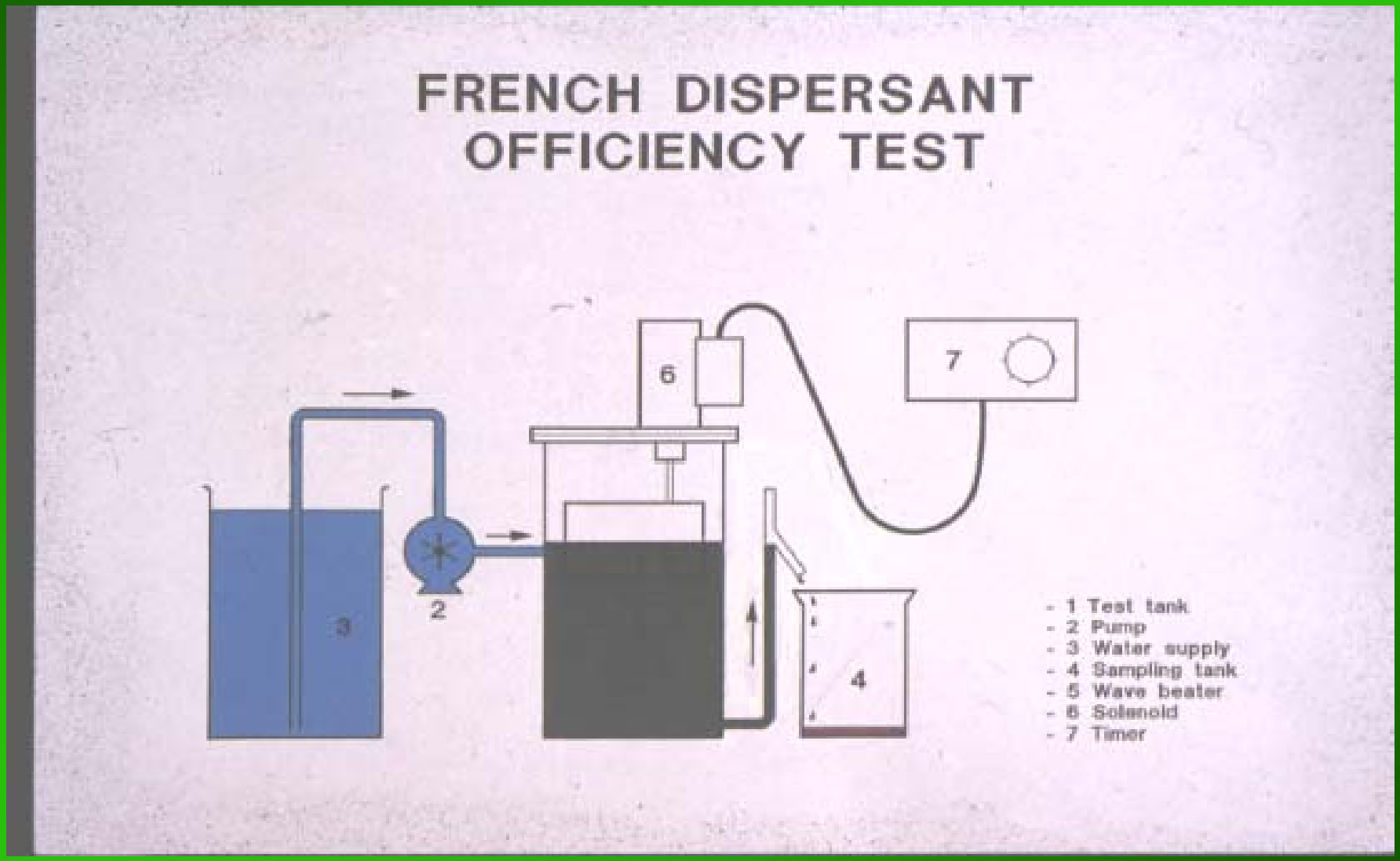




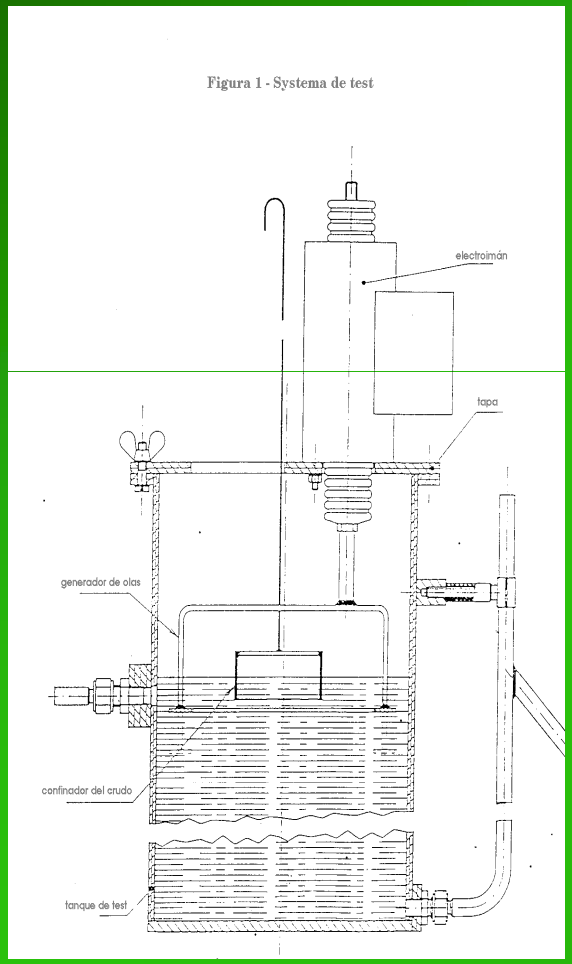
the IFP test

- Originally designed in 1983 – 1986 to replace a previous rotary flask test method
- Validated through field trials conducted in open sea and in sheltered area
- Official test method for the dispersant French approval scheme since 1988
- Listing of approved dispersants *http://www.cedre.fr*
- Use for dispersion study (e.g. oil dispersibility)

The IFP test


FRENCH DISPERSANT
OFFICIENCY TEST
6
7
2
3
4
- 1 Test tank
- 2 Pump
- 3 Water supply
- 4 Sampling tank
- 5 Wave beater
- 6 Solenoid
- 7 Timer

The IFP test

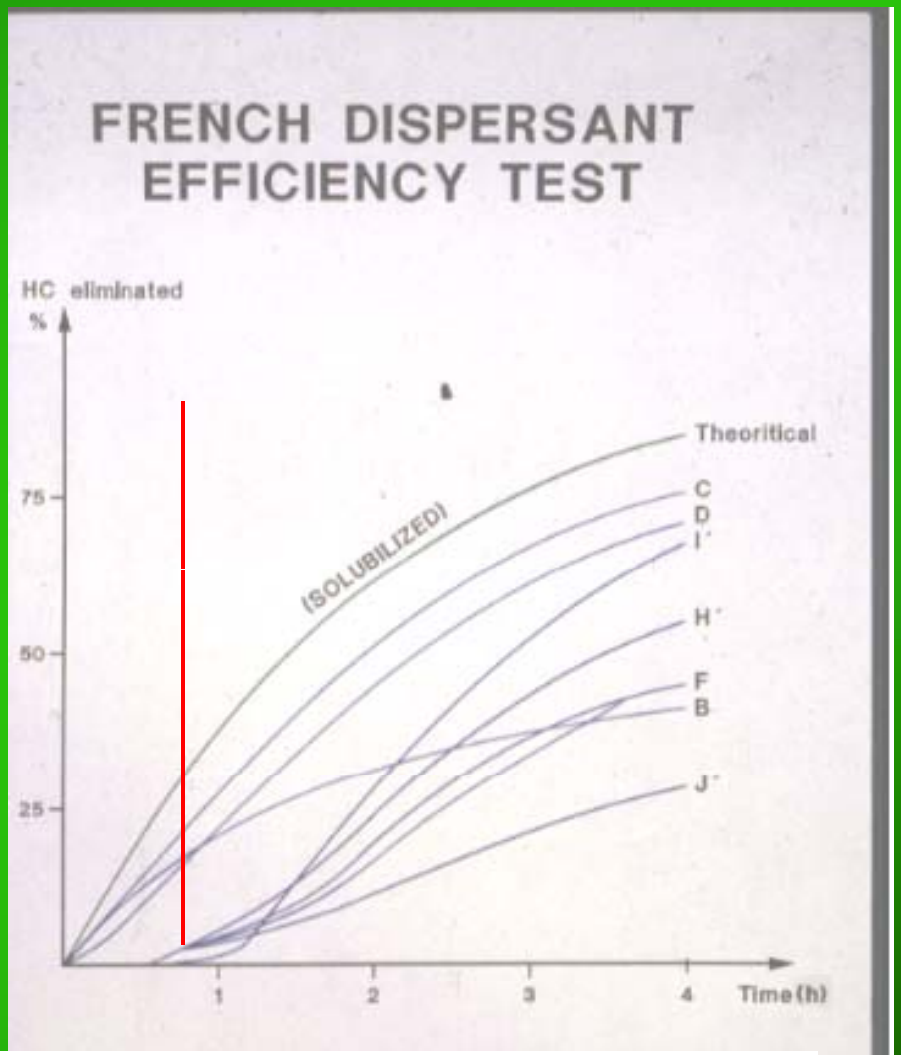


NF T 90 345

The IFP test

Efficiency = the proportion of dispersed oil collected after 1 hour in the beaker in comparison with what would have been recovered if the oil would have been a pure soluble compound

$$E = \frac{\text{recovered dispersed oil}}{\text{theoretical amount of soluble prodt recovd}}$$



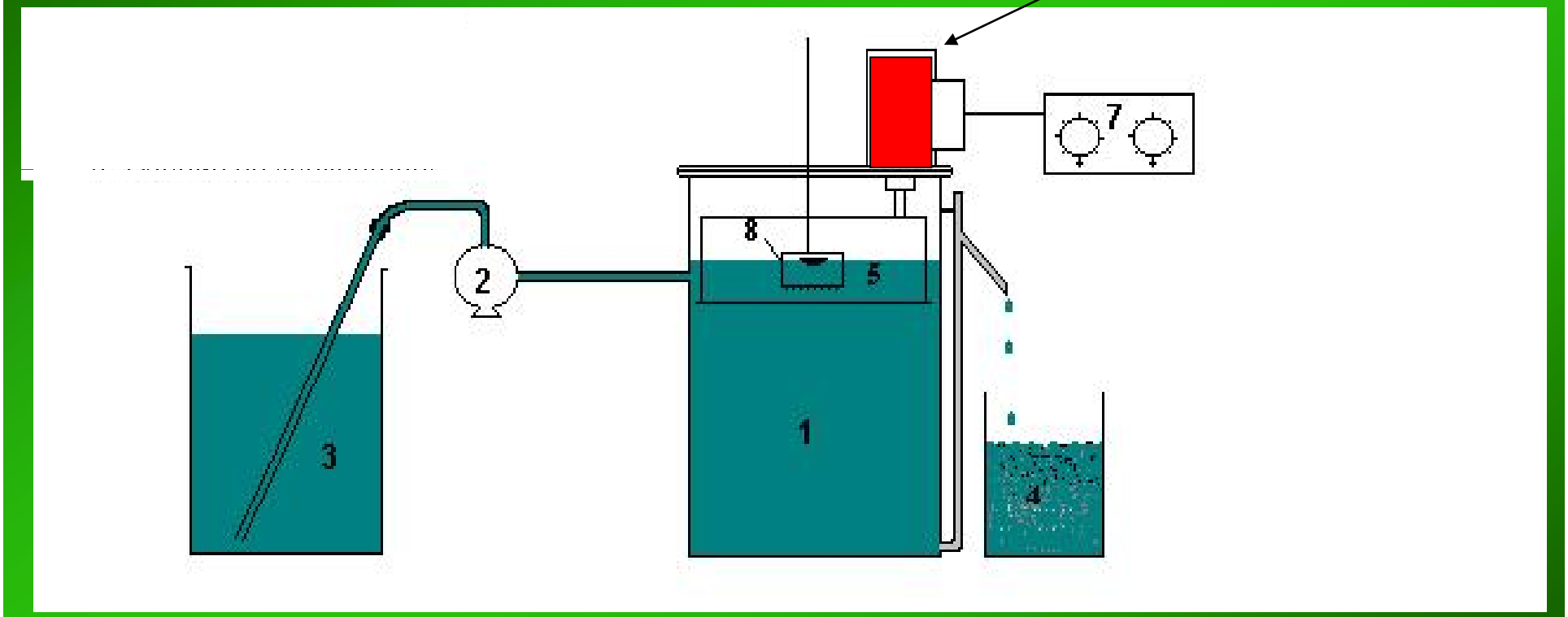
Low energy test

Hight Water / HC ratio : (5000 + 2500) / 5

“Medium term test” : 1 hour

IFP test method

- Critical parameters of the test:
  - Dilution rate
  - Energy (frequency, stroke, depth of the beater)

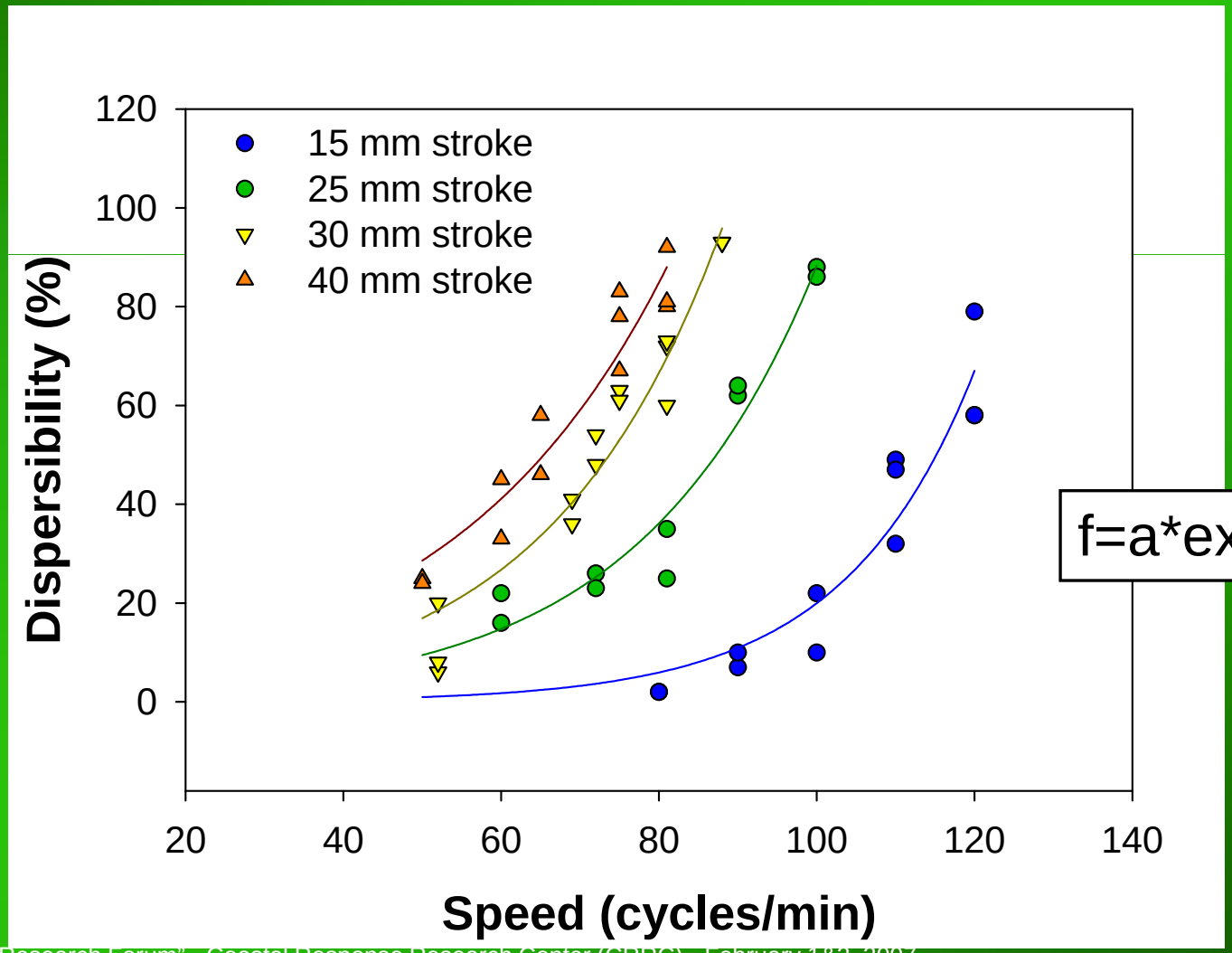

solenoid
7
8
5
2
3
1
4

prototype

Mechanical energy source

Preliminary results

Evolution of the efficiency according to the speed rotation and different strokes



f=a*exp(b*x)

Preliminary results

- **Comparison of the regular test and the new one**

Dispersant	A	B	C
Regular test	69±3	73±3	77±3
Test prototype	50 - 55	61 - 60	73 - 74

Efficacy of 3 dispersants A, B & C

New test design

Tests conditions comparison

New test	Température : 20°C Viscosity : (1300 ± 100) mPas Density : 0,967 stroke : 30 mm Depth : 50 mm Speed : 72 cycles/min Energy : mechanical
Regular test	Température : 20°C Viscosity : (1300 ± 100) mPas Density : 0,967 Stroke : 15 mm Depth : 35 mm Speed : 15 cycles/min Energy : electric solenoid

Tableau 3 : Conditions opératoires des 3 séries d'essais

Conclusions

These are preliminary results,
The next step will be to test different dispersants,
Sintef should get one equipment in order to carry out cross validation

<u>In the dispersion process, the energy is a key factor</u>.

Mechanically driven wave beater give the possibility :

1) to tune the energy level
2) possibly to quantify the energy supply to the system

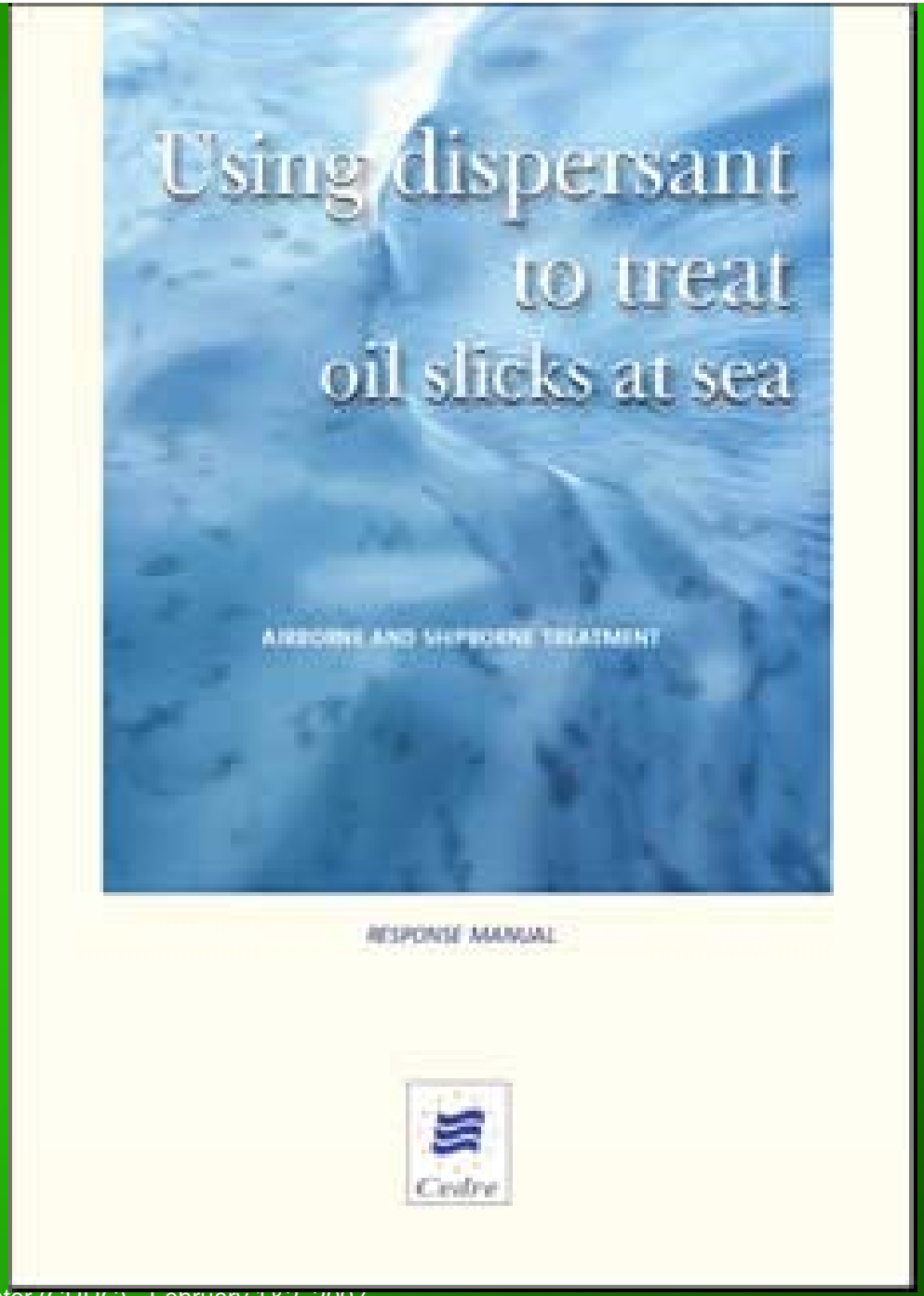
It opens new possibilities for working on dispersion as:

- setting levels of dispersibility with the same test
- links with studies on the assessment of the wave energy

Cedre guidelines on dispersants

can be download on

- ***www.cedre.fr***



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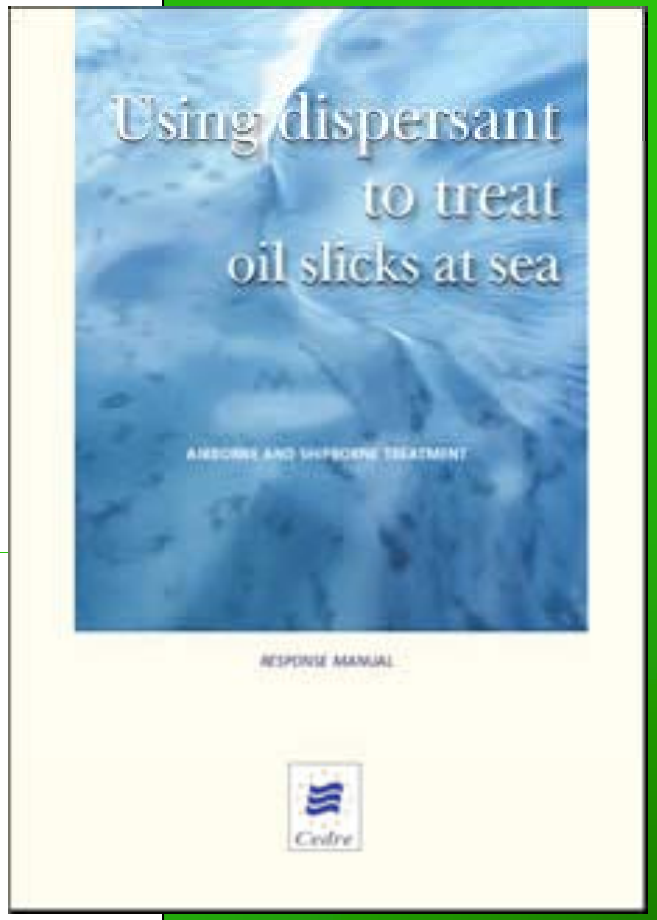

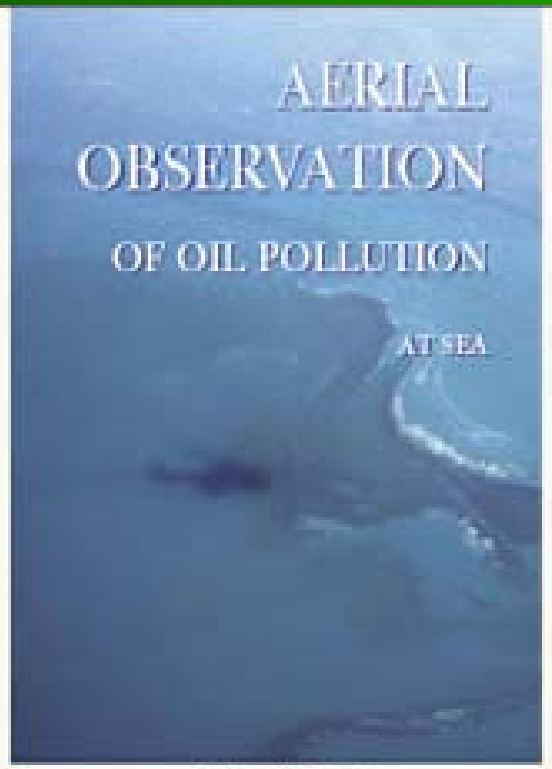
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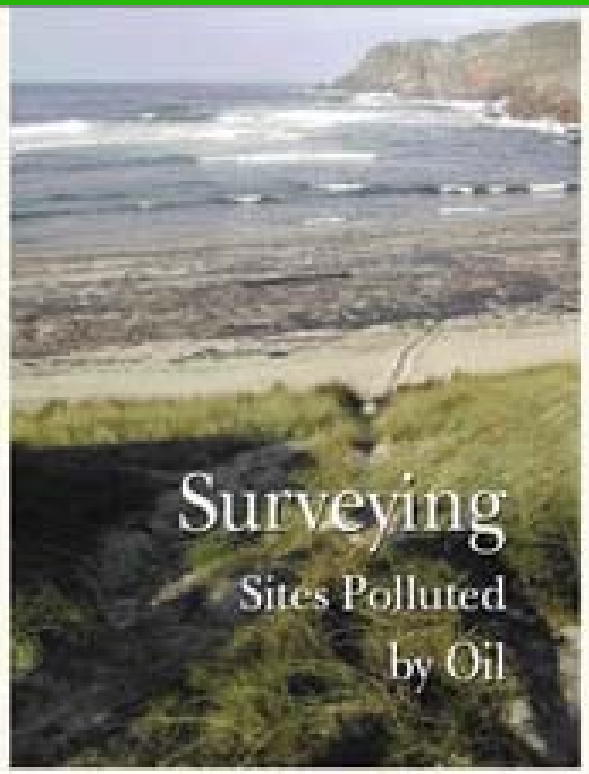
OBSERVATION
OF OIL POLLUTION
AT SEA
OPERATIONAL GUIDE
Cedre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