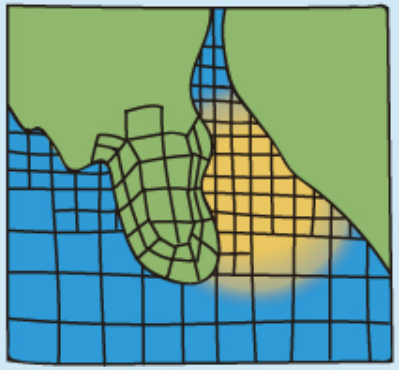

HAZRUNOFF

PROJECT

Integration of sensing and modelling technologies for early detection and follow-up of hazmat and flood hazards in transitional and coastal waters

Cardiff Workshop 20th June 2019

Learning from past incidents; preparing for the future

Florence Poncet, Stéphane Le Floch
CEDRE

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content

Characterisation of spills in estuaries and inland waters over the 20 last years, from Cedre database data

learnt lessons from two past experiences :

- Oil spill in Loire estuary
- Flood in Parisian Basin

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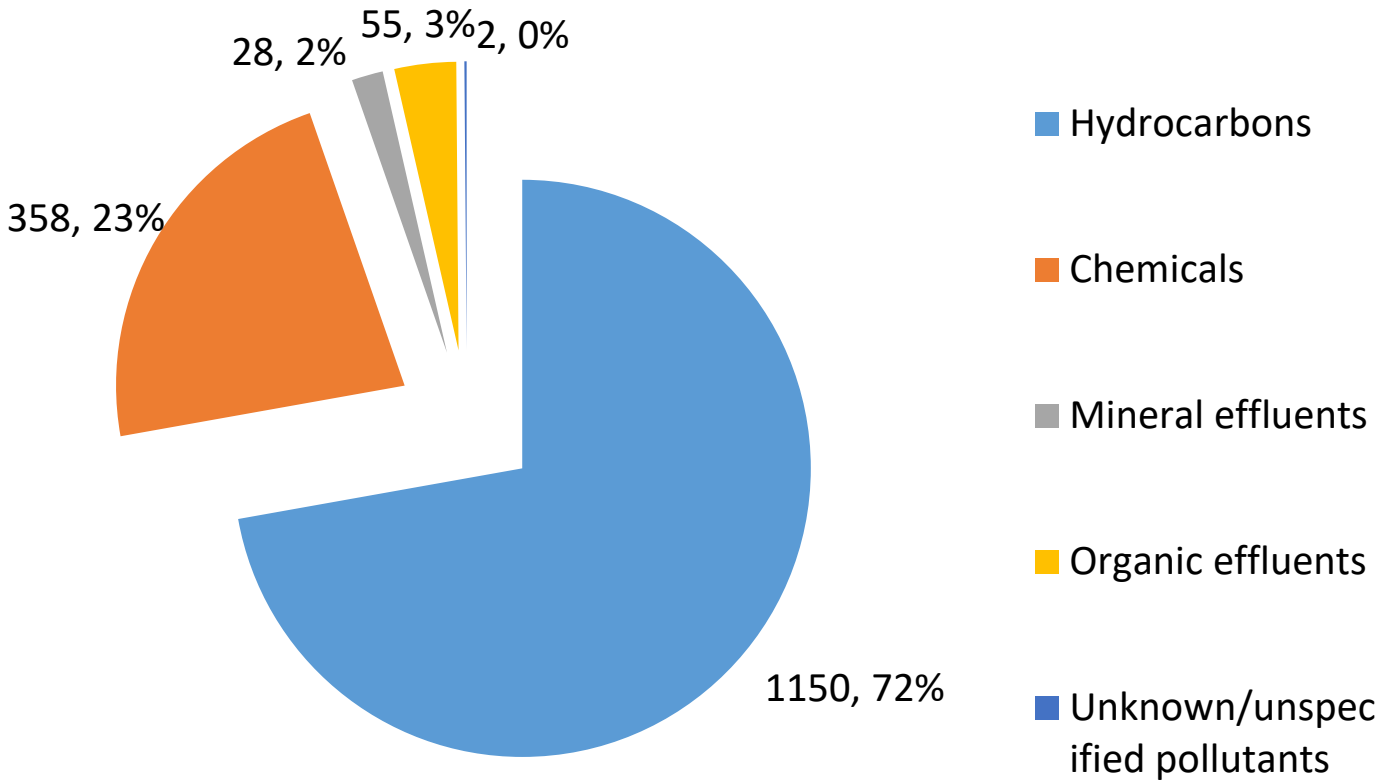
Characterisation of spills in estuaries and inland waters

Distribution : Number of spills (%) by type of products; 1998-2018 ; any volume



Source Cedre database : worldwilde data , from bibliography, media, specialized websites and newsletter, FIPOl etc…

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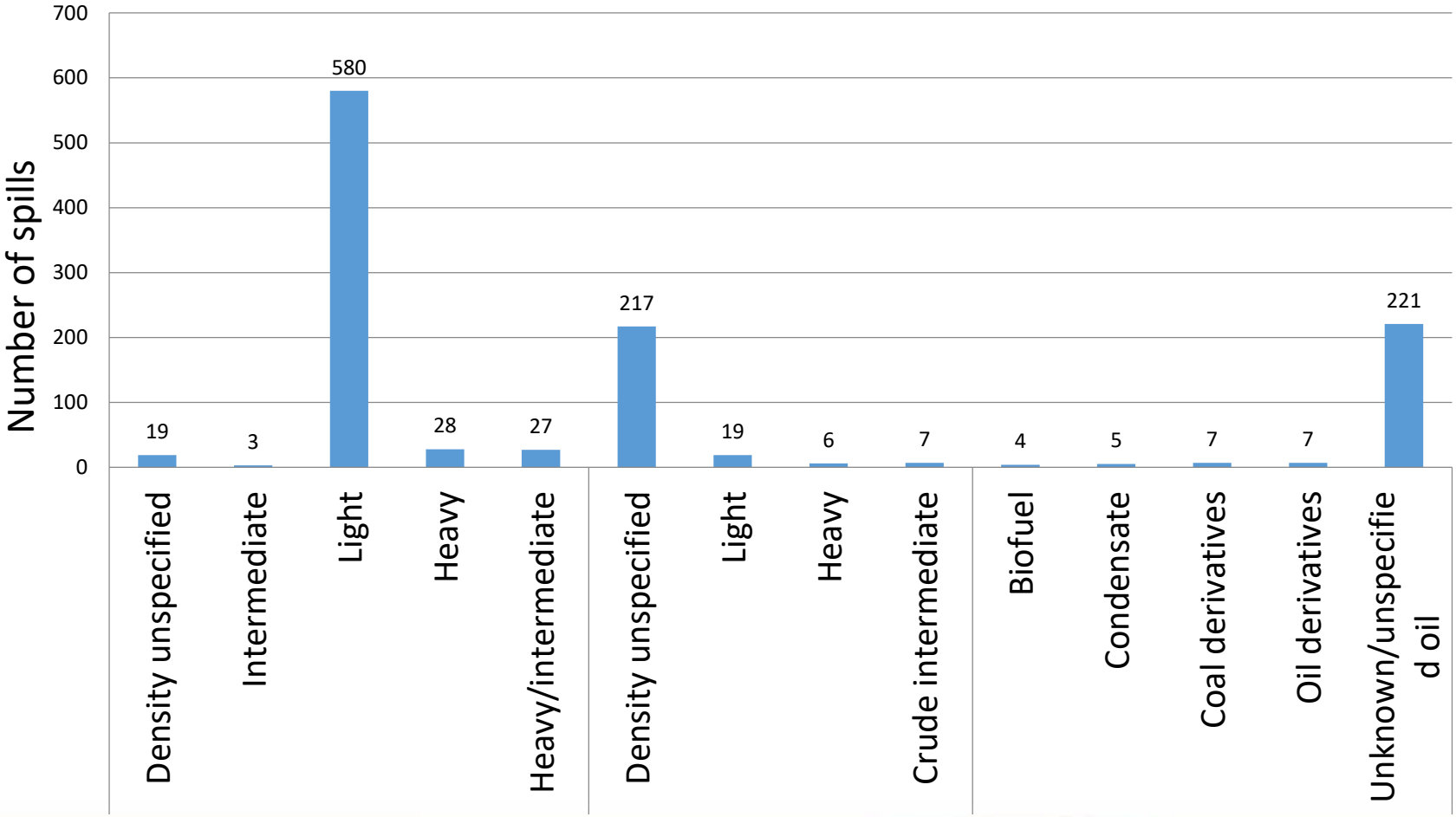
Characterisation of spills in estuaries and inland waters

Distribution : Number of spills by type of oil 1998-2018 ; any volumes



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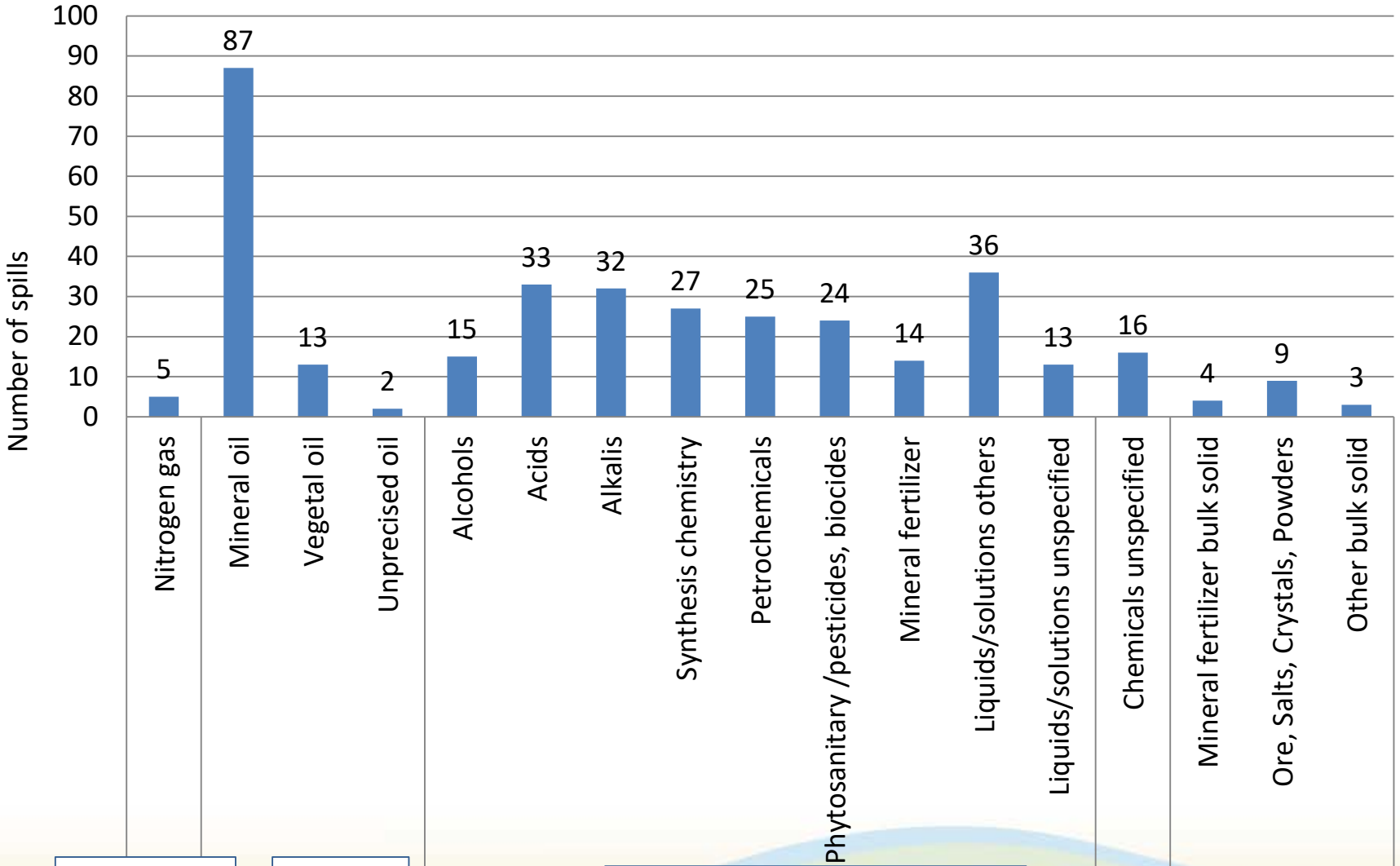
Characterisation of spills in estuaries and inland waters

Distribution : Number of spills by types of chemicals; 1998-2018 ; any volumes



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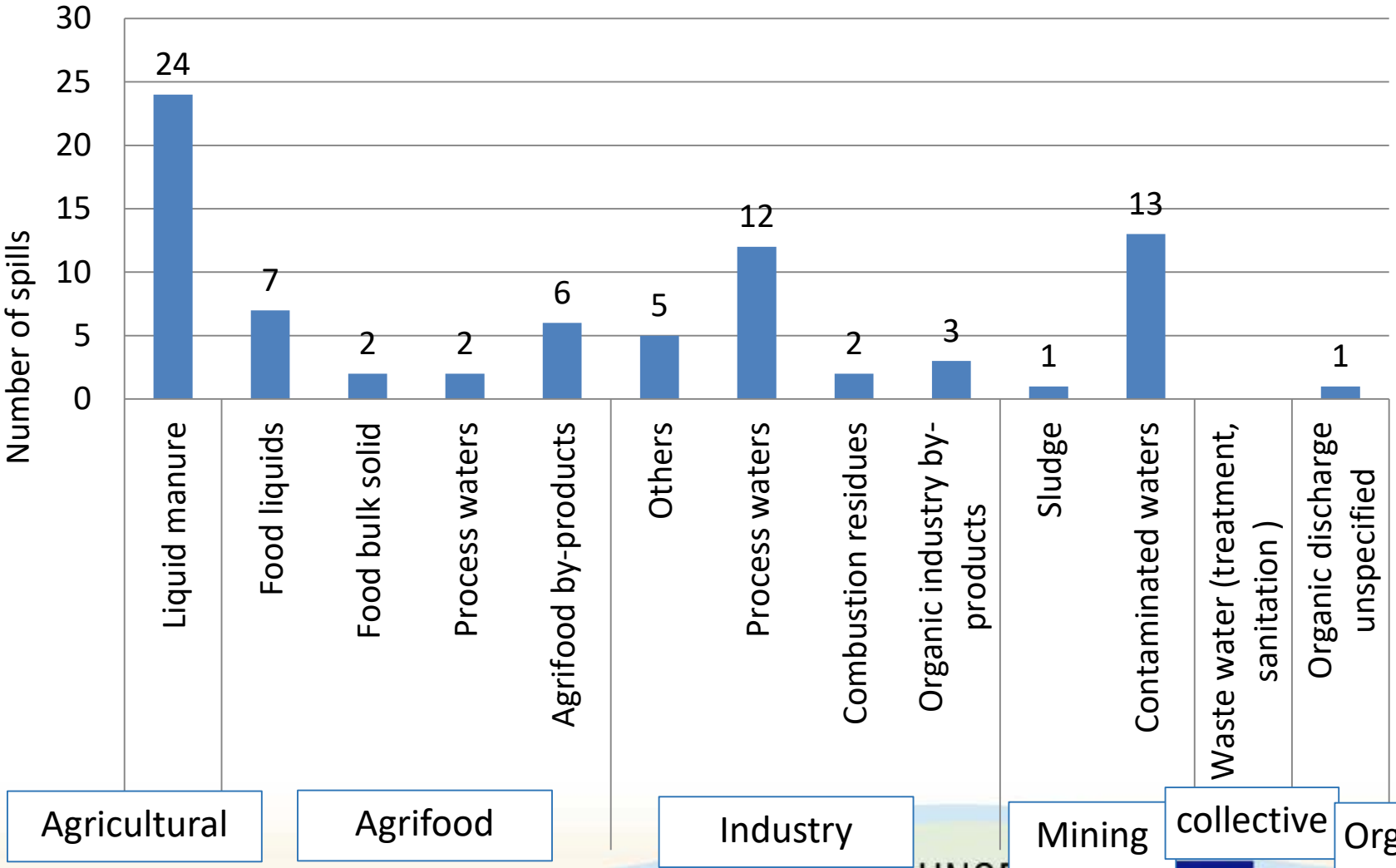
Characterisation of spills in estuaries and inland waters

Distribution : Number of spills by other types of subst /activities; 1998-2018 ; any volumes



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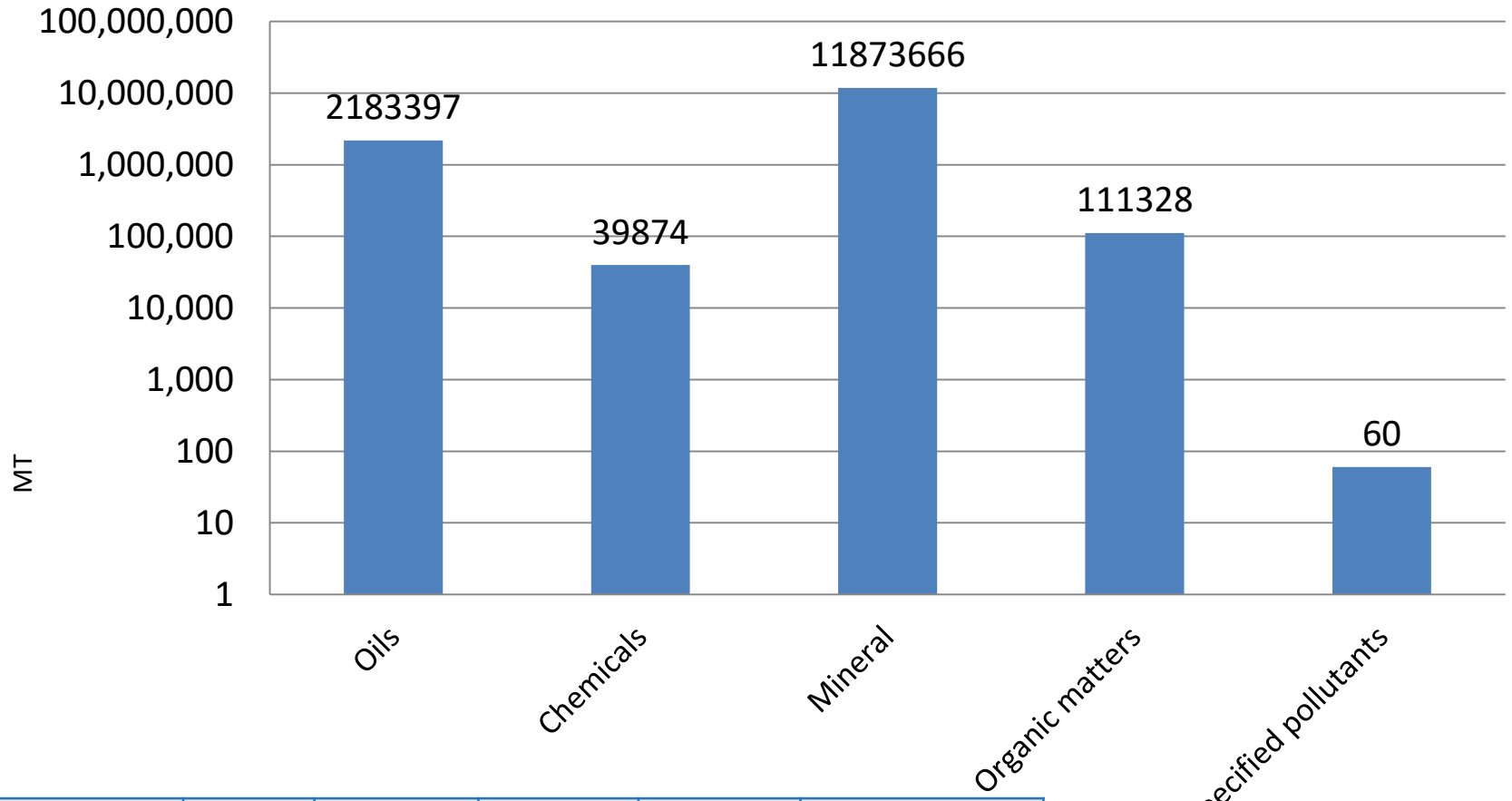
Characterisation of spills in estuaries and inland waters

Spilled quantities (cumulative quantities for the period 1998-2018 ; MT) by type of products;



Typical spill / type of pollutant	Oil	chemicals	Mineral	Organic matters	unspecified pollutants
Median quant. (MT)	11	5	9 463	38	N/A

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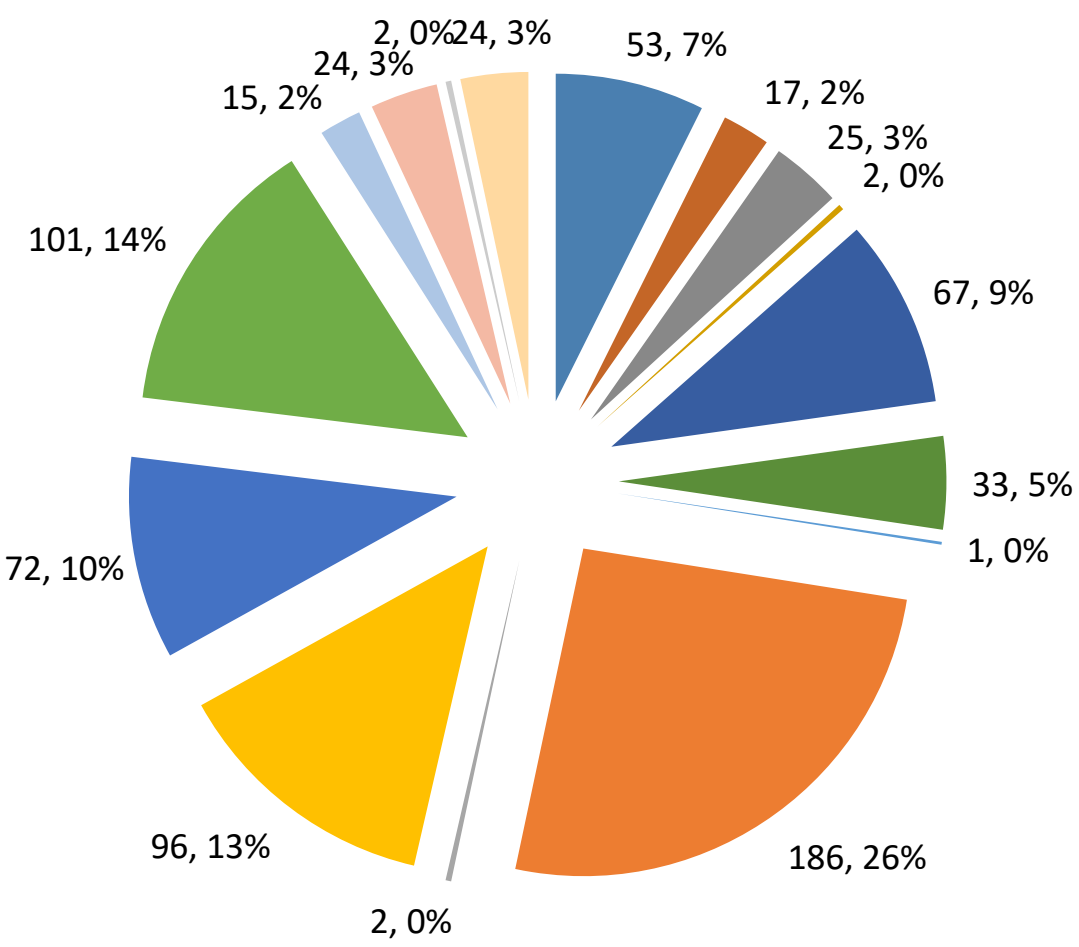
Characterisation of spills in estuaries and inland waters

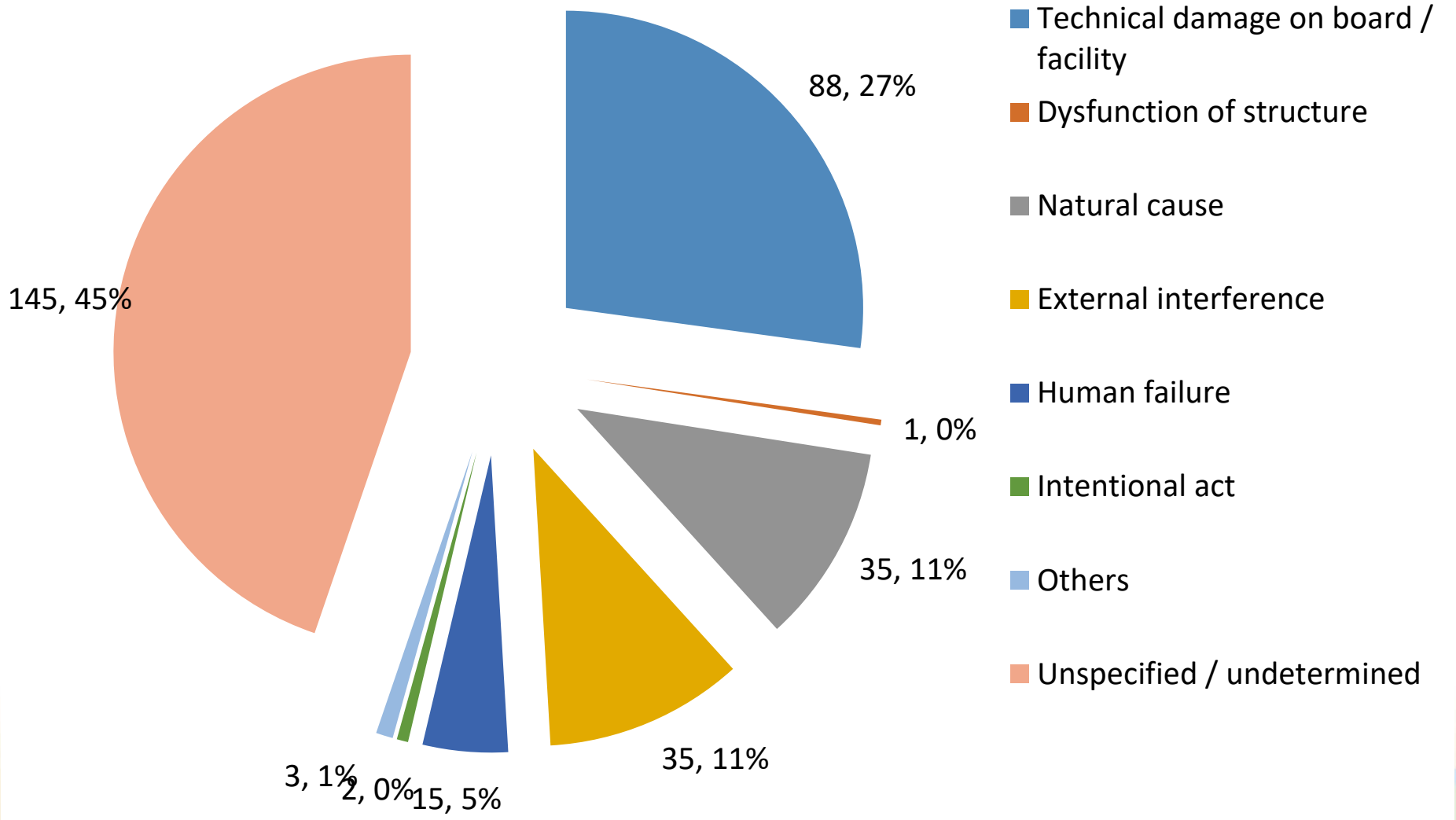
Spill sources : Number of spills all pollutants ; quantity > 10mt ; 1998-2018



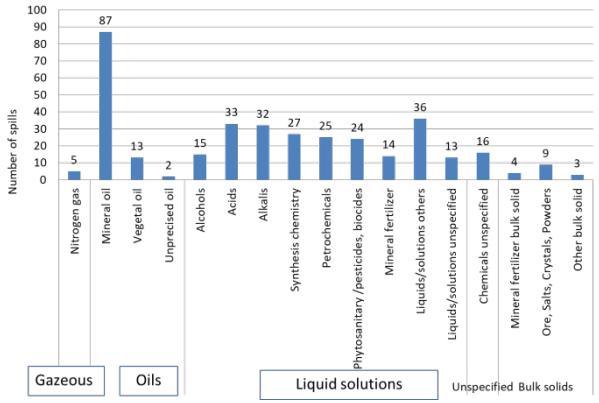
- Tanker vessels
- Cargo vessels
- Other vessels
- Unspecified vessels
- Trucks / trailers
- Trains
- Other mobiles structures
- Pipelines
- Offshore oil facilities
- Onland oil facilities
- Onland industrial facilities
- Diverse (large and small) facilities
- Mineral facilities
- Unspecified onland facilities
- Others
- Unspecified / unidentified sources

Characterisation of spills in estuaries and inland waters

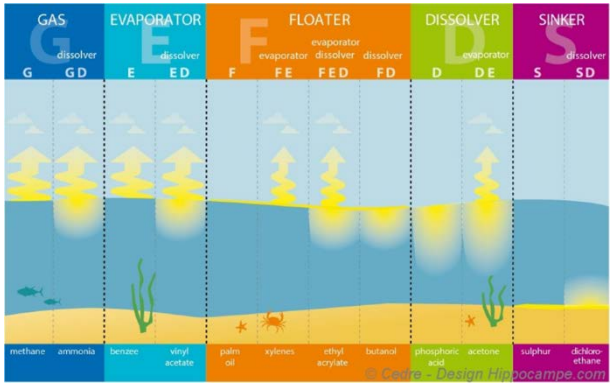
Spill causes: Number of spills by type of causes ; all pollutants ; quantity > 10mt ; 1998-2018



High diversity of products



High diversity of Behaviours



Which are linked to environmental parameters

Will determined:

- ✓ potential impact on the environment
- ✓ Response strategy which can be deployed

Need to

- ✓ Better understand the behaviour of chemicals (chemical bench)
- ✓ Get relevant information on past accidents (feedback)
- ✓ Test new response equipment (booms, filter systems…)
- ✓ Develop and/or optimise modelling tool

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Laboratory tests to better understand behaviour of chemicals at sea and in transitionnal waters conditions

"Chemical Bench Test"

To study the fate of HNS depending of

- ✓ Wind,
- ✓ Sunshine,
- ✓ Water salinity.

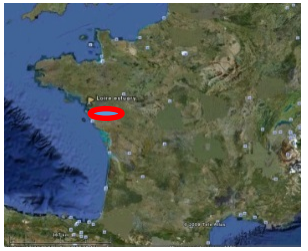
A total of 10 NHS have been tested and, for each, the fate has been described taking into account environmental parameters

The data is collected in the Hazrunoff project database with a linked to a second EU project (HNS-MS)

Feed back on past accidents

Oil spill in the Loire estuary (France) from a pipeline in an oil refinery

16 of march 2008

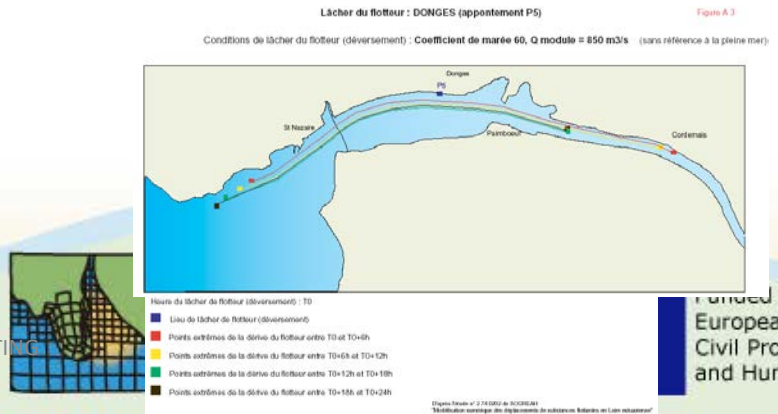


500 tons of intermediate fuel oil spilled (IFO 380), 200 t contaminated 32 km of banks the estuary

3 000 ha of floodplain were inundated (**approximatly 200 ha of wet meadows heavily oiled)**

Available model for oil slick drift forecast in the estuary

- **Hydrodynamic model : 3 to 4 days were needed to run the model and get results ……**
- **In the Contingency Plan : trajectory simulations were prepared in advance**
  - Currents were calculated for :
    - one tide amplitude (neap to spring tide)
    - Different river flows (low-water to flood)
    - 2 wind conditions
  - Model results compared to 3 floaters trajectories dropped in 3 different locations in the estuary, every 2 hours, during a complete tide cycle.
  - Four scenario were chosen (48 maps)
- **A synthetic map was elaborated which shows the extreme points reached by the oil in the estuary (results were OK)**



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Evolution of oiling conditions

First days :

- due to neap tide and river flow, oil remains on water and on low part of the banks

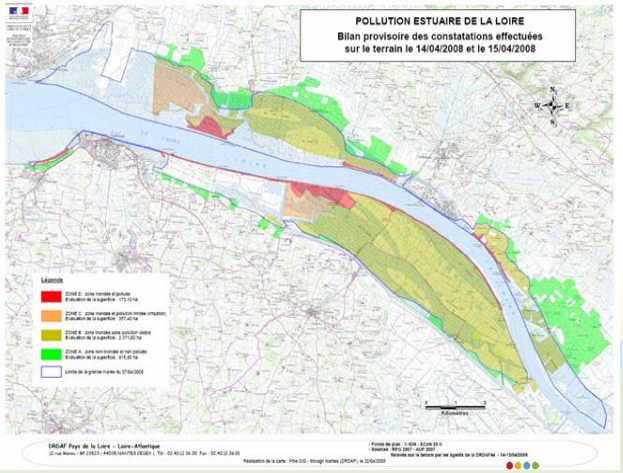
On the fourth day after the spill :

- Increase in tide, flood and currents
- Changes and strengthening in wind

<u>As a result</u> :

Water overflow in the floodplain (4000 ha of meadows submerged and potentially contaminated)

Oil penetrates into small creeks and overflows spreading oil into meadows and wetlands



Oil extension in the estuary :
32 km

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Response operations: protection by boom deployment

Attempt to protect sensitive areas and strategic ressources in the estuary

- Anchoring difficulties
- **Strong currents, over the limit of booms efficiency**

➢As expected, a limited efficiency

Water intake of the power station

Anchorage in a meadow

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Response operations : recovery of floating oil

Very short time opportunity : floating oil only during 4 days :

- Navy *OSRV Argonaute* (with *Thomsea* trawlnet)
- Mobilisation of small fishing boats
- Moored *Thomsea* trawl nets in small creeks
- Few skimming barges suited for shallow waters, but none available in the area
  - ➢ **Most of the floating oil was in very shallow waters close to the banks (pb of draught of the vessels)**
  - ➢ **High currents, limited efficiency of booms**
  - ➢ **Very low quantity recovered**

BSAD Argonaute Source French Customs

Source French Customs

Cedre

As a result : 3 months of cleanup operations on banks (25 000 man days)

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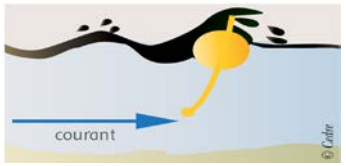
Lessons learnt and future developments

- **Model improvement and faster transmission of forecast results** (Hazrunoff project and French authorities);
- **New tools as UAV to help oil spill extension assessment** (test in the frame of **Hazrunoff project);**
- **Prototype of hovercraft for operations on mudflats and in shallow waters was developped by Italian partners in the framework of a European project;**
- **Better adapted equipments for recovery in fast currents** : since 2013 Cedre, partners and manufacturers organise tests of the capabilities of these new equipments in the Loire estuary, <u>with Harbour teams and vessels;</u>
- .

Test of equipments adated to high-currents

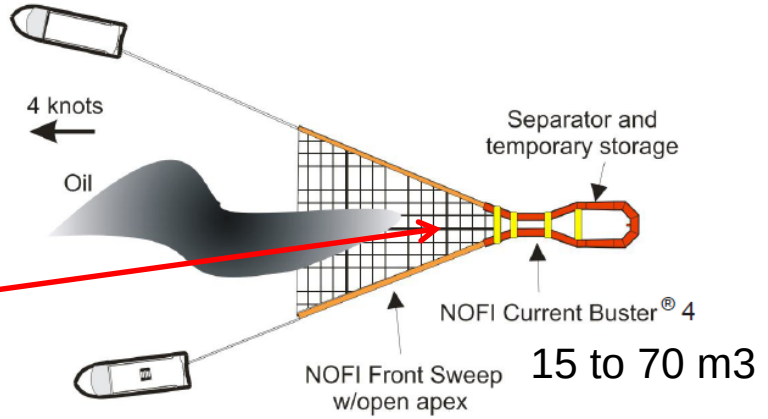
Conventional booms are efficient for currents up to 0,35m/s (0,7 knots) in perpendicular configuration



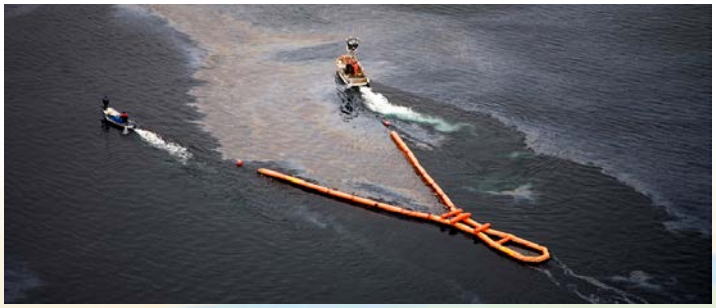
Specific equipments are developed for high currents :

- **example of *NOFI* « *Current buster* »** efficient up to 4 knots used for dynmamic/static recovery

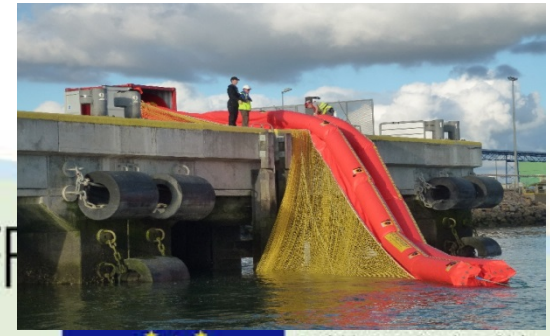
An open worknet to slow down the current



Towed by 2 vessels



Towed by 1 vessel and a paravane (deflectore)



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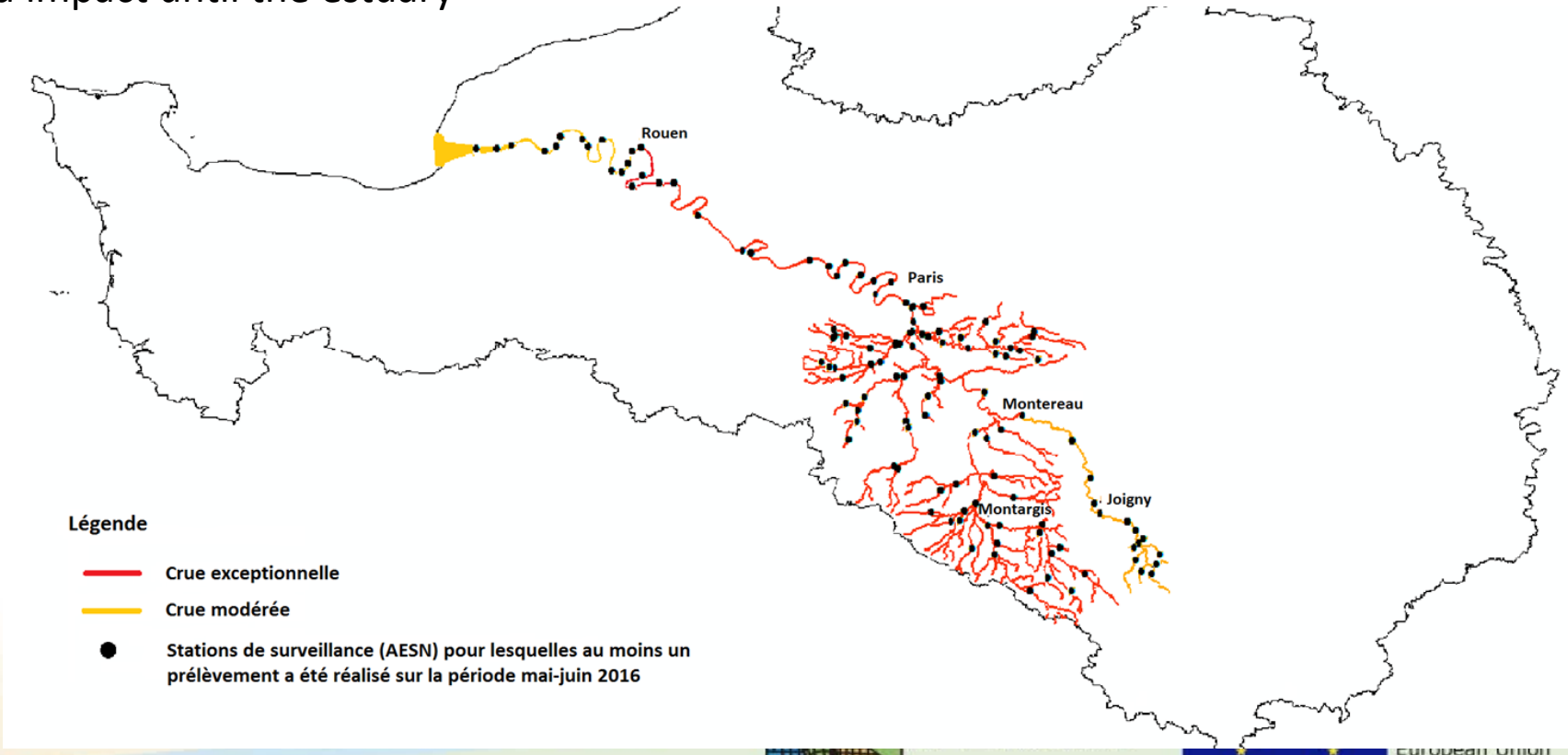
Second example : Flood in the Parisian Basin - june 2016

Exceptionnal flood, out of «historical » floods period as it occurs in june
Elevated pluviometry and saturated soils before the event due to rain
Many important Seine afluents
(In Paris a peak with elevation level of 6,10 m in 1 night) (a 20 years return period flood and more for upstream affluents)
Flood impact until the estuary



Flood in the Parisian Basin - 2016

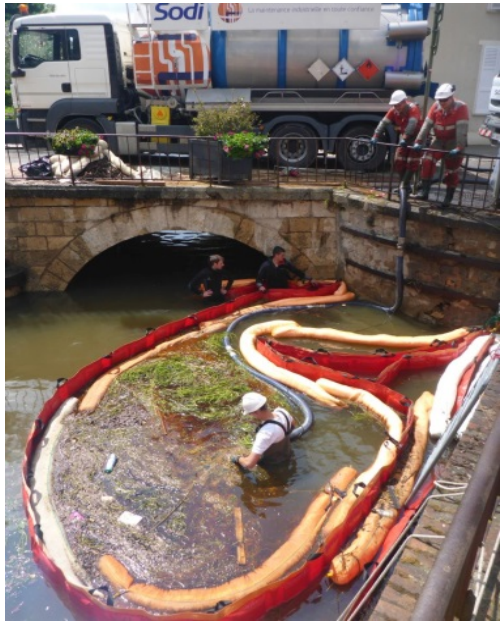
Visible Contamination :

- **Domestic fuel oil**
- Oils from filling stations
- Used oils from garages
- Wastes, debris

Invisible contamination :

- Phytosanitary, pesticides…
- Chemicals from professional activities (painting, plumbing ect..
- Organic (sanitation systems, liquid manure tanks….)

Response on oils : containment, pumping, use of sorbents



Makeshift solutions : filtration of contaminated waters in river bed or pumped in houses and basements

Makeshift filtration barrier (wire-mesh and loose sorbent)

Dilling holes at the bottom of a bin filled with loose-sorbent

Water and sediment monitoring

A monitoring group was set up (25 stakeholders (public services, providers of water, water management committies, sanitation companies)
to share their data and organise :

- water monitoring
- Sediment analysis of the fine sediment deposits of receding waters

Contamination results :

- some localized increase of contamination with relation with spills for :
  - HAP , mineral contamination
- Organic contaminants level under past floods contamination (decrease due to regulations of past 10 years)
- Due to season a peak of nitrate and pesticides during few days

In conclusion the group proposed:

- **to set up a platform to facilitate and speed data exchanges**
- **to work on data formats**

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