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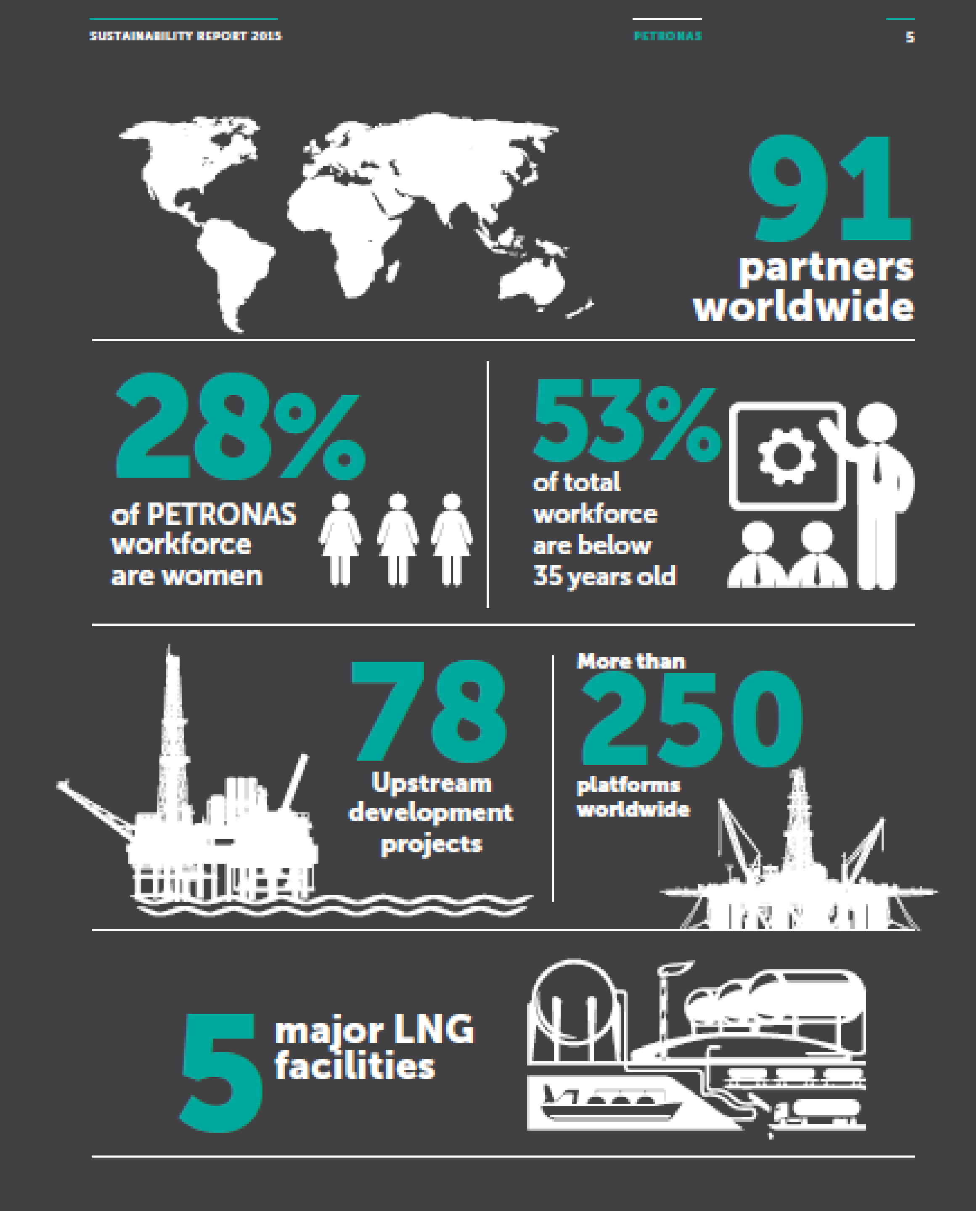
PETRONAS

Environmental Management in Oil Spills

Presentation to the 10th Cooperation Forum on Safety of Navigation and Environmental Protection in the Straits of Malacca and Singapore

2-4 October 2017



PETRONAS at a Glance

- **118 owned and in-chartered LNG, Chemical and Petroleum fleet.**
- **16 offshore floating facilities.**
- **Fleet combined capacity of over 12 million dwt.**
- **Tank terminal capacity of approximately 8.1 million cbm.**

Why protect the marine environment?

People
- Livelihoods
- Goods and services
- Health

Environment
- Sustainability
- Ecosystems and habitats

Assets
- Integrity
- Financial and economic losses

Reputation
- Licence to operate
- Adverse media attention

International and National Legal Obligations

As a corporation that operates internationally PETRONAS observes national and international laws and regulations and adopts industry best practices in all aspects of its operations and businesses

National laws

- PETRONAS’ policy requires that it complies with all relevant national laws
- Varying standards exist in host countries
- Internal standards complement national laws

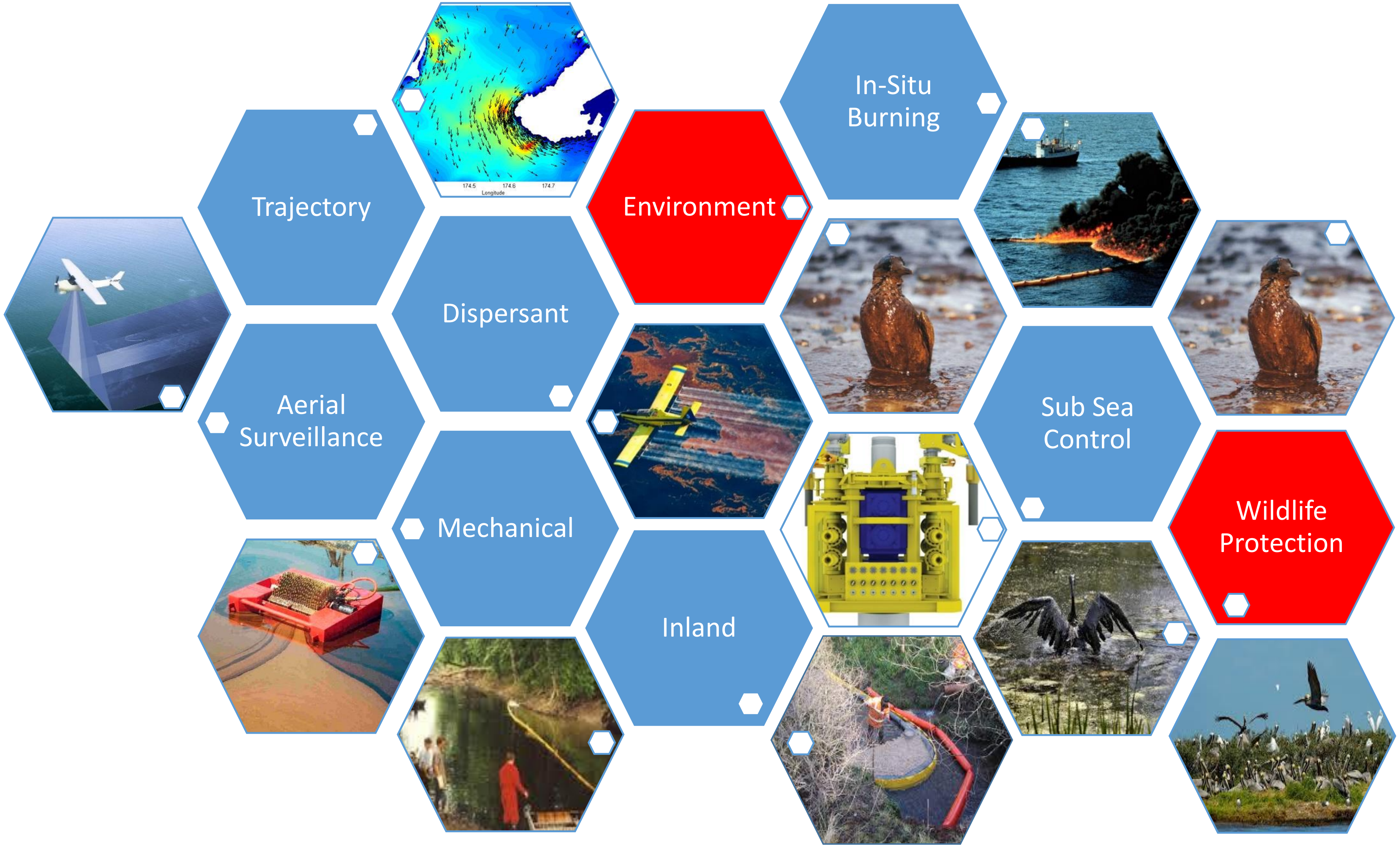
International law

- Depends on the international conventions ratified by host country
- Primary international conventions include:
  - UNCLOS
  - MARPOL 73/78
  - OPRC 1990
  - UNFCCC
  - KYOTO PROTOCOL

Industry best practices

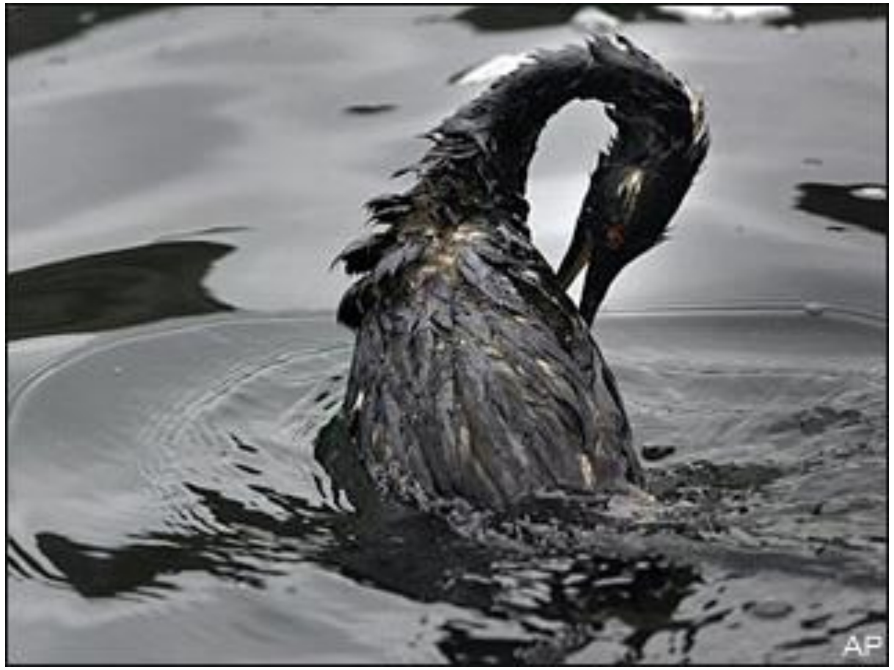
- IOGP
- IPIECA
- ITOPF
- IFCs

Oil Spill Response Elements



Marine Oil Spills

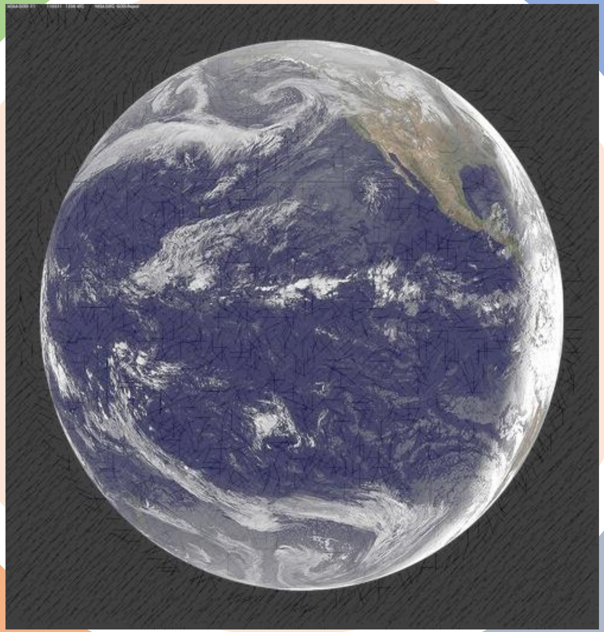
- Oil spills make good headlines
- Images of wildlife covered in oil, oil slicks or in-situ burning of oil capture public attention
- But are bad for the environment, local economy and reputation of oil companies
- Examples of recent ones include the Macondo blow-out spill in the Gulf of Mexico
- Oil spill management involves preventive, response, recovery and rehabilitation



Protecting the Environment Throughout the Project Life Cycle

Environmental Design Basis
- Based on regulatory requirements, risks and impact assessment
- Solutions to reduce impact
    - Site selection
    - Environmental management plan
    - Design philosophy/approaches
    - Best available technology

Decommissioning
- Options
- Risk and impact assessment
- Post monitoring



Operational Control
- Standard Operating Procedure
- Maintenance
- Monitoring

Incident Prevention and Control
- Environmental Sensitivity Index Mapping
- Oil spill preparedness and response
- Crisis management

Oil Spill Management and Response in PETRONAS

Corporate (Group Health, Safety, Security and Environment)

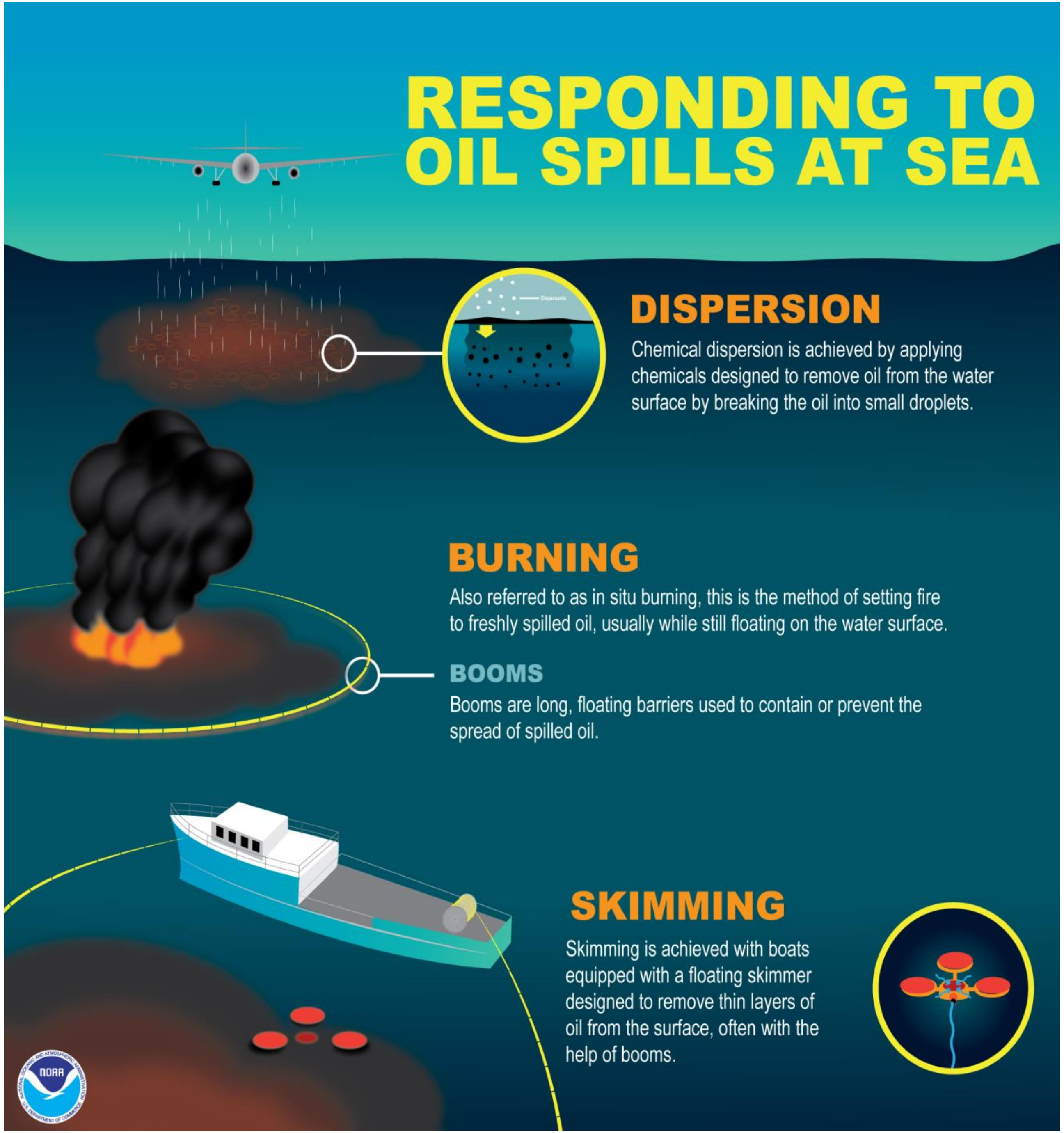
- Crisis Management
- PETRONAS Technical Standard on Oil Spill Contingency Planning
- Engagement with authorities and service providers (PIMMAG and OSRL)

Business Units/Operational Production Unit

- Emergency response plans
- Oil spill response teams and Tier 1 oil spill control equipment
- Exercises

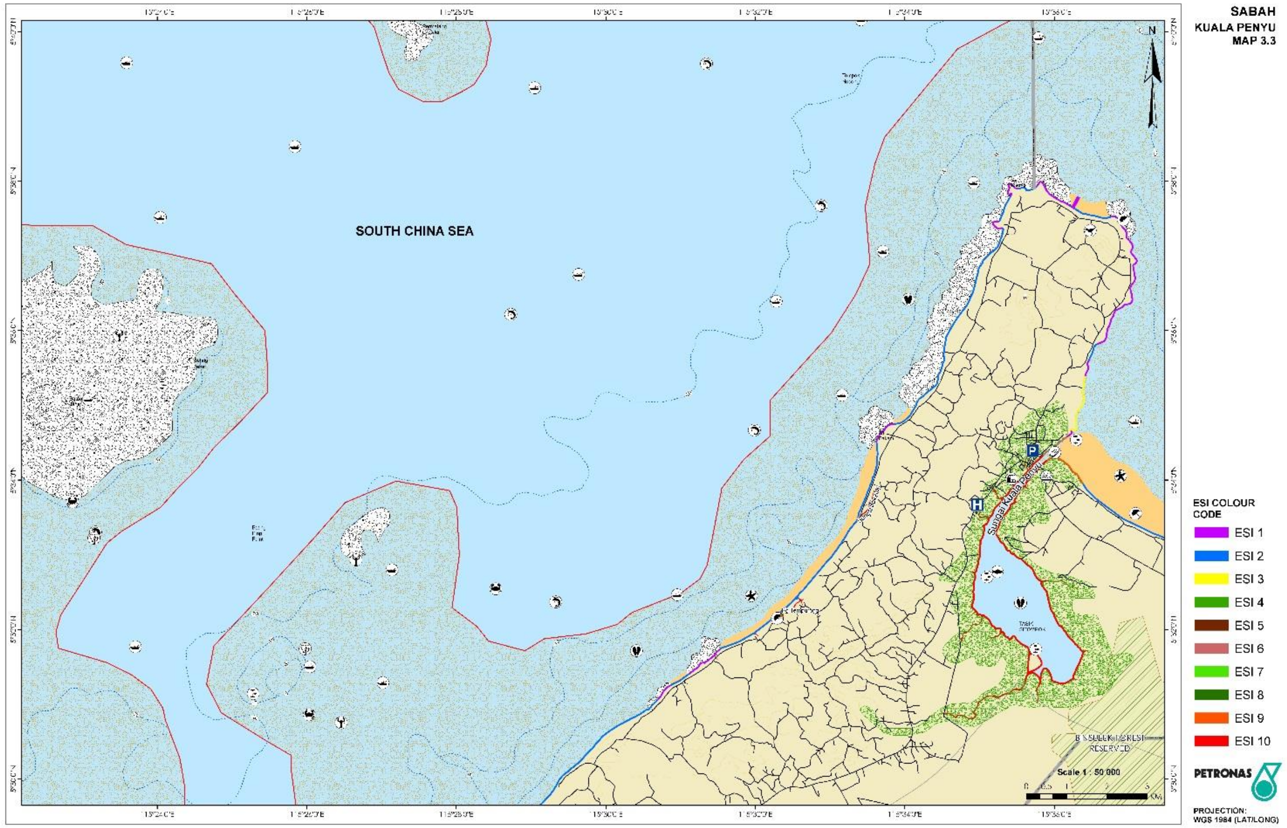
Shipping

- Compliance with international convention
- Shipboard Oil Pollution Emergency Plan (SOPEP)



Marine Department Peninsular Malaysia OSR vessels deploying containment boom during the recent National Oil Spill Control exercise

Environmental Sensitivity Index (ESI)Mapping



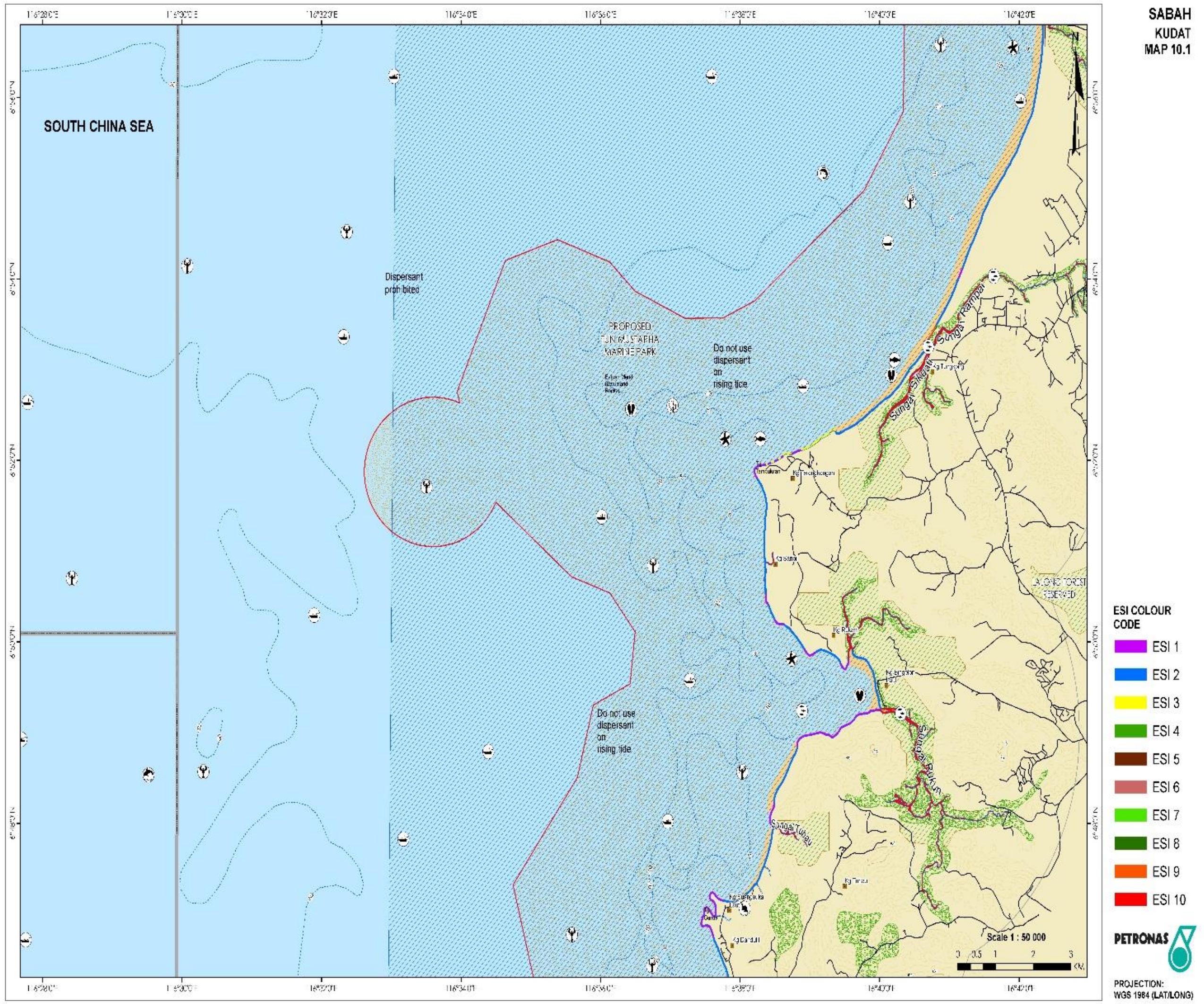
ESI maps completed for East Coast Peninsular Malaysia, Sarawak and West Coast of Sabah

- Provides overview of environmental, economic and cultural assets in a particular region

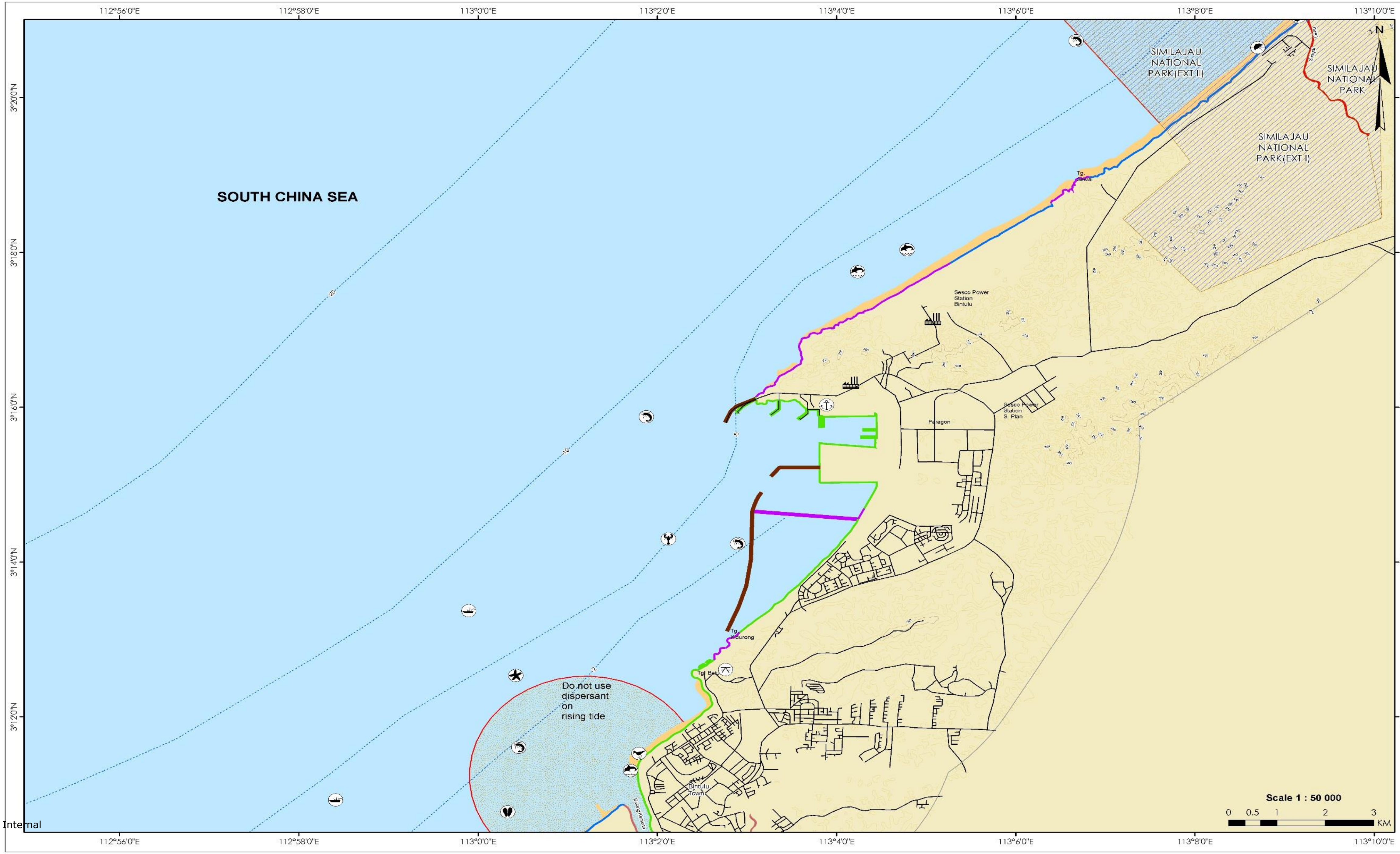
- Assist oil spill responders identify and protect important coastal ecosystems and human activities

Environmental Sensitivity Index (ESI)Mapping

ESI Rank No.	Type of Shoreline
1	Exposed Rocky Headlands, Wave-cut Platform and Seawall (Least Sensitive)
2	Exposed Fine-Grained Sand Beaches and Sandy Shoals
3	Exposed Medium To Coarse-Grained Sand Beaches
4	Exposed Mixed Sand and Gravel Beaches and Sand Gravel Fills
5	Exposed Gravel Beaches and Rip-Raps
6	Exposed Tidal Flats
7	Sheltered Rocky Shores, Seawalls, Sand Beaches and Raised Tidal Flats
8	Sheltered Tidal Flats
9	Exposed Mangroves
10	Sheltered mangroves (Most Sensitive)



SARAWAK
BINTULU
MAP 13.2



ESI COLOUR CODE

- ESI 1
- ESI 2
- ESI 3
- ESI 4
- ESI 5
- ESI 6
- ESI 7
- ESI 8
- ESI 9
- ESI 10

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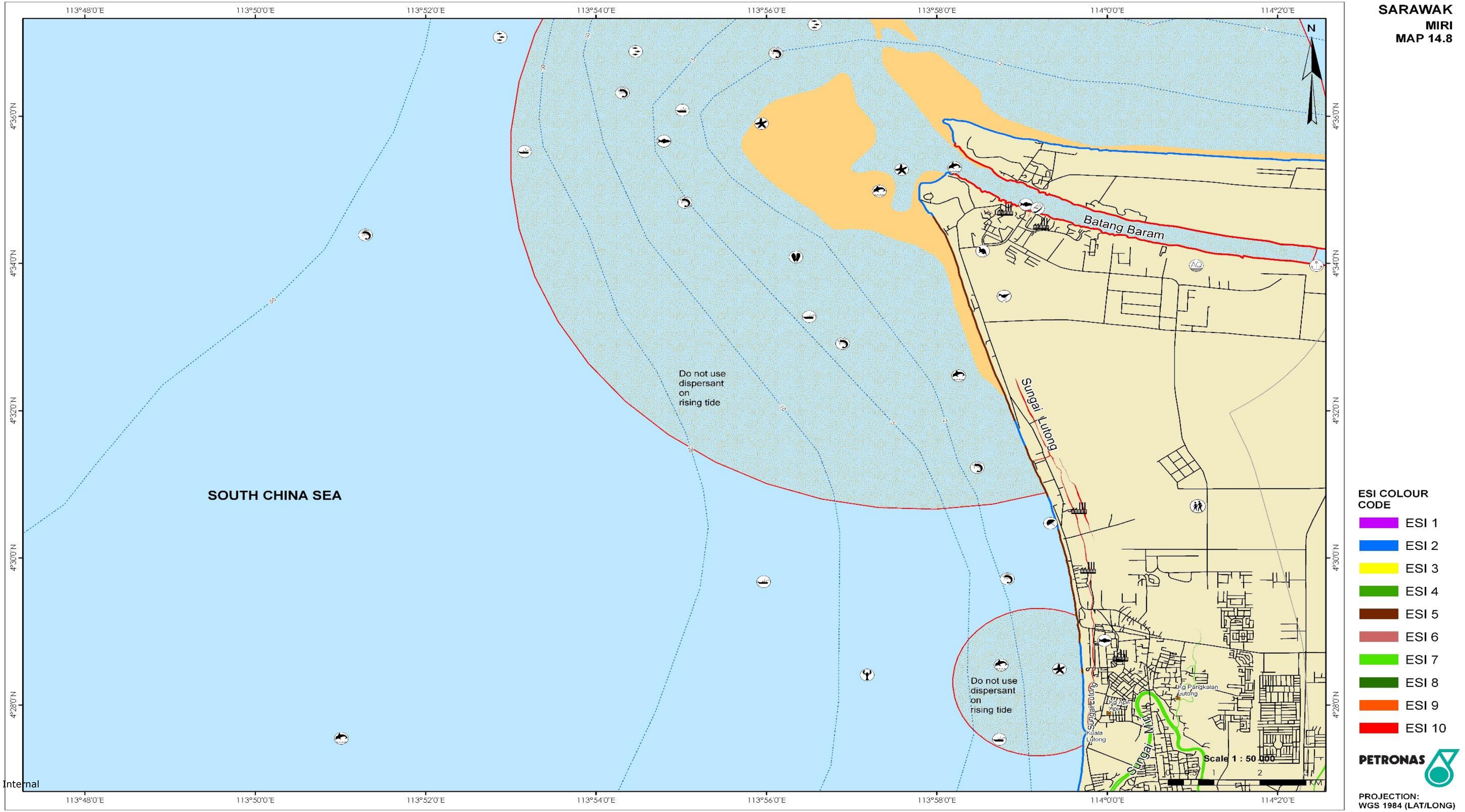
PROJECTION:
WGS 1984 (LAT/LONG)


SARAWAK
MIRI
MAP 14.8
N
113°48'0"E
113°50'0"E
113°52'0"E
113°54'0"E
113°56'0"E
113°58'0"E
114°0'0"E
114°2'0"E
4°36'0"N
4°34'0"N
4°32'0"N
4°30'0"N
4°28'0"N
SOUTH CHINA SEA
Do not use dispersant on rising tide
Do not use dispersant on rising tide
Batang Baram
Sungai Lutong
Sungai Lutong
Kuala Lutong
Kg Pangkalan Lutong
Kg Api Api
Sungai Miri
Scale 1 : 50,000
KM
ESI COLOUR CODE
ESI 1
ESI 2
ESI 3
ESI 4
ESI 5
ESI 6
ESI 7
ESI 8
ESI 9
ESI 10
PETRONAS
PROJECTION:
WGS 1984 (LAT/LONG)

ESI 2 – exposed fine grain sand beach and sandy shoals

ESI 6 – exposed tidal flats

ESI 9 and 10:
- exposed mangroves

- sheltered mangroves

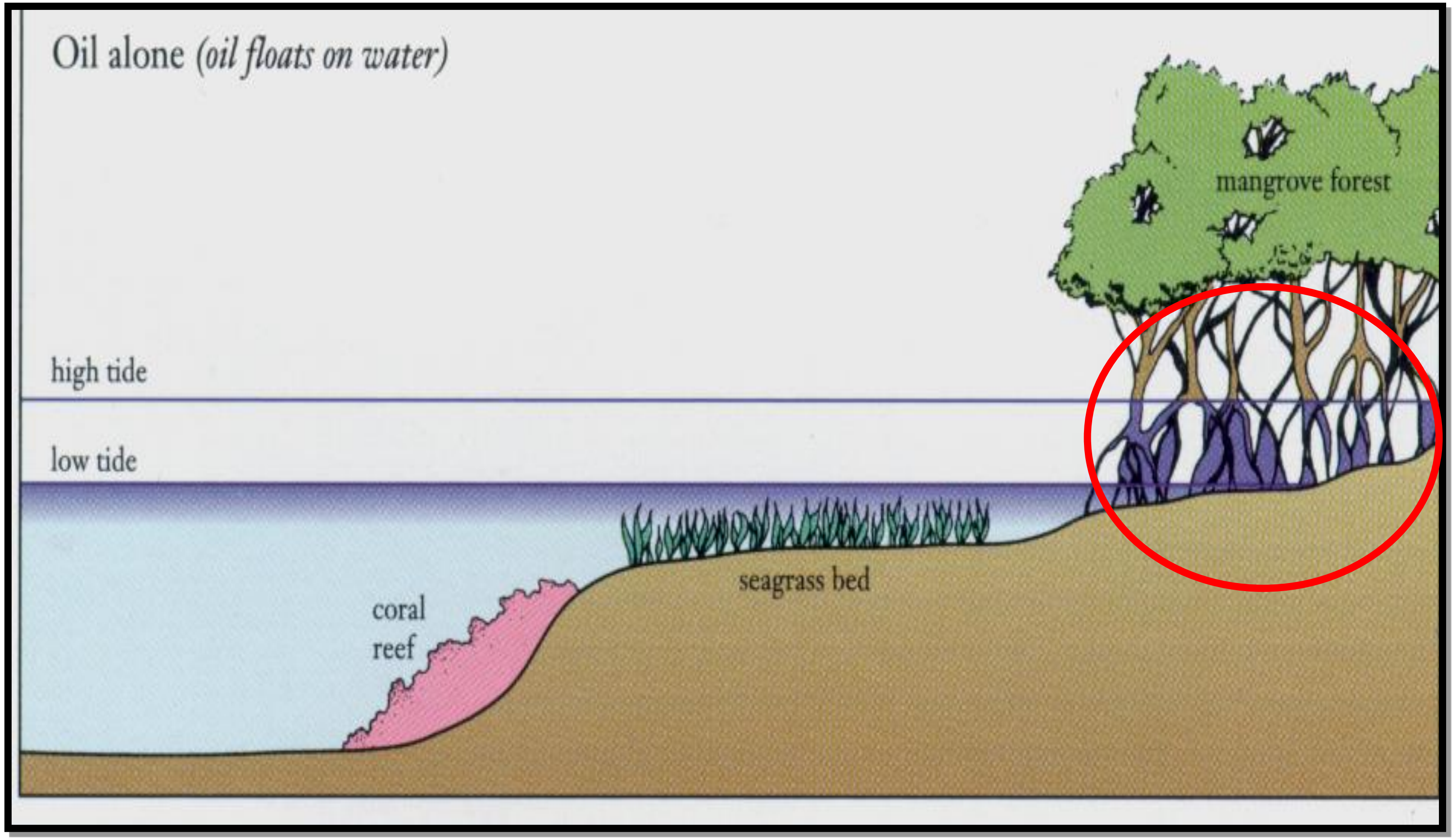
SCAT - Shoreline Clean-up Assessment Technique

- Simple, structured and comprehensive survey of an affected shoreline.
- Systematic approach using standardized terminology to collect data on shoreline oiling conditions.
- Support decision making for shoreline clean-up.
- Flexible in term of scale of the survey and detail of the data collected.



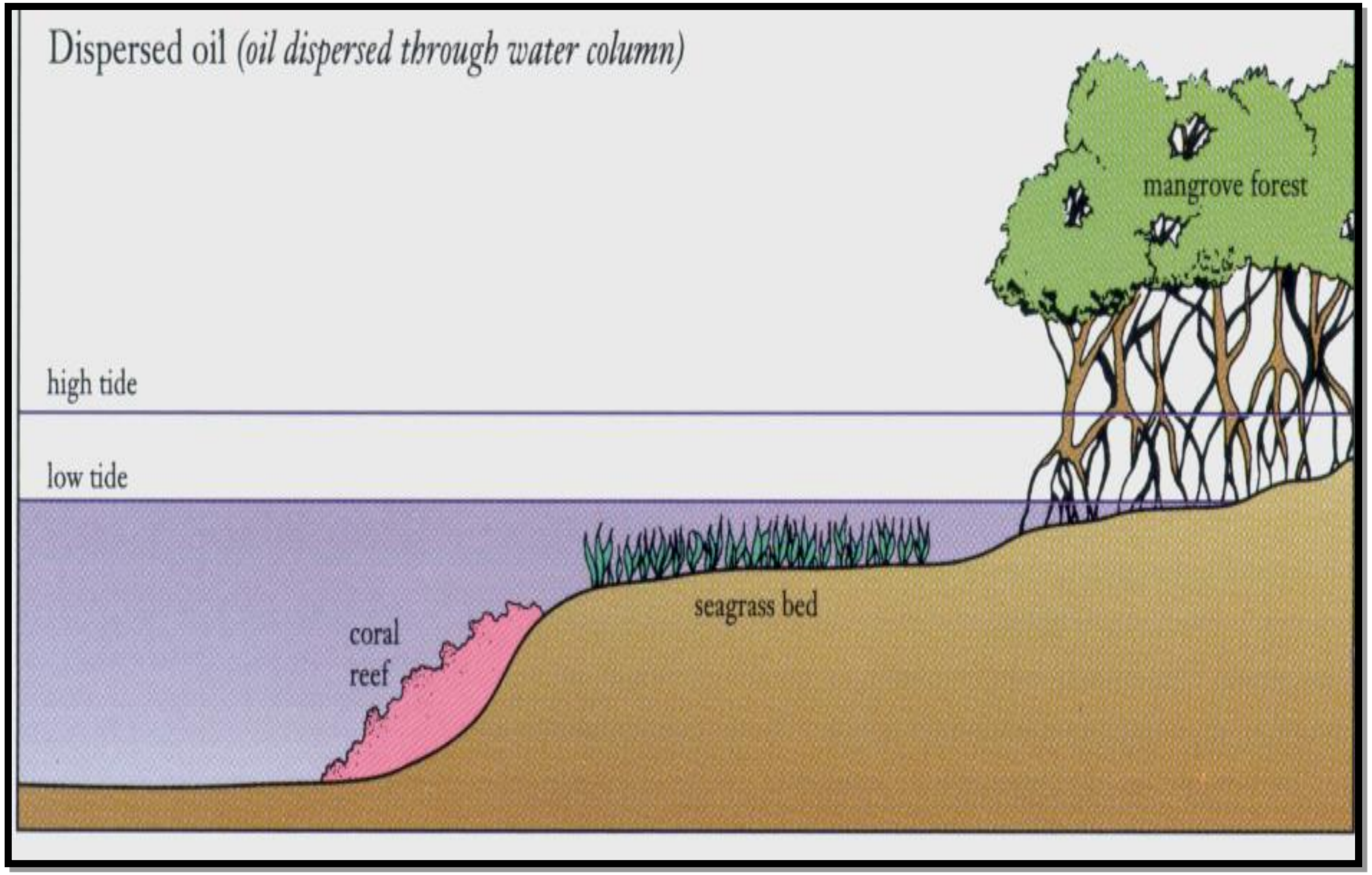

NEBA (Net Environmental Benefit Analysis)

Floating oil does not impact coral or sea grasses but can kill mangroves

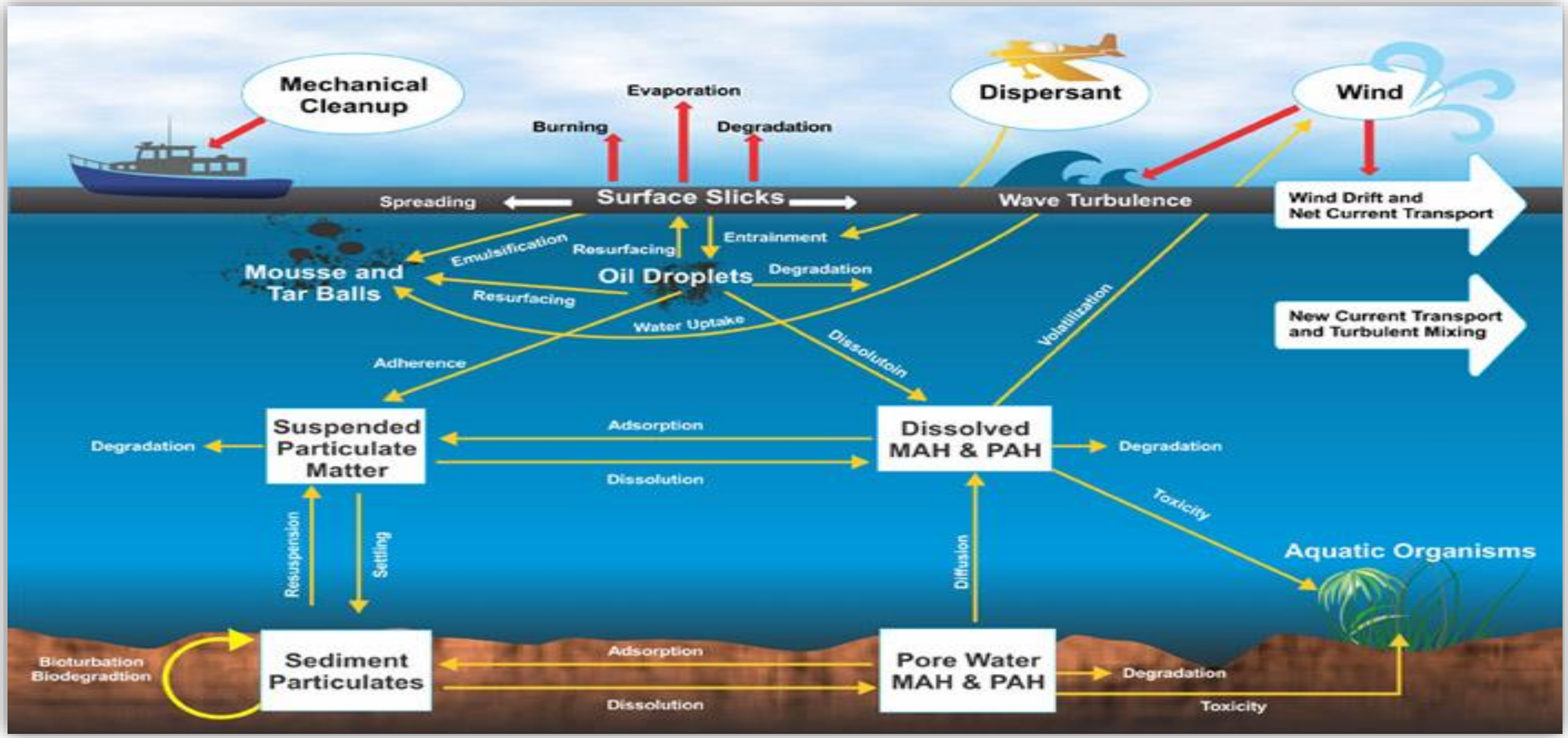


NEBA (Net Environmental Benefit Analysis)

Dispersed oil impacts coral and sea grasses but spares the mangroves



Fate of Oil in Open Water and the Marine Environment



Why Do Post-Oil Spill Monitoring?

- **Primary impact:** the need to provide early evidence of potential environmental and economic impact to key stakeholders

- **Wider effects:** the need to apply an appropriate and effective method of investigating the impact on the wider marine environment and its resources.

Best methods:
Impact assessment methodology needs to be considered that not only assesses the short-term impacts, but also allows the prediction of potential longer-term impacts.

- **Efficient resource use:** the need to ensure effective use of resources during monitoring so that unnecessary procedures are avoided but that potentially useful ones are not overlooked.

- **Mitigation effectiveness:** the need to provide an assessment of the effectiveness of spill response and clean-up activities, including the use of dispersants.

- **Compensation/liability:** the need to provide monitoring and assessment input to the determination of compensation and/ or liability issues as necessary.

Natural Resource Damage Assessment

PURPOSE: To determine the type and amount of restoration needed to compensate the public for the environmental impacts of oil spills.
Typical Natural Resource Damage Assessment process involves a team of scientists, economists, restoration experts, and attorneys who:

- Determine what parts of the coastal and marine environment were injured.
- Collect data to assess threats and injuries to natural resources.
- Quantify injuries to the environment and lost public uses, and
- Develop a restoration plan to compensate for environmental impacts and associated public losses.

Decommissioning

Decommissioning Options for upstream are provided in the IMO guideline and standards. Structures may be reused in new location, or used for other purposes. It may also be partially removed, totally removed or left in it's place. Some examples of other uses covers artificial reefs, wind power, geothermal power, research centre, fishing industry and government use.

Partial removal

Government use

Rigs to reefs

PETRONAS

Thank You