Strategies for Response

- Monitor and Evaluate
- Dispersants
- Contain and Recover
- Protection
- In-Situ Burning
- Shoreline Clean-up

Monitoring: Surveillance

- Oil slick observation
  - locate
  - track
  - quantify
- Aerial observation essential
  - comprehensive overview
- Required for other strategies
  - ‘spotter’ for dispersant spraying
  - directing vessels to slicks

Basic Surveillance

- Aerial observation
  - visual
  - camera
  - video
  - remote sensing
- Consider slick trajectory and liaise with pilot to locate slick
- Document observations for both tactical operations and historic records

Colour as Indicator of Quantity

Colour	Oil Type	Thickness (mm)	Vol. / sq. km (m^3)
Silvery	Sheen	~0.0001	~0.1
Iridescent	Sheen	~0.0003	~0.3
Dark brown / black	Crude / fuel oil	~0.1	~100
Light brown / orange	Emulsion	~1	~1,000

Sheen

Black oil

Emulsion

Remote Sensing

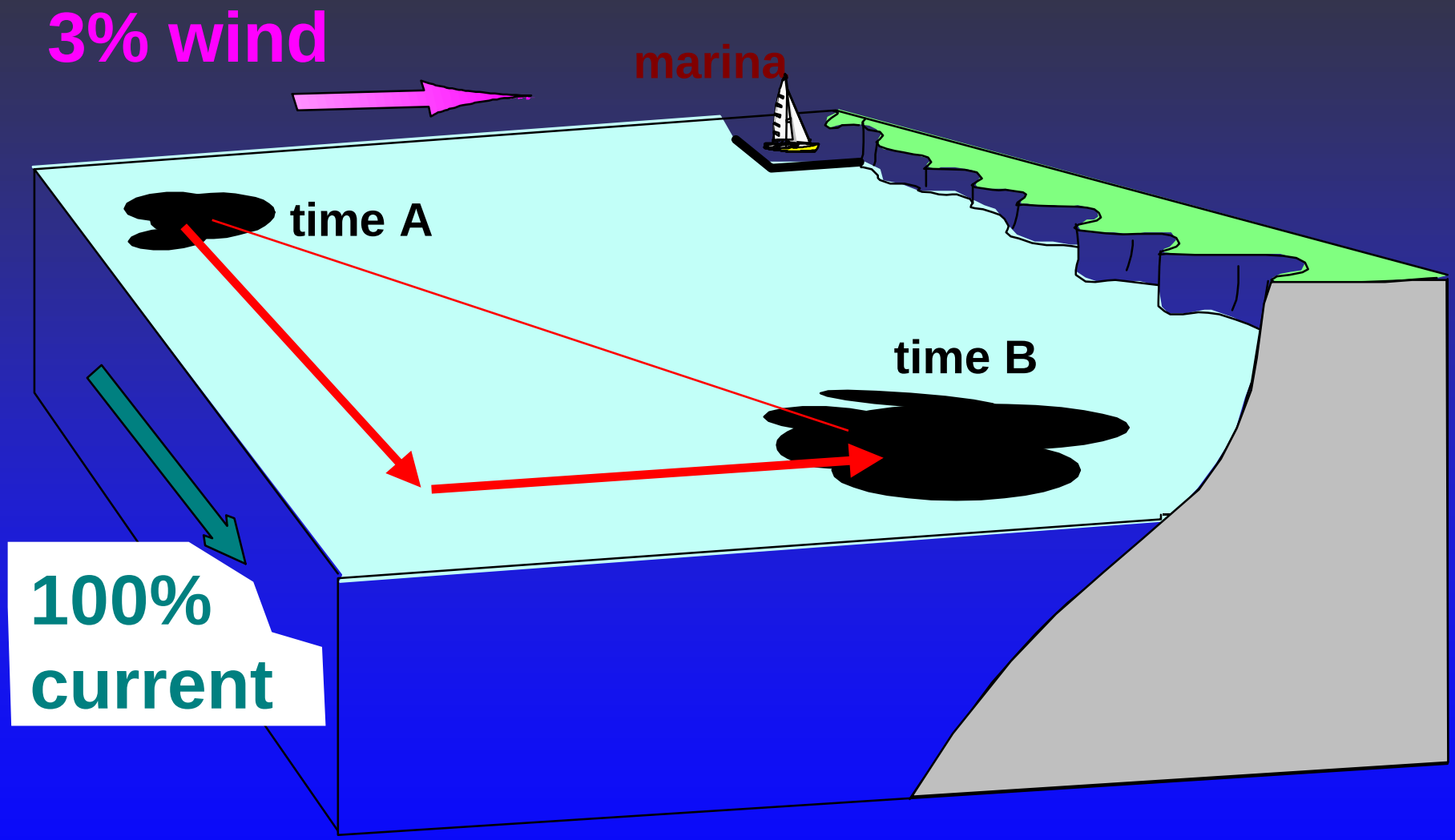
- Side looking airborne radar (SLAR)
  - all weather and night operation
  - large area coverage
  - dependent on wind conditions and no oil thickness
- Ultra violet (UV)
  - produce video
  - detect all hydrocarbon - no oil thickness
  - clear daylight only
- Thermal infra red (TIR)
  - night operation
  - produce video
  - relative oil thickness
  - cannot penetrate cloud

POLLUTION PATROL
-MPCU

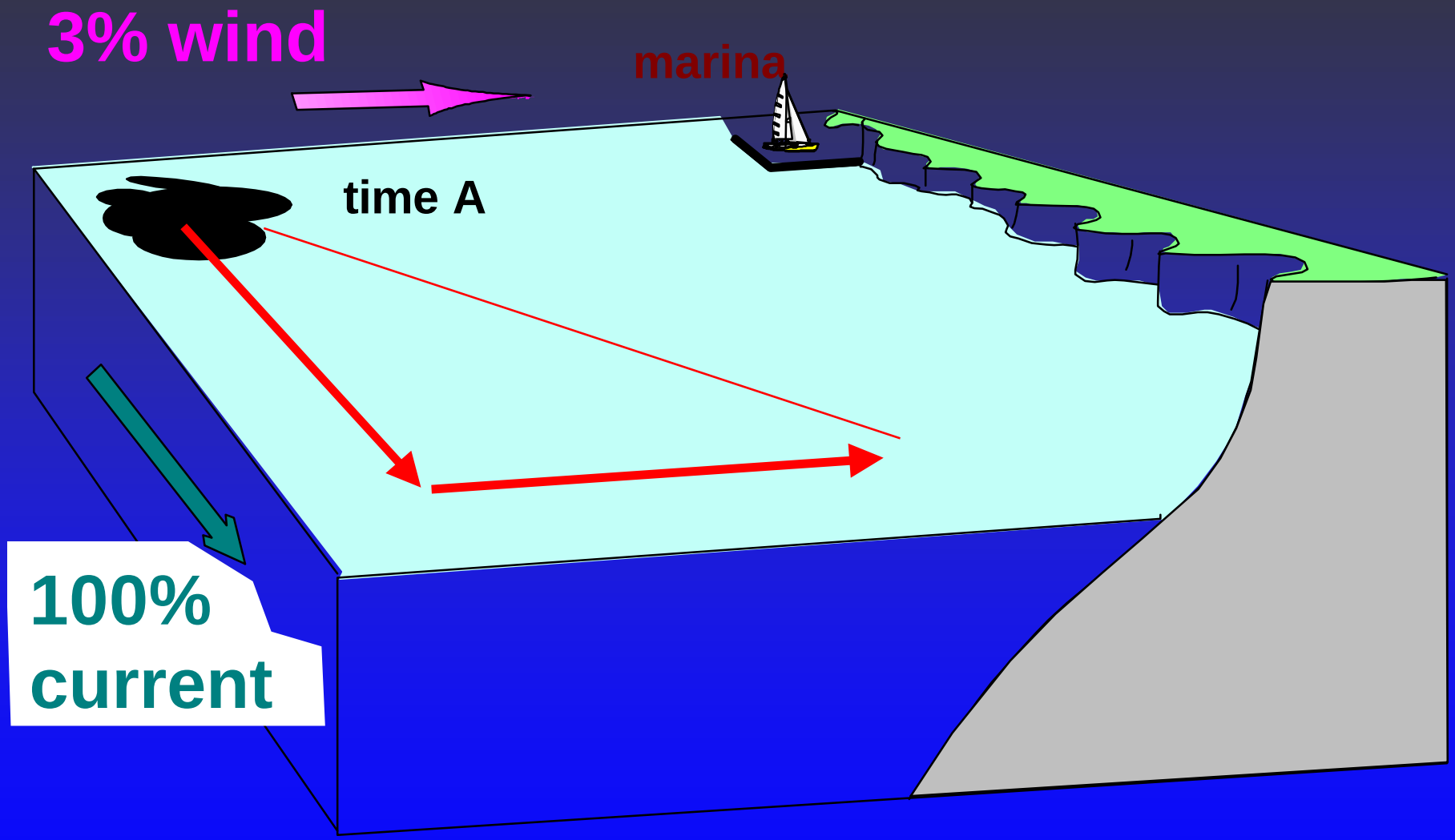
Justifying Monitor and Evaluate

- Safety
  - fire, salvage, rescue priorities
  - severe weather
- Natural weathering
- NEBA favours passive response
- Must monitor and be prepared to take appropriate action

Trajectory Estimations



Oil Movement on Sea's Surface



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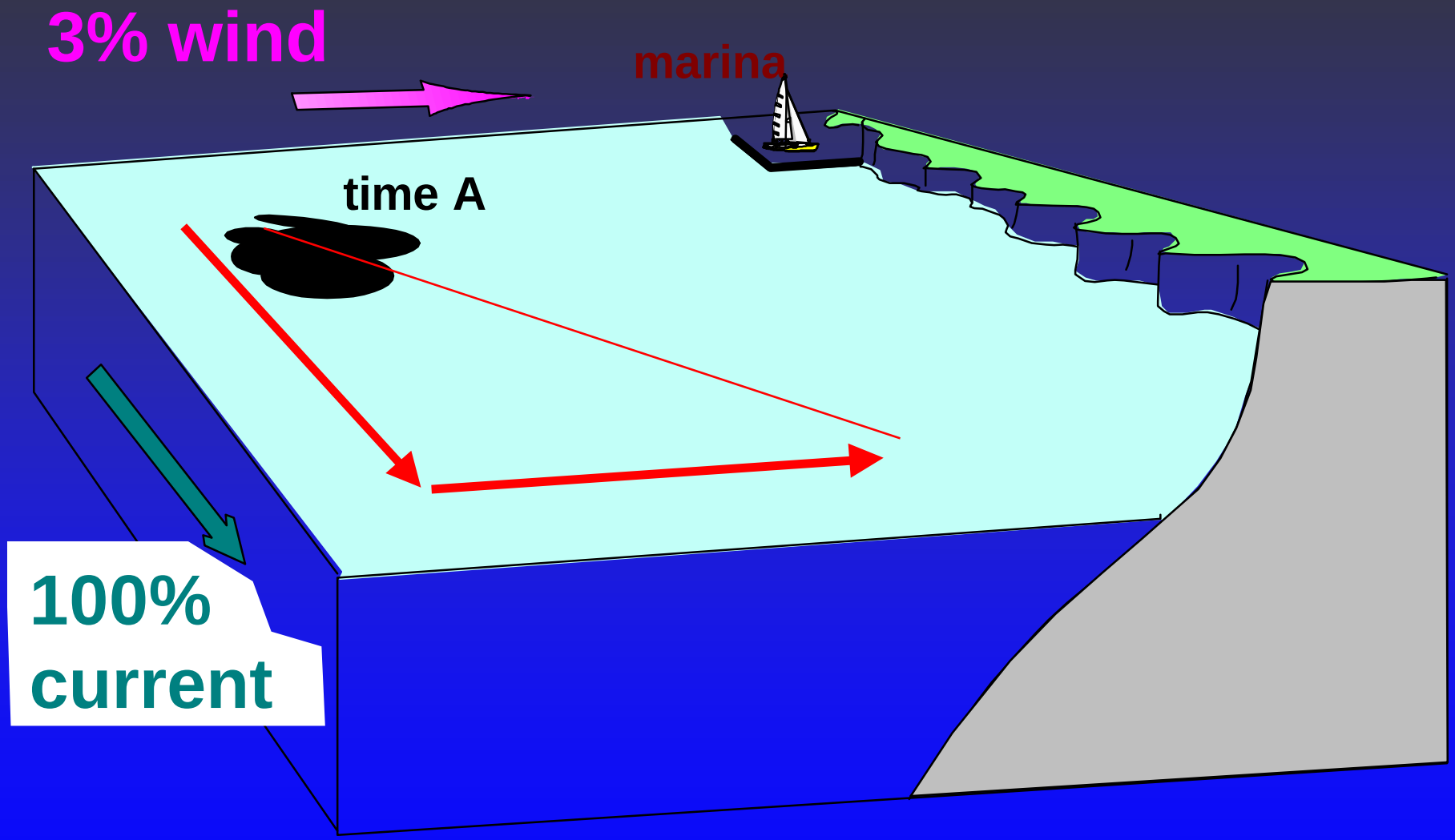

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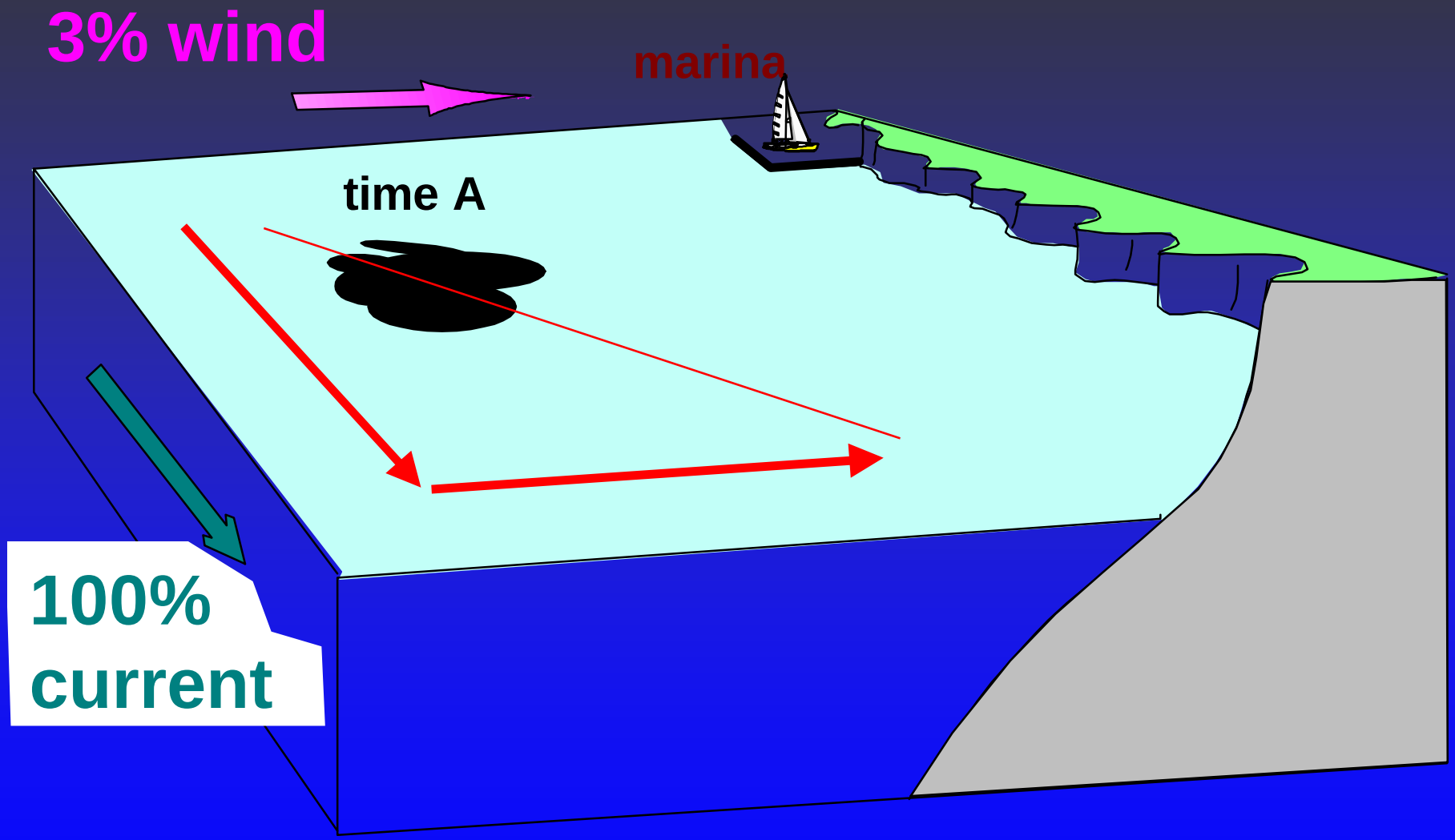

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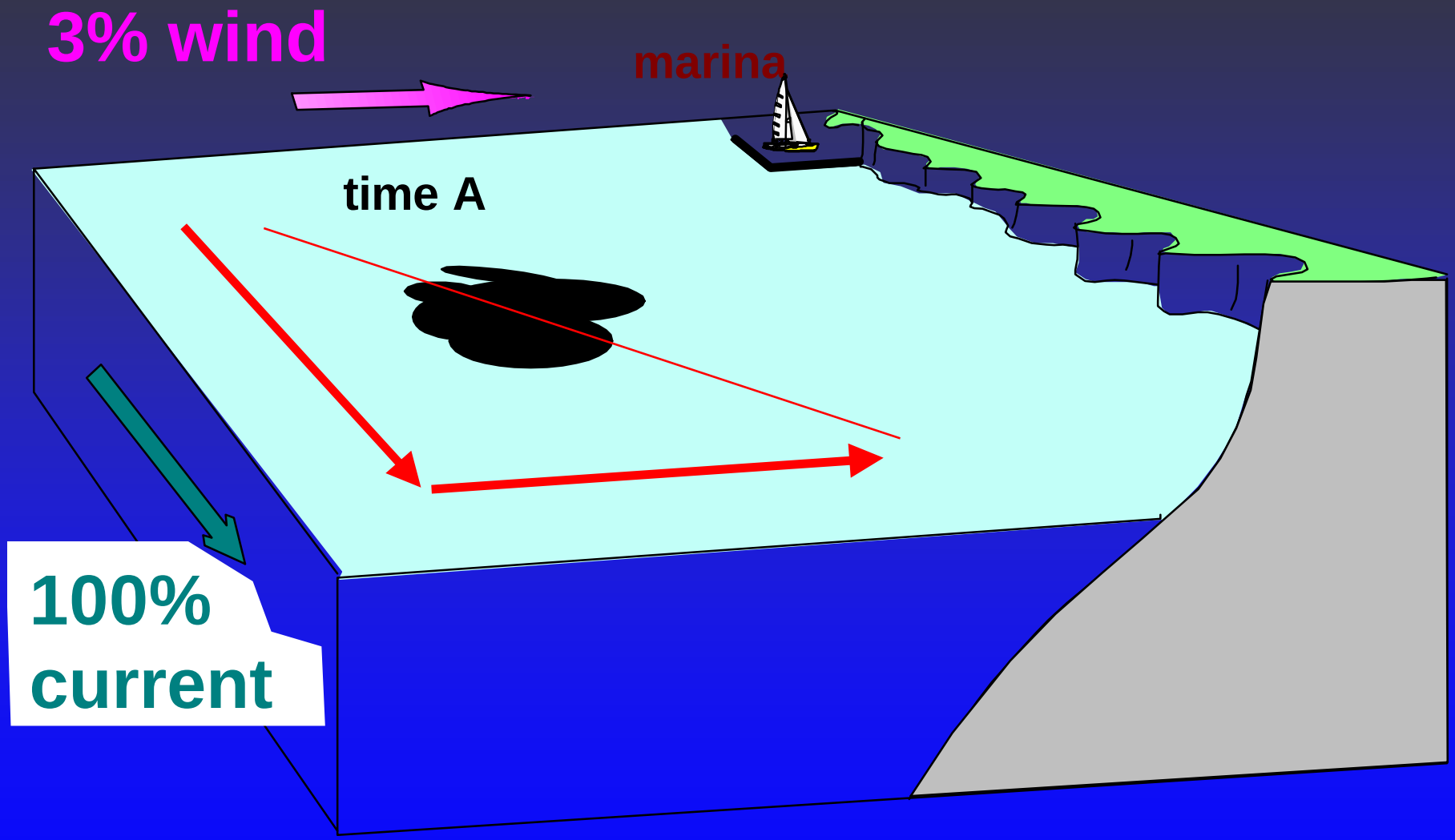

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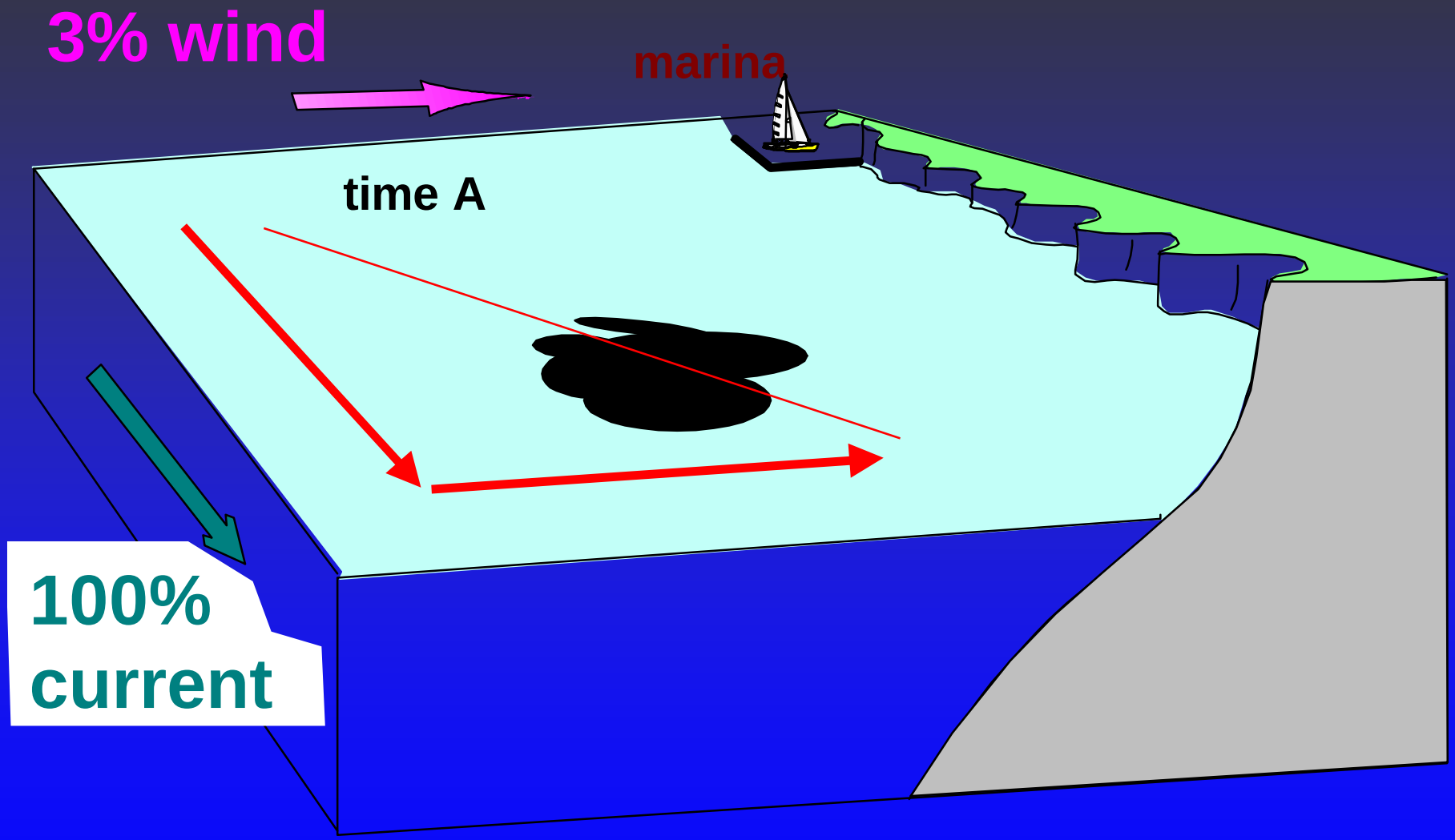

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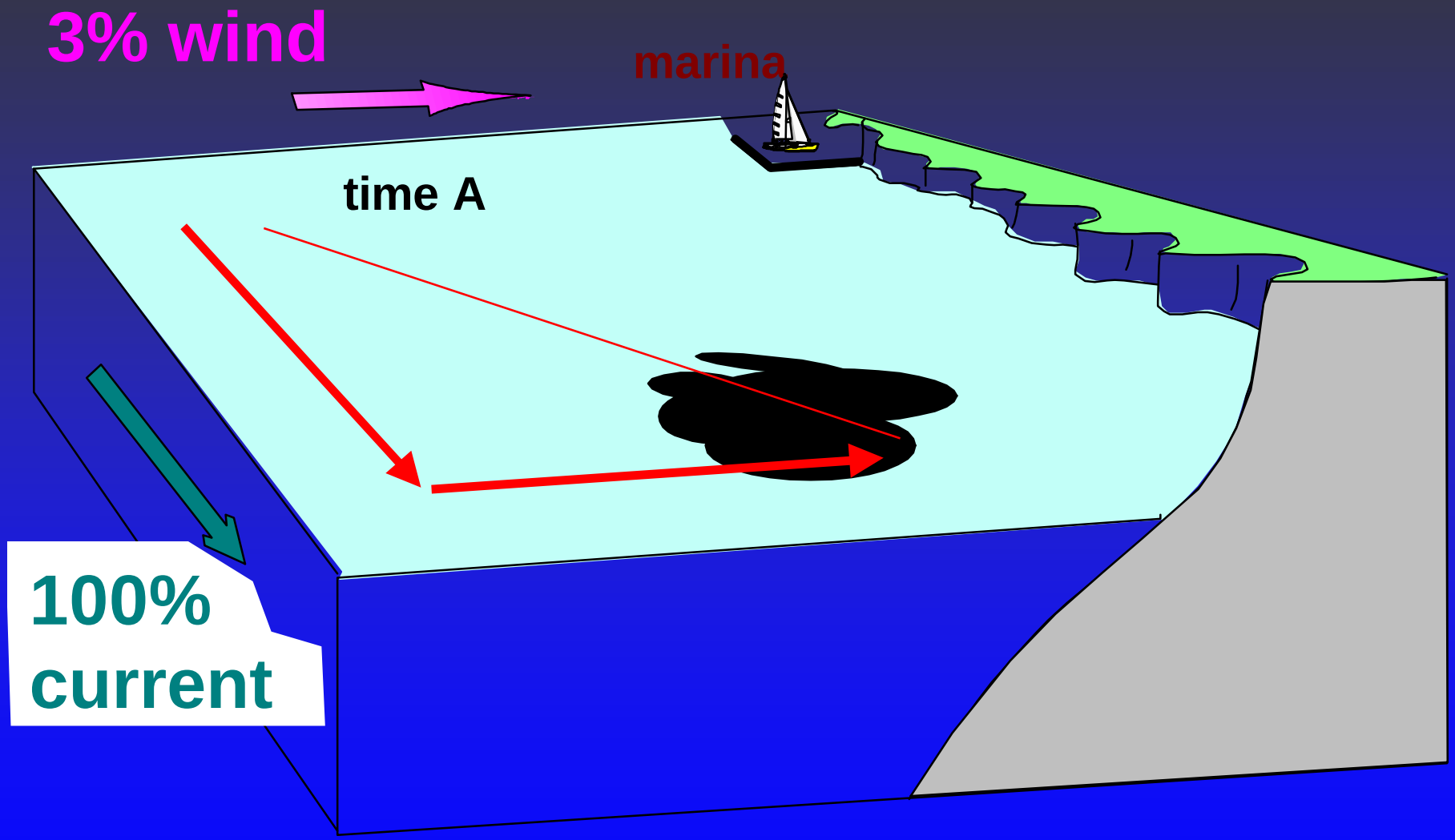

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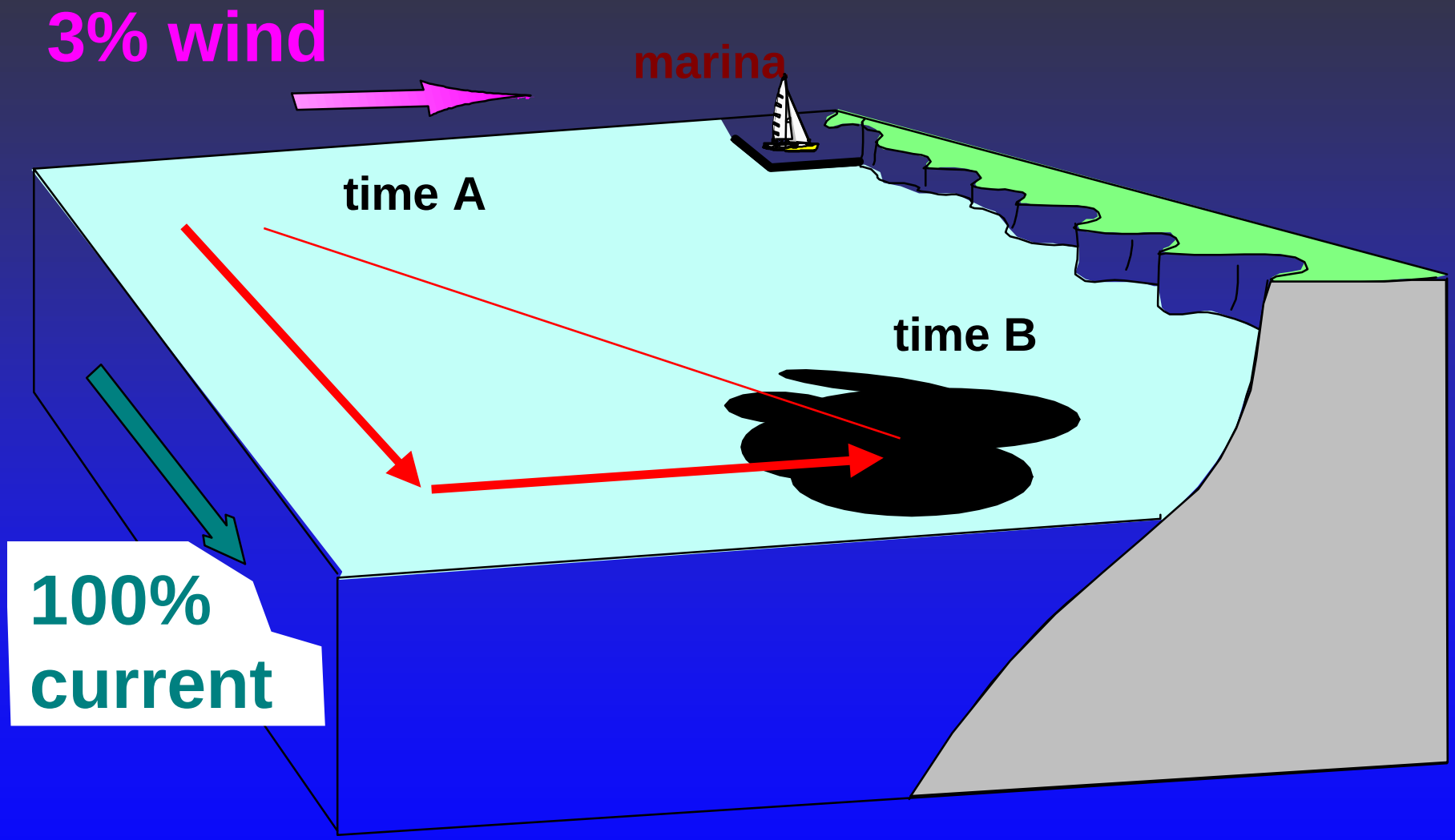


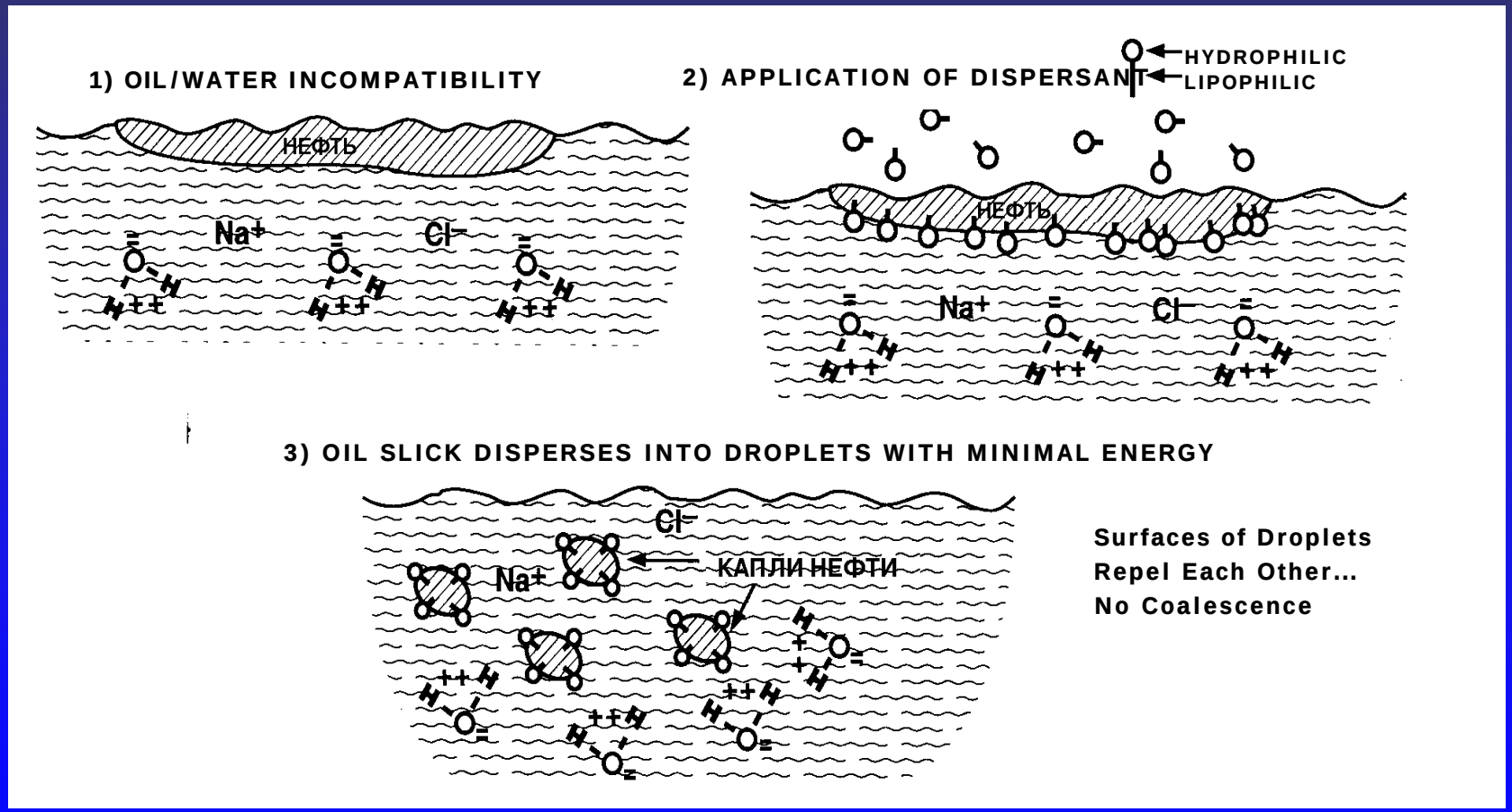
Dispersants

- What is a dispersant?
  - solvents
  - surfactants

- What does it do?
  - enhances natural dispersion by reducing the oil-water 'interfacial tension'
  - redistributes oil into the water

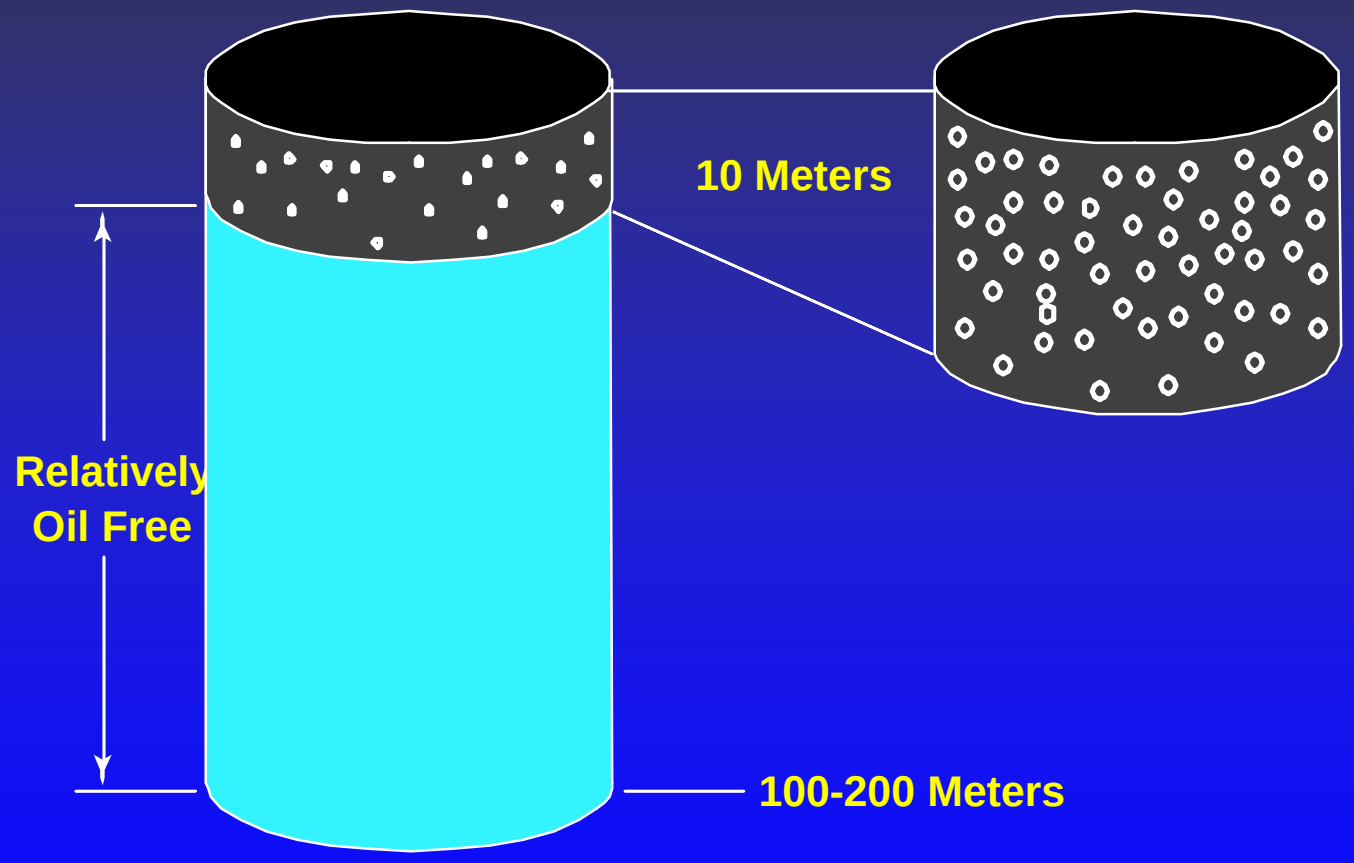
HOW DISPERSANTS WORK

THE KEY: REDUCE OIL CONC. TO BELOW IMPACT LEVELS AS RAPIDLY AS POSSIBLE

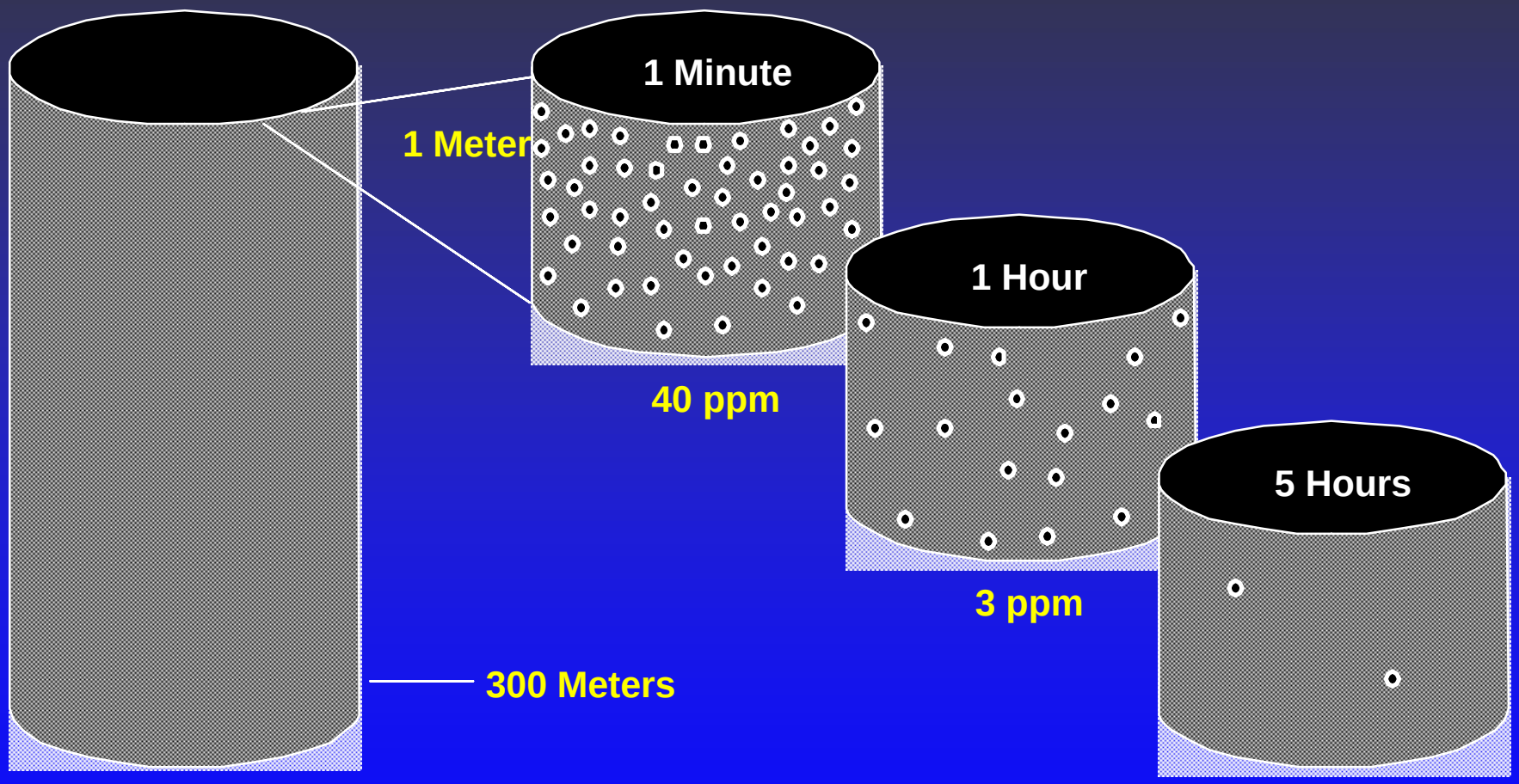


Surfaces of Droplets Repel Each Other…
No Coalescence

Highest Levels of Dispersed Oil are in Top 10 Meters



Dispersion and Dilution



Source: Alaska RRT Dispersant Guidelines

Advantages

- Rapid response over large distances and areas is possible
- Applicable in relatively rough weather
- Reduces the risk of contamination of birds, shorelines and sensitive habitats
- May ‘break’ or inhibit the formation of emulsions
- Reduces waste and improves biodegradation

Disadvantages

- Oil is not removed, but re-distributed
- Can adversely affect sensitive resources
  - toxicity and ‘tainting’ e.g. farmed fish, shellfish and coral reefs
  - industrial water intakes
- ‘Time window’ for effective use

  as viscosity rises...

  ...effectiveness falls
- Generally inappropriate in shallow water

Consider Dispersant Use

- When Physical Removal Alone is Not Adequate
- When Oil is Moving Toward Shore and All Available Methods of Control are Required to Minimize the Environmental Impact
- When Weather/Sea Conditions Preclude the Use of Recovery Equipment

Do Not Use Dispersants

- In Water With Poor Circulation Such as Small Enclosed Bays and Harbors
- In Water That is Used for Drinking Water Supplies
- On Solidified Oil
- Directly Over Fish Farms or Mariculture

Dispersants Are Approved In Many Countries

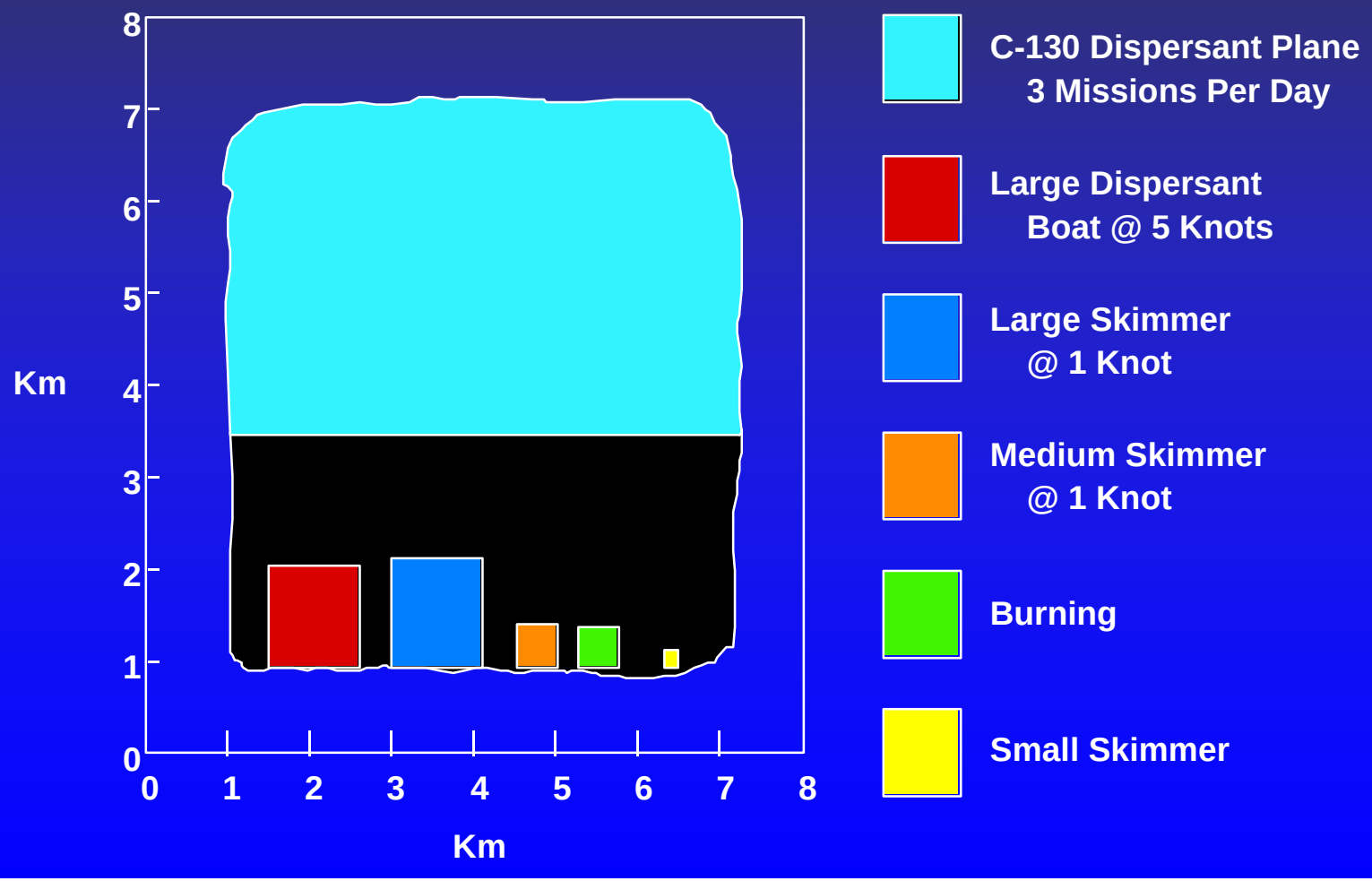
- North America: U.S., Canada, and Mexico
- Europe: UK, Norway, France, Italy, Spain, Portugal, Greece, Germany Re-Considering
- L&S America: Argentina, Colombia, Chile, Jamaica, Bermuda, Puerto Rico, Venezuela, Panama
- Middle East: Bahrain, Egypt, Iran, Iraq, Kuwait, Oman, Saudi Arabia, UAE
- Africa: Angola, Ivory Coast, Kenya, Libya, Nigeria
- Far East: Australia, Hong Kong, Indonesia, Japan, Malaysia, Singapore
- Russia

Pre-use Considerations

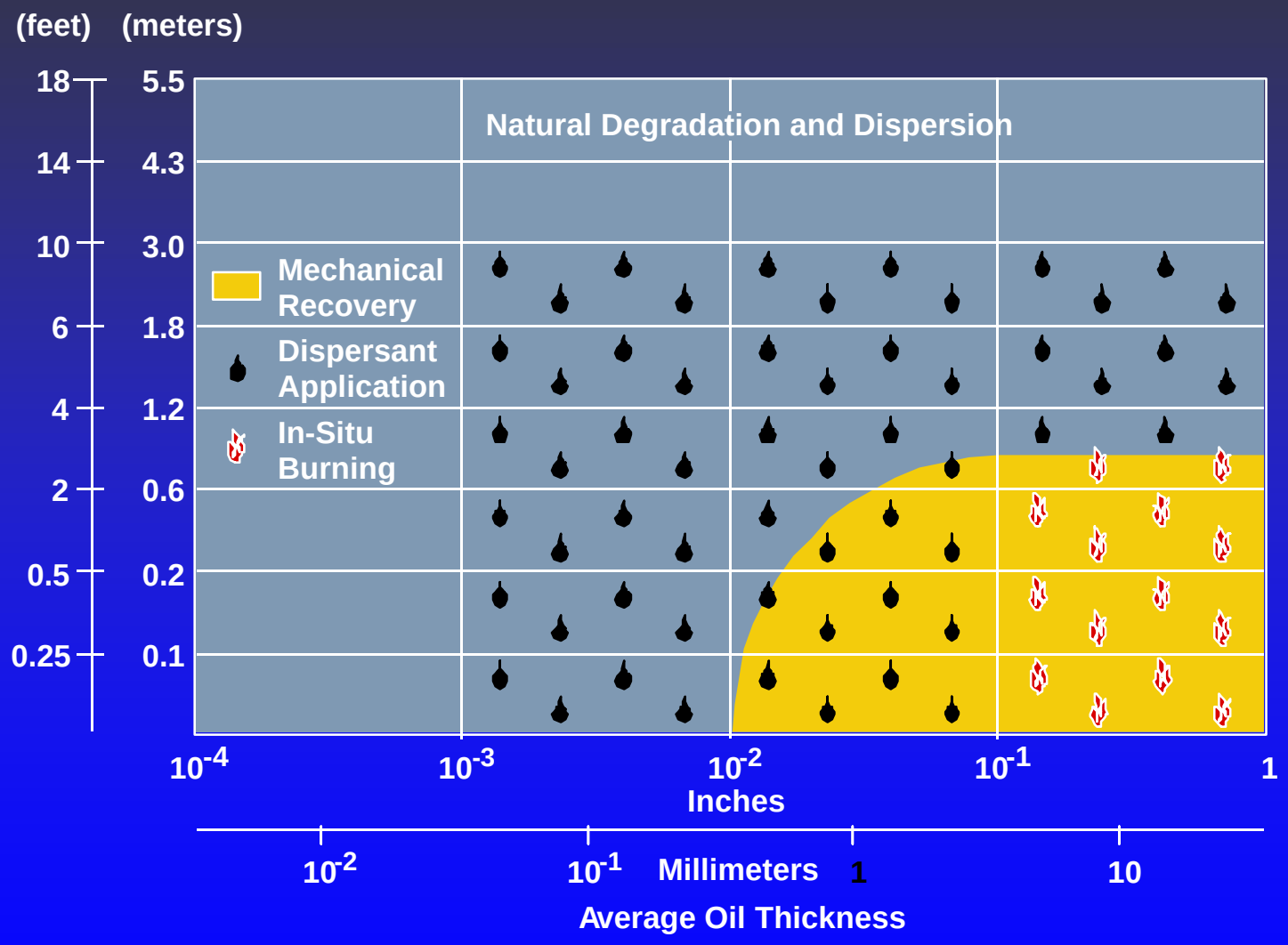
- Compliance with regulations / permission
- Apply NEBA
- Include dispersant usage zones on maps and charts
- Must be part of the contingency plan

2 Day Coverage Rates For Spill Response Systems

Basis: 10,000 Tonne Spill; 0.2 mm Thick; 20% Evaporation;
8 Hrs Operation Each Day; 30 Miles Transit



Spill Response Options



Many Factors Affect Toxicity

Biology

Species

Lifestage

Seasonality

Test Conditions

Duration

Temperature

Prior Exposure

Properties of “Toxicant”

Solubility

Chemical Structure

Contain and Recover

- High capital investment
- Logistics
- Operational limitations
- Encounter rate
- Training
- Temporary storage & disposal

Wave Following Characteristics

CLEAN
Ro-skim pump

Komara 12 K disc skimmer

Containment and Recovery Issues

- If it fails or has poor success:
  - competence
  - lack of preparedness
- Logistical support
- Disposal

Protection

- Prioritisation of sensitivities
- Effective use of available resources
- Logistics and practicality
- Cost effectiveness

In-Situ Burning

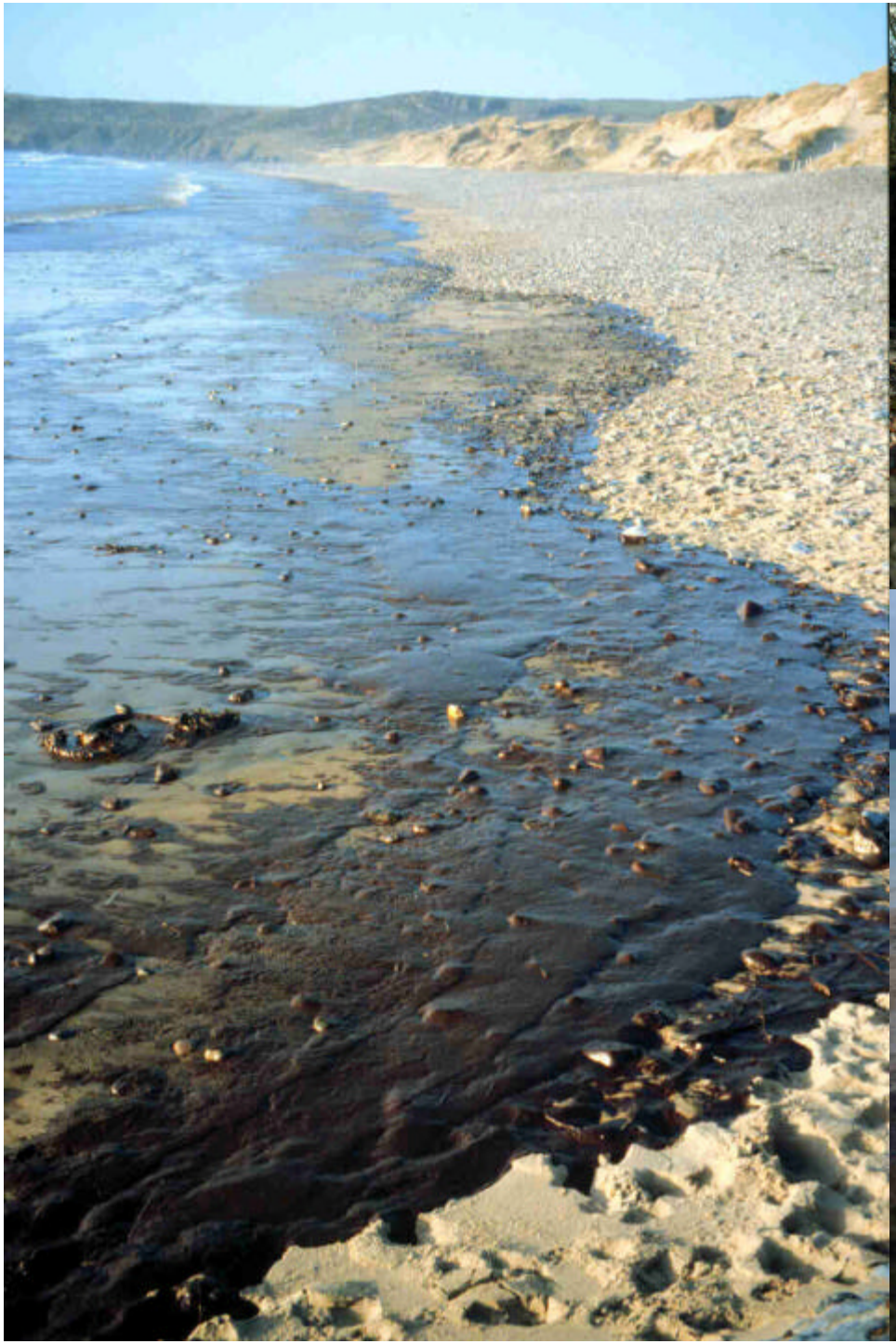
- Combustion requires:
  - igniters
  - low water content in oil
  - minimum oil thickness (~3mm)
  - specialised containment booms

In-Situ Burning Issues

- Burning
  - need to contain oil
  - safety & health
  - air pollution

Shoreline Clean-up

- Shoreline type
  - sensitivity
  - amenity
  - access
- Project management
  - labour intensive
  - low-technology
  - logistics



OIL ON
BEACH

Shorelines

Energy

Exposed

Sheltered

Vulnerability

Low

High

Cliffs

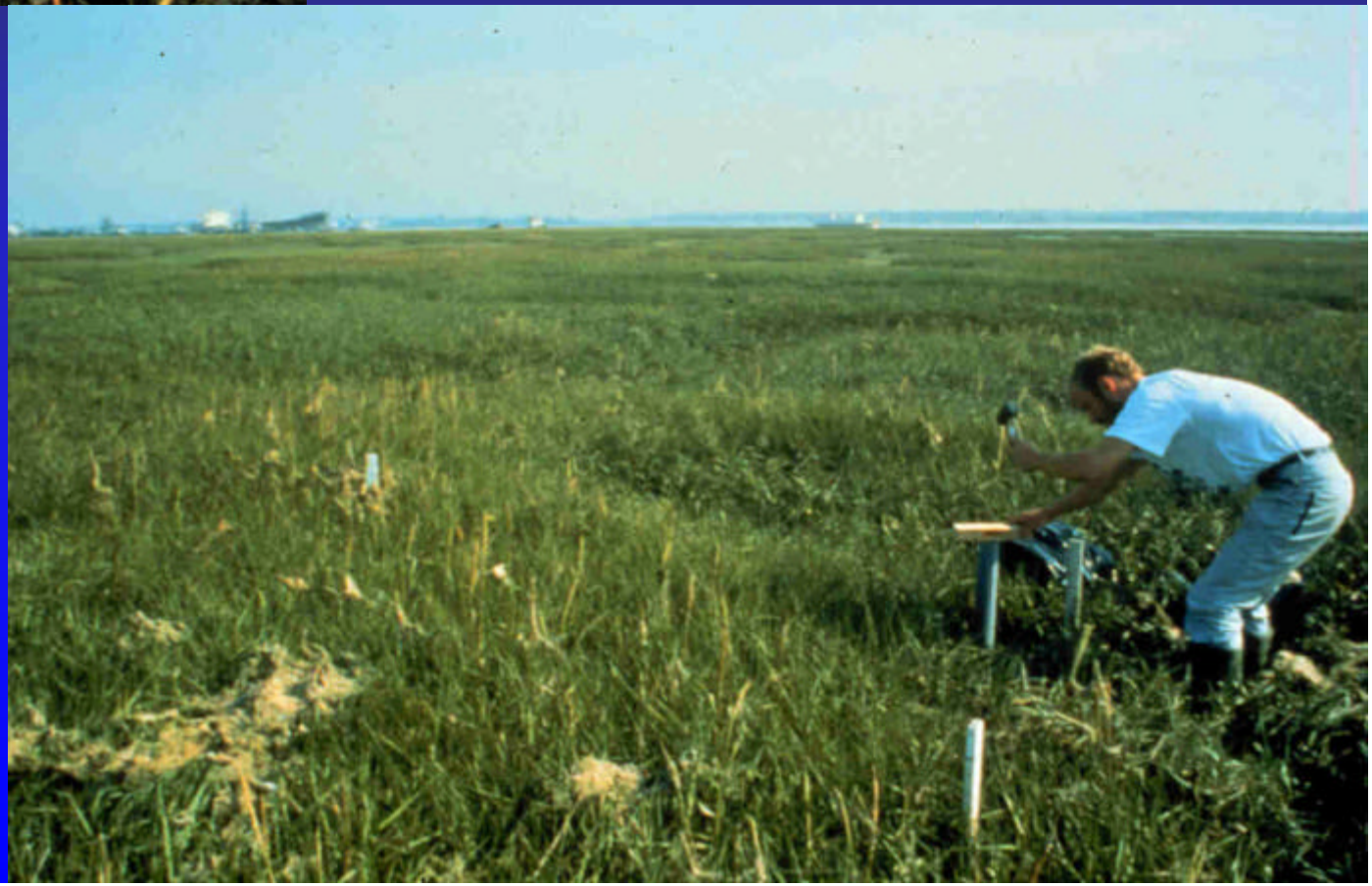
Rocks

Pebble / cobble

Sand

Mud

Saltmarsh / mangrove



Shoreline Clean-up

Issues

- Pollution may be plainly visible and lead to pressures from:
  - community, media, politicians and ‘greens’
- Potential adverse effects on:
  - coastal ecology, amenity and industry
- Clean-up activities:
  - who is responsible?
  - how clean is 'clean'?
  - termination decisions