

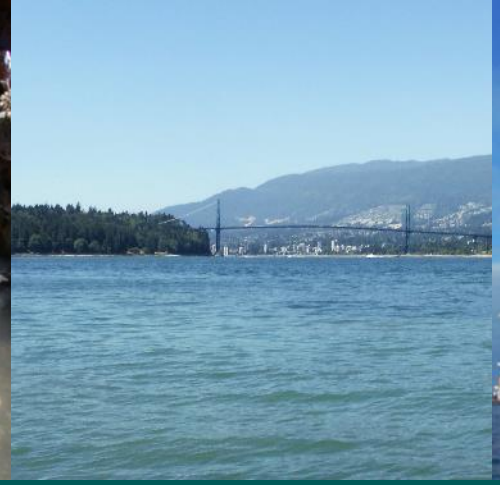


Better planning and preparation: Lessons learned from spill response and how to improve the outcome

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HEMMERA

Learning Objectives

1. To learn about challenges from marine spills and experiences in both urban and remote areas.
2. To become more familiar with assessment and measurement endpoint considerations for marine spills.
3. To learn about ways to improve data collection and management; and subsequent integration of data to facilitate environmental impacts assessment and closure of spills.

Challenges and Experiences of Oil Spills in Urban and Remote Settings

Under ideal conditions, Marathassa spill cleanup should have been easy — The Globe and Mail

Vancouver oil spill response 'embarrassing,' says international expert
Anita Burke calling for re-opening of Kitsilano Coast Guard station in wake of English Bay spill — CBC News

ANALYSIS | Toxic fuel spill in English Bay is wake-up call for port, says marine expert
Critics of pipeline expansion say response proves Vancouver isn't ready for heavy tanker traffic — CBC News

A year after Marathassa, Vancouver still not prepared for an oil spill, says city
Federal and provincial officials are still working on coordinated response plan — CBC News

Clam beds at risk after sinking tug spills fuel near Bella Bella, says local First Nation
Tug boat and empty fuel barge run aground in environmentally sensitive Great Bear Rainforest — CBC News

Stephen Hume: Small oil spill near Bella Bella highlights response deficiencies — Vancouver Sun

Oily sheen from B.C. diesel spill can't be recovered but will evaporate, officials say
Remnants are 'utterly unacceptable,' says Kwikwasut'inuxw Haxwa'mis First Nation chief — CBC News

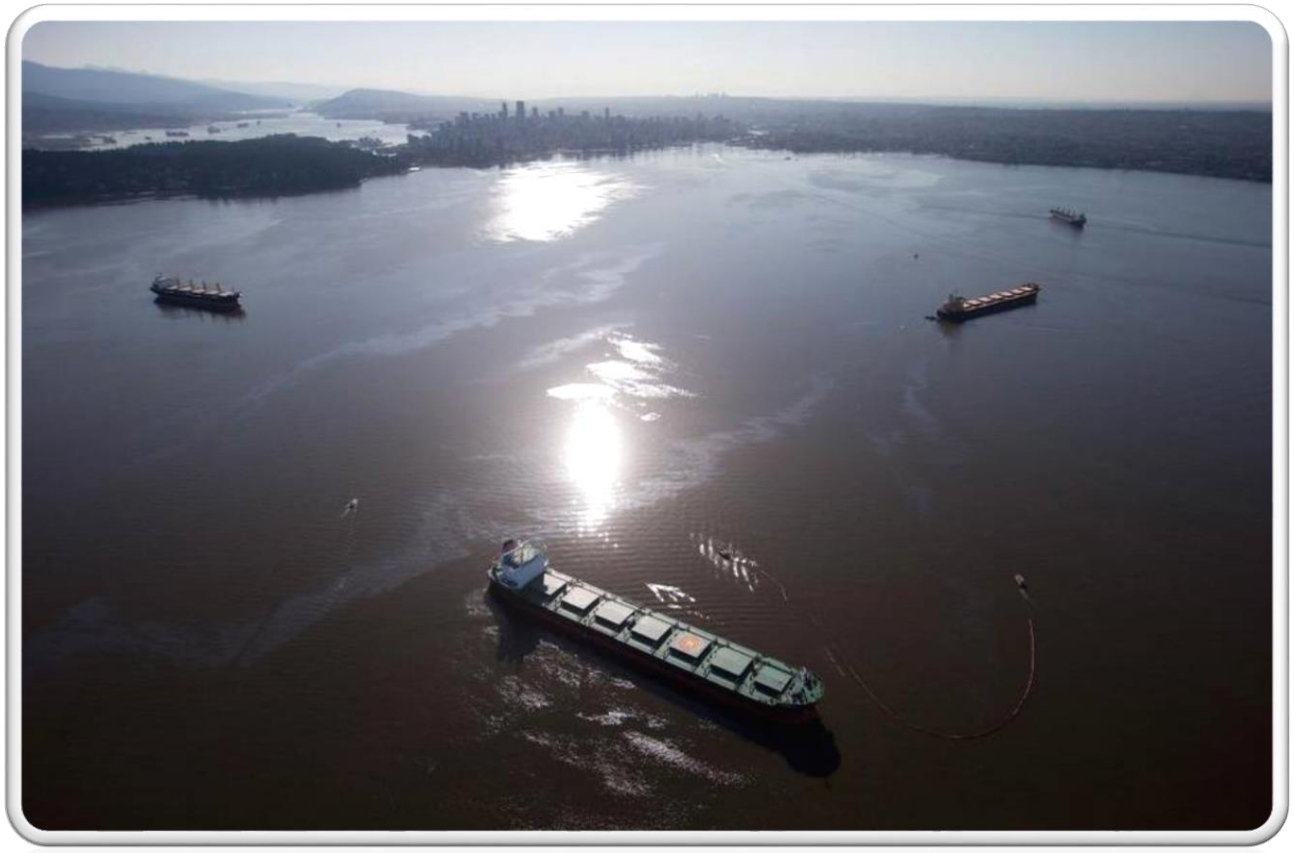
Challenges and Experiences of Oil Spills in Urban and Remote Settings

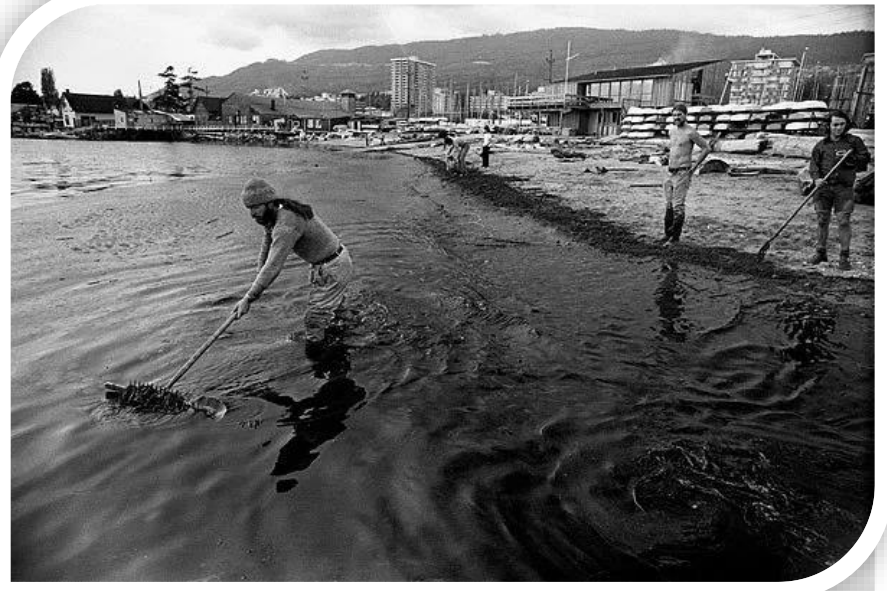
Challenges and Experiences of Oil Spills in Urban and Remote Settings

Remote Settings

- Limited population
- Difficult to access
- Important ecological resources
- Relatively unimpacted
- Limited and/or old baseline data
- Diversity of biophysical shoreline types
- First Nations communities
  - Culturally important areas
- Slower to report incidents – high dependency on proponent
- Limited resources

Challenges and Experiences of Oil Spills in Urban and Remote Settings





Fisheries and Oceans Canada | Pêches et Océans Canada

DANGER

SHELLFISH AREA CLOSED

SHELLFISH (OYSTERS, CLAMS, MUSSELS AND OTHER BIVALVE MOLLUSCS) IN THE AREA DESCRIBED BELOW ARE CONTAMINATED AND ARE NOT SAFE FOR CONSUMPTION.

AREA DESCRIPTION:

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.....

THIS AREA IS CLOSED. UNLESS AUTHORIZED BY A LICENCE ISSUED UNDER THE MANAGEMENT OF CONTAMINATED FISHERY REGULATIONS, FISHING FOR OR CATCHING AND RETAINING ANY SHELLFISH IN THIS AREA IS PROHIBITED BY LAW AND PERSONS DOING SO ARE SUBJECT TO PROSECUTION UNDER THE FISHERIES ACT.

ZONE FERMÉE À LA RÉCOLTE DES MOLLUSQUES

LES MOLLUSQUES (HUÎTRES, CLAMS, MOULES ET AUTRES MOLLUSQUES BIVALVES) PROVENANT DE LA ZONE DÉCRITE CI-DESSOUS SONT CONTAMINÉS ET IMPROPRES À LA CONSOMMATION.

DESCRIPTION DE LA ZONE:

.....

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CETTE ZONE EST FERMÉE. SAUF SI AUTORISÉ PAR UN PERMIS DÉLIVRÉ EN VERTU DU RÈGLEMENT SUR LA GESTION DE LA PÊCHE DU POISSON CONTAMINÉ, IL EST INTERDIT À QUICONQUE DE PÊCHER OU DE PRENDRE ET DE GARDER TOUT MOLLUSQUE PROVENANT DE CETTE ZONE. LES CONTREVENANTS SERONT PASSIBLES DE POURSUITES EN VERTU DE LA LOI SUR LES PÊCHES.

Canada

Challenges and Experiences of Oil Spills in Urban and Remote Settings

Urban Settings

- Heavily populated
- Diversity of shoreline use and access
  - Industrial docks, and piers with shipping
  - Public parks and community access areas
  - First Nations communities
  - Culturally important areas
- Important ecological resources
- Diversity of shoreline types
- Multiple spill incidents/reports
- Impacted areas, confounding baseline data

What happens in the event of a "Spill" – The Basics

Incident

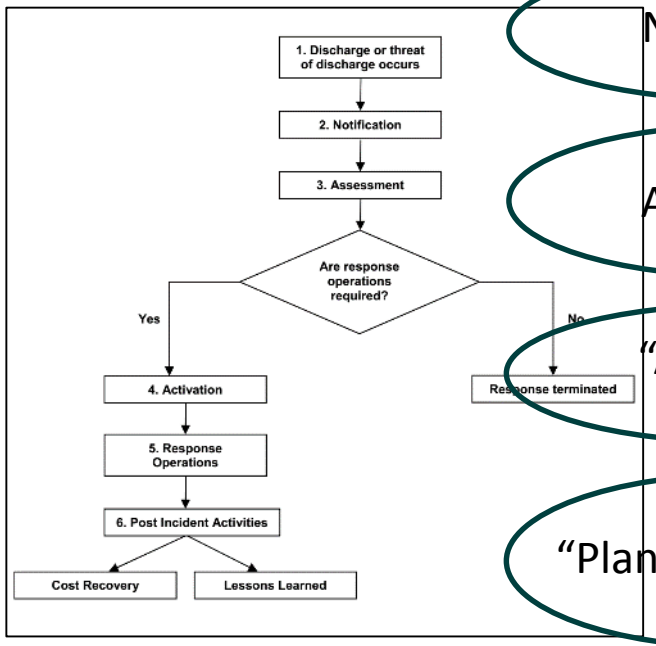
Notification

Assessment

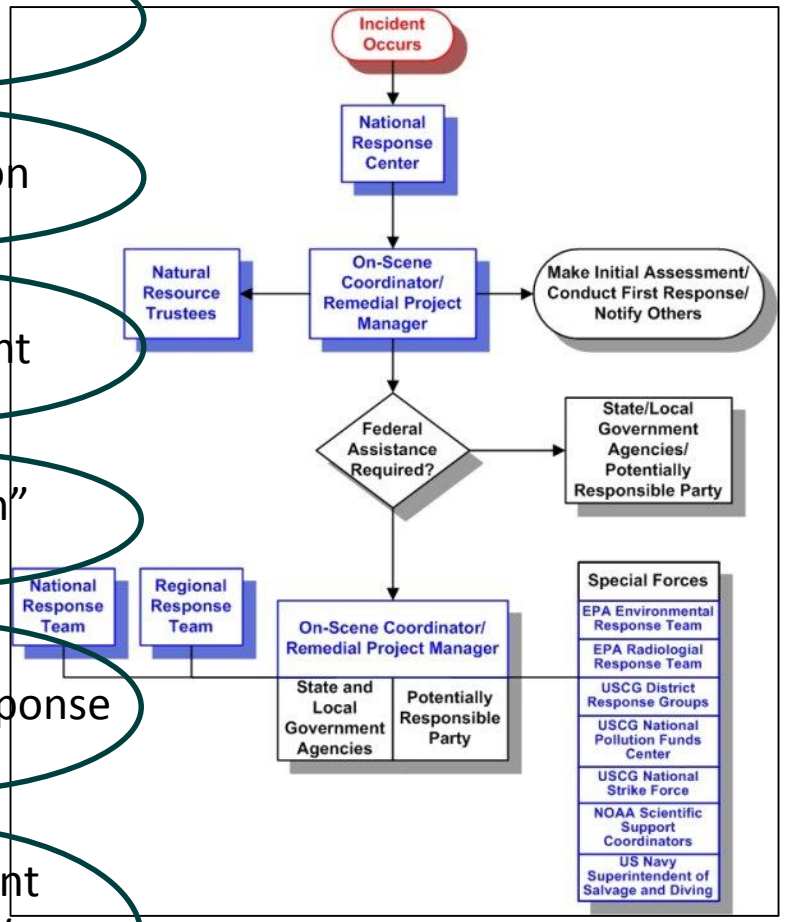
"Activation"

"Planned" Response

Post Incident Recovery/ Monitoring



From: Canadian Coast Guard Environmental Response Marine Spills Contingency Plan



From: US EPA: National Response System Flowchart

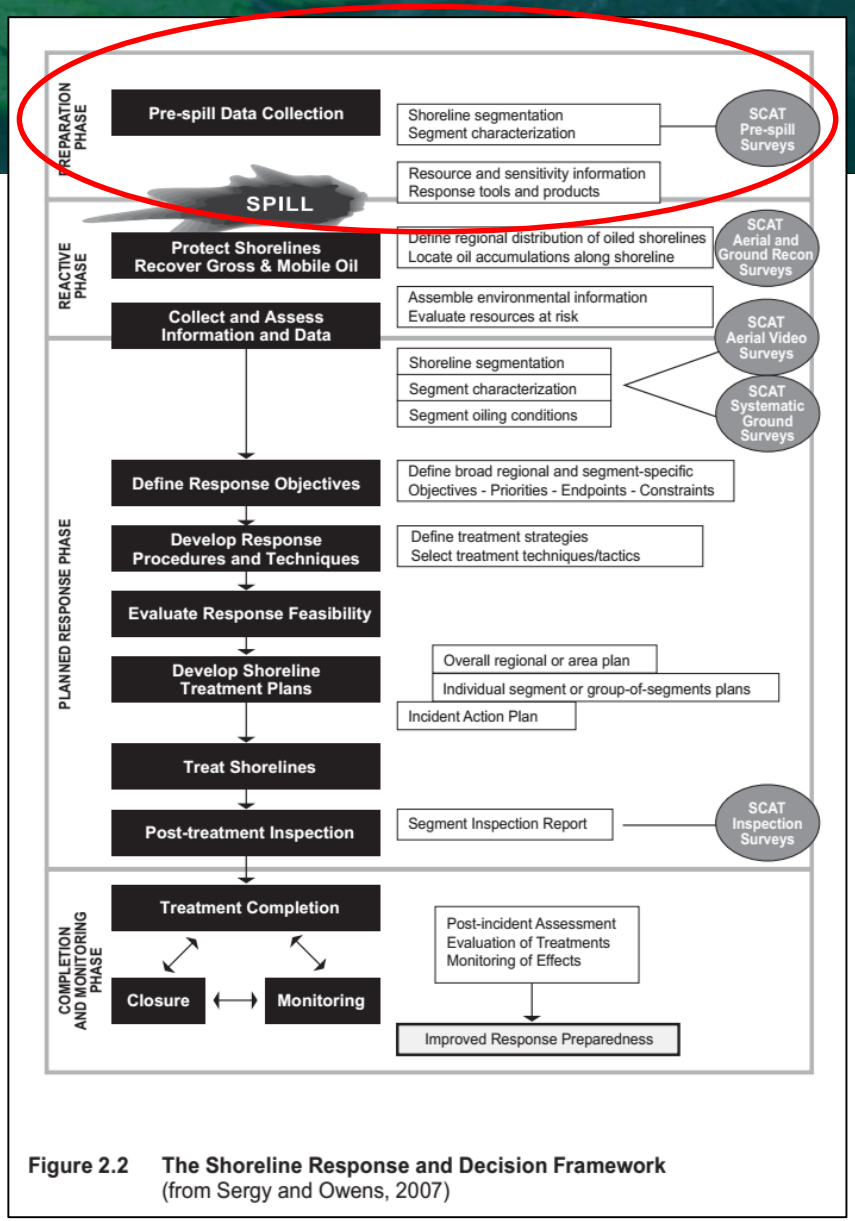
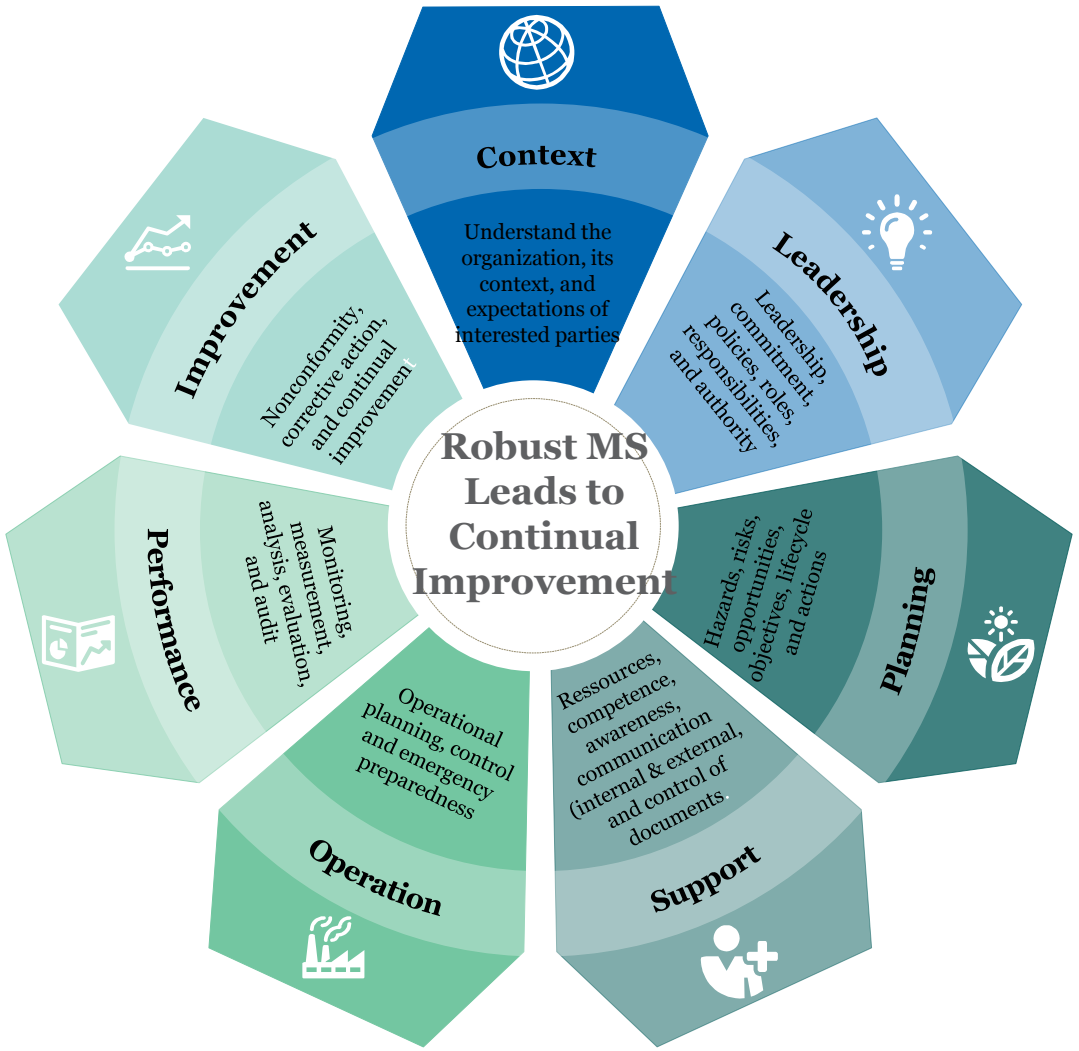


Figure 2.2 **The Shoreline Response and Decision Framework** (from Sergy and Owens, 2007)

From: Environment and Climate Change Canada, A Field Guide to Oil Spill Response on Marine Shorelines, prepared and provided by Polaris Applied Sciences., and S3 Environmental Inc., Ottawa, ON, 2016.

Purpose of developing Pre-spill Plans



Plan – Do – Check – Act

- Define the context which includes identifying interested parties and their expectations
- Clearly define “Leadership” – roles and responsibilities
- Understanding and identifying the Risks/Hazards
- Undertake pre-SCAT, if not possible, define requirements of SCAT based on identified risks
- Working out the “high-level” endpoints/VCs based on Risk/Hazards to determine sampling and monitoring plan
- Design a monitoring and sampling plan
- Evaluate and test the plan
- Learn and improve performance from activation of the plan

Monitoring Program Framework

- Comparison of post-spill and pre-spill data
- Comparison of data from spill impacted areas to reference sites
- Monitoring changes in contaminants over time

Purpose of the Monitoring and Sampling Program

- Authenticate the source and extent of the oil spill
- Measure contamination in water, sediments, and tissue (intertidal and subtidal) over time
- Determine the effects of the oil spill on commercial/recreational/aboriginal fish and invertebrates
- Assessing the human health risks either through exposure to the spill or consumption of seafood
- Determining when the spill cleanup ends – endpoints/objectives

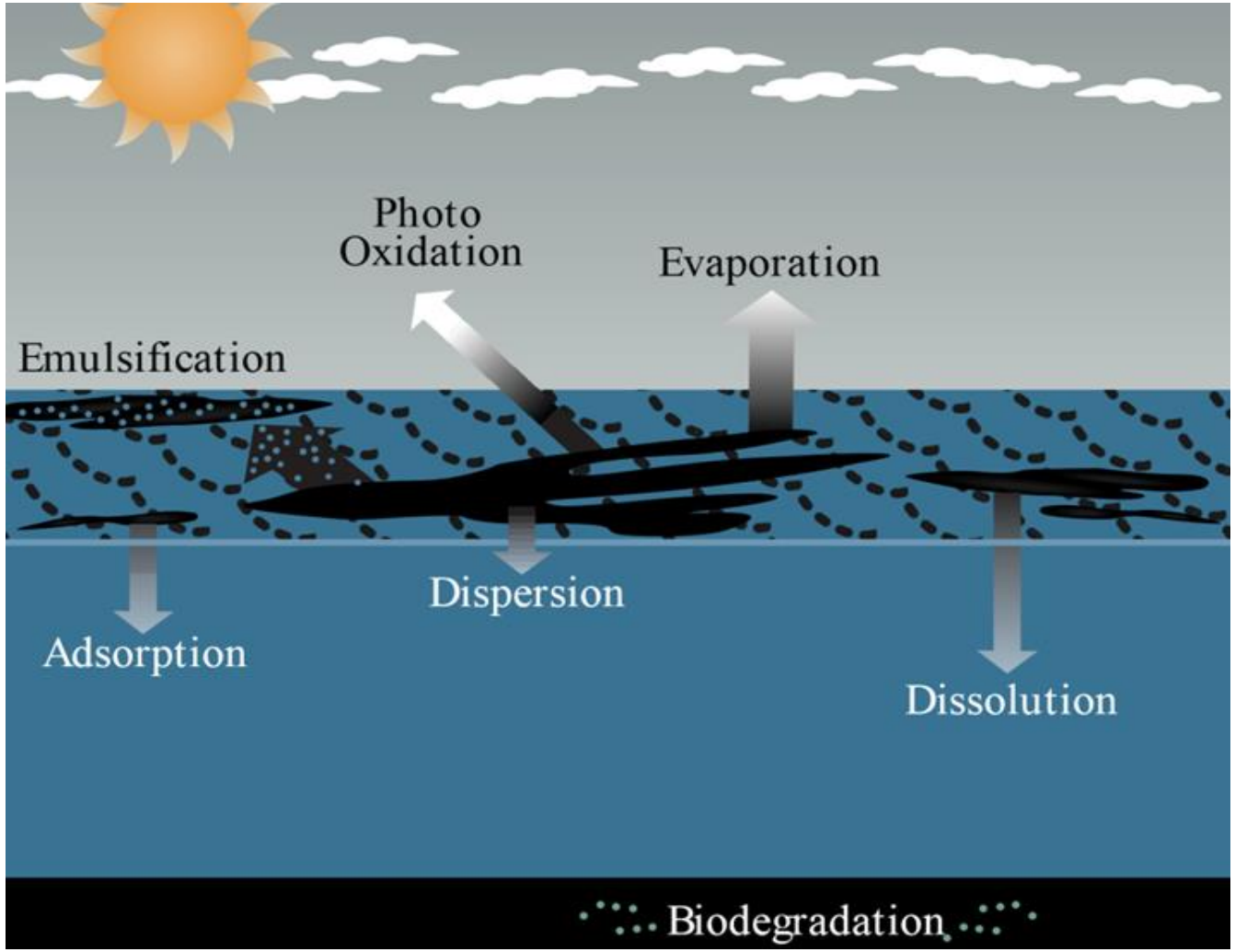
Fate and Effects of Oil

An understanding of the fate, behaviour and effects of the spilt oil and the potential pathways by which resources may be exposed will determine whether a monitoring program is needed and facilitate the program design.

Petroleum Hydrocarbon Fraction	% of total mass
Volatile hydrocarbons (nC6-nC10) effective boiling point range	*~7 to 9%*
Total Volatiles (VPH)	7.5
VH (C6 to C10)	8.4
Light extractable hydrocarbons (nC10-C19)	*14*
Heavy extractable hydrocarbons (C19-c32)	*21*
Total	**42 to 51%**
L/HEPH by aromatics vs aliphatics	
Aliphatic EPH (C10-C19)	8.1
Aromatic EPH (C10 to C19)	3.7
Aliphatic EPH (C19-C32)	7.3
Aromatic EPH (C19 to C32)	9.9
Subtotal	**29%**
Total Unsubstituted (parent) PAHs	0.093%
Total Alkyl + Parent PAHs	0.84%

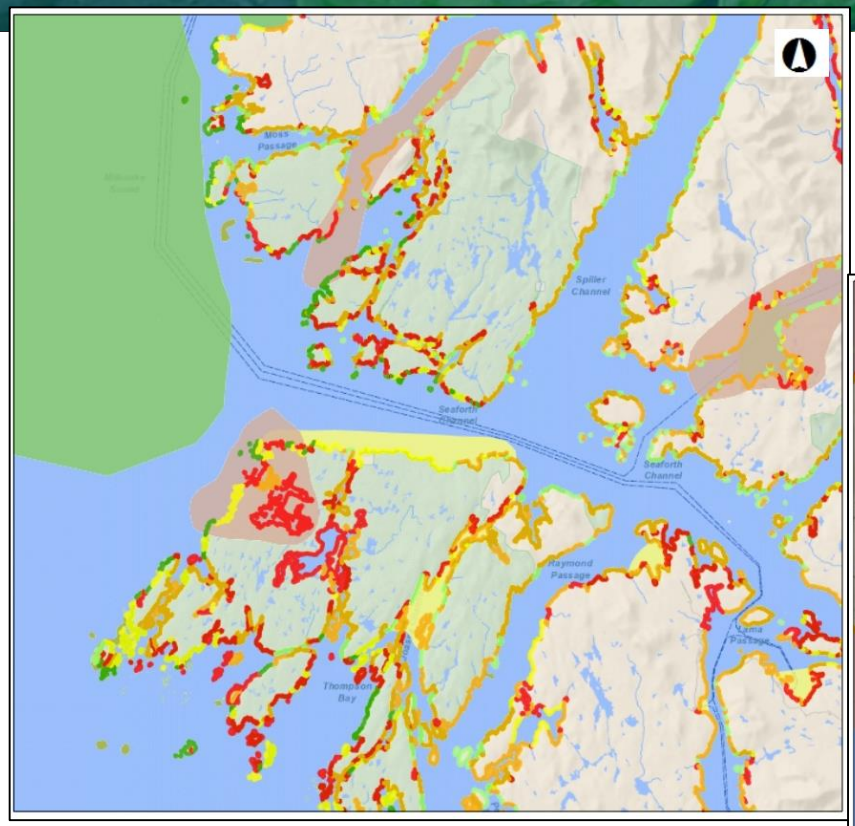
Source: Spilled Oil Sample 2007 Westridge Terminal NEB 2012

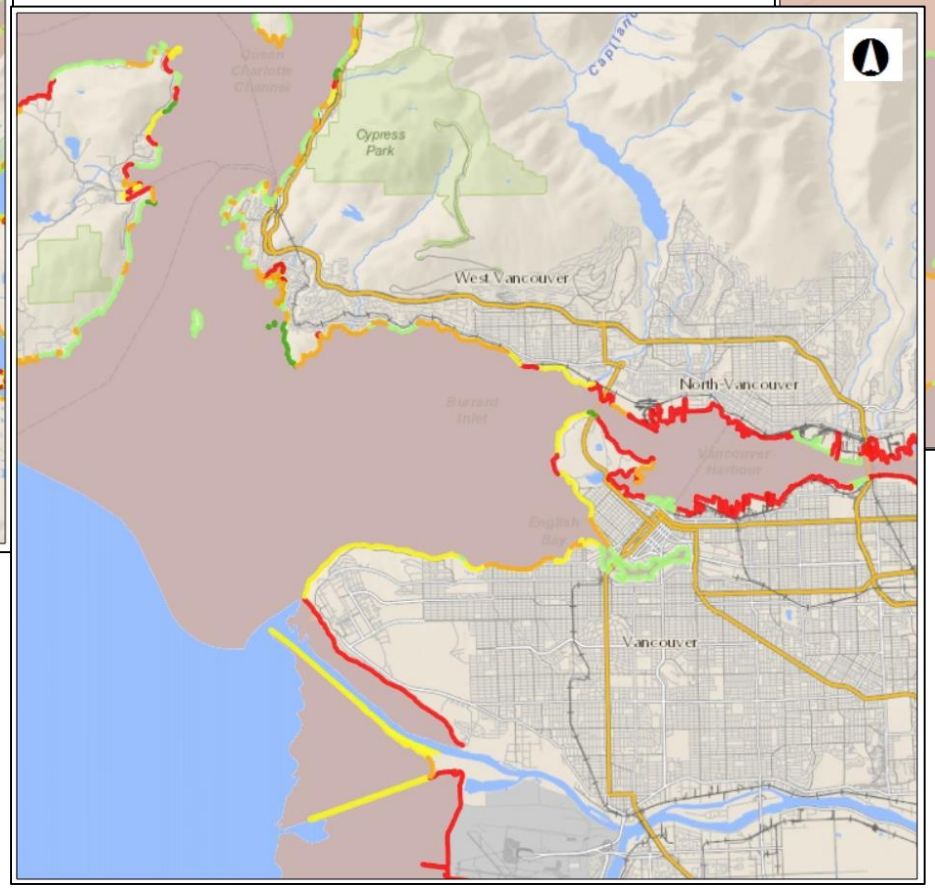
Oil Weathering Process

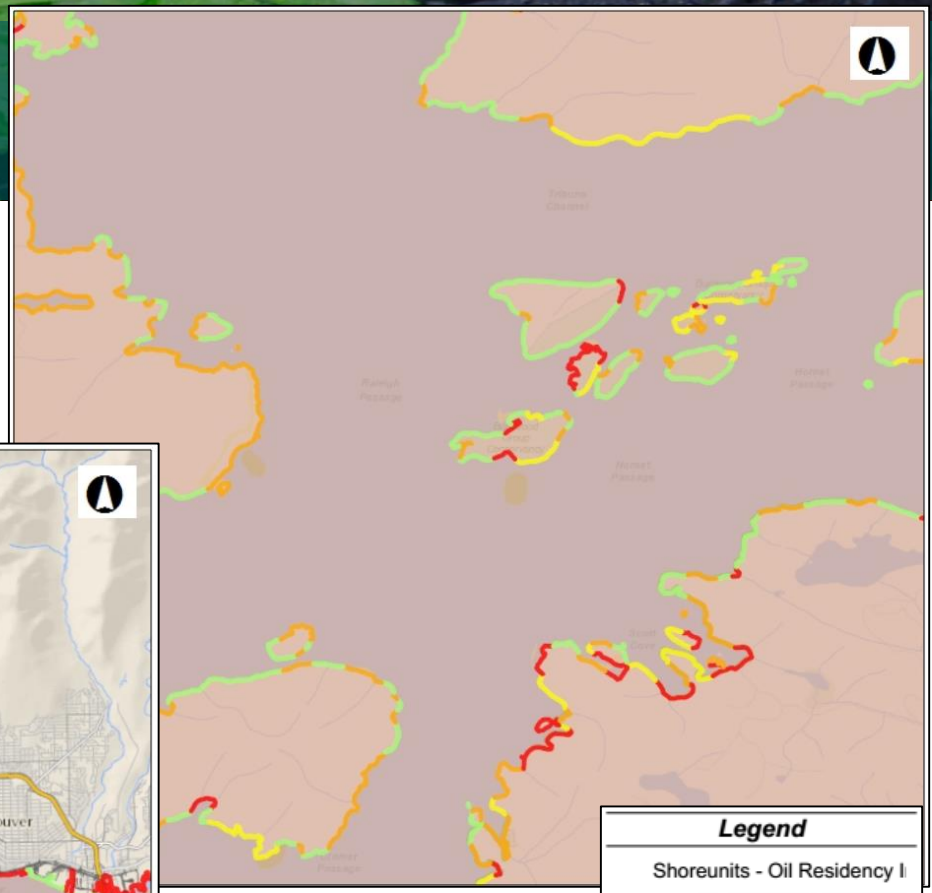


Source: NOAA

Oil Residency







Legend

Shoreunits - Oil Residency I

OIL_RESIDENCY_DEFINITION

- Unknown
- DAYS to WEEKS
- WEEKS To Months
- weeks to MONTHS
- MONTHS To Years
- months to YEARS

Relative Importance - Shore

Marine Plants - Eelgrass - C

Marine Plants - Kelp Beds -

Other Biological Resources · Colour Filled

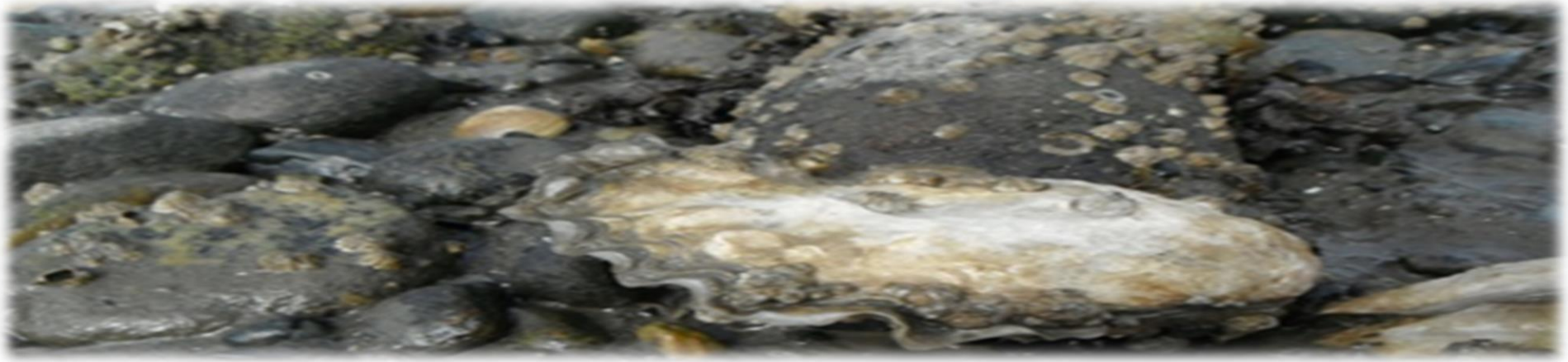
Other Biological Resources · Lines

Assessment and Endpoints

- Does the component reflect a legislative or regulatory requirement or government management priority (e.g., sediment quality standards, water quality standards, human health standard, species at risk)?
- Does the component pertain to First Nations interests, cultural or archeological feature?
- Is the component itself or the potential adverse effect of particular concern to the public, First Nations, or regulators/government?
- Is the component particularly sensitive or vulnerable to oil spill contamination?

Background and Reference Sites

- Background and Reference Sites
  - Urban areas usually the subject of long term environmental monitoring programs. (e.g. Burrard Inlet Environmental Action Program, Puget Sound Water Quality Authority) – sometimes remote
  - Remote sites, selection of appropriate reference sites can be difficult
  - Be careful of sites that could result in false-positives



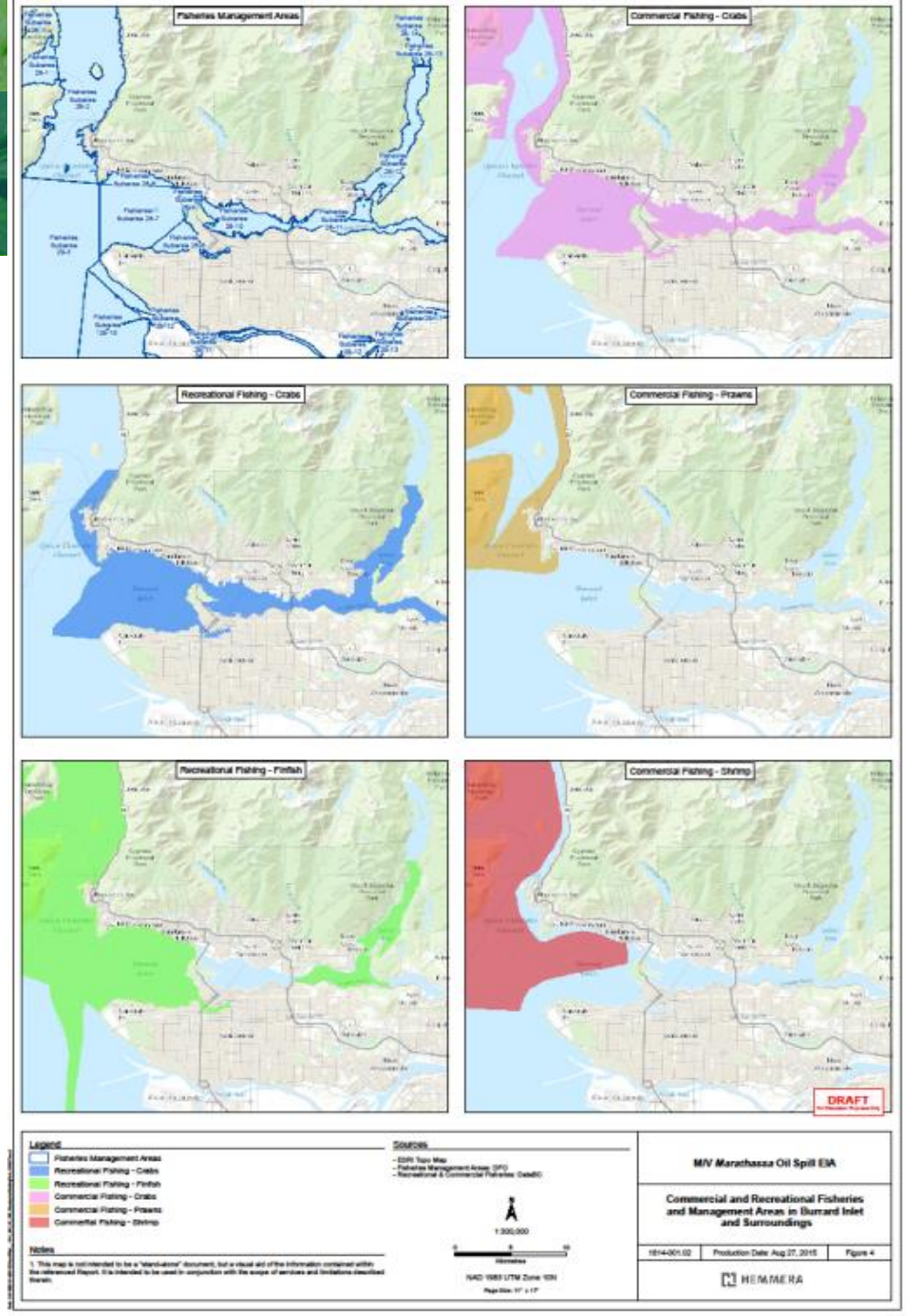
Background PAH levels

- Vancouver Harbour sediments :
  - Naphthalene: 0.026 – 0.29 µg/g dw
  - Acenaphthylene: 0.0072 – 0.10 µg/g dw
  - Acenaphthene: 0.008 – 0.062 µg/g dw
  - Fluorene: 0.022 – 0.11 µg/g dw
  - Phenanthrene: 0.11 – 0.55 µg/g dw
  - Anthracene: 0.11 – 0.18 µg/g dw
  - Fluoranthene: 0.14 – 0.73 µg/g dw

– Yunker et al (2000) BIEAP EQOMAT 2006

Commercial and Recreational Fisheries Areas and Management Areas in Burrard Inlet

Source: Hemmera 2015



Examples of common marine species in BC

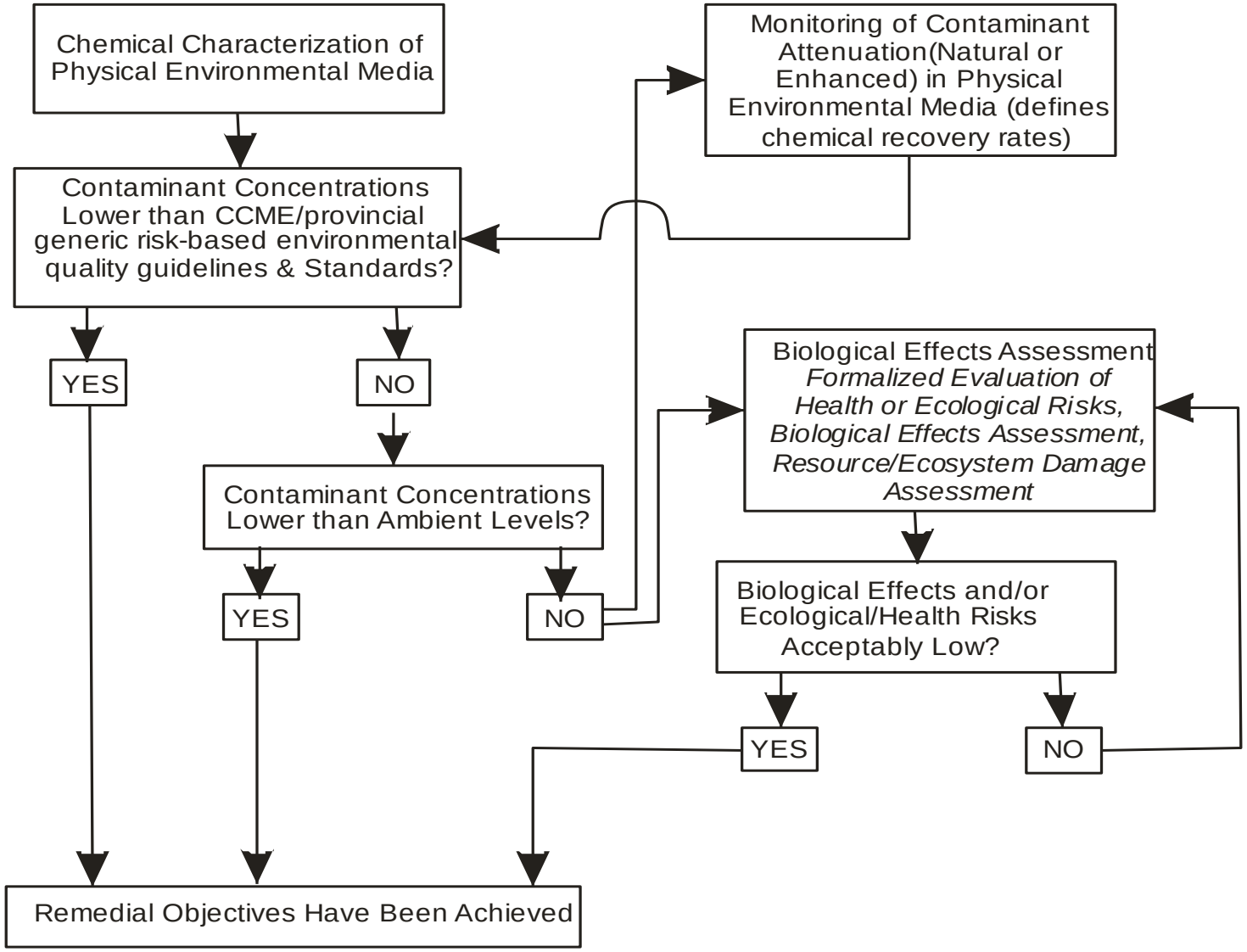
- crabs (Dungeness and red rock crabs),
- bivalves (mussels),
- prawns (spot prawns),
- flatfish (starry flounder),
- juvenile salmon, and
- forage fish (e.g., herring, surf smelt).

Subject to seasonal distribution and spawning

Biological Endpoints

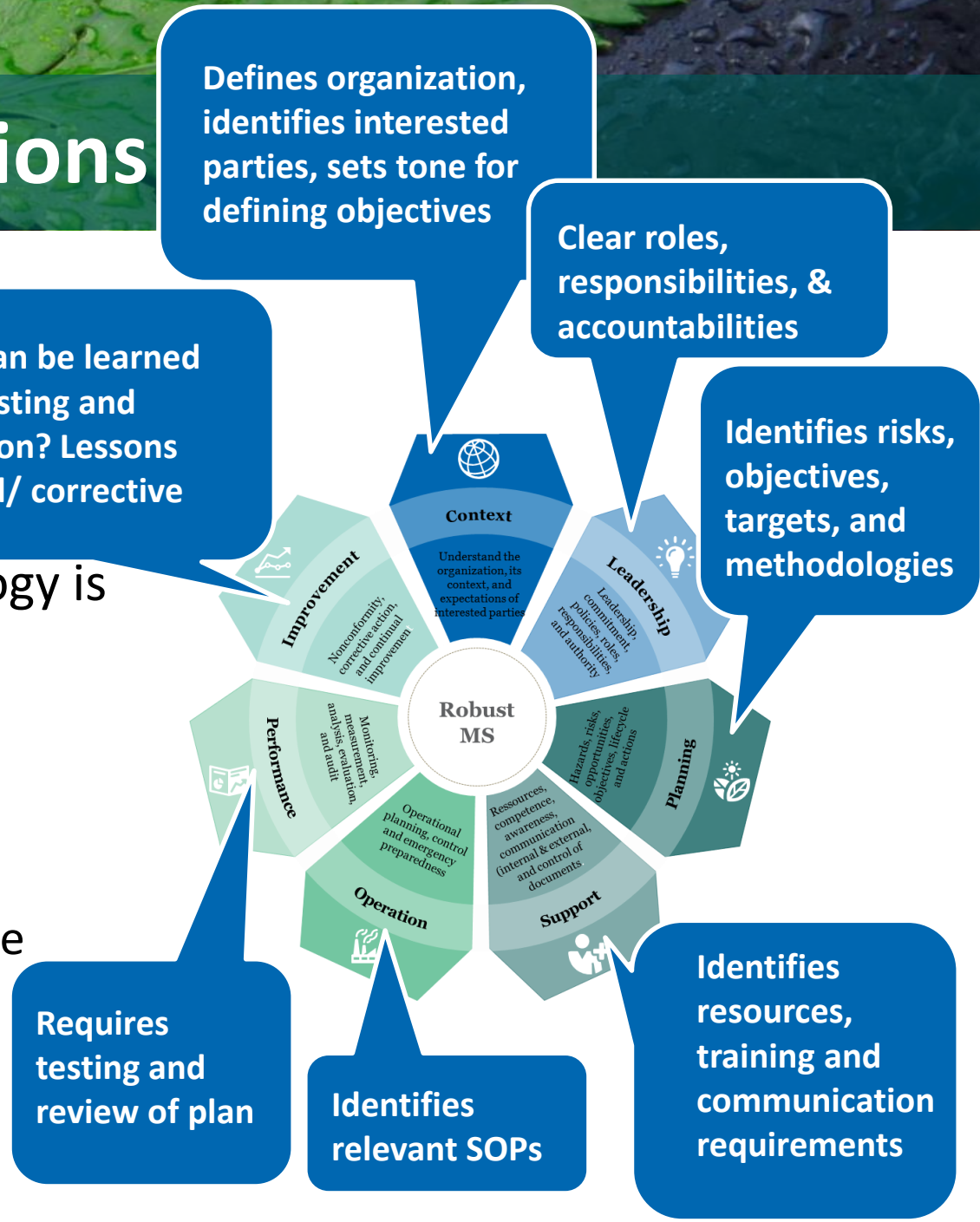
- PAH tissue concentrations within the range of background levels reported for English Bay, Burrard Inlet, or nearby areas,
- Observed tissue concentrations of PAHs below BC tissue quality guidelines
- E.g., Surf smelt, embryo mortality rates consistent with unoiled areas
- Ensure data collection methodology is based on the defined objectives

Environmental Assessment of Spill Effects



Conclusions and Recommendations

- Clarity within the Environmental Unit on Mc
  Program Goals, Spatial Sampling and metho
  Valued Components, and Endpoints are nec
- Consistency in monitoring and sampling methodology is important.
- Develop and test plans early.
  - Using a framework like ISO14001 helps align organizational governance with Emergency response
- Good communication is key.



Thank you. Questions?

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