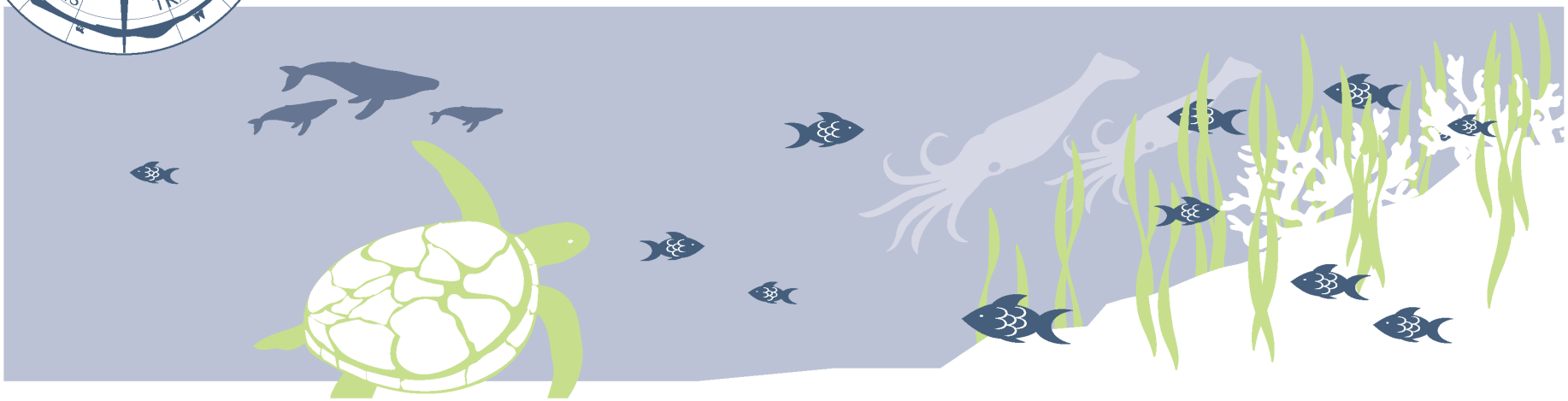
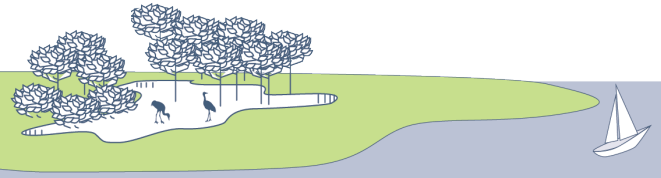
NET ENVIRONMENTAL BENEFIT ANALYSIS

FOR EFFECTIVE OIL SPILL PREPAREDNESS & RESPONSE



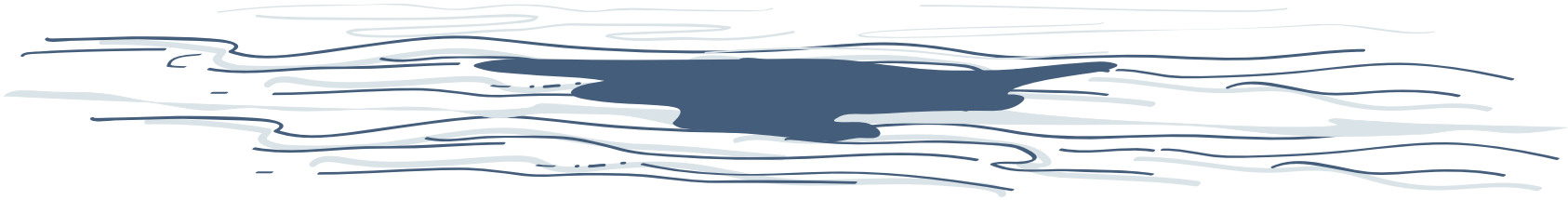


Topics For Today's Discussion

- What are our primary goals and values?
- What is Net Environmental Benefits Analysis (NEBA)?
- How is NEBA used during the entire oil spill preparedness and response process?
- How can you support effective use of NEBA to minimize impact on the environment and communities?

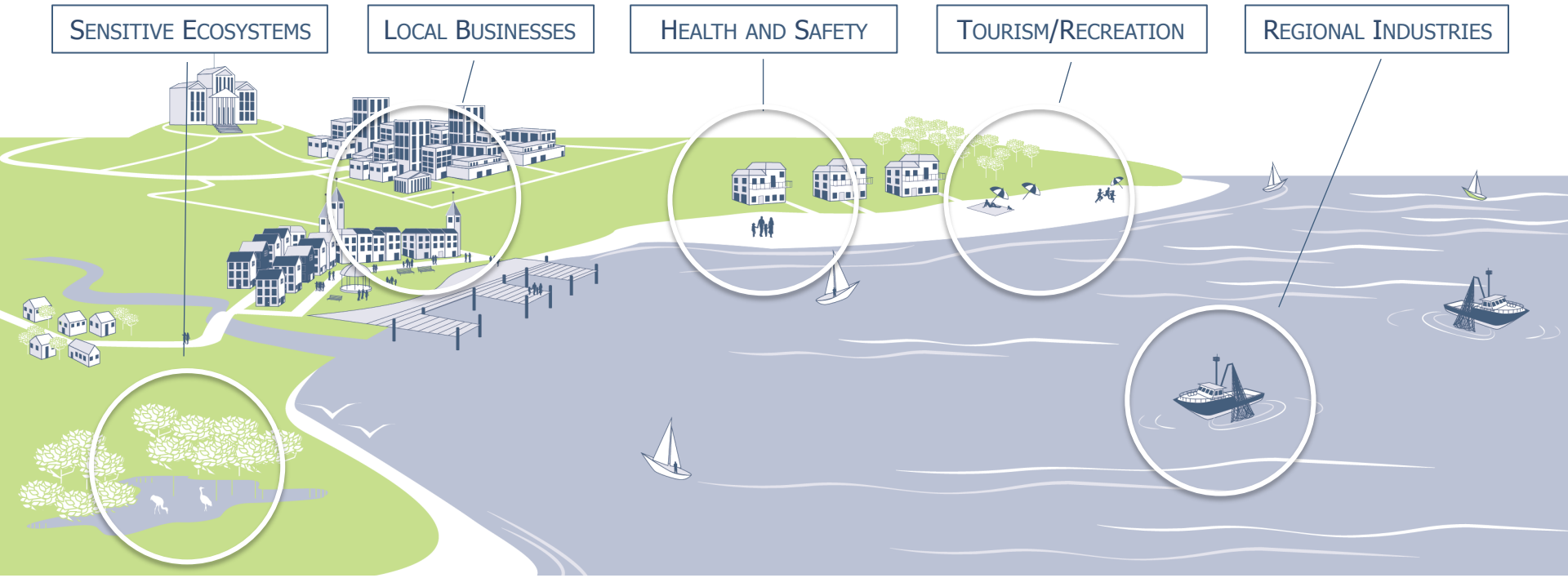
Our Goal Is to Prevent Spills Entirely

The best scenario is to never have an oil spill, and the industry takes significant precautions to prevent spills from occurring.

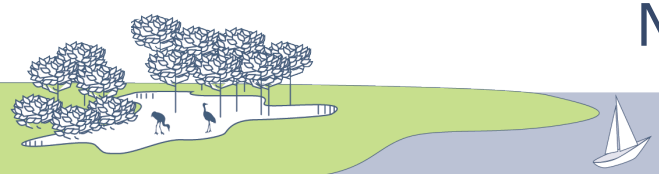


Protecting Our Shared Values

The oil industry's goal is to uphold our common values.

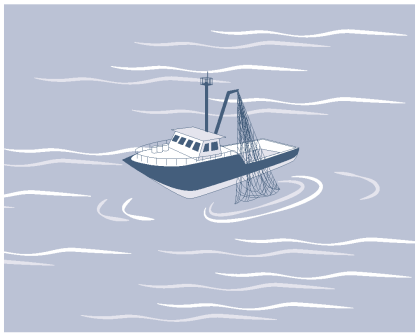


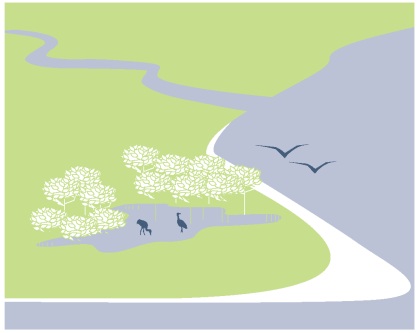
NEBA Helps Protect People and the Environment

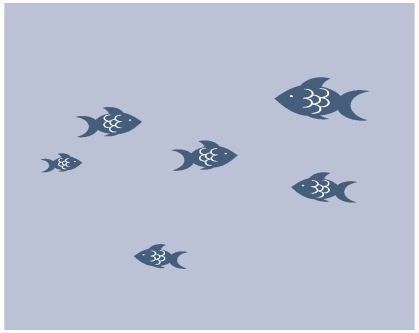


NEBA

Net Environmental Benefit Analysis (NEBA) is a process used by the response community for making the best choices to minimize impacts of oil spills on people and the environment.







Through the use of NEBA, the oil and gas industry strives to uphold community values and protect community assets with every operational decision.

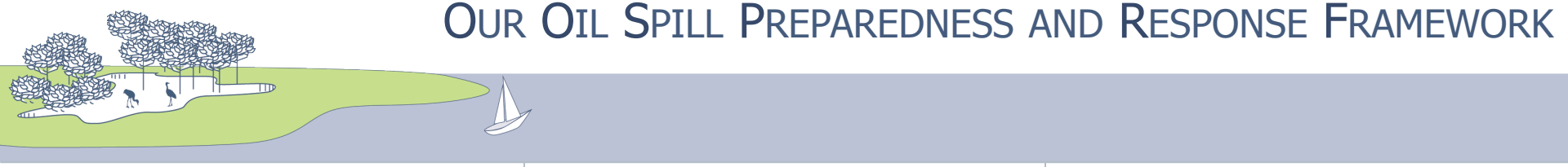
We Engage with Diverse Stakeholders in Response

Coordination between governments, industry and communities before, during and after a spill facilitate the least possible impact to the environment and community resources.

- Responsible party
- Government entities
- Impacted stakeholders
- Affected community
- Scientific SMEs
- First responders

Response community interacts with diverse stakeholders

Our Oil Spill Preparedness and Response Framework



Before

- ☑ **Assess:** Identify and prioritize environmental and community assets and review previous spill cases
- ☑ **Plan:** Develop plans for possible scenarios
- ☑ **Frame Decisions:** Design decision frameworks based on environmental conditions and social factors

During

- ☑ **Decide:** Select the most effective response approach based upon priorities and tradeoffs
- ☑ **Deploy:** Implement response using appropriate tools and techniques and monitor results
- ☑ **Adapt:** Adapt response approach based upon changing conditions and additional information gathered

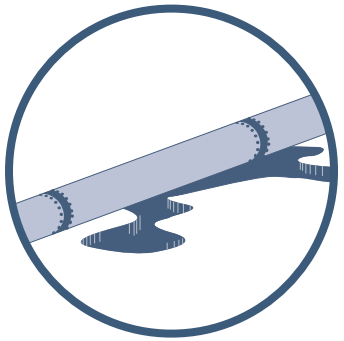
After

- ☑ **Restore:** Work with communities and governments to restore the environment and community assets to pre-spill states
- ☑ **Learn:** Gather and incorporate lessons learned into future policies, plans and good practice guides

Communication & Monitoring

WE ARE PREPARED FOR THE UNLIKELY EVENT OF A SPILL, WITH STRATEGIES AND TOOLS TO RESPOND TO POSSIBLE SCENARIOS.

POSSIBLE SPILL SCENARIOS

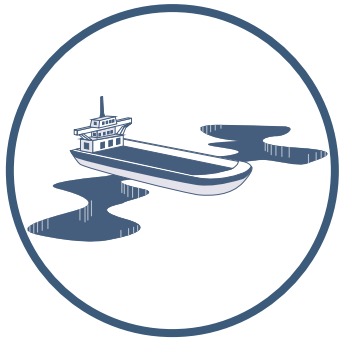


ONSHORE

INLAND

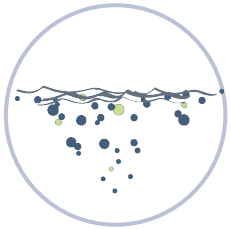
SUBSEA

NEAR SHORE

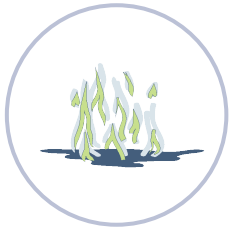


OFFSHORE

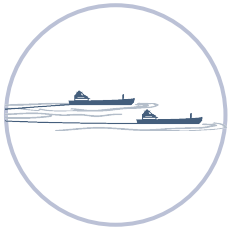
RESPONSE CAPABILITIES



DISPERSANTS



IN-SITU BURNING



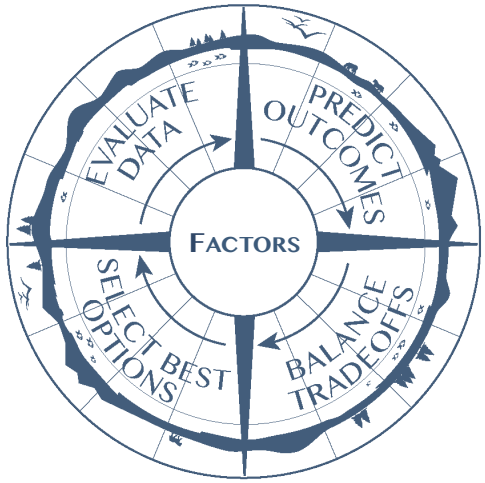
MECHANICAL RECOVERY

NATURAL REMOVAL

PHYSICAL REMOVAL

Our Navigational Guide for Selecting Response Tools

In oil spill response, we use a four step process to consider four primary factors in informing response tool selection:



Factors

Effectiveness: Which tool will remove the most oil?

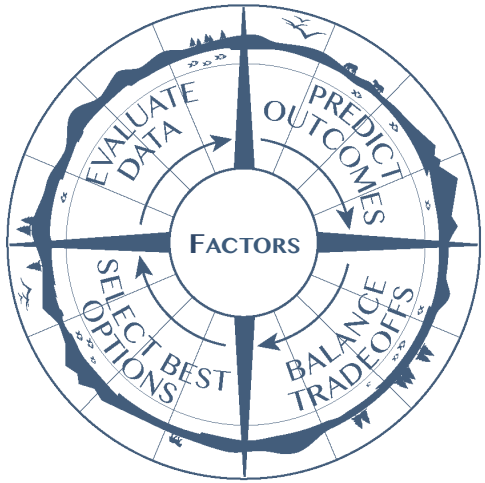
Feasibility: Which tool can be physically and safely executed?

Net Environmental Benefit Analysis: Which tool will minimize impact on the environment and the community?

Regulations: Which tool will the regulatory framework allow?

Our Navigational Guide for Selecting Response Tools

If options cannot be deployed within the boundaries of regulations, the oil response community must re-evaluate the process to select tools:



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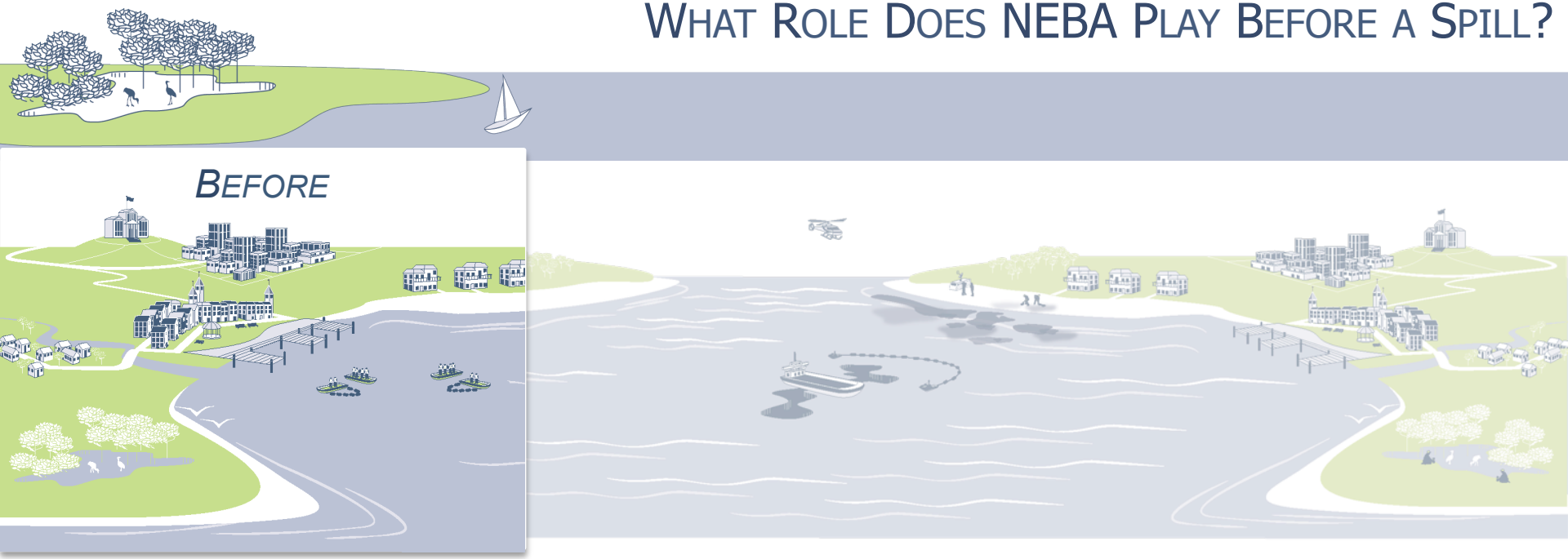
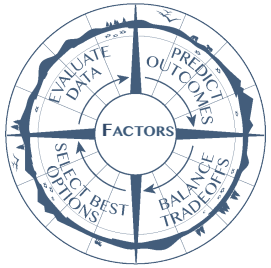
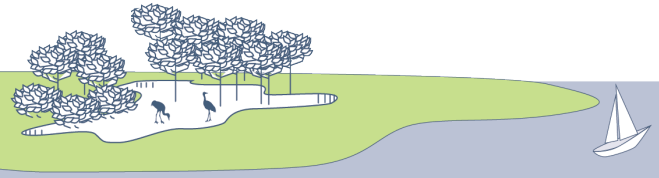
What Role Does NEBA Play Before a Spill?



Response Tool Selection Process

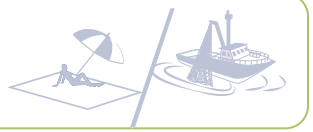


Evaluate Data	Predict Outcomes	Balance Tradeoffs	Select Options
NEBA			
Identify and prioritize environmental and community assets based upon environmental sensitivities and social values	Review and compare previous spill cases, including restoration considerations, to understand potential impacts	Weigh environmental and social impacts to determine most effective oil spill response tools and balance tradeoffs	Establish plans and put pre-approvals in place to support environmental and social values



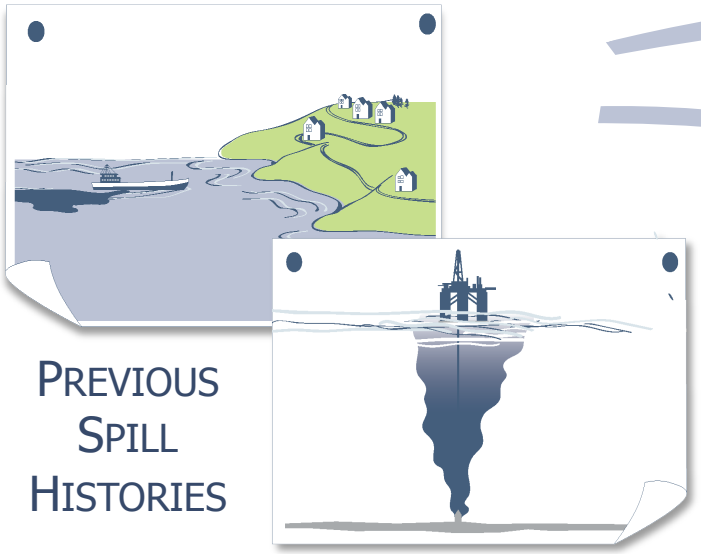
IN NEBA, THE OIL SPILL RESPONSE COMMUNITY IDENTIFIES AND PRIORITIZES A COMMUNITY'S MOST CRITICAL ENVIRONMENTAL AND SOCIAL VARIABLES

ENVIRONMENTAL AND SOCIAL VARIABLES

- **Proximity to Local Population** 
- **Presence of Sensitive Species** 
- **Proximity to Sensitive Shorelines** 
- **Impact on Regional Industries** 
- **Impact on Regional Infrastructure** 
- **Geographical Considerations** 
- **Seasonal Variables** 
- **Weather (Wind, Temperatures, etc.)** 
- **Wave Conditions** 
- **Oil Type, Viscosity, and Thickness** 
- **Oil Depth, Movement and Volume** 

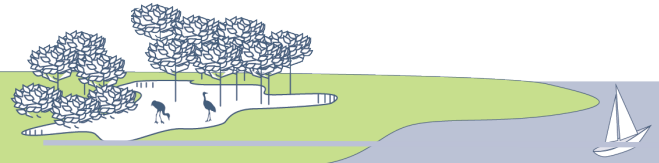
Predicting Outcomes

What were the impacts?

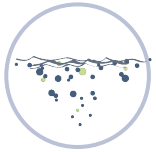


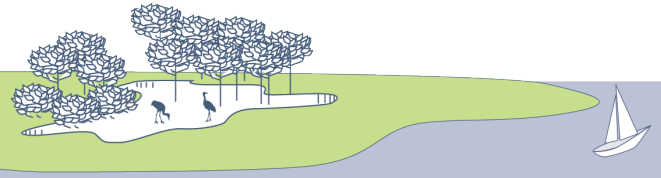
Previous Spill Histories

Environmental Impacts

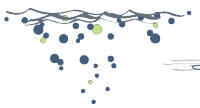
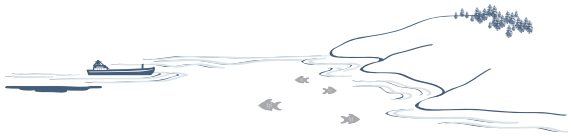
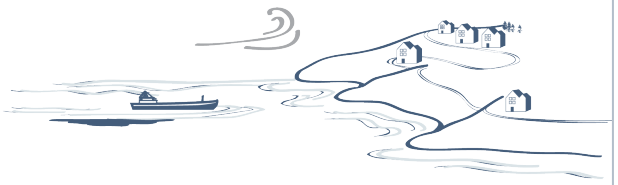
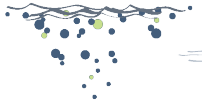
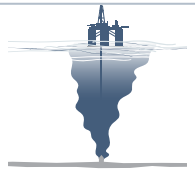
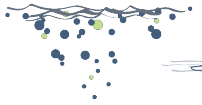
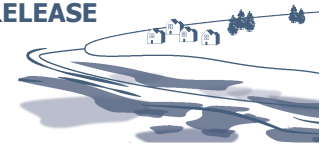


BALANCING TRADEOFFS

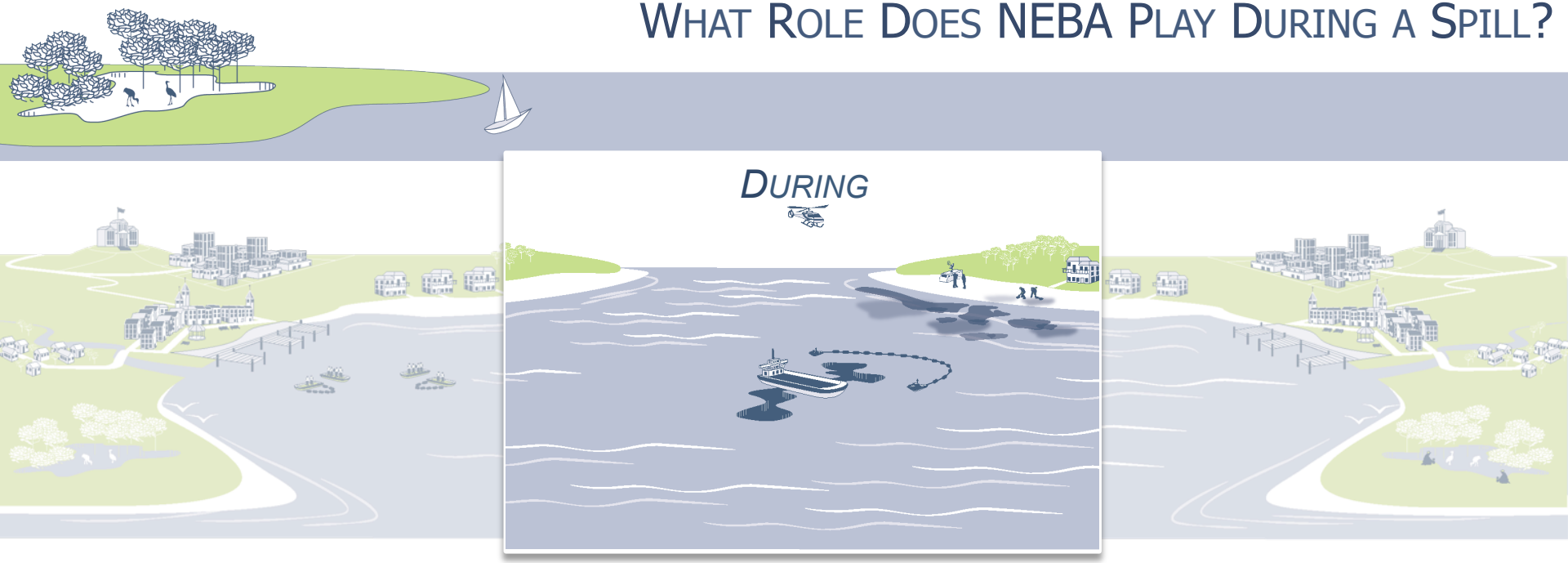
	BENEFITS	DRAWBACKS
DISPERSANTS 	• Removes surface oil that could harm wildlife and keeps oil from spreading to shoreline; enhances natural biodegradation of oil	• Dispersed oil has the potential to affect water column-dwelling wildlife and vegetation
IN-SITU BURNING 	• Removes large amounts of oil rapidly and reduces vapors on water surface	• Burning presents a risk of fire spreading and localized reduction of air quality; burn residue can be difficult to recover
MECHANICAL RECOVERY 	• Removes oil with minimal environmental impact	• Mechanical recovery is extraordinarily slow and labor-intensive, with typically no more than 10-20 percent oil
NATURAL REMOVAL 	• Does not involve intrusive removal/cleanup techniques that further damage the environment, allowing for the natural biodegradation of oil	• In natural removal, oil is not removed, and winds and currents can change, sending the oil spill toward sensitive areas
PHYSICAL REMOVAL 	• Reduces secondary impacts to animals that reside on shorelines and prevents remobilization of the oil	• Aggressive removal methods may impact shoreline and shore organisms, with typically no more than 10-20 percent oil recovery



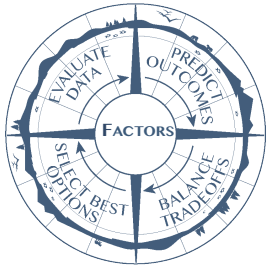
PRE-SELECTING OPTIONS

SITUATION	POSSIBLE RESPONSE TOOLS
OFFSHORE RELEASE 	DISPERSANTS  MECHANICAL RECOVERY  IN-SITU BURNING  NATURAL REMOVAL 
NEAR SHORE RELEASE SPAWNING SEASON 	MECHANICAL RECOVERY  IN-SITU BURNING  NATURAL REMOVAL 
NEAR SHORE RELEASE WIND BLOWING SPILL TOWARD POPULATED AREA 	DISPERSANTS  MECHANICAL RECOVERY  NATURAL REMOVAL 
SUBSEA SPILL OFFSHORE 	DISPERSANTS  MECHANICAL RECOVERY  IN-SITU BURNING  NATURAL REMOVAL 
ONSHORE OR NEAR SHORE RELEASE NEAR MARSH OR SAND BEACH  	PHYSICAL REMOVAL  IN-SITU BURNING  NATURAL REMOVAL 

What Role Does NEBA Play During a Spill?



Response Tool Selection Process

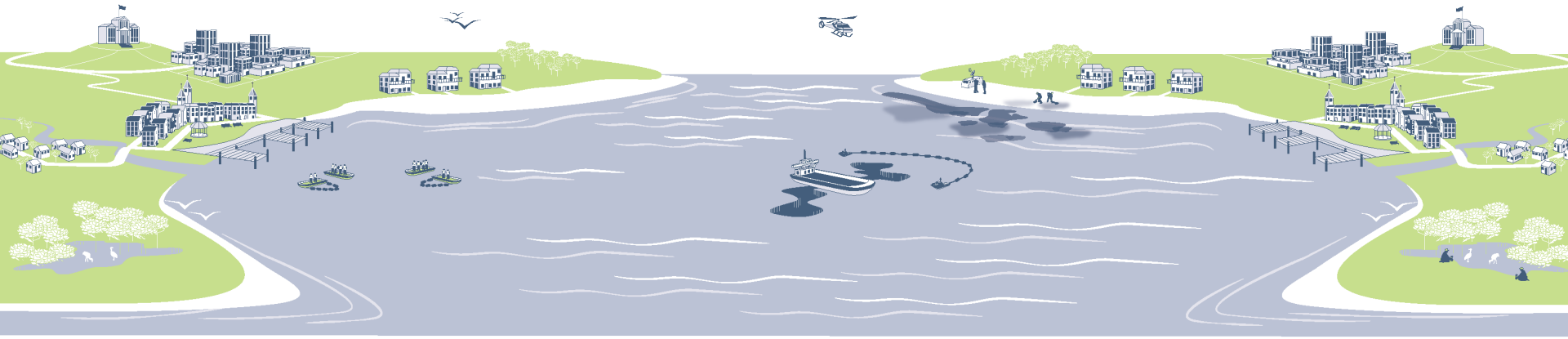


Evaluate Data	Predict Outcomes	Balance Tradeoffs	Select Options
NEBA			
Assess specific oil spill conditions to determine most effective tools to minimize environmental and social impacts	Confirm effectiveness and feasibility of response options to achieve optimal results	Re-evaluate environmental and social impacts to determine most effective oil spill response tools and balance tradeoffs	Inform rapid decision-making and implementation of oil spill response tools based on evaluations

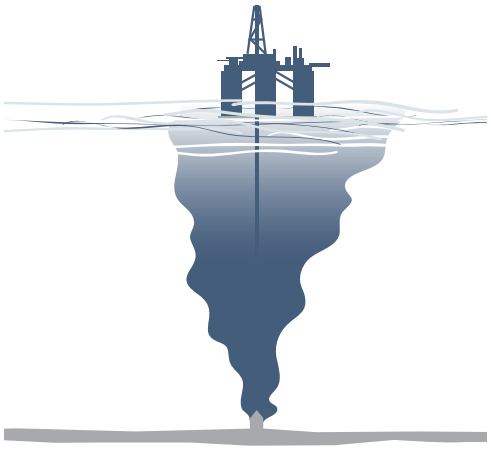
Guiding Principles for Oil Spill Preparedness and Response

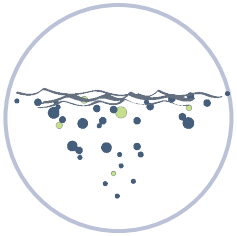
We follow a set of guiding principles that allow the response community to achieve a rapid, well-managed, and unified response effort:

- Prevent oil from getting to shore in offshore scenarios
- Prevent oil from getting into water in onshore scenarios
- Prioritize safety and health of people
- Stop the source of a spill as quickly as possible
- Minimize environmental and community impact



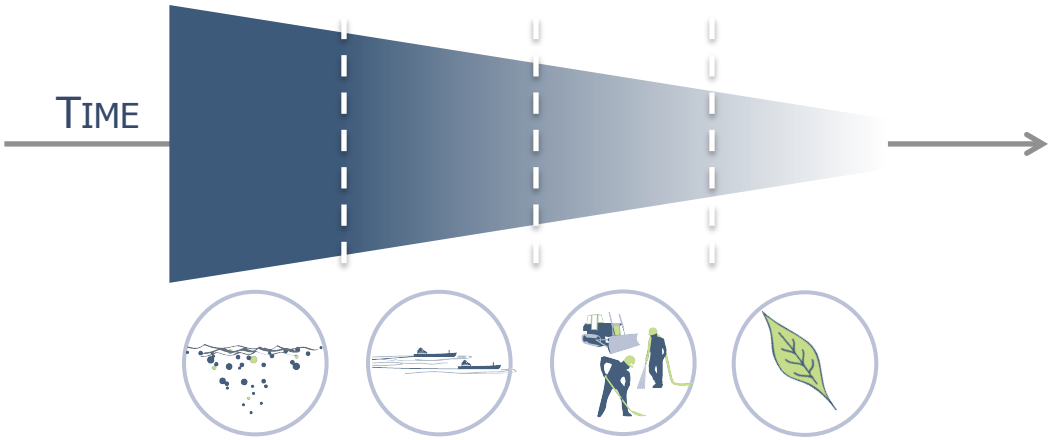
NEBA In Action: Subsea Spill





DISPERSANTS

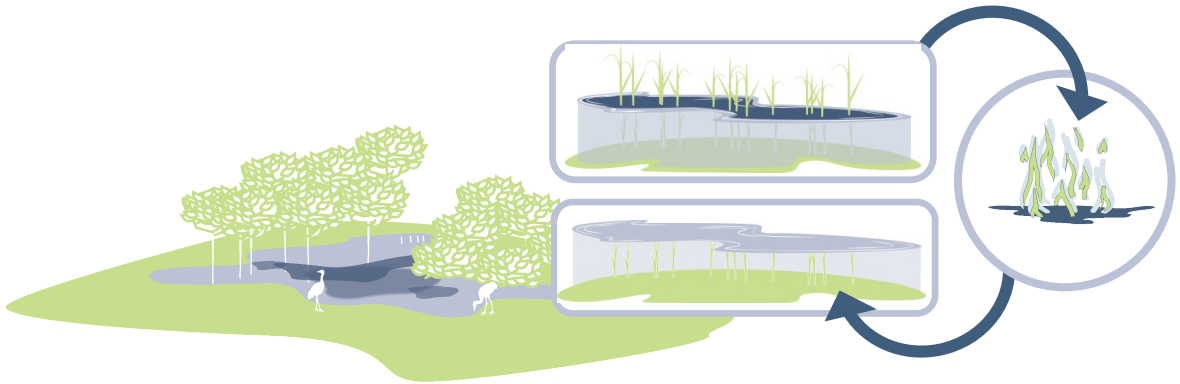
Bulk Oil Removal Over Time

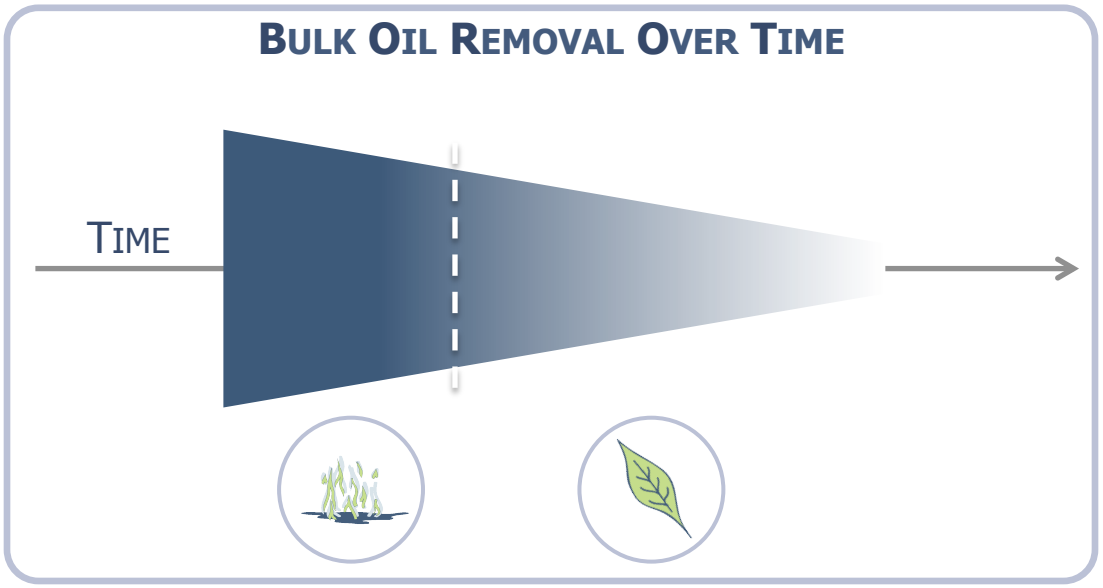


Subsea Dispersant Application:

In this scenario, **subsea dispersant application is probably the most effective selection.** Dispersants break oil slicks down at the source of the leak and allow for bio-degradation to happen sooner.

NEBA in Action: Oil Release in Wetland Area

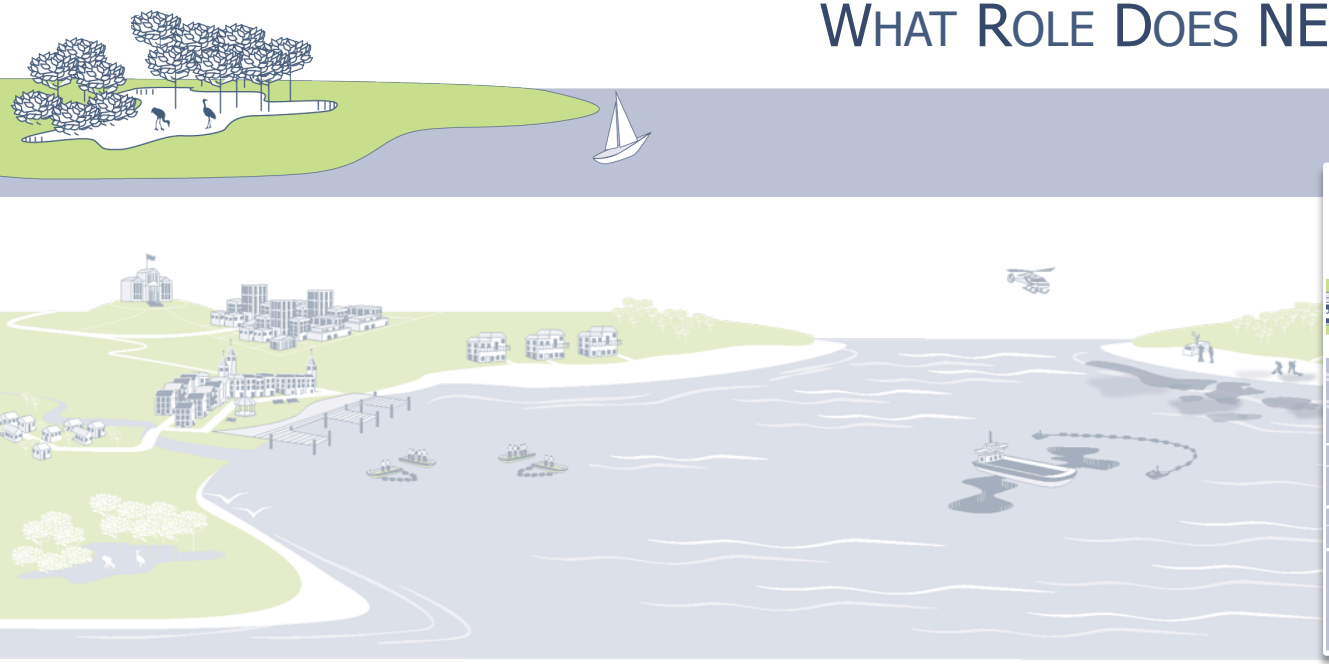




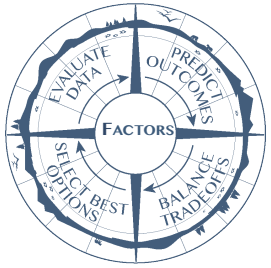
In-Situ Burning:

In this scenario, **in-situ burning may be the most effective option** because it will remove the oil from the surface without harming the root system of the wetland vegetation.

What Role Does NEBA Play After a Spill?



Response Tool Selection Process



Evaluate Data	Predict Outcomes	Balance Tradeoffs	Select Options
NEBA			
Gather lessons learned and best practices to understand environmental and social impacts resulting from oil spill response and use data to inform restoration decisions	Inform restoration activities and spill cases for future oil spill response exercises, drills, and scenario planning	Re-evaluate environmental and social impacts to determine most effective oil spill response tools and balance tradeoffs for future oil spill incidents	Inform rapid decision-making protocols and pre-selection of most effective tools in future oil spill incidents

Industry, Government, and Community Coordination is Key

A well-managed response must include:

Safety at the forefront of response decisions

Use of NEBA and consideration of tradeoffs in response decisions

Availability of appropriate **response equipment and tools**

Informed, trained teams that understand policies and procedures

Governments and industry working together in response

Effective, timely **communication** between government, industry, and communities

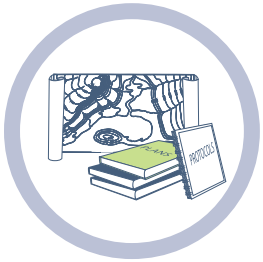
We Partner for Response Across the Globe

Global partnerships are critical for the development of policies and solutions that ensure effective, coordinated oil spill response.

Cedre
ITOPF
IPIECA
United States Environmental Protection Agency
NRC
arpel
U.S. Department of Homeland Security
concawe
Clean Caribbean & Americas
Oil Spill Response
BSEE Bureau of Safety and Environmental Enforcement
energy API
OGP International Association of Oil & Gas Producers
AMOSC Australian Marine Oil Spill Centre Pty Ltd
Australian Government Australian Maritime Safety Authority
SINTEF
IMO International Maritime Organization
MSRC Marine Spill Response Corporation
NOFO
National Oceanic and Atmospheric Administration NOAA U.S. Department of Commerce
EMSA European Maritime Safety Agency
U.S. Department of the Interior March 3, 1849

How Can You Support Oil Spill Preparedness and Response?

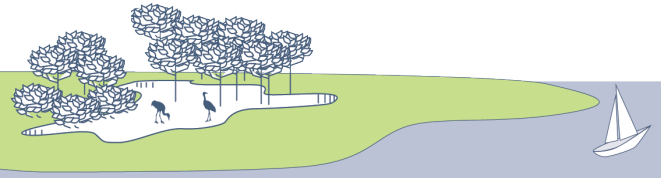
Our shared goal is to preserve human life, the environment, and community well-being during oil spill response



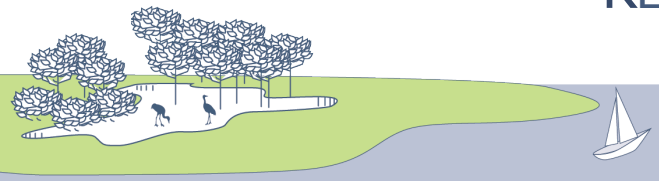
Every government and community member can help us in achieving our goal of a rapid and unified response.

- Partner with us before a spill, participating in conversations with industry on a regular basis.
- Join us for drills and exercises in your community.
- Support our efforts to put plans and pre-approvals in place before a spill.

Through effective preparation, we can create a quicker and more efficient response together.



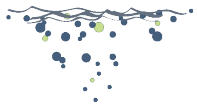
BACKUP



Key Points:

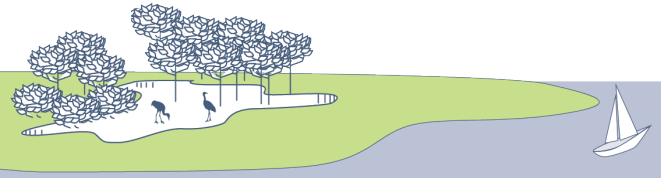
- Responders carefully apply decision frameworks, considering the significant tradeoffs involved in response.
- Inherent limitations exist in terms of the amount of oil that can be recovered during any given response effort.
- There will be negative side effects of oil spills, even when the most effective tool is chosen.
- Government, communities, and industry must assess potential spill impacts and make decisions together.
- Access to appropriate response tools is critical for successful response.

Our Response Toolbox

Response Toolbox	Benefits	Drawbacks
Natural Removal  **Natural Removal allows more effective recovery in environments where intervention would be detrimental.**	• No intrusive removal/cleanup techniques that further damage the environment • Complements other response techniques • May be best option if there is little to no threat to human or environmental well-being • When used in certain areas/conditions, the environment can recover from the spill more effectively than it might when using other response tools	• Winds & currents can change, sending the oil spill toward sensitive areas • Oil can impact shoreline, ecology, wildlife, & economically relevant resources • Public perception that responders are doing nothing
Dispersants  **Dispersants allow small oil droplets to form which speeds up natural breakdown in the water column.**	• High areal coverage rate possible at the water surface • High treatment efficiency possible subsea • Large volumes of oil can be treated • Potentially high oil elimination rate • Reduced vapors at the water surface improves safety • No recovered oil storage requirements • Lower manpower requirements • Potentially the quickest response countermeasure • Useful in strong wind/sea conditions • Effective over wide range of oil types & conditions	• Special approvals required • Less known about long term effects of subsea use • Limited window of opportunity for batch spills • Perceived that not suitable for calm seas • Short-term, localized reduction in water quality • Potential impact on water column ecology • Specialized equipment and expertise required • Use near shore results in added risks to shoreline and sediment
In-Situ Burning  **In-Situ Burning involves igniting contained oil slicks.**	• High oil elimination rate possible • Reduced vapors at the water surface improves safety • No recovered oil storage requirements (except for burn residue) • Effective over wide range of oil types & conditions • Specialized equipment (boom) is air transportable • Minimal environmental impact	• Special approvals required • Ineffective in inclement weather or high seas • Black smoke perceived as significant impact on people & the atmosphere • Localized reduction of air quality • Specialized equipment and expertise required • Potential for secondary fires during inland use
Mechanical Recovery  **Mechanical Recovery uses skimmers and booms to contain and remove oil from the water surface.**	• Well accepted, no special approvals needed • Effective for recovery over wide range of spilled products • Large window of opportunity • Minimal side effects • Greatest availability of equipment & expertise • Recovered product may be reprocessed	• Inefficient & impractical on thin slicks • Ineffective in inclement weather or high seas • Requires storage capability • Typically recovers no more than 10-20 percent of the oil spilled • Labor-intensive
Physical Removal  **Physical Removal consists of physical removal of surface oil by crews with tools and machinery.**	• Non-aggressive methods can have minimal impact on shore structure & shore organisms • Useful for detailed cleaning of near-shore environment in specific or sensitive areas	• Aggressive removal methods may impact shoreline & shore organisms (e.g., sand removal and cleaning) • Potential for heavy equipment use and trampling of sensitive areas to cause damage • Removal occurs after oil has already impacted shore • Labor-intensive

SOURCE: EXXONMOBIL OIL SPILL RESPONSE GUIDELINES

TRADEOFFS OF DISPERSANTS



BENEFITS

- Removes surface oil that could harm sea birds, mammals and other wildlife
- Prevents oil from spreading to shoreline, reducing risk for sensitive shoreline vegetation and wildlife
- Reduces impact on community assets and local industries
- Allows for significantly more oil to be removed than other response methods
- Speeds up oil removal from the water column by enhancing natural biodegradation

DRAWBACKS

- Potential effects of dispersed oil on water column-dwelling wildlife and vegetation (anticipate short-lived and localized exposures)
- Does not directly collect and remove the oil from the environment
- Potential impact to fishing industries due to public distrust of dispersants' effects on seafood

TRADEOFFS OF MECHANICAL RECOVERY

BENEFITS

- Removes oil with minimal environmental impact
- Well accepted, no special approvals needed
- Effective for recovery over wide range of spilled products
- Large window of opportunity
- Minimal side effects
- Greatest availability of equipment & expertise
- Recovered product may be re-processed

DRAWBACKS

- Extraordinarily slow
- Does not remove as much oil before it hits the shore
- Harder to recover a lot of oil in larger spill cases
- Inefficient & impractical on thin slicks
- Ineffective in inclement weather or high seas
- Requires storage capability
- Typically recovers no more than 10-20 percent of the oil spilled
- Labor-intensive

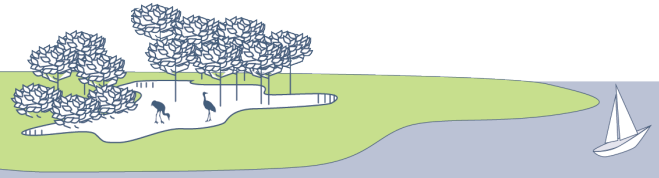
TRADEOFFS OF IN-SITU BURNING

BENEFITS

- Rapid removal of large amounts of oil
- Much less oil left for disposal
- High efficiency rates (up to 98-99%)
- Less equipment and labor required and specialized equipment (boom) is air transportable
- May be only viable option (e.g., marshes, ice)
- High oil elimination rate possible
- Reduced vapors on water surface improves safety
- No recovered oil storage requirements (except for burn residue)
- Effective over wide range of oil types & conditions
- Minimal environmental impact

DRAWBACKS

- Black smoke perceived as significant impact on people & the atmosphere
- Limited window-of-opportunity for spills on open water (emulsified oils do not burn)
- Risk of fire spreading (safety)
- Burn residue can be difficult to recover (may sink from burns of very heavy oils)
- Special approvals required
- Localized reduction of air quality
- Potential for secondary fires during inland use



TRADEOFFS OF NATURAL REMOVAL

RESPONSE DECISION: NATURAL REMOVAL

BENEFITS

- No intrusive removal/cleanup techniques that further damage the environment
- Complements other response techniques
- Allows responders to follow the progress of the oil
- Observations & data gained from monitoring inform response decisions & tool selection
- May be best option if there is little to no threat to human or environmental well-being
- When used in certain areas/conditions, the environment can recover from the spill more effectively than it might when using other response tools

DRAWBACKS

- Not removing the oil
- Winds & currents can change, sending the oil spill toward sensitive areas
- Oil can impact shoreline, ecology, wildlife, & economically relevant resources
- Public perception that responders are doing nothing

TRADEOFFS OF PHYSICAL REMOVAL

BENEFITS

- Removes oil
- Reduces potential for oil spreading further
- Reduces secondary impacts to animals that come down to shorelines
- Prevents remobilization of the oil
- Non-aggressive methods can have minimal impact on shore structure & shore organisms
- Useful for detailed cleaning of near-shore environment in specific or sensitive areas

DRAWBACKS

- Further damage to environment: aggressive removal methods may impact shoreline & shore organisms (e.g., sand removal and cleaning)
- Requires storage capability
- Typically recovers no more than 10-20 percent of the oil spilled
- Labor-intensive
- Potential for heavy equipment use and trampling of sensitive areas to cause damage
- Removal occurs after oil has already impacted shore

How Can You Support a Rapid And Unified Oil Spill Response?

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THE FACTS ABOUT
OIL SPILL RESPONSE.

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