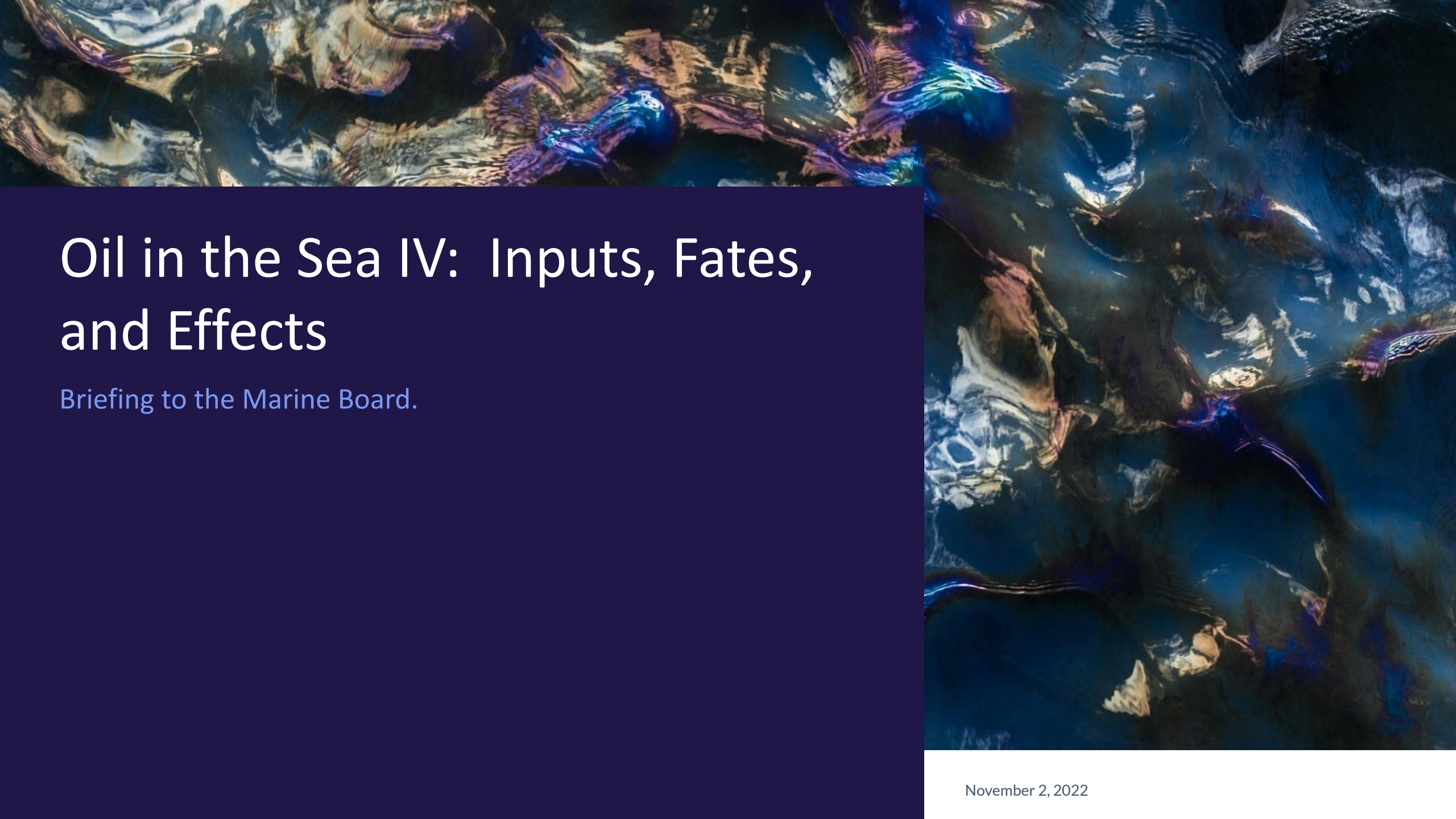




Oil in the Sea IV: Inputs, Fates, and Effects

Briefing to the Marine Board.

Agenda

- 1 Project context and overview
- 2 Inputs of oil into the sea
- 3 Overarching themes to advance oil spill science
- 4 Key Takeaways
- 5 Q&A

Study Overview

- 2-year consensus study (100% virtual)
- Sponsored by:
 - American Petroleum Institute
 - Bureau of Ocean Energy Management
 - Bureau of Safety and Environmental Enforcement
 - Gulf of Mexico Research Initiative
 - NASEM President's Circle Fund
 - Oceans and Fisheries Canada
- 17-member Committee
- Monthly meetings - input from: committee expertise, scientific literature, 58 invited speakers, and 3 consultant teams
- Resulting report was peer-reviewed by an additional 13 experts

Oil in the Sea IV: Inputs, Fates, and Effects

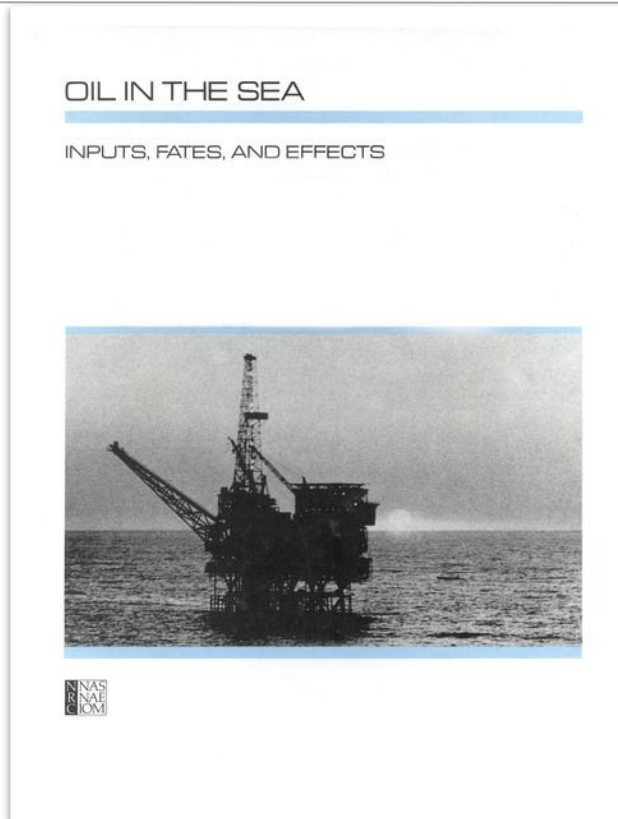
Study Context



1975

NATIONAL
ACADEMIES

Sciences
Engineering
Medicine



1985



2003



2022

What is different about this update?

- 1 Extensive discussion of fates and effects includes many advances in understanding over the last 20 years.
- 2 Highlights and synthesizes the extensive amount of post-DWH research following 10-years of dedicated funding for oil spill science.
- 3 Inclusion of details on complexity of oil mixtures.
- 4 Inclusion of oil spill response; its importance to minimizing both the amount of oil spilled and effects on environment and people.
- 5 Inclusion of human health and seafood safety.
- 6 Detailed discussion and identification of gaps in understanding and suggestions for future research.
- 7 Provide overarching recommendations that cross-cut multiple chapters.

How will this report be helpful?

- 1 Report summary for the casual reader and conclusions at the end of each chapter for a quick overview.
- 2 Textbook-style explanations of the current definitions and state of knowledge of oil spill science (chemistry, fate, effects, and response) with a detailed table of contents to guide the reader.
- 3 Synthesis of over 1,300 references.
- 4 Current estimations of volumes of oil entering the sea and projections for the future.
- 5 Each chapter includes tables identifying critical research needs
- 6 Recommendations for better estimating important inputs, decreasing inputs, decreasing effects, and preparing for future spill scenarios.

Report Structure



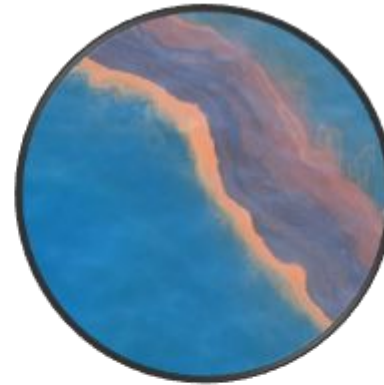
**What is
Oil?
(Chapter 2)**



**Where does
oil in the sea
come from?
(Chapter 3)**



**What can be
done?
(Chapters 3 & 4)**



**Where does
the oil go?
(Chapter 5)**

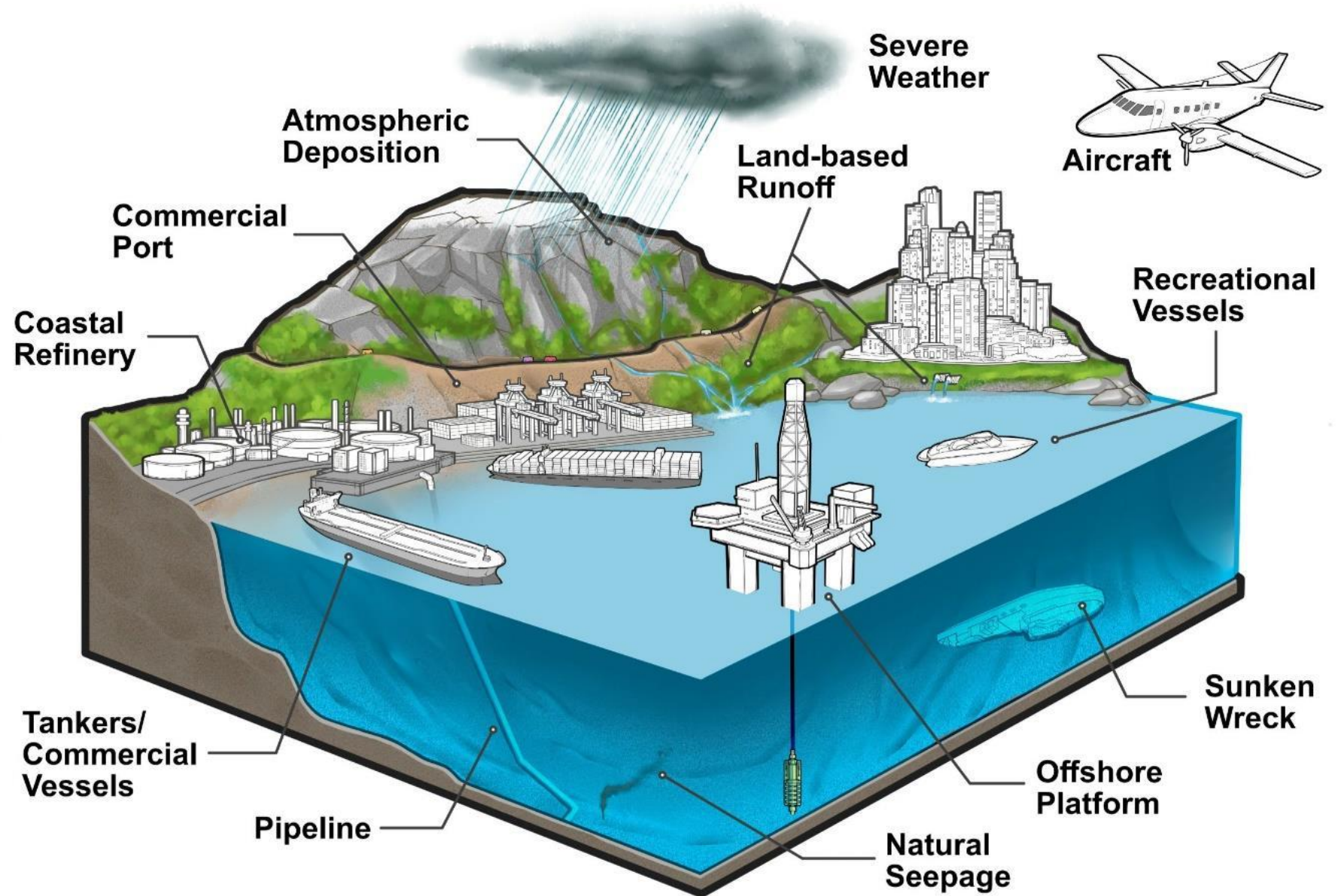


**What harm
could the oil
do?
(Chapter 6)**

Oil in the Sea IV: Inputs, Fates, and Effects

Ch. 3 Inputs

2010 – 2019



Ch. 3 Annual Inputs – Comparison between Decades

		Oil in the Sea IV (2010 – 2019) (MT/yr)	Oil in the Sea III (1990 – 1999) (MT/yr)
Natural Oil Seeps		100,000	160,000
Extraction	Including DWH	67,000	3,000
	Excluding DWH	10,000	
Transportation		800	9,200
Consumption		1,200,000	84,000
Total (Rounding to 2 significant digits)		1,400,000	260,000
Total (excluding consumption)		170,000	170,000
Total (excluding consumption, DWH)		110,000	170,000

Ch. 3 Inputs – Comparison: Transportation

	Oil in the Sea IV (MT/yr)	Oil in the Sea III (MT/yr)
Pipeline Spills	380	1,900
Tank Vessel Spills	200	5,300
Commercial Vessel Spills	8	99
Coastal Terminal & Refinery Spills	230	1,900
Atmospheric Deposition	NR	10
Total	818	9209

- 68% reduction in oil spilled from pipelines due largely to safety improvements.
- 95% decrease in volume from tankers due to increased safety measures and double hull.
- 87% reduction in spills from coastal terminals.
- The committee did not estimate atmospheric deposition inputs from transportation.

Ch. 3 Inputs – Comparison: Consumption

	Oil in the Sea IV (MT/yr)	Oil in the Sea III (MT/yr)
Land-based Runoff	1,200,000	54,000
Recreational Marine Vessels	NR	5,600
Spills (non-tank vessels)	390	1,200
Op. Discharges (Vessels > 100 GT)	9	100
Op. Discharges (Vessels < 100 GT)	0	120
Atm. Deposition	NR	21,000
Aircraft Jettison	NR	1,500
Total	1,200,399	83,520

- Land-based runoff increase reflects an increase in urban population and number of vehicles.
- No estimate of recreational marine vessels but would have decreased with a decrease in 2-stroke engines.
- 70% reduction in spills from non-tank vessels.
- Operational discharges have also decreased, however, the numbers reported assume full MARPOL compliance.

Ch. 3 Inputs – Future Challenges

- Aging offshore infrastructure risks (pipelines, platforms, sunken wrecks).
- Damage to offshore and coastal infrastructure caused by increases in extreme weather and sea-level rise.
- More challenging and remote drilling environments, such as deeper waters and Arctic conditions.
- Changes in shipping routes.
- New fuels with unknown fate and effects.
- Additional sources of oil hydrocarbons, i.e., plastics.

Ch. 4 Reduction of Inputs – Accidental Spill Mitigation



Image Credit: Oil Spill Response, Ltd.



Image Credit: NOAA



Image Credit: NOAA

Ch. 7 – Common Themes: Long-term Funding

Long-term, sustained funding to:

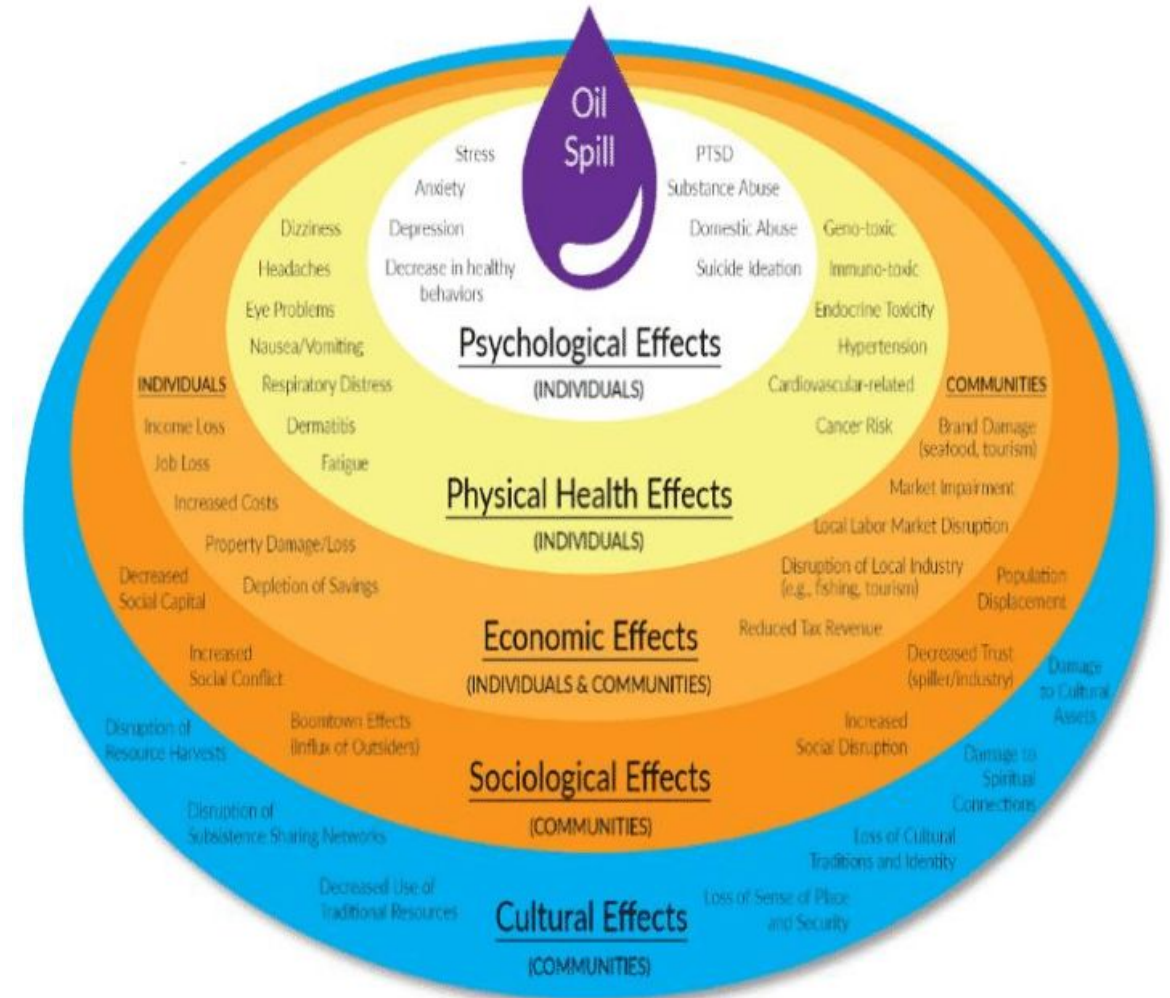
- Support multidisciplinary research,
- Improve response capabilities, and
- Apply new data and technologies to advance knowledge.



Ch. 7 – Common Themes: Human Health

A more holistic approach in the Incident Command System decision-making and response process regarding human and ecosystem health, including:

- Individual and community mental and behavioral health effects, and
- Community socioeconomic disruptions.



Ch. 7 – Common Themes: Open Water Experimentation

- Controlled in situ field trials using real oils.
- Use of spills of opportunity as appropriate.



Image Credit: NOAA

Ch. 7 – Common Themes: Oil in the Arctic

Fate and effects of oil in the Arctic marine ecosystem:

- Baseline surveys,
- Response and mitigation options,
- Remediation strategies, and
- Ecosystem effects in Arctic waters and shorelines.



Image Credit: NOAA

Ch. 7 – Common Themes: New Fuels

- Composition, toxicity, and behavior of new types of fuels, such as diluted bitumen and low sulfur fuel oils.
- Understand their fates and effects to inform effective response.



Image Credit: EPA

Key Takeaways

- Available data are inadequate for accurate quantification of most inputs.
- Estimates of land-based inputs, by far, outweigh all other sources.
- Future sources of oil in the sea may look different due to, e.g., intense weather, sea level rise, aging infrastructure, new shipping routes, and new fuels. The broad oil spill community should be prepared for these new challenges.
- Unprecedented progress has been made in understanding oil spill science in the last two decades.
- Sustained funding is needed to continue progress and adapt to changing parameters.
- Human health effects of oil includes adverse individual and community harm.
- Many research gaps remain in understanding fates and effects of oil in the sea that, if filled, could inform more effective and efficient response in a changing environment (baseline and co-stressors).

The background is a complex, abstract pattern of swirling colors, including deep blues, purples, and hints of gold or light brown, creating a marbled or liquid-like effect. A solid dark purple rectangular box is centered horizontally and vertically, containing the text.

Thank you!

Q&A

SEPTEMBER 27, 2022