Title	Oil in the Sea IV: National Academies of Sciences, Engineering, and Medicine (NASEM)
Administered by	Headquarters
BOEM Contact(s)	Brian Zelenke (brian.zelenke@boem.gov)
Procurement Type(s)	Contract
Performance Period	FY 2020–2021
Date Revised	March 6, 2019
PICOC Summary	Write one or two sentences for each of the following elements, as appropriate.
Problem	The comprehensive review and synthesis of the scientific understanding to date of the inputs of oil into the sea needs to be updated.
Intervention	The NASEM has developed a plan to update the Oil in the Sea synthesis report, to be entitled *Oil in the Sea IV*.
Comparison	The previous report, *Oil in the Sea III*, was completed in 2003 and, following the *Deepwater Horizon* disaster in 2010, the analysis needs to be updated.
Outcome	The study will publish a NASEM consensus report.
Context	The report will estimate the volume of hydrocarbon input to the marine environment worldwide from all sources, with an emphasis on North American waters.

BOEM Information Need(s): An inclusive review and synthesis of the scientific understanding to date of input of oil into the sea will give the Bureau of Ocean Energy Management (BOEM) the ability to make more comprehensive impact assessments. BOEM's National Environmental Policy Act (NEPA) analyses and compliance will be improved. The study will provide information on environmental impacts, specifically of oil into the sea—including natural seep, large, low-level, and chronic discharges—in the context of activities authorized by BOEM.

Background: In 1985 the U.S. Coast Guard requested that the Ocean Sciences Board of the National Research Council prepare a report, using data that had been acquired since 1975. Forty-six experts were invited to prepare summary reports on all aspects of petroleum hydrocarbon discharges into the marine environment and to evaluate the fates and effects of these discharges. The resulting report was entitled *Oil in the Sea: Inputs, Fates, and Effects* (1985). Subsequently, in 2003, BOEM precursor agency the Minerals Management Service approached the NASEM's Ocean Studies Board to undertake an update of the 1985 report. This effort produced the report *Oil in the Sea III: Inputs, Fates, and Effects* (2003). Since this time, the *Deepwater Horizon* disaster has spurred new research and renewed interest in the issues of this topic.

Objectives: Specifically the committee will:

- Assess and discuss the physical and chemical characteristics and behavior of these hydrocarbons, the transport and fate of various hydrocarbon mixtures in

the marine environment, and review the effects of these mixtures on marine life and ecosystems.

- Evaluate, to the degree possible, the relative risk posed to the marine environment by fossil fuel hydrocarbon components or type of input, given the range of organisms, ecosystems, or cultural resources likely to be affected (Hamdan *et al.*, 2018; Haridas *et al.*, 2018; Mugge *et al.*, 2019; Salerno *et al.*, 2018).

- Review progress in implementing the recommendations from the 2003 report regarding fates and effects and identify priority recommendations that have yet to be implemented.

- Provide recommendations to improve understanding of the fates and effects of hydrocarbon inputs from human activities and strategies for reducing the more harmful effects (National Research Council, 2005).

Methods: NASEM will empanel an expert committee. The committee will provide an update of the previous report's (*Oil in the Sea III: Inputs, Fates, and Effects*, 2003) assessment of the state of the science on the fate and effects of fossil fuel hydrocarbons in the marine environment. To the extent possible, *Oil in the Sea IV* will identify, categorize, and quantify these sources of hydrocarbons (and their chemical composition) with an emphasis on North American waters. The committee will examine worldwide data in an effort to place numbers derived for North American waters into a global context. This examination will include identifying data sources, with input from BOEM and others, and working with supporting partners (*e.g.*, the Bureau of Safety and Environmental Enforcement) to access data.

Specific Research Question(s):

1. What are the sources, composition, and quantity of hydrocarbon inputs to the marine environment? How ought anthropogenic inputs be reduced?

2. What is the relative risk posed to the marine environment by fossil fuel hydrocarbon components or type of input, given the range of organisms or ecosystems likely to be affected?

References:

Hamdan, L. J., Salerno, J. L., Reed, A., Joye, S. B., and Damour, M. (2018). *The Impact of the* Deepwater Horizon *Blowout on Historic Shipwreck-associated Sediment Microbiomes in the Northern Gulf of Mexico.* Sci. Rep. 8:9057. doi: 10.1038/s41598-018-27350-z.

Haridas D., Biffinger J. C., Boyd T. J., Fulmer P. A., Hamdan L. J., and Fitzgerald L. *Laboratory Growth of Denitrifying Water Column Microbial Consortia from Deep-Sea Shipwrecks in the Northern Gulf of Mexico. F1000Research* 2018, 6:1834 (doi: 10.12688/f1000research.12713.2)

Mugge R. L., Brock M. L., Salerno J. L., Damour M., Church R. A., Lee J. S. and Hamdan L. J. (2019) *Deep-Sea Biofilms, Historic Shipwreck Preservation and the* Deepwater Horizon *Spill*. Front. Mar. Sci. 6:48. doi: 10.3389/fmars.2019.00048

National Research Council. 1985. *Oil in the Sea: Inputs, Fates, and Effects*. Washington, D.C.: The National Academies Press. https://doi.org/10.17226/314.

National Research Council. 2005. *Oil Spill Dispersants: Efficacy and Effects*. Washington, D.C.: The National Academies Press. https://doi.org/10.17226/11283.

Salerno J. L., Little B., Lee J. and Hamdan L. J. (2018) *Exposure to Crude Oil and Chemical Dispersant May Impact Marine Microbial Biofilm Composition and Steel Corrosion*. Front. Mar. Sci. 5:196. doi: 10.3389/fmars.2018.00196.

Transportation Research Board and National Research Council. 2003. *Oil in the Sea III: Inputs, Fates, and Effects*. Washington, D.C.: The National Academies Press. https://doi.org/10.17226/10388.