



Interagency Coordinating Committee on Oil Pollution Research: FY 2022-2023 Activities

Report to Congress
December 9, 2024



U.S. Coast Guard

This page was intentionally left blank.

Message from the Chair, Interagency Coordinating Committee on Oil Pollution Research

The *Oil Pollution Act of 1990* requires the Chair of the Interagency Coordinating Committee on Oil Pollution Research to submit biennial reports on the Interagency Committee's activities. The U.S. Coast Guard chairs the Interagency Committee and first reported to Congress in 1994. This report responds to the latest Congressional requirements.

The Interagency Committee member agencies addressed gaps in oil pollution research by leveraging the collective skills and resources of their research agenda as well as those of state and local governments, industry, and academia. This approach helped reduce duplication of efforts and advanced the state of oil pollution research.

The Interagency Committee's member agencies continued their high level of activity over the past two years. Collectively, they conducted and sponsored 158 oil pollution related research projects and published 94 reports and papers. The Interagency Committee, as a coordinating body, continued to promote coordinated and collaborative research through its outreach to industry, academia, research institutions, state governments, and other nations.

Pursuant to Congressional requirements, this report is provided to the following members of Congress:

The Honorable Maria Cantwell
Chair, Senate Committee on Commerce, Science, and Transportation

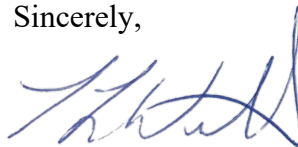
The Honorable Ted Cruz
Ranking Member, Senate Committee on Commerce, Science, and Transportation

The Honorable Sam Graves
Chairman, House Committee on Transportation and Infrastructure

The Honorable Rick Larsen
Ranking Member, House Committee on Transportation and Infrastructure

Should you require any additional assistance, please contact the Coast Guard's Senate Liaison Office at (202) 224-2913 or House Liaison Office at (202) 225-4775.

Sincerely,



Trey Wirth
Captain, U.S. Coast Guard
Chair, Interagency Coordinating Committee
on Oil Pollution Research

This page was intentionally left blank.



Interagency Coordinating Committee on Oil Pollution Research: FY 2022-2023 Activities

Table of Contents

I. Executive Summary	1
II. Legislative Requirement	3
III. Background and Legacy Obligations	4
IV. Interagency Committee Activities	6
V. Future Activities.....	17
VI. List of Acronyms	19
Appendix A: Listing of Fiscal Year 2022 and 2023 Research Projects and Papers	
Appendix B: ICCOPR 2022-2027 R&T Plan Standing Research Areas (SRAs) and Subcategories	

I. Executive Summary

Title VII of the *Oil Pollution Act of 1990* (OPA 90) (Pub. L. No. 101-380) established the Interagency Coordinating Committee on Oil Pollution Research (ICCOPR, also referred to as the “Interagency Committee”) to “coordinate a comprehensive program of oil pollution research, technology development, and demonstration among the federal agencies, in cooperation and coordination with industry, universities, research institutions, state governments, and other nations, as appropriate” and to “foster cost-effective research mechanisms, including the joint funding of research.” This report discusses Interagency Committee activities carried out in fiscal years (FY) 2022 and 2023, as well as activities proposed for FY 2024 and 2025.

The Interagency Committee advanced the state of oil pollution research through its activities and member agencies’ research agendas. The Interagency Committee identified research gaps and coordinated the collective skills and resources of the federal member agencies with those of state and local governments, industry, and academia. Over the current reporting period, this approach reduced duplicative efforts and capitalized on individual agency strengths.

In FY 2022-2023, member agencies continued to oversee many research projects related to the prevention of, preparedness for, and response to oil spills. Overall, there were 158 active member projects during the reporting period, and member agencies’ funded research generated over 95 publications.

In December 2021, the Interagency Committee released its FY 2022 - 2027 Oil Pollution Research and Technology Plan (OPRTP), which continued the research framework, originally established in the FY 2015 - 2021 OPRTP, grouped into four broad classes: Prevention, Preparedness, Response, and Injury Assessment and Restoration. The OPRTP further classified and prioritized research within the classes into 28 Standing Research Areas (SRAs), representing the most common research themes encountered for oil spills. The Interagency Committee established 171 research priorities across the 28 SRAs. In 2022 - 2023, the Interagency Committee focused their efforts on continuing to promote research and development in the four research classes. During this reporting period, member agency research addressed 54 percent (15 out of 28) of the SRAs.

The Interagency Committee encouraged member agency participation in key oil spill related workshops and conferences. Several member agencies sponsored and took leadership roles in planning and conducting major conferences including the Clean Gulf and Clean Pacific Conferences, the Offshore Technology Conference, and the Gulf of Mexico Conference (which replaced the Oil Spill and Ecosystem Science Conferences and merged the event with the triannual State of the Gulf Summit and the annual Gulf of Mexico Alliance events). There was no International Oil Spill Conference (IOSC) during FY 2022 and 2023; however, Interagency Committee members are preparing for the May 2024 IOSC. These conferences and workshops enable the Interagency Committee to stay abreast of the latest research initiatives.

The Interagency Committee’s future initiatives include the continuation of increasing joint interagency research initiatives, tracking and monitoring efforts under the OPRTP, developing a formalized public communication outreach strategy, and exploring best practices of transitioning research to operations for spill response. These initiatives were first introduced in the FY 2016 -

2017 report and the committee's member agencies have been actively incorporating these essential initiatives over the past two years. The Interagency Committee continues to monitor the changing landscape of oil pollution issues and necessary research. For example, research projects included in Appendix A focus on increased challenges in freshwater and/or ice-covered environments as well as emerging issues pertaining to alternative fuels (e.g., low-sulphur fuel oil, diluted bitumen, dielectric fluids). The Interagency Committee is also adapting research to address the potential impacts of climate change, particularly in the Arctic, and the environmental impacts associated with alternative energy development (e.g., wind farms).

II. Legislative Requirement

This report responds to language in Section 7001(e) of the *Oil Pollution Act of 1990* (Pub. L. No. 101-380):

SEC. 7001. OIL POLLUTION RESEARCH AND DEVELOPMENT PROGRAM

“(e) BIENNIAL REPORTS - The Chair of the Interagency Committee shall submit to Congress every 2 years on October 30 a report on the activities carried out under this section in the preceding 2 fiscal years, and on activities proposed to be carried out under this section in the current 2 fiscal year period.”

III. Background and Legacy Obligations

Purpose of the Interagency Committee

As prescribed by law, the purpose of the Interagency Committee is twofold: (1) to coordinate a comprehensive program of oil pollution research, technology development, and demonstration among the federal agencies; and (2) to promote cooperation with industry, universities, research institutions, state governments, and other nations through information sharing, coordinated planning, and joint funding of projects.

Membership

The 16 independent agencies, departments, and department components represented on the Interagency Committee are:

Department of Commerce (DOC), represented by:

- National Oceanic and Atmospheric Administration (NOAA)
- National Institute of Standards and Technology (NIST)

Department of Energy (DOE)

Department of the Interior (DOI), represented by:

- Bureau of Safety and Environmental Enforcement (BSEE)
- Bureau of Ocean Energy Management (BOEM)
- U.S. Fish and Wildlife Service (USFWS)
- U.S. Geological Survey (USGS)

Department of Transportation (DOT), represented by:

- Maritime Administration (MARAD)
- Pipeline and Hazardous Materials Safety Administration (PHMSA)

Department of Defense (DOD), represented by:

- U.S. Army Corps of Engineers (USACE)
- U.S. Navy (USN)

Environmental Protection Agency (EPA)

National Aeronautics and Space Administration (NASA)

Department of Homeland Security (DHS), represented by:

- U.S. Coast Guard (USCG)
- Federal Emergency Management Agency (FEMA)

U.S. Arctic Research Commission (USARC)

Guided by Section 7001(c) of OPA 90, the Interagency Committee monitors, supports, and publicizes a variety of oil pollution research and development initiatives with industry, universities, research institutions, state governments, and other entities. Several ventures were completed in the Interagency Committee's first decade, while others continue to progress through the current reporting period. Listed below are key initiatives, identified in Section 7001(c):

Oil Pollution Technology Research: The cornerstone of the Interagency Committee is the research that is funded, monitored, conducted, and coordinated by its members. Appendix A includes a list of projects overseen by member agencies, with further details on the Interagency Committee's website: <http://www.dco.uscg.mil/iccopr>.

Simulated Environmental Testing: Section 7001(c)(7) directed agencies of the Interagency Committee to ensure the long-term use and operation of the Oil and Hazardous Materials Simulated Environmental Test Tank (Ohmsett). Ohmsett, which is operated by BSEE, provides independent and objective performance testing of full-scale oil spill response equipment and marine renewable energy systems (wave energy conversion devices) along with hands-on oil response training. It is the largest outdoor saltwater wave/tow tank facility in North America and is the only facility where full-scale oil spill response equipment testing, research, and training can be conducted in a simulated marine environment using real oil under controlled environmental conditions. The Ohmsett facility, located in Leonardo, NJ, can simulate varying wave conditions (such as breaking waves), drift ice conditions, and vessel movement up to six knots with the movable bridges. For more information on Ohmsett's capabilities and current projects, see [OHMSETT – The National Oil Spill Response Research & Renewable Energy Test Facility \(bsee.gov\)](#).

IV. Interagency Committee Activities

The Interagency Committee pursued several different activities during this reporting period. These activities addressed Government Accountability Office (GAO) recommendations^{1,2} and emerging and continuing oil pollution research needs. The research activities of the member agencies, coordinated through the Interagency Committee, focused on research priorities, as identified in the OPRTP.

Organizational Changes

Leadership Changes: NOAA served as the Vice Chair during the reporting period in accordance with the changes made to ICCOPR leadership in the Elijah J. Cummings Coast Guard Authorization Act of 2020 (CGAA 2020). The CGAA 2020 removed the rotational Vice-Chairs assignments between NOAA, BSEE, and EPA and made NOAA the permanent Vice Chair. The USCG, as Interagency Committee Chair, hired a full-time Executive Director in 2023 to provide the Interagency Committee with consistent organization, coordination, and outreach.

Interagency Committee Meetings

The Interagency Committee meetings are traditionally conducted in person with remote access available. The health risks of the COVID-19 pandemic and related safety precautions affected the ability to hold in-person meetings during most of the reporting period, so the Interagency Committee held its quarterly meetings in a virtual format. The Interagency Committee formally met eight times during FY 2022 – 2023:

- December 16, 2021 – Virtual: Quarterly Meeting
 - Main Themes: Canine oil detection presentation, Gulf Research Program presentation, review of FY 2022 - 2027 Research and Technology plan and finalization.
- March 23, 2022 – Virtual: Quarterly Meeting
 - Main Themes: Overview of the Oil Spill Recovery Institute (OSRI), which supports research, education, and demonstration projects for the Arctic and sub-Arctic. The Ocean Studies Board at the National Academy of Sciences provided updates on their projects, including Oil in the Sea V, their review of the ICCOPR R&T plan, and review of the inland estimated recovery system calculator prototype.
- June 28, 2022 – Virtual: Quarterly Meeting
 - Main Themes: Natural Resource Damage Assessment (NRDA) and Restoration presentation by NOAA focused on defining NRDA and some current studies looking at effects of oil/PAHs exposure to fishes and aquatic organisms. Identified need for

¹ Government Accountability Office, Federal Oil and Gas: Interagency Needs to Better Coordinate Research on Oil Pollution Prevention and Response. GAO-11-319, March 2011.

² Government Accountability Office, Oil Dispersants: Additional Research Needed, Particularly on Subsurface and Arctic Applications. GAO-12-585, May 2012.

better understanding of the effects on the environment of different types of oil (e.g., diesel). Presentation on Marine Induced Polarization and the use of electrical currents to detect oil under ice. Plan to establish a subsurface dispersant working group to address GAO report and recommendations.

- October 13, 2022 – Virtual: Quarterly Meeting
 - Main Themes: Updates on on-going projects and documents. National Academy of Sciences, Engineering, and Medicine (NASEM) briefed on their review of the FY 2022 - 2027 R&T report. Update on status of the revised Oil in the Sea IV: Input, Fates and Effects. ICCOPR Chair provided an update on Subsurface Dispersant Injection (SSDI) Work Group (WG), which had been established and held meetings starting in August 2022.
- December 14, 2022 – Virtual: Quarterly Meeting
 - Main Themes: International initiatives from Norwegian Coastal Administration (NCA) including R&D Activities. The Norwegian Governmental Forum, inspired by ICCOPR, has been working since 2020 on coordinating research efforts. Presentation on project from six European countries to study effects of ultra-low sulphur fuel. Other studies in Norway include oil spill response viability, Emergency Preparedness and Response Analysis, oil on water trials of response equipment, and results of testing helicopters for deploying dispersants in the Arctic.
- March 16, 2023 – Virtual: Quarterly Meeting
 - Main Themes: Updates on NASEM review of FY 2022 - 2027 R&T plans. Updates from SSDI WG regarding plans to address GAO recommendations.
- May 23, 2023 – Virtual: Quarterly Meeting
 - Main Themes: Introduction of new ICCOPR Executive Director. Overview of USCG Great Lakes Oil Spill Center of Expertise (GLCOE), and presentation by Dr. Michael Bouefadel on his research of effects of dispersant injection during an underwater release.
- September 12, 2023 – Virtual: Quarterly Meeting
 - Main Themes: Presentation by Mr. Jim Pettigrew, Gulf Research Program, National Academy of Sciences, Engineering, and Medicine. Developing ICCOPR work plan for FY 2024. Updates on Biennial Report WG progress and SSDI WG progress.

During the quarterly meetings, the Interagency Committee shared information on recent research projects; identified new research issues; hosted presenters from government agencies, industry, and academia; and developed strategies for future initiatives. At each meeting, the member agencies shared their research updates, fostering new ideas and opportunities for joint agency projects or new initiatives.

The meeting with PWSRCAC provided an opportunity for Interagency Committee members to share information with this stakeholder organization and to hear their issues and perspectives on research needs. The Interagency Committee has conducted these annual information exchange meetings with PWSRCAC since FY 2013.

Publication of the 2022 - 2027 Oil Pollution Research and Technology Plan (OPRTP)

In December 2021, USCG, as the ICCOPR Chair, published the OPRTP, which details the state of oil pollution research among member agencies and partners. It can be found at: [2022 2027 ICCOPR ORTP Plan.pdf \(uscg.mil\)](#).

The OPRTP also details how research priorities were identified in each of the four key ICCOPR research areas: Prevention, Preparedness, Response, and Injury Assessment and Restoration. These were then organized into SRAs. Some SRAs include Subcategories to better refine the research need. These SRAs and Subcategories provide the framework for research from FY 2022 – 2027. The research projects and papers detailed in Appendix A align with the SRAs and SRA subcategories established in the most recent OPRTP. Appendix B provides the full list of SRAs and subcategories. For additional information on these, please see Chapter 9 of the FY 2022 – 2027 OPRTP.

Reports for the Interagency Committee

National Academy of Sciences, Engineering, and Medicine review of the FY 2022-2027 Oil Pollution Research and Technology Plan

The National Academy of Sciences, Engineering, and Medicine (NASEM) was contracted by USCG on behalf of ICCOPR to review the FY 2022 - 2027 Oil Pollution Research and Technology Plan (OPRTP, referred to below as the ICCOPR R&T Plan or simply R&T Plan) consistent with the requirements in OPA 90. The review was published in 2023 and includes five recommendations:

Recommendation 1: The ICCOPR R&T Plan development process should be improved and streamlined. A more continuous process for identification of research needs and documentation of research progress would result in a more complete, transparent, and community-driven research agenda.

Recommendation 2: Future revisions of the R&T Plan should provide sufficient and appropriate descriptions for each priority research need, including the general research that should be addressed, followed by the goals and objectives of the research. Recommended metrics, desired outcomes, and timelines for completing the research agenda should also be included.

Recommendation 3: ICCOPR should lead an effort to develop and maintain an oil pollution research dashboard. The dashboard would support an ongoing process to streamline and improve data gathering, research prioritization, and evaluation of the R&T Plan. It would also facilitate communication of the R&T Plan—in terms of both research priorities and access to federally funded research results—and implementation through coordination and collaboration with the larger oil pollution research community.

Recommendation 4: ICCOPR should initiate development of a regulatory process to enable the conduct of experimental open-water field trials. In conjunction, ICCOPR agencies should pursue opportunities for open-water field trials through national and international collaborations (with countries such as Canada and Norway, which have established a formal authorization process for

such tests). Continuous releases associated with offshore seeps (i.e., Santa Barbara, Gulf of Mexico) and well-designed “spill of opportunity” research projects could present opportunities for conducting field tests.

Recommendation 5: The R&T Plan descriptions of Classes, Standing Research Areas, and Research Needs should include metrics to measure outputs, outcomes, and impacts. Such metrics should, at a minimum, enable a performance evaluation against NDAA requirements and should tie directly to biennial reports to Congress.

ICCOPR members are reviewing the recommendations and how to integrate the review into the current planning cycle. The full report is available at:

[Review of ICCOPR's 2022-2027 Oil Pollution Research and Technology Plan | The National Academies Press](#)

2021 GAO Audit – Offshore Oil Spills, Additional Information is Needed to Better Understand the Environmental Tradeoffs of Using Chemical Dispersants. December 2021. GAO 22-104153

In 2021 the GAO published their report, “Offshore Oil Spills: Additional information is Needed to Better Understand the Environmental Tradeoffs of Using Chemical Dispersants” which included four recommendations. Two of the recommendations were directed at USCG and EPA and two of the recommendations were directed at ICCOPR. Those recommendations called on ICCOPR to establish an interagency working group (WG) to identify ways to improve the quality of information about the effectiveness of the subsurface use of dispersants and identify ways to better ensure that experiments about chemically dispersed oil toxicity and biodegradation result in quality information.

ICCOPR established a SSDI WG in 2022 that has been meeting regularly to address the recommendations in the GAO report and establish timelines. Members of the WG include EPA, BSEE, NOAA and USCG. It is anticipated that the products from this WG will be completed by 2026.

Member Research and Technology Initiatives

Member agencies conducted research activities with some constraints imposed by COVID-19 health restrictions during parts of the reporting period. By the end of FY 2023, activities generally returned to pre-COVID protocols. Access to research facilities such as (Ohmsett) and Cold Regions Research and Engineering Laboratory (CRREL) increased compared to the FY 2020 - 2021 time-period.

An analysis of the Interagency Committee member agencies’ activities, detailed in Appendix A, indicates that 158 projects and 94 papers were initiated or completed during this reporting period³. During this reporting period, member agencies conducted research in 54 percent (15 out of 28) of the SRAs identified as research priorities in the current OPRTP. In some instances, research was conducted in priority areas by other entities such as federal agencies not currently

³ Projects that have been initiated, on-going and/or completed during FY 2022 - 2023.

represented on the Interagency Committee, or by state, local, academic, and industry researchers. This analysis is to assess the federal government's research relative to the research priorities in the current OPRTP.

Highlights of a small sampling of the research projects that were conducted or initiated by agencies of the Interagency Committee are presented below. These selected projects illustrate the value of the Interagency Committee's coordinated approach to conducting research, and the cross pollination of ideas, expertise, and resources. Appendix A includes a complete list of projects conducted by the Interagency Committee members in FY 2022 - 2023⁴.

Prevention Research Class:

Easy Deployed Distributed Acoustic Sensing System for Remotely Assessing Potential and Existing Risks to Pipeline Integrity

Lead Agency: PHMSA.

The project will investigate the feasibility of using Distributed Fiber-Optic Sensing cables, specifically, their Distributed Acoustic Sensing capabilities, to detect and locate pipeline integrity risks based on vibration. Furthermore, the feasibility study will consider the effectiveness and robustness of using different cable deployment methods, especially easily deployed cables inside the pipeline. This research effort will focus on internal cables, rather than the cost prohibitive installation of externally mounted cables, which would require significant excavation.

<https://primis.phmsa.dot.gov/matrix/prjhome.rdm?prj=955>

Advanced Offshore Research

Lead agency: DOE.

The technologies and advances made by the Offshore Research Portfolio, Phase 2, seek to reduce the likelihood and prevent impacts from deleterious events associated with offshore hydrocarbon drilling and production, while optimizing and improving the economic potential of domestic offshore hydrocarbon resources.

<https://www.netl.doe.gov/project-information?p=FWP-1022409>

Preparedness Research Class:

Development of Uncrewed Aircraft Systems (UAS) Operations in Great Lakes Ice Environments

Lead agency: NOAA. Funding agency: USCG GLCOE.

This project was initiated to advance our understanding of the strengths and limitations of using multispectral and thermal sensors mounted on UAS platforms to detect and characterize oil in ice-laden waters.

Assessing baseline contaminants in the 1002 Area of the Arctic National Wildlife Refuge in Alaska

Lead Agency: USFWS. Collaborator: USGS.

Project to assess baseline contaminant levels and types in biotic and abiotic matrices in the coastal plain of the Arctic National Wildlife Refuge (NWR) prior to oil and gas exploration and

⁴ More detail on these projects, as well as publications, can be found through the Interagency Committee website: <http://www.dco.uscg.mil/iccopr>.

development activities. Results to be used for development impact assessments; addressing subsistence concerns; evaluating water quality. Work is ongoing to assess baseline levels and types of contaminants in biotic and abiotic matrices in the coastal plain (the 1002 Area) of the Arctic NWR prior to oil and gas exploration and development activities. Baseline data can be used for site-specific and area-wide assessments of development impacts; addressing subsistence concerns of Arctic NWR users; evaluating water quality degradation; and, if needed, serving in the Natural Resource Damage Assessment and Restoration (NRDAR) process.

Response Research Class:

Development and Calibration of Near-Source Air Dispersion for *In Situ* Burning

Lead Agency: BSEE. Collaborators: EPA, NOAA, USGS.

This project was a joint effort between BSEE, EPA, NOAA and USGS with support from the University of Alaska, Fairbanks for testing at the Poker Flat Research Range. Emissions data, together with meteorological data, were measured to evaluate and improve Hybrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) near-source dispersion models. The work supports Special Monitoring of Applied Response Technologies (SMART) monitoring, protecting first responders and downwind populations from potentially harmful exposures.

Behavior of Diluted Bitumen in Freshwater

Lead Agency: USCG. Collaborators: USACE.

USCG RDC led a three-experiment study to evaluate the behavior of diluted bitumen (dilbit) products in freshwater at the U.S. Army Corps of Engineers (USACE) Cold Regions Research and Engineering Laboratory (CRREL). Throughout the experiments, the project team visually assessed the oil slicks and collected samples for physical and chemical analysis. The project provided for a more complete understanding of dilbit fate and transport and added to the Federal On-Scene Coordinators' (FOSCs) knowledge base for response considerations.

Injury Assessment and Restoration Research Class:

Low Sulfur Fuel Oil Characterization

Lead Agencies: EPA and NOAA.

EPA and NOAA participated in a working group through the Arctic Council for Emergency Prevention, Preparedness and Response – Protection of the Arctic Marine Environment (EPPR-PAME). The effort characterized five low sulfur fuel oils (LSFOs) for chemical-physical properties, behavior, and toxicity. LSFOs are increasingly used as marine fuel replacements in response to International Maritime Organization requirements for lower sulfur oxide emissions during shipping. Increased transport of LSFOs in cold regions highlighted the need for understanding their properties and behavior under cold conditions.

Assessment of Chemicals Associated with Offshore Wind Facilities and Potential Environmental Impacts on the Atlantic Outer Continental Shelf (OCS)

Lead Agency: BOEM.

This study will provide updated assessments of: 1) the chemicals and quantities that could be present on offshore wind turbines and offshore substations proposed for use on

the Atlantic OCS; 2) chemical transfer, storage, and disposal methods; 3) the risk of a spill or other release (i.e., material degradation) of the identified chemicals; and 4) the transport, fate, and impacts of the identified chemicals in the event of a spill.

Member Collaboration and Ongoing Initiatives

In addition to the specific research projects, some member agencies prepared joint research strategies and initiatives and presented them to the Interagency Committee. These initiatives provide pathways for further research collaboration. They include:

BSEE/USCG Quality Partnership: Through this partnership, BSEE and USCG coordinated strategic policy and oil spill preparedness and response in the offshore environment. BSEE and USCG coordinated their research and development priorities to align their on-going and future research and development project portfolios, allowing greater synergies. BSEE included a USCG representative in the annual research project evaluation and selection process.

Arctic Domain Awareness Center (ADAC): ADAC, a Department of Homeland Security (DHS) Science and Technology Center of Excellence (COE), was established in 2014 to provide mission-focused support to USCG operations in the high latitudes. Interagency Committee member agencies were integral advisors to, and members and customers of, the research conducted by ADAC and its network of academic researchers. As of this reporting period, FY 2022 - 2023, the ADAC is an Emeritus COE. In January 2024, DHS S&T launched a new Center of Excellence for Homeland Security in the Arctic, “Arctic Domain Awareness Center – Addressing Rapid Changes through Technology, Innovation, and Collaboration (ADAC-ARCTIC). ICCOPR intends to leverage the COE to assist with closing Arctic related oil spill response and preparedness gaps.

Oil in the Sea, IV: Inputs, Fates, and Effects: BOEM and BSEE were among the agencies that sponsored the National Academies of Sciences, Engineering, Medicine (NASEM) on producing the “Oil in the Sea, IV: Inputs, Fates, and Effects” report along with other federal, industry, non-profit, and international partners. The partnership includes the American Petroleum Institute, BSEE, Department of Fisheries and Oceans (DFO) Canada, Gulf of Mexico Research Initiative (GoMRI), and NASEM’s Presidents’ Circle Fund. The 2022 final report is an update of the previous report’s (Oil in the Sea III: Inputs, Fates, and Effects, 2003) inventory of the sources, composition, and quantity of hydrocarbon inputs to the marine environment, and provides assessment of the fate and effects of fossil fuel hydrocarbons in the marine environment. For more details, please visit: [Oil in the Sea IV Inputs Fates and Effects | National Academies](#).

BSEE/NOAA Partnership: This BSEE and NOAA partnership features a multidisciplinary team of scientists from agencies such as BSEE, EPA, NOAA, USCG, NASA, the Canadian Department of Fisheries and Oceans, World Health Organization, University of New Hampshire, University of Southern Florida, as well as industry partners. Research partners collaborate on numerous projects to advance oil spill response, including surface oil and oil in the water column characterization. The research extends beyond the laboratory setting, including testing at BSEE’s Ohmsett facility, as well as open water testing.

USCG Great Lakes Oil Spill Center of Expertise: The Great Lakes region is a uniquely challenging environment for oil-spill preparedness and response. Congress mandated that the

USCG establish the GLCOE. Section 807 of the Frank LoBiondo Coast Guard Authorization Act of 2018 (Pub. L. 115-282) directs the GLCOE to conduct research and training activities relevant to oil-spill research specific to freshwater and ice-affected environments. The activities of the GLCOE fall into two primary themes:

- Serve as scientific subject-matter experts that facilitate the transition of cutting-edge scientific and technological advances from the research phase to applied practices for spill response operators.
- Serve as a repository of knowledge and fund research across organizations to close gaps and advance the scientific and engineering agenda related to the challenges unique to oil-spill response in freshwater and ice-affected environments.

The GLCOE headquarters is co-located with Lake Superior State University's Center for Freshwater Research and Education in Sault Ste. Marie, Michigan. The GLCOE also has staff co-located with NOAA's Great Lakes Environmental Research Lab in Ann Arbor, Michigan. Since its inception, the GLCOE has partnered with various partners and the Interagency Committee members. In Fiscal Year 2023, the GLCOE funded an infrastructure project to build a wave tank at Lake Superior State University to expand regional freshwater oil spill research capacity. To further diversify the GLCOE's research portfolio, a broad agency announcement for GLCOE research proposals was initiated in 2023. Proposals that address the GLCOE's legislative mandate were received from non-profit, government, industry, and academic partners. The first group of these publicly sourced projects will begin in FY 2024.

External Interagency Committee Collaborations

Coordination and cooperation with external stakeholders are critical to advancing oil pollution research in the United States. During the reporting period, the Interagency Committee pursued collaboration with numerous external oil spill related programs through direct engagement and participation in joint meetings, forums, and workgroups.

National Academy of Sciences Gulf Research Program (NAS GRP): The Interagency Committee members met with NAS GRP Advisory Board members and staff several times to help shape future NAS GRP grant opportunities, in alignment with OPRTP. These interactions satisfy the requirements of the BP and Transocean Settlement Agreements for the NAS GRP to annually seek the advice of the Interagency Committee on program direction. Interagency members also participated in several NAS workshops across the spectrum of oil spill response.

Prince William Sound Regional Citizen's Advisory Council (PWSRCAC): The Interagency Committee and the PWSRCAC continued their annual meetings begun in 2013 to share current and future research initiatives, as well as results of studies of interest conducted by the members of both organizations. The Interagency Committee and PWSRCAC met once virtually over this reporting period.

Gulf of Mexico Research Initiative (GoMRI): GoMRI and Interagency Committee members collaborated on and shared research information throughout the program's 10-year life, which ended in 2020. In 2021 GoMRI completed its Synthesis and Legacy effort, which involved several Interagency Committee member representatives. Additional papers and research products were made available during FY 2022. The results of the GoMRI program provided important information for various research community projects during the reporting period. The Synthesis

will provide valuable input to the Interagency Committee's work on the next Research and Technology Plan.

The Multi-Partner Research Initiative (MPRI) began in 2016 under Canada's Oceans Protection Plan (OPP) and was renewed in 2022. Originally led by the Department of Fisheries and Oceans, it now resides in Natural Resources Canada. The MPRI supports collaboration among leading oil spill experts to fill knowledge gaps and improve the understanding and response capabilities in coastal, marine, and freshwater environments. Activities under the initiative also aim to increase knowledge about the potential impacts of spills on organisms, develop new technologies for clean-up, and support science-based decisions that minimize damage to the environment and enhance habitat recovery. The renewed MPRI is especially focused on freshwater research and is collaborating with several Interagency Committee member agencies, including the USCG GLCOE, NOAA, USGS and EPA.

The Emergency Prevention, Preparedness, and Response (EPPR) working group is an international forum for collaboration on emergency prevention, preparedness, and response and one of six working groups of the Arctic Council. There are three expert groups, including the Marine Environmental Response Expert Group, MER EG. The EPPR was established in 1991 to enhance information sharing, cooperation, data sharing and risk analysis related to Arctic emergencies, but is not an operational response organization. EPPR works with other Arctic nations, indigenous communities, and external groups.

Member Agency Participation in Workshops and Conferences

Each year, a variety of workshops and conferences are held that address various facets of the petroleum industry and oil pollution research. The Interagency Committee members use these platforms as an opportunity to share their research findings and monitor them to stay abreast of the latest topics and issues that support on-going and future research initiatives. During the reporting period, the Interagency Committee's member organizations participated in or directly sponsored many of these workshops and conferences, including:

International Oil Spill Conference (IOSC): The IOSC is a triennial conference that attracts international and domestic attendees. Five Interagency Committee member agencies are on the permanent conference committee for IOSC: USCG, BSEE, NOAA, USEPA, and PHMSA. There was no IOSC during the reporting period however, ICCOPR members have been engaged in preparation for the May 2024 IOSC.

Gulf of Mexico Conference (GOMCON): The GOMCON combines the annual Gulf of Mexico Alliance (GOMA), the annual Gulf of Mexico Oil Spill and Ecosystem Science (GoMOSES), and the triannual State of the Gulf Summit. The conference focuses on science, policy and management in the Gulf of Mexico and ICCOPR members regularly participate to share research.

Clean Gulf/Clean Pacific/Clean Waterways Series: These regional conferences focused on improving oil and hazardous materials spill prevention, preparedness, and response for inland, offshore, and coastal incidents. ICCOPR members are engaged in planning, presenting and attending these conferences. Clean Gulf is held each November, Clean Pacific was held August 2022, Clean Waterways was held April 2022.

Offshore Technology Conference (OTC): Department of Energy representatives attended the annual OTC in Houston, TX in May 2022 and 2023. The OTC is the world's largest oil and gas sector trade show, where energy professionals meet to exchange ideas and opinions to advance scientific and technical knowledge for offshore resources and environmental matters.

No Spills Conference: No Spills is a premier environmental and emergency response annual event focused on prevention of hazardous substance releases and oil spills into the Great Lakes and its tributaries. ICCOPR member agencies attended this regional conference in February 2023.

International Association for Great Lakes Research: International Association for Great Lakes Research is a global conference that convenes researchers to share their work on Great Lakes ecology, human dimensions, modeling and remote sensing in the lakes, resource management, and more. GLCOE-funded modeling work was presented in the special session on Great Lakes Oil Spill Science: Planning and Response in a Changing Climate. ICCOPR member agencies attended this international conference in May 2023.

Website and Other Outreach

The Interagency Committee continued to provide information through its website, <http://www.dco.uscg.mil/iccopr>. The website provides data on research projects in accordance with the OPRTP.

Several member agencies published periodic newsletters that highlighted agency activities, including oil spill-related research. In addition, some member agencies have websites that detail their research and publications, including oil pollution research. Examples include the following:

BOEM

Journal: Ocean Science quarterly Journal: <https://www.boem.gov/newsroom/library/ocean-science-archive>)

Research: Environmental Studies Information website (<https://www.boem.gov/environment/environmental-studies/environmental-studies-information#tabs-7561>) that provides over 50 years of research project reports and publications addressing BOEM's most pressing offshore energy and minerals information needs, which include oil spill-related studies.

BSEE

Newsletter: Semi-annual Ohmsett Gazette
[Download the Ohmsett Gazette \(bsee.gov\)](#)

Research: [Research Records | Bureau of Safety and Environmental Enforcement \(bsee.gov\)](#)

USARC

Arctic Daily Update: [Arctic Update | US Arctic Research Commission](#)

USFWS Fish & Wildlife

News: [Fish & Wildlife News | U.S. Fish & Wildlife Service \(fws.gov\)](#)

NOAA

OR&R Weekly Reports: [OR&R Weekly Report | response.restoration.noaa.gov](#)

Incident News: [Home | IncidentNews | NOAA](#)

Research: <https://response.restoration.noaa.gov/orr-research-projects>

<https://response.restoration.noaa.gov/orr-research-projects>

USCG

Research: [RDT&E \(uscg.mil\)](#)

EPA

Research: [Oil Spill Research | US EPA](#)

V. Future Activities

The Interagency Committee will continue to promote research and development in the four research classes: Preparedness, Prevention, Response, and Injury Assessment and Restoration. The Interagency Committee and its members plan to conduct the following future actions:

Integrate the 2022 - 2027 Oil Pollution Research and Technology Plan (OPRTP): The Interagency Committee will continue to use its Oil Pollution Research Categorization Framework as a tool to track and measure research progress within the government, academia, and industry. The Interagency Committee 2022 - 2027 OPRTP was published in December 2021. In 2023, the NASEM completed their review. The Interagency Committee plans to continue to release revised versions of the OPRTP every six years to reflect timely conditions and needs and will review and integrate the NASEM review into the process.

Collaborate with the National Academy of Sciences (NAS) Gulf Research Program (GRP): The Interagency Committee will continue to work closely with NAS as it executes the 30-year NAS GRP that is “focused on human health and environmental protection, including issues relating to offshore oil and hydrocarbon production and transportation in the Gulf of Mexico and on the United States’ outer continental shelf.”

Continue Outreach (engagement) to Non-Federal Stakeholders: The Interagency Committee will continue to engage non-federal stakeholders to gain insights into additional research needs, share research results and ideas, and promote advancements in the state of oil pollution research and technology. The upcoming years will include an increased focus on coordination with industry and academic research programs.

Address Emerging Issues and Challenges: The Interagency Committee will continue to monitor technological advancements for oil spill prevention and response, as well as the conditions that increase the risk of oil spills, including climate change. The Interagency Committee has begun research on, and will continue to monitor the prevalence of, non-traditional oils (e.g., dielectric fuels, Sulphur fuels). The Interagency Committee is also adapting research to address the impacts of climate change, particularly in the Arctic, as well as the risks associated with alternative energy methods (e.g., wind farms and associated pollution risks).

Evaluate the Committee Membership: The Interagency Committee will continue its standing practice of evaluating other federal agencies for membership, as recommended by the 2019 GAO Audit (GAO 19-31). This practice led to the addition of the U.S. Geological Survey (USGS) as a member.

Coordinate with the Trustee Councils: The Interagency Committee will continue to work with ICCOPR trustee agencies, NOAA and DOI, to identify opportunities to engage with NRDA trustee councils, as recommended by the 2019 GAO Audit (GAO 19-13). For example, NRDA trustee agencies participated in the review and development of ICCOPR’s Oil Pollution Research and Technology Plan for FY 2022 – 2027.

Encourage Transition of Research to Operations: The Interagency Committee will examine the best practices of member agencies skilled at transitioning research to operations and will seek to accelerate this transition for promising Interagency Committee priority research areas.

VI. List of Acronyms

ADAC	Arctic Domain Awareness Center
AUV	Autonomous Underwater Vehicle
BOEM	Bureau of Ocean Energy Management
BSEE	Bureau of Safety and Environmental Enforcement
CRRC	Coastal Response Research Center
CRREL	Cold Regions Research and Engineering Laboratory
DFO	Department of Fisheries and Oceans Canada
DHS	U.S. Department of Homeland Security
DOC	U.S. Department of Commerce
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOI	U.S. Department of the Interior
DOT	U.S. Department of Transportation
EPA	U.S. Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FY	Fiscal Year
GAO	U.S. Government Accountability Office
GLCOE	Great Lakes Oil Spill Center of Excellence
GNOME	General NOAA Operational Modeling Environment
GOM	Gulf of Mexico
GoMOSES	Gulf of Mexico Oil Spill and Ecosystem Science
GoMRI	Gulf of Mexico Research Initiative
IOSC	International Oil Spill Conference
ISB	<i>In-situ</i> burning
NAS	National Academy of Sciences
NAS GRP	National Academy of Sciences Gulf Research Program
NASA	National Aeronautics and Space Administration
NASEM	National Academy of Science, Engineering, and Medicine
NOAA	National Oceanic and Atmospheric Administration
NRDA	Natural Resource Damage Assessment
NRT	National Response Team
OCS	Outer Continental Shelf
Ohmsett	Oil and Hazardous Materials Simulated Environmental Test Tank
OPA 90	Oil Pollution Act of 1990 (Public Law 101-380)
OPRTP	Oil Pollution Research and Technology Plan
OTC	Offshore Technology Conference
PHMSA	Pipeline and Hazardous Materials Safety Administration
PWSRCAC	Prince William Sound Regional Citizen's Advisory Council

R&D	Research and Development
S&T	Science and Technology
SRA	Standing Research Area
UAS	Unmanned/Uncrewed Aircraft Systems
USACE	U.S. Army Corps of Engineers
USARC	U.S. Arctic Research Commission
USCG	U.S. Coast Guard
USCG RDC	U.S. Coast Guard Research and Development Center
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

This page was intentionally left blank.

Appendix A: Listing of Fiscal Year 2022 and 2023 Research Projects and Papers

I. PREVENTION

A. Human Error (10000) – Research Projects

1. Oil-Spill Occurrence Estimators: Storm and Vessel Traffic Adjustment Factor Analyses

Lead Agency: BOEM. Collaborator: BSEE.

This study evaluated causal factors of actual and potential oil spills in the Gulf of Mexico, Pacific, and Arctic Outer Continental Shelf, extrapolating Gulf of Mexico and Pacific historical oil spill rates to the Arctic.

https://espis.boem.gov/Final%20Reports/BOEM_2022-013.pdf

2. Alternative Oil Spill Occurrence Estimators for Determining Rates for the Atlantic Outer Continental Shelf

Lead Agency: BOEM.

This study will examine the Bureau of Ocean Energy Management's (BOEM's) Atlantic OCS planning areas to predict and validate the most applicable methodologies for determining oil spill occurrence rates.

https://espis.boem.gov/final%20reports/BOEM_2021-065.pdf

B. Offshore Facilities and Systems (10100) – No Research Papers or Projects

C. Onshore Facilities and Systems (10200) – Research Projects

1. Arctic Facilities and Infrastructure Environmental Change Risk Index

Lead Agency: DHS. Collaborator: USCG.

Project was designed to better inform the USCG on the impact of climate change to infrastructure in the Arctic. It focused on bulk oil, fuel containers, pipelines, piers, docks, and platforms in permafrost coastal and riverine landscapes of the Bering, Chukchi and Beaufort Seas.

<https://arcticdomainawarenesscenter.org/>

2. Remote Unmanned Aircraft System (UAS) Inspection and Response Team Development in the Bering Strait Region

Lead Agency: DHS. Collaborator: USCG.

The project utilized UAS systems to pioneer a new method for infrastructure inspections. The project trained community members in Unalakleet, AK to perform inspection operations and co-produced infrastructure inspection protocols and emergency response flight protocols.

<https://arcticdomainawarenesscenter.org/>

D. Waterways (10300) – No Research Papers or Projects

E. Vessel Design (10400) – No Research Papers or Projects

F. Drilling (10500) – Research Papers

1. Geohazards and Subsurface Uncertainty Smart Modeling with the Subsurface Trend Analysis Tool (2022, DOE)
https://netl.doe.gov/sites/default/files/netl-file/22RS-27_Mark-Moser_A.pdf
2. Infrastructure and Metocean Technology: The Ocean & Geohazard Analysis (2022, DOE)
https://netl.doe.gov/sites/default/files/netl-file/22RS-27_Mark-Moser_B.pdf
3. Smart Infrastructure Integrity Models to Support Remediation and Inform Safe Use Strategies (2022, DOE)
https://netl.doe.gov/sites/default/files/netl-file/22RS-27_Romeo.pdf
4. Relative Permeability for Offshore HPHT (2022, DOE)
https://netl.doe.gov/sites/default/files/netl-file/22RS-27_Crandall.pdf
5. Thermodynamic Modeling of Mineral Scale at High Temperatures and High Pressures (2022, DOE)
https://netl.doe.gov/sites/default/files/netl-file/22RS-27_Gamwo.pdf
6. Kick Signatures through Advanced Multi-Phase Data (2022, DOE)
https://netl.doe.gov/sites/default/files/netl-file/22RS-27_Carney.pdf
7. Prediction of Barium Sulfate Deposition in Petroleum and Hydrothermal Systems (2022, DOE)
<https://edx.netl.doe.gov/offshore/prediction-of-barium-sulfate-deposition-in-petroleum-and-hydrothermal-systems/>
8. In-Situ Applied Coatings for Mitigating Gas Hydrate Deposition in Deepwater Operations (2023, DOE)
<https://netl.doe.gov/project-information?p=FE0031578>
9. Key Technology Qualification of a Full Scale Subsea Chemical Storage and Injection System (2022, DOE)
<https://onepetro.org/OTCONF/proceedings-abstract/22OTC/4-2OTC/D041S054R004/484507>
10. Final Scientific/Technical Report: In-situ applied coatings for mitigating gas hydrate deposition in deepwater operations (2023, DOE)
<https://www.osti.gov/biblio/1986259>

G. Drilling (10500) – Research Projects

1. Hexagonal Boron Nitrate Reinforced Multifunctional Well Cement for Extreme Conditions

Lead agency: DOE.

This project provides a system approach for developing the next generation of well cementing with multifunctional, high-performance characteristics— including mechanical, thermal, rheological, and durability properties—to prevent offshore spill and leakage at extreme high temperature, high pressure, and corrosive conditions. A proof-of-concept hexagonal boron-nitride/cement composite will be developed and tuned to offer optimum slurry formulation and rheological properties, and the best hybrid nanostructure. The actual barrier efficiency and performance of this cement formulation will be tested against gas/liquid leakage inside a simulated environment. The well cement product is cost-effective, has no toxicity, and easily integrates to existing equipment and facilities.

<https://netl.doe.gov/project-information?p=FE0031574>

2. In-Situ Applied Coatings for Mitigating Gas Hydrate Deposition in Deepwater Operations

Lead agency: DOE.

The overall objectives of this research effort are to design, test, and validate robust pipeline coatings for commercial utilization that mitigate hydrate deposition in subsea pipelines. A novel coating developed during a previous DOE sponsored collaboration between CSM-Center for Hydrate Research (CHR) and Oceanit showed promise for hydrate deposition prevention in small-scale apparatuses. The technology and methods to be used in this research will advance and scale-up this concept with second generation hydrate-phobic coatings in larger multiphase flowing systems. The project will include the multiphase transient simulation and design of a full-scale field trial. The research will also evaluate the long-term survivability of the coating under high pressure, variable temperature, chemical exposure, and abrasive conditions.

<https://netl.doe.gov/project-information?p=FE0031578>

3. Project Ultra: Underwater Laser Telecommunications and Remote Access

Lead agency: DOE.

The objective of this project is to address bandwidth and parallelism deficiencies in currently available undersea wireless optical communications technologies. These goals will be achieved using tight beam focused free space optical networks of 450nm light amplification by stimulated emission of radiation (LASER) nodes distributed along the sea floor, allowing for a highly scalable network backbone connecting a wide array of residency sensors as well as command and control devices.

<https://www.netl.doe.gov/project-information?p=FE0031857>

4. Advanced Multi-Dimensional Capacitance Sensors Based Multiphase Mass Flow Meter to Measure and Monitor Offshore Enhanced Oil Recovery Systems

Lead agency: DOE.

This innovation is based on advanced multi-dimensional extensions of Electrical Capacitance Volume Tomography (ECVT) sensors that involve ECVT, Displacement Current Phase Tomography (DCPT), Maxwell-Wagner-Sillars polarization effect (MWS), and velocimetry which exploit the variation of electric properties between the oil, water, and gas coming out of the well. Capacitance sensors are embedded on the inside of a pipe spool and placed in line with the subsea oil line piping on the extraction end of the well. The difference in dielectric, dielectric loss, surface polarization, and velocity of each phase are used in the multi-dimensional algorithm to measure the volume fraction, distribution, velocity, mass flow rate, and flow regime of the mixture moving through the pipe.

<https://www.netl.doe.gov/project-information?p=FE0031858>

5. Enhancing Offshore Recovery by Enabling Longer, Safer, and Cheaper Subsea Well Tiebacks

Lead agency: DOE.

The objective of this project is to engineer, build, permit and deploy a deepwater chemical container for storage of exploration and production liquids in the offshore environment. This shuttle is intended be a safe, effective, low-cost solution to assist with the monetization of economically stranded resources via subsea wells tied back to existing host facilities. This two-phase project will construct and qualify a full-scale (200 BBL) prototype subsea chemical storage and injection system for production chemicals, enabling longer tiebacks and significantly lowering costs on shorter distances.

<https://www.netl.doe.gov/project-information?p=FE0031859>

6. Advanced Offshore Research

Lead agency: DOE.

The technologies and advances made by the Offshore Research Portfolio, Phase 2, seek to reduce the likelihood and prevent impacts from deleterious events associated with offshore hydrocarbon drilling and production, while optimizing and improving the economic potential of domestic offshore hydrocarbon resources.

<https://www.netl.doe.gov/project-information?p=FWP-1022409>

7. Corrosion Resistant Aluminum Components for Improved Cost and Performance of Ultra-Deepwater Offshore Oil Production

Lead Agency: DOE.

The objective of this project is to develop critical technologies that will support the industry's development of aluminum risers for ultra-deepwater drilling. The primary technical objective to support this project is the development of high strength, corrosion resistant weldments that connect 7XXX series aluminum riser flanges and pipes. A secondary technical objective with this project is the development of technologies that will mitigate the corrosion of 7XXX series alloys.

<https://www.netl.doe.gov/project-information?p=FWP-072971>

H. Rail and Truck Transportation (10600) – No Research Papers or Projects

I. Pipeline Systems (10700) – Research Projects

1. Monitoring the Long-Term Compatibility of VCI and CP Associated Components

Lead Agency: PHMSA.

The project will research and identify technologies that can detect and quantify the interaction between Vapor Corrosion Inhibitors (VCI)- and Cathodic Protection (CP)-associated components. Additionally, the project will provide an in-depth understanding of the VCI technology's operating parameters—including delivery methods, coverage, dosages, monitoring, reinjection, and interaction with CP and associated components such as anodes.

<https://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=994>

2. Developing Corrosion Control Monitoring Technology for Hazardous Liquid Breakout Tanks

Lead Agency: PHMSA.

The project will research and identify validated technologies for monitoring corrosion conditions under breakout tanks. Additionally, the project will develop successful monitoring programs and processes that can be quickly implemented by tank operators.

<https://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=993>

3. Forced Resonance Imaging for 3-D Mapping of Buried Gas Pipes

Lead Agency: PHMSA.

The project will field-test and fine-tune the technology and develop the software used to detect buried plastic gas pipelines, collect three-dimensional (3-D) location information with increased accuracy, and provide additional information on pipe diameter by 3-D mapping or volumetric image reconstructions.

<https://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=915>

4. Fiber Optic Sensors for Direct Pipeline Monitoring Under Geohazard Conditions

Lead Agency: PHMSA.

This Phase 1 Small Business Innovative Research project will demonstrate that distributed fiber optic sensing is a viable and cost-effective means to monitor ground movement threats to transmission pipelines.

<https://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=889>

5. Managing Geohazards Quantitative Risk Assessment for Pipelines

Lead Agency: PHMSA.

This Phase 1 Small Business Innovative Research project will address risk from both isolated and cascading hazards (e.g., earthquake followed by landslide), support economic analysis of proposed mitigation to reduce risk at both the asset management level and project level, and outline the requirements for a data collection tool to close the gap on pipeline asset inventory and natural hazards.

<https://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=888>

6. Probabilistic Performance Evaluation of Cathodically Protected Pipeline Considering Alternating Current Corrosion

Lead Agency: PHMSA.

The project will probabilistically evaluate the performance of cathodically protected pipelines under Alternating Current-induced corrosion.

<https://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=900>

7. Distributed Strain Sensing for Pipeline Safety Against Fault Moving and Landslide.

Lead Agency: PHMSA.

The project will develop a robust distributed fiber optic strain sensing system for long-term monitoring structural performance of pipeline subjected ground movements at fault crossing and landslide sites.

<https://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=899>

8. Technical Services for Pipeline Safety Research Projects at Transportation Technology Center

Lead Agency: PHMSA.

The project will involve technical research services for various pipeline safety research projects that include applications involving railroads. The Research will occur at the Federal Railroad Administration's Transportation Technology Center located in Pueblo, Colorado and currently has three tasks: Task 1, Fatigue Testing on Pipe Transported by Rail (Pipe by Rail); Task 2, Technical Testing of Pipe Subjected to Railroad Loading (Pipe Under Rail); and Task 3, Project Management.

<https://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=885>

9. Feasibility of Using Alternative-Steel and Composite Material in Gas and Hazardous Liquid Pipeline Systems

Lead Agency: PHMSA.

The project will establish design qualifications, requirements, inspection procedures, and a roadmap for using alternative steel and non-steel composite systems. As part of the scope, the project will review PHMSA's requirements under 49 CFR Parts 192 and 195 and the special permits issued under 49 CFR Part 190.341. This regulatory and special permit review will assist PHMSA and the industry's ability to develop engineering-based integrity inspection requirements that mitigate risk and support safe operations.

<https://primis.phmsa.dot.gov/matrix/prjhome.rdm?prj=951>

10. Development and Validation of a Probabilistic Method for Estimating Accumulated Strain and Assessing Strain Demand and Capacity on Existing Pipelines

Lead Agency: PHMSA.

The project will develop an estimate of the reserve strain capacity of a steel pipeline and a set of recommended interventions for mitigating situations where it is determined that

there is insufficient strain reserve, lack of data, and/or inconsistency in the modeling process. The models will combine historic and new data with interacting threat models that address knowledge gaps in estimating compressive buckling and tensile overload risks that will be prioritized for intervention.

<https://primis.phmsa.dot.gov/matrix/prjhome.rdm?prj=944>

11. Pipeline Risk Management Using Artificial Intelligence-Enabled Modeling and Decision Making

Lead Agency: PHMSA.

The project will develop Artificial Intelligence (AI)-enabled tools to improve accuracy of probabilistic performance modeling. Furthermore, the tools will support decision-making of inspection and repair actions in pipeline risk management. The researcher will develop the AI tools by identifying connections between pipeline safety datasets through machine learning approaches.

<https://primis.phmsa.dot.gov/matrix/prjhome.rdm?prj=954>

12. Easy Deployed Distributed Acoustic Sensing System for Remotely Assessing Potential and Existing Risks to Pipeline Integrity

Lead Agency: PHMSA.

The project will investigate the feasibility of using Distributed Fiber-Optic Sensing cables, specifically, their Distributed Acoustic Sensing capabilities, to detect and locate pipeline integrity risks based on vibration. Furthermore, the feasibility study will consider the effectiveness and robustness of using different cable deployment methods, especially easily deployed cables inside the pipeline. This research effort will focus on internal cables, rather than the cost prohibitive installation of externally mounted cables, which would require significant excavation.

<https://primis.phmsa.dot.gov/matrix/prjhome.rdm?prj=955>

13. Ensuring Oil and Gas Pipeline Safety Following a Geomagnetic Disturbance Event

Lead Agency: PHMSA.

This Interagency Agreement with the Department of Energy will evaluate the ability of oil and gas pipelines and associated infrastructure to maintain a safe state and, if needed, to safely shut down following a Geomagnetic Disturbance event.

<https://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=927>

14. Fiber Optic Sensors for Direct Pipeline Monitoring Under Geohazard Conditions

Lead Agency: PHMSA.

This Phase 2 Small Business Innovative Research project will expand upon the Phase 1 project and conduct field demonstrate to validate distributed fiber optic sensing can perform under real conditions and collect the necessary data to monitor ground movement threats to transmission pipelines.

<https://primis.phmsa.dot.gov/matrix/prjhome.rdm?prj=889>

15. River Scour Monitoring System for Pipeline Threat Prevention

Lead Agency: PHMSA.

The project will develop a river scour monitoring system capable of determining the degree of scour in a river bed thereby alerting pipeline operators should the amount of cover of the pipeline become reduced.

<https://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=740>

16. Optimized Radar to Find Every Utility in the Street (ORFEUS) Obstacle Detection for Horizontal Directional Drilling (HDD)

Lead Agency: PHMSA.

The project will produce a field proven, market ready, obstacle location technology for use in HDD applications. ORFEUS is an effort aimed at developing a safe, cost effective “look-ahead” obstacle detection system for HDD equipment.

<https://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=736>

17. Modernize the Assessment of River Crossings

Lead Agency: PHMSA.

This project intends to supplement guidance from American Petroleum Institute, Recommended Practice 1133 “Guidance for Onshore Hydrocarbon Pipelines Affecting High Consequence Floodplains,” and to expand and improve the capabilities of existing tools available to assess and monitor pipeline river crossings.

<https://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=746>

18. Fiber-Optic Excavation Monitoring Sensor (FOCOS) System

Lead Agency: PHMSA.

This Small Business Innovative Research Phase I project will develop a new Fiber-Optic Excavation Monitoring Sensor (FOCOS) system, based on phase-sensitive optical time-domain reflectometry (ϕ -OTDR), machine learning (ML) algorithms, and Internet of Things (IoT) communication. Specifically, the innovative implementation of ϕ -OTDR in fiber-optics for excavation detection together with ML algorithms, based on convolution neural network (CNN) for data interpolation, provides vibration detection with high spatial resolution, long sensing distance, threat localization/classification, low false alarms, and strong EMI immunity.

<https://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=974>

19. Performance Evaluation and Risk Assessment of Excessive Cathodic Protection on Vintage Pipeline Coatings

Lead Agency: PHMSA.

The project will develop a model for use by operators to investigate coating disbondment from vintage pipelines under cathodic protection (CP). The researcher will use the experimental testing, numerical analysis, and the resulting coating performance data to develop a probabilistic degradation model that operators can use to determine pipeline sections in need of coating remediation and recoating times.

<https://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=977>

20. Dynamic Geohazard Risk and Decision Support Platform

Lead Agency: PHMSA.

The project will develop a web-based, GIS-enabled recommendation tool for identifying and assessing the impact of geohazards in cast iron and non-cast iron oil and gas pipelines. The tool will: follow industry standards and best practices; incorporate satellite-based radar geohazard detection and monitoring technology; and be cloud-based to enable efficient scaling to pipeline systems of any size.

<https://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=986>

21. Developing Corrosion Control Monitoring Technology for Hazardous Liquid Breakout Tanks

Lead Agency: PHMSA.

The project will research and identify validated technologies for monitoring corrosion conditions under breakout tanks. Additionally, the project will develop successful monitoring programs and processes that can be quickly implemented by tank operators. Monitoring under-tank corrosion conditions will provide tank operators the following critical assessments: whether the active corrosion control methods are adequate; corrosivity trending of the tank pad material over time; and whether the need exists to implement additional corrosion control measures such as Vapor Corrosion Inhibitors (VCIs).

<https://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=993>

22. Monitoring the Long-Term Compatibility of VCI and CP Associated Components

Lead Agency: PHMSA.

The project will research and identify technologies that can detect and quantify the interaction between Vapor Corrosion Inhibitors (VCI)- and Cathodic Protection (CP)-associated components. Additionally, the project will provide an in-depth understanding of the VCI technology's operating parameters—including delivery methods, coverage, dosages, monitoring, reinjection, and interaction with CP and associated components such as anodes.

<https://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=994>

23. Vibration Sensing System to Monitor for Potential Excavation Damage

Lead Agency: PHMSA.

This Small Business Innovation Research Phase II project will continue development of a new Fiber-Optic Excavation Monitoring Sensor (FOCOS) system, based on phase-sensitive optical time-domain reflectometry (ϕ -OTDR), machine learning (ML) algorithms, and Internet of Things (IoT) communication. Specifically, the innovative implementation of ϕ -OTDR in fiber-optics for excavation detection together with ML algorithms, based on convolution neural network (CNN) for data interpolation, provides

vibration detection with high spatial resolution, long sensing distance, threat localization/classification, low false alarms, and strong EMI immunity.

<https://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=1001>

24. An Integrated Knowledge Graph Model for Geohazard Monitoring Data

Lead Agency: PHMSA.

The project objectives are: 1) Leveraging the power of knowledge graphs and web and cloud technologies to develop a comprehensive knowledge graph framework that offers seamless access to multiple geohazard monitoring data repositories and provides efficient search, processing, visualization and analytical capabilities to end users; 2) extracting meaningful insights and relationships from the integrated datasets by leveraging the semantic capabilities of knowledge graphs to reduce the risks and uncertainties related to geohazards management in natural gas and hazardous materials pipelines; and 3) empowering stakeholders to make informed decisions regarding hazard assessment, early warning systems, and disaster response planning by providing a unified view of the data and developing methodologies to capture the essential decision-related information.

<https://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=1011>

25. Innovative Leak Detection Methods for Gas and Liquid Pipelines

Lead Agency: PHMSA.

The project will develop the following: Improved algorithms to better estimate pipeline inventories short of full pipeline transient modeling applications. A new algorithm for enhanced zone balancing calculations. Recommended practices to troubleshoot facilities with high error probabilities. Pattern identification methods that identify how corrected zone balances shift based on changes in system flow. These methods, in turn, will be used to identify issues that are most likely attributing to measurement flow error sowing.

<https://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=995>

26. Development of a Framework for Assessing Cathodic Protection (CP) Effectiveness in Pipelines Based on Artificial Intelligence (AI)

Lead Agency: PHMSA.

The main objective is to provide a framework to identify, characterize, and assess CP systems on remote and difficult-to-access buried pipelines.

<https://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=1023>

27. Effectiveness Assessment of Pipeline Cathodic Protection (CP) Systems Using Remote Sensing, Advanced Modeling, and Data Analytics

Lead Agency: PHMSA.

The main objective is to develop an innovative method for assessing the effectiveness and protection level of CP systems through the integration of remote inspection, advanced simulation, and data analytics.

<https://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=1018>

28. Improve Pipeline Leak Rate Estimation

Lead Agency: PHMSA.

The project will improve existing leak rate estimation models that can estimate the expected leak rates for pipelines with through wall cracks of various types and sizes. The model will support evaluating the consequence of a through wall crack, operational responses when incidents occur, and remedial action strategies and timelines.

Additionally, the technology will serve as a linkage between inspection capability and leak detection technology specifications.

<https://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=919>

29. Hydrostatic Retesting Optimization for Older Liquid Pipelines

Lead Agency: PHMSA.

The project will determine the minimum number of pressure cycles after a hydrotest liquid pipelines so that any surviving surface cracks will not rupture. The project will develop an approach to optimize hydrotest pressure of lower operating pressure (liquid) pipelines to avoid unnecessary repairs when using hydrotest guidelines for gas lines, to define a rupture-free fatigue life for liquid lines that experience pressure cycling.

<https://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=924>

J. Geohazards (10800) – No Research Papers or Projects

K. Subsea Systems Automation and Reliability (10900) – No Research Papers or Projects

II. PREPAREDNESS

A. Pre-Spill Baseline Studies (20000) – Research Projects

1. Aquatic Toxicity Assessment for No. 2 diesel fuel in freshwater systems.

Lead agency: USGS

Due to the uncertainties in the water accommodated fraction (WAF) that are used to estimate toxicity and the potential for diesel to affect aquatic organisms (e.g., reduced growth, reduced survival) in small to medium sized streams, we are proposing to determine the toxicity of a commonly spilled product, No. 2 diesel. The results of this study will be used in a weight-of-evidence approach outlined by the U.S. EPA (USEPA 2016) to develop toxicity thresholds that can be used at future NRDAR cases to estimate injury to the aquatic biota from a diesel spill.

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

Lead Agency: BOEM. Funded by: BSEE.

This study provides an update of the Oil in the Sea III: Inputs, Fates, and Effects (2003) inventory of the sources, composition, and quantity of hydrocarbon inputs as well as an assessment of the state of the science on the fate and effects of fossil fuel hydrocarbons in the marine environment.

<https://nap.nationalacademies.org/catalog/26410/oil-in-the-sea-iv-inputs-fates-and-effects>

3. High Resolution Modeling of the Gulf of Mexico
Lead Agency: BOEM.
This study will provide BOEM with 20 years of hindcast of high-resolution oceanographic data for use in Oil Spill Risk Analysis (OSRA) applications.
<https://www.boem.gov/sites/default/files/documents/BOEM-ESP-NT-20-05.pdf>
4. Biological effects of Cook Inlet crude oil degradation products and suspect screening of oxidized polycyclic aromatic hydrocarbons (PAHs).
Lead Agency: BOEM.
The study will compare photo oxidized samples to control samples. Receptor based in-cell bioassays will be used to detect and quantify the presence of cytotoxic compounds in parallel with a contemporary mass spectrometry method to detect and screen for the specific oxidized PAHs that may correlate with bioassay response.
https://www.boem.gov/sites/default/files/documents/regions/alaska-ocs-region/FE_AK-19-02-16_3.pdf
5. Investigating the Impacts of Oil Exposure and Changing Snow Cover on Sea Ice Diatom Communities in the Alaskan Arctic.
Lead Agency: BOEM.
This study will investigate how oil spills may alter primary production in the changing Arctic by developing new genetic markers for sea-ice algae, using the diatom *Nitzschia frigidula* as a model species.
https://www.boem.gov/sites/default/files/documents/regions/alaska-ocs-region/environment/BOEM_2022-062.pdf
6. Synthesis of Contaminants Data for Cook Inlet: Evaluation of Existing Data as “Baseline Conditions” and Recommendations for Further Monitoring
Lead Agency: BOEM.
This study will compile existing information about a suite of contaminants to provide the foundation upon which to better evaluate any potential impacts to water and sediment quality from Federal OCS oil and gas related activities in Cook Inlet.
https://www.boem.gov/sites/default/files/documents/FE_AK-21-02_5.pdf
7. Improvements to the Oil Spill Risk Analysis (OSRA) Input Quality Assurance/Quality Control (QA/QC) and Validation.
Lead Agency: BOEM.
This study will produce a set of standardized processes and tools to facilitate verification and validation of General Circulation Model GCM results and formatting those model results for input to OSRA.
https://www.boem.gov/sites/default/files/documents/FE_AK-20-05_7.pdf
8. Cook Inlet Physical Oceanography: Synthesis and Modeling
Lead Agency: BOEM.

This project will collate physical oceanographic data since 2000 in Cook Inlet and Shelikof Strait. Researchers will synthesize the data into a regional framework and identify information needs for sampling and improved modeling approaches to support future oceanographic modeling efforts.

<https://www.boem.gov/sites/default/files/documents/environment/environmental-studies/AK-22-04.pdf>

9. Assessment of Chemicals Associated with Offshore Wind Facilities and Potential Environmental Impacts on the Atlantic Outer Continental Shelf (OCS)

Lead Agency: BOEM.

This study will assess the applicability of the 2013 BOEM study to proposed offshore wind projects currently under review by BOEM and, where necessary, provide updated assessments of 1) the chemicals and quantities that could be present on different types of offshore wind turbines and offshore substations proposed for use on the Atlantic OCS; 2) chemical transfer, storage, and disposal methods; 3) the risk of a spill or other release (i.e. material degradation) of the identified chemicals; and 4) the transport, fate, and impacts of the identified chemicals in the event of a spill.

10. Compendium on Oil Spill Science

Lead Agency: BOEM.

Compile literature on the known impacts from oil spills in a range of sizes and ecosystems and identify what information is unknown about oil spills and oil spill response impacts.

<https://www.boem.gov/sites/default/files/documents//BOEM-ESP-NT-19-02.pdf>

11. Hydrocarbon Seeps in the Lower Cook Inlet, Gulf of Alaska, Chukchi Sea and Beaufort Sea OCS Planning Areas

Lead Agency: BOEM.

Researchers will identify and map any available information about the locations, volumes, and chemical and weathering characteristics of hydrocarbon seeps on the Alaska OCS, as well as information regarding hydrocarbon-consuming organisms in the area.

https://espis.boem.gov/Final%20Reports/BOEM_2022-057.pdf

12. Pipeline Gas Release Frequency, Scenarios, and Impacts

Lead Agency: BOEM.

This study will collate and synthesize existing technical information on U.S. onshore, offshore, and offshore OCS pipeline gas releases and their impacts to the environment.

This study will also model pipeline gas release scenarios relevant to the Alaska OCS using readily available software models or mathematical algorithms.

https://www.boem.gov/sites/default/files/documents//FE_AK-23-03.pdf

13. Marsh Resilience Study (Post Oil Spill Clean-Up)

Lead Agency: NOAA.

This is a remote sensing study using the abundant aerial photography available for the study area in the time period of interest, with the objective of comparing landscape-scale marsh resilience metrics between heavily oiled sites with and without marsh cleanup.

14. Environmental Resource Areas: Developing Products to Support Oil-Spill Risk Analysis (OSRA) and National Environmental Policy Act (NEPA)

Lead Agency: BOEM.

This study will update the North Pacific Pelagic Seabird Database (NPPSD) by consolidating approximately 200,000 km of new survey information conducted in the Gulf of Alaska, Aleutian Islands, and the Bering, Chukchi and Beaufort seas since the last NPPSD update in 2012.

https://www.boem.gov/sites/default/files/documents/newsroom/BIO_AK-18-01_7.pdf

15. Ice-over Characterization on Rivers near Oil Transportation Infrastructure.

Lead agency: USGS.

Archived Sentinel-1 SAR data will be used to develop a machine learning model to characterize physical properties of ice on major rivers in the Great Lakes region. From these results, vulnerability maps will be developed where ice covered areas and oil transport areas intersect with ecological, hydrological, and cultural resources. Archived Sentinel-1 SAR data will be used to develop a machine learning model to characterize physical properties of ice on major rivers in the Great Lakes region. From these results, vulnerability maps will be developed where ice covered areas and oil transport areas intersect with ecological, hydrological, and cultural resources. As a second objective, historical inland oil spills on ice that may coincide with available of Sentinel-1 SAR data, or other publicly available SAR data will be evaluated to further refine risk metrics. Similar machine learning algorithms utilizing Sentinel-1 are being developed for flood mapping by USGS and will be a basis for accelerating model development in this project.

16. Assessing the Impact of Oil Spills Using Three-Dimensional Oil Spill Modeling

Lead Agency: BOEM. Collaborator: NOAA.

Extend NOAA's oil spill Trajectory Analysis Planner (TAP) tool by integrating NOAA's new web-based General NOAA Operational Modeling Environment (GNOME) tool in 3-D and apply the result to BOEM's Oil Spill Risk Analysis (OSRA) in Southern California.

https://www.boem.gov/sites/default/files/documents/environment/PC-16-03_2.pdf

17. Assessing baseline contaminants in the 1002 Area of the Arctic National Wildlife Refuge in Alaska

Lead Agency: USFWS. Collaborator: USGS.

Project to assess baseline contaminant levels and types in biotic and abiotic matrices in the coastal plain of the Arctic National Wildlife Refuge prior to oil and gas exploration and development activities. Results to be used for development impact assessments;

addressing subsistence concerns; evaluating water quality. Work is ongoing to assess baseline levels and types of contaminants in biotic and abiotic matrices in the coastal plain (the 1002 Area) of the Arctic National Wildlife Refuge prior to oil and gas exploration and development activities. Baseline data can be used for site-specific and area-wide assessments of development impacts; addressing subsistence concerns of Arctic NWR users; evaluating water quality degradation; and, if needed, serve in the NRDAR process.

B. Response Management Systems (20100) – Research Papers

Maritime Environmental Response Common Operating Picture (2023, USCG)

Berman, B.; Eberly, L.; and Elis, A. “Maritime Environmental Response Common Operating Picture,” New London, CT, September 2023.

C. Response Management Systems (20100) – Research Projects

1. Update to the Lake Ontario Environmental Sensitivity Index (ESI) datasets

Lead Agency: NOAA. Collaborator: EPA.

The Lake Ontario ESI datasets are being updated for the first time since 1993. ESIs contain information regarding shoreline types, biological resources, and human use resources, including cultural and historic sites, in a given geographical area. ESIs are used to support a wide variety of coastal planning activities, but were specifically developed to support spill planning, preparedness, and response activities. They are used by agencies at all levels of government, as well as by industry. Funding for this project came from the Great Lakes Restoration Initiative (GLRI), which is a program managed by the EPA.

2. Update to the Lake Michigan ESI datasets

Lead Agency: NOAA. Collaborator: EPA.

The Lake Michigan ESI datasets are being updated for the first time in decades. The four datasets that currently comprise Lake MI (eastern (1985), western (1993), northern and southern (1994) are being combined into one dataset for the entire lake. ESIs contain information regarding shoreline types, biological resources, and human use resources, including cultural and historic sites, in a given geographical area. ESIs are used to support a wide variety of coastal planning activities, but were specifically developed to support spill planning, preparedness, and response activities. They are used by agencies at all levels of government, as well as by industry. Funding for this project came from the Great Lakes Restoration Initiative (GLRI), which is a program managed by the EPA.

3. Update to the Lake Superior ESI datasets

Lead Agency: NOAA. Collaborator: EPA.

The Lake Superior ESI datasets are being updated for the first time since 1994. ESIs contain information regarding shoreline types, biological resources, and human use resources, including cultural and historic sites, in a given geographical area. ESIs are used to support a wide variety of coastal planning activities, but were specifically

developed to support spill planning, preparedness, and response activities. They are used by agencies at all levels of government, as well as by industry. Funding for this project came from the Great Lakes Restoration Initiative (GLRI), which is a program managed by the EPA.

4. Update to the Lake Huron ESI datasets

Lead Agency: NOAA. Collaborator: EPA.

The Lake Huron ESI datasets are being updated for the first time since 1994. ESIs contain information regarding shoreline types, biological resources, and human use resources, including cultural and historic sites, in a given geographical area. ESIs are used to support a wide variety of coastal planning activities, but were specifically developed to support spill planning, preparedness, and response activities. They are used by agencies at all levels of government, as well as by industry. Funding for this project came from the Great Lakes Restoration Initiative (GLRI), which is a program managed by the EPA.

5. Update to the Lake Erie ESI datasets

Lead Agency: NOAA. Collaborator: USCG. GLCOE funded.

The Lake Erie ESI datasets were updated for the first time since 1985. ESIs contain information regarding shoreline types, biological resources, and human use resources, including cultural and historic sites, in a given geographical area. ESIs are used to support a wide variety of coastal planning activities, but were specifically developed to support spill planning, preparedness, and response activities. They are used by agencies at all levels of government, as well as by industry.

6. Development of an ESI Enterprise Solution

Lead Agency: NOAA. Collaborator: EPA.

Develop an Enterprise Solution (ES) for ESI data that will enable easier, faster, and more frequent updates to the ESI datasets. The ES will initially focus on the Great Lakes, but is intended to be expanded to handle ESIs nationwide. This project is being funded by the GLRI, which is a program managed by the EPA.

7. Improvements to ESI reporting and display in ERMA

Lead Agency: NOAA.

OR&R is working to improve ESI reporting from ERMA. Projects include development of an application programming interface to allow the USFWS IPAC tool to access ESI query results, clip and ship ESI query results, and auto generation of ICS 232 resources at risk reports, among others.

8. Web GNOME

Lead Agency: NOAA. Collaborator: BSEE.

Expand the availability of forecast models to cover offshore areas and will allow users to run WebGNOME more easily, using available operational forecast models.

Focus/priority areas are the Gulf of Mexico out to 200 miles, the Arctic, Cook Inlet, Southern California, and the Atlantic seaboard.

9. Shoreline Oil Spill Response Gaps and Opportunities Workshop

Lead Agency: BSEE. Collaborator: NOAA.

Intra-agency workshop that brought together Subject Matter Experts (SME) from the spill response community, academia, and industry for the exchange of ideas and the exploration of the current state of the science of shoreline oil spill research. The results of this workshop will help guide Shoreline Research and Technologies (R&T) in fulfillment of BSEE's mission.

<https://www.bsee.gov/shoreline-oil-spill-response-gaps-and-opportunities-workshop>

10. Proof of Concept for Oil Detection Technologies, and USCG Polaris/PYXIS Oil Spill Detection System (PODS)

Lead Agency: NOAA. Collaborator: USCG. Funded by GLCOE.

Test and evaluate Polaris/PYXIS systems' ability to monitor and detect oil in various environmental conditions.

11. Development of UAS Operations in Great Lakes Ice Environments

Lead Agency: NOAA. Collaborator: USCG. Funded by GLCOE.

This project was initiated to advance our understanding of the strengths and limitations of using multispectral and thermal sensors mounted on UAS platforms to detect and characterize oil in ice-laden waters.

12. UAS Guidance & Training

Lead Agency: NOAA. Collaborator: USCG. Funded by GLCOE.

Create job aids explaining: 1) How to use sUAS to collect imagery during emergency response on shoreline and on water; and 2) Data management, storage, and delivery. Create training products.

13. ERMA Enhancements Part I (FY22)

Lead Agency: NOAA. Collaborator: USCG. Funded by GLCOE.

Upgrade ERMA by adding Great Lakes Environmental Sensitivity Index atlases (St. Mary's River, St. Lawrence River), update EPA Inland Sensitivity Atlases, prepare auto-generated ICS 232 feature, update infrastructure, and create training materials.

14. ERMA Enhancements Part II (FY23)

Lead Agency: NOAA. Collaborator: USCG. Funded by GLCOE.

Upgrade ERMA by creating sensitive resource, threatened and endangered species layers, improving image upload/download capability, enhancing website user features, and improving data search functions. Create documentation and training for all additional features developed.

15. Enhancing Great Lakes Modeling

Lead Agency: NOAA. Collaborator: USCG. Funded by GLCOE.

Host and facilitate working group meetings for a general modeling group and a General NOAA Operational Modeling Environment (GNOME) evaluation working group. Create a set of tools within WebGNOME that enhances the interaction with ERMA and aids in information movement between the two programs.

16. Computer-Aided Management of Emergency Operations (CAMEO) Suite Updates

Lead Agency: NOAA. Collaborator: EPA.

Developed by NOAA & EPA to access, store, and evaluate information developing emergency plans, supports regulatory compliance by helping report requirements of EPCRA, a.k.a. SARA Title III. The system integrates a chemical database and a method to manage the data, an air dispersion model, and a mapping capability.

17. Nearshore and Inland Evaluation of the Estimated Recovery System Potential (ERSP) Calculator

Lead Agency: USCG.

This project was initiated to assess the feasibility of, costs and benefits for, and potentially undertake the work to expand the BSEE Estimated Recovery System Calculator to the inland environments. RDC is currently developing a conceptual model of the inland ERSP calculator.

18. Maritime Environmental Response Common Operating Picture

Lead Agency: USCG. Collaborator: NOAA.

This project developed a custom dashboard prototype showing endangered species habitat data and integrated it into CG-MER's COP and NOAA's ERMA. The dashboard displays which oil spill response is most appropriate for an incident that may affect an endangered species habitat and also incorporates data from OILMAP.

19. Operationalizing the Use of Uncrewed Systems for Environmental Response: UAS Platforms

Lead Agency: USCG. Collaborator: NOAA. Funded by GLCOE.

Develop procedures for using USCG UAS systems to collect data in support of oil pollution events in the Great Lakes. Train USCG UAS pilots and responders in best practices and appropriate procedures so they can respond appropriately and effectively.

20. Reach-scale surface velocity mapping using small Unoccupied Aircraft Systems (UASs)

Lead Agency: USGS.

Pilot project to establish best practices for creating reach-scale surface velocity maps, including sensor type (visible, thermal, and multi-spectral), data collection, ground control surveying, data processing, data delivery, and data publishing. Maps are designed to inform river dynamics and spill behavior. A model is being validated in the Green

River Spill Exercise (October 2021).

21. Reach-scale surface velocity mapping using small Unoccupied Aircraft System

Lead Agency: USCG.

Pilot project to establish best practices for creating reach-scale surface velocity maps, including sensor type (visible, thermal, and multi-spectral), data collection, ground control surveying, data processing, data delivery, and data publishing. Maps are designed to inform river dynamics and spill behavior. A model is being validated in the Green River Spill Exercise (October 2021).

D. Renewable Energy Systems (20200) – No Research Papers or Projects

E. Other – Research Papers:

1. U.S. Coast Guard Academy Internship with Great Lakes Oil Spill Center of Expertise - testing impacts of oil on native microbial communities in Upper Great Lakes region.

Lead Agency: USCG. Funded by GLCOE.

Using sediment samples collected from the upper Great Lakes region, identify native microbial communities capable of degrading oil. Determine which taxa are unable to withstand exposure, which are able to persist, and compare responses across several sampling sites with different background conditions.

III. RESPONSE

A. Structural Damage Assessment and Salvage (30000) – Research Projects

1. Report on Estimating and Measuring Oil Slick Thickness

Lead Agency: NOAA

The OR&R project, funded through the Canadian Multi Partner Research Initiative, involved several years of collaboration, including conducting a workshop with multiple oil spill response and assessment stakeholders, followed by testing with eight different scientists who can estimate and/or measure oil slick thickness.

B. At Source Control and Containment (30100) – No Research Papers or Projects

C. Chemical and Physical Modeling and Behavior (30200) – Research Papers

1. Guidance Document – Behavior of Diluted Bitumen in the Fresh Water Environment (2023, USCG)

Lead Agency: USCG

Adewale, B.S.; Fitzpatrick, M.; Cooke, T.J.; Boufadel, M.C.; and Wurl, M.A. New London, CT, August 2023. <https://discover.dtic.mil/>

D. Chemical and Physical Modeling and Behavior (30200) – Research Projects

1. Oil Spill Modeling for Improved Response to Arctic Maritime Spills: The Path Forward (AMSM)

Lead Agency: DHS. Collaborator: USCG.

This research evaluates the various approaches to Arctic response modeling that yields accurate results with clear uncertainty bounds in response timeframes and recommends what new components/sub-models should be developed and validated. Sub-category – Emerging Crude (84-85).

[Projects \(arcticdomainawarenesscenter.org\)](http://Projects.arcticdomainawarenesscenter.org)

2. Chemical characterization and toxicity of new Low Sulfur Fuel Oils (LSFO)

EPA and NOAA are participating in the EPPR-PAME project (Norway led) to evaluate new Low Sulfur Fuel Oils (LSFO). There are emergency response cleanup concerns with LSFOs, particularly in Arctic regions. EPA and NOAA are two of the participating laboratories to test three LSFO products.

3. Behavior of Diluted Bitumen (Dilbit) in Fresh Water

Lead Agency: USCG.

Provide a more complete understanding of dilbit fate and transport and add to FOSCs' knowledge base for further response considerations. Objective is to learn more information regarding evaporation of diluents or light ends, and suspension or sinking of heavier bitumen.

4. Examination of Physical and Chemical Properties of Three Selected Dielectric Fluids

Lead Agency: BSEE. Collaborator: USCG.

The project will consist of the chemical analysis and the evaluation of physical and behavioral properties of representative samples of three dielectric fluids. The fluids include synthetic ester based, natural ester based, and petroleum (i.e., mineral oil) based fluids.

5. The Web based General NOAA Oil Modeling Environment (WebGNOME) Anywhere

Lead Agency: BSEE. Collaborator: NOAA.

This project will expand the availability of forecast models to cover offshore areas where BSEE's regulated facilities reside. This added feature will enable the ability to run WebGNOME more easily, using available operational forecast models. The project team is developing the features necessary to easily set up and run WebGNOME with a number of operational forecast models.

<https://www.bsee.gov/the-web-based-general-noaa-oil-modeling-environment-webgnome-anywhere>

6. Great Lakes Oil Spill Modeling

Lead Agency: NOAA. Collaborator: USCG. Funded by GLCOE.

This project was initiated to assess General NOAA Operational Modeling Environment (GNOME) performance as an oil spill model in the Great Lakes. Areas of underperformance were to be identified and remediated. GNOME was also to be used to investigate oil spill modeling in freshwater ice environments.

7. Great Lakes Trajectory Analysis Planner
Lead Agency: NOAA. Collaborator: USCG. Funded by GLCOE.
Develop a Trajectory Analysis Planner analysis for Lake Erie (initial) and the rest of the Great Lakes (future) using available hindcasts of currents, wind and ice. Incorporate ESI datasets to improve oil spill planning and response.
 8. U.S. Coast Guard Academy Great Lakes Geographic Response Strategies Validation Project
Lead Agency: USCG. Funded by GLCOE.
The USCG Academy students and staff modeled spill scenarios near Mackinac Island, MI to validate booming strategies outlined in the Northern Michigan Area Contingency Plan. Spill trajectories were overlaid with a biological impact analysis to provide information for planning and response decisions.
 9. Asphalt Products Fact Sheet and Case Studies
Lead Agency: NOAA
Asphalts are highly complex and not well-characterized materials containing saturated and unsaturated aliphatic and aromatic compounds with up to 150 carbon atoms. This fact sheet summarizes asphalts and several case studies.
- E. *Oil Spill Detection and Surveillance (30300) – Research Papers*
1. LiDAR Oil Characterization and Automated Software Development (2023, BSEE)
D. Josset, Stephanie Cayula, Stephen Sova, Jay Cho, and Scott Pegau. IOSC 2024.
 2. Machine Learning Models for Coplanar Electrical Capacitance Tomography (ECT) (2023, BSEE)
Reeda Al Saintbai, Sacha Hakim, Paul Karim Khaled, Ali Wehbi, Mahmoud Altrabolsi, Imad H. Elhajj, and Daniel Asmar. IEEE 8th International Conference on Smart Instrumentation, Measurement and Applications (ICSIMA), Melaka, Malaysia. American University of Beirut (AUB).
 3. Cellphone-based machine learning software for analysis of oil samples (2022, USGS)
Steevens, J., and Dong, X. Prov Patent Number U.S. 63/307104.
 4. A study of the sensitivity of SAR ocean backscatter to oil slick properties using an electromagnetic scattering model (2023, BSEE)
Jaruwatanadilok, S.; X. Duan, B. Holt, and C. E. Jones. IEEE Transactions on Geoscience and Remote Sensing, currently in review.
- An automated algorithm for calculating the ocean contrast in support of oil spill response (2023, BSEE)

Jones, C. E. *Marine Pollution Bulletin*, 191, 114952.

5. An automated algorithm for calculating the ocean contrast with application to estimation of oil slick thickness (July 2023, BSEE)
Jones, C. E.; O. Garcia-Pineda, B. Holt, F. Monaldo, and C. Quigley. IGARSS 2023. https://2023.ieeeigarss.org/view_paper.php?PaperNum=2749
6. Detection and Thickness Estimation of Oil under Saline Ice Using Machine Learning (2023, BSEE)
Mahmoud Altrabolsi, Chafic Labaki, Imad H. Elhajj, and Daniel Asmar. IEEE Sensors Applications Symposium (SAS), Sundsvall, Sweden, American University of Beirut (AUB).
7. Comparing Recent Advances in Estimating and Measuring Oil Slick Thickness: An MPRI Technical Report (2023, BSEE)
CRRC, NOAA, MPRI, and BSEE, “Comparing Recent Advances in Estimating and Measuring Oil Slick Thickness: An MPRI Technical Report” (2023). 1129AA. Coastal Response Research Center. <https://scholars.unh.edu/crrc/33>
8. Development of an Oil Thickness Sensor Phase II (2022, BSEE)
Elhajj I., Asmar D., Saleh M., Tabikh A., Ammouri M., Babikian S., Oueidat G., Alayass M., and Alameh, M. American University of Beirut, Beirut, Lebanon. Washington, DC (NW): U.S. Department of the Interior, Bureau of Safety and Environmental Enforcement. Report No.: 1103 Contract No. 140E0118C0003. [1103aa.pdf \(bsee.gov\)](https://www.bsee.gov/1103aa.pdf)
9. Dual-Modality Capacitive-Ultrasonic Sensing for Measuring Floating Oil Spill Thickness (2022, BSEE)
Saleh, M., Tabikh, A. R., Elhajj, I. H., McKinney, K., and Asmar, D. IEEE Transactions on Instrumentation and Measurement, 71, 1-14. [Dual-Modality Capacitive-Ultrasonic Sensing for Measuring Floating Oil Spill Thickness | IEEE Journals & Magazine | IEEE Xplore](https://ieeexplore.ieee.org/abstract/document/9888888)
10. Potential for commercial PlanetScope satellites in oil response monitoring (EPA, 2022)
Schaeffer, B.A.; P. Whitman, R.N. Conmy, W. Salls, M. Coffey, D. Graybill, and M.C. Lebrasse. *Marine Pollution Bulletin*. doi: 10.1016/j.marpolbul.2022.114077.
11. Autonomous Water Sampler for Underwater Hydrocarbon Plume Assessment (2022, EPA)
Gomez-Ibanez, D., A. Kukulya, A. Belani, E. Fischell, R.N. Conmy, D. Sundaravadivelu, H. Forth, and L. Dipinto. *Journal of Marine Science and Engineering*, 10(4): 526. <https://doi.org/10.3390/jmse10040526>

12. Fluorescence-estimated Oil Concentration in the Deepwater Horizon Subsea Oil Plume (2022, EPA)
Conmy, R.N.; A. Hall, D. Sundaravadivelu, and B.A. Schaeffer. *Marine Pollution Bulletin*. doi: 10.1016/j.marpolbul.2022.113808.
13. UAS Characterization of Oil in Ice: Volumes I and II (USCG, 2022)
Garcia-Pineda, O.; Balsley, A.; DiPinto, L.; Kinner, N.; and Panetta, P. New London, CT, February 2022. Vol I: <https://apps.dtic.mil/sti/citations/AD1165443>
Vol II: <https://apps.dtic.mil/sti/citations/AD1165444>
14. Advancing Detection Capabilities for Monitoring Oil Spills in Ice Environments (2023, USCG)
Garcia-Pineda, O.; Balsley, A.; DiPinto, L.; and Kinner, N. New London, CT, September 2023. <https://apps.dtic.mil/sti/citations/trecms/AD1215192>
15. Assessing Environmental Oil Spill based on Fluorescence Images of Water Samples and Deep Learning (2023, USGS)
D. P. Liu, Ming Liu, Guangyu Sun, Zhiqian Zhou, Duolin Wang, Fei He, Jiaxin Li, Ryan Gettler, Eric Brunson, Jeffery A. Steevens, and Dong Xu. *J. Environ. Informatics*. doi.org/10.3808/jei.202300491. <https://www.usgs.gov/publications/assessing-environmental-oil-spill-based-fluorescence-images-water-samples-and-deep>

F. Oil Spill Detection and Surveillance (30300) – Research Projects

1. LiDAR Oil Characterization and Automated Software Development
Lead Agency: BSEE.
This project tested the LiDAR system’s ability to detect and characterize oil on the surface and varying subsurface layers thickness values and depth in the water.
<https://www.bsee.gov/lidar-oil-characterization-and-automated-software-development-0>
2. Slick Thickness Characterization Based on Low Noise, Polarized Synthetic Aperture Radar
Lead Agency: BSEE. Collaborator: NASA.
The project team evaluated the capability of low noise L-band (1.26 GHz) synthetic aperture radar (SAR) imagery acquired by the Uninhabited Aerial Vehicle Synthetic Aperture Radar (UAVSAR) sensor. The goal was to determine how accurately slick thickness can be determined from SAR, including the extent to which weather conditions change the SAR backscatter and affect the parameters used to determine the oil thickness and fraction.
<https://www.bsee.gov/slick-thickness-characterization-based-on-low-noise-polarized-synthetic-aperture-radar>
3. Oil Detection and Thickness Estimation Under/In Ice Based on Electrical Capacitance Tomography (ECT)

Lead Agency: BSEE.

This project developed and tested the Electrical Capacitance Tomography (ECT) sensor to detect oil in/under ice. A final report is being currently reviewed and will be posted.

<https://www.bsee.gov/oil-detection-and-thickness-estimation-underin-ice-based-on-electrical-capacitance-tomography-ect>

4. Advancement of MARINE SCOUT

Lead Agency: BSEE.

The purpose of this project was to advance the current MARINE SCOUT payload for algorithm development and semi-automation for (near) real-time data processing. A full payload dry run was performed for 24 hours using both oil samples and seaweed confusers. Algorithm development was conducted using the collected imagery.

<https://www.bsee.gov/advancement-of-marine-scout-0>

5. Marine Induced Polarization Methods for the Detection and Mapping of Oil in an Arctic Marine Oil Spill—Ruggedized Field Kit Production and Testing formerly Marine Induced Polarization Methods for the Detection and Mapping of Oil in an Arctic Marine Oil Spill; Including Investigation of Oil within and Under Broken Ice Fields

Lead Agency: DHS. Collaborator: USCG.

This research effort worked to test and evaluate performance of the Marine Induced Polarization technology to locate and assesses very low percentage polarizable mineral and particle distributions, such as hydrocarbons, in water, ice, and sediment. This project was funded and conducted by the DHS Center of Excellence Arctic Domain Awareness Center (arcticdomainawarenesscenter.org).

6. Development of Propeller Driven Long Range Autonomous Underwater Vehicle (LRAUV) for Under-Ice Mapping of Oil Spills and Environmental Hazards

Lead Agency: DHS. Collaborator: USCG.

The project created a propeller driven long range autonomous underwater vehicle with buoy system to enhance situational awareness. The platform is designed to be able to conduct environmental mapping and detect/ characterize oil in and under ice. This project was funded and conducted by the DHS Center of Excellence Arctic Domain Awareness Center (arcticdomainawarenesscenter.org).

7. Advancing UAS and AUV Capabilities to Characterize Water Column and Surface Oil in Ice Environments

Lead Agency: USCG. Collaborator: NOAA.

Test a variety of Unmanned Aerial System (UAS) platforms and associated sensors for characterizing oil in ice environments. The project built on previous National Oceanic and Atmospheric Administration (NOAA) (sensors) and the Bureau of Safety and Environmental Enforcement (BSEE) (facility) work in ice-free water.

8. Great Lakes UAS Capacity Building

Lead Agency: USCG. Collaborator: NOAA. Funded by GLCOE.

Through a series of controlled tests, optimize existing NOAA Great Lakes Environmental Research Lab (GLERL) sensors for oil detection in freshwater and test up to three additional sensors.

9. Oil spill detection under ice and on seafloor

Lead Agency: BSEE.

This project will Investigate and advance the current underwater technology to detect and measure thickness of oil under ice, encapsulated in ice and/or on the seafloor.

<https://www.bsee.gov/oil-spill-detection-under-ice-and-on-seafloor>

10. MPRI - Comparing Recent Advances in Estimating and Measuring Oil Slick Thickness

Lead Agency: NOAA. Collaborator: BSEE.

This project was a collaborative effort between BSEE, National Oceanic Atmospheric Administration (NOAA), Fisheries and Oceans Canada (DFO), the U.S. Coast Guard (USCG), the Environmental Protection Agency (EPA), University of New Hampshire Coastal Response Research Center (CRRC), Oil Spill Recovery Institute (OSRI), and Johns Hopkins to advance the response community's ability to characterize and measure oil slick thickness through collaboration, knowledge sharing, and independent systematic technology assessment and testing. Multi Partner Research Initiative (MPRI) – Comparing Recent Advances in Estimating and Measuring Oil Slick Thickness | Bureau of Safety and Environmental Enforcement (bsee.gov).

[Multi Partner Research Initiative \(MPRI\) - Comparing Recent Advances in Estimating and Measuring Oil Slick Thickness | Bureau of Safety and Environmental Enforcement \(bsee.gov\)](#)

G. In and on water containment and recovery (30400) – Research Papers

1. The Use of Additive Manufacturing to Investigate Novel Surface Geometries for Improved Oil Skimmer Recovery in Thin Oil Slicks (2022, BSEE)
Clements, Z., Hewitt, G., & Bruneau, M (Deep Analytics LLC, Montpelier VT). U.S. Department of the Interior, Bureau of Safety and Environmental Enforcement. 62 p. Report No.: 1130. Contract No. 140E0121C0008.
2. Effect of Surface Microgeometries on Oil Skimming Drums (2023, BSEE)
International Spill Control Organization News, Issue 889, pp. 8-10.
<https://spillcontrol.org/2023/05/13/isco-889-newsletter/>
3. Phase I Summary Report for Deployable System to Recover Oil Under Solid Ice (ORUI) (2021, BSEE)
Phoenix International Holdings, Inc., Largo (MD). U.S. Department of the Interior, Bureau of Safety and Environmental Enforcement. Report No.: 1105. Contract No. 140E0120C0006. BSEE 1105aa.pdf (bsee.gov)

4. Emerging Pollution Response Technology: Adsorbents (2023, USCG)
Balsley, A.; Wurl, M.A.; and McKinney, K. New London, CT, June 2023.
<https://apps.dtic.mil/sti/citations/trecms/AD1215187>
5. Validation of Oil Boom CFD Models Relative to Real-World Performance (2023, BSEE)
Johnson, G.; Paul, B.; Fitzpatrick, M.; and McKinney, K. 45th AMOP Technical Seminar on Environmental Contamination and Response, 2023. (researchgate.net)
6. Assessing the Validity of Physical Scale Models for the Testing of Oil Boom Systems (2023, BSEE)
Johnson, G.; Paul, B.; Fitzpatrick, M.; & McKinney, K. 45th AMOP Technical Seminar on Environmental Contamination and Response, 2023.

H. In and on water containment and recovery (30400) – Research Projects

1. Advancement of the Recovery Efficiency Sensor
Lead Agency: BSEE.
This project is developing a Recovery Efficiency (RE) sensor that can be used during oil response operations to accurately measure the percentage of oil and water in recovered fluid across the entire range of concentrations.
[Development of a Recovery Efficiency Sensor - Phase II | Bureau of Safety and Environmental Enforcement \(bsee.gov\)](#)
2. Advancing the BOWHEAD Vessel Ice Management System
Lead Agency: BSEE.
This project will advance the BOWHEAD Vessel Ice Management System. The BOWHEAD is designed to provide an ice-free zone for oil recovery in drift ice conditions.
[Advancing the BOWHEAD Vessel Ice Management System | Bureau of Safety and Environmental Enforcement \(bsee.gov\)](#)
3. Emerging Pollution Response Technology Evaluation (1011)
Lead Agency: USCG. Collaborator: BSEE.
This project was initiated to assist the Federal On-Scene Coordinators (FOSCs) and other oil spill responders to independently evaluate promising new and emerging mechanical spill response technologies. The goal is to give oil spill responders reliable and relevant data about the technology for their consideration in advance of an oil spill incident. The project will evaluate the efficacy of new/emerging adsorbents and the performance of existing mechanical skimmers with several dielectric fluid types.
4. Development of an Advancing Recovery System Test Protocol
Lead Agency: BSEE.

This project is developing a defined, repeatable test protocol for testing advancing recovery systems. The resulting protocol will produce test results that can be used as inputs to the Estimated Recovery System Potential (ERSP) calculator.

[Development of an Advancing Skimmer Test Protocol | Bureau of Safety and Environmental Enforcement \(bsee.gov\)](#)

5. Testing of Type I Sorbents (TOST 2022)

Lead Agency: BSEE. Collaborator: USCG.

This effort tested multiple innovative type I sorbents at Ohmsett. Sorbent products were solicited through a Request for Information announcement, and submissions were evaluated using the USCG's recently developed technology evaluation process.

Technologies that were rated highly were invited to submit their products for testing at Ohmsett.

[Testing of Oil Spill Technologies \(TOST\) Program | Bureau of Safety and Environmental Enforcement \(bsee.gov\)](#)

6. Enhancements to Ohmsett's Testing Capabilities in a Drift Ice Environment

Lead Agency: BSEE.

This project enhanced Ohmsett's capability to conduct testing in a drift ice environment.

[Enhancements to Ohmsett's Testing Capabilities in a Drift Ice Environment | Bureau of Safety and Environmental Enforcement \(bsee.gov\)](#)

7. 2023 TOST Testing of Skimmers in Dielectric Fluids

Lead Agency: BSEE. Collaborator: USCG.

The project will evaluate oil recovery skimmer performance with dielectric fluids.

8. Development of an Oil Thickness Sensor Phase II

Lead Agency: BSEE.

This project developed oil thickness sensors to measure the thickness of oil floating on water. Two unique sensors were developed to measure oil thickness greater than 3mm in real time.

[Development of an Oil Thickness Sensor Phase II | Bureau of Safety and Environmental Enforcement \(bsee.gov\)](#)

9. Testing of Type 1 Sorbent Efficacy to Dielectric Fluids

Lead Agency: BSEE.

The project will evaluate the efficacy of conventional sorbents to dielectric fluids.

10. Oil Spill Boom Computational Fluid Dynamics and Physical Modeling Study

Lead Agency: BSEE.

This project is investigating towed oil containment boom systems to assess how computational fluid dynamics (CFD) modeling and physical scaled model testing results may predict full-scale boom performance.

[Oil Spill Containment Boom Computational Fluid Dynamics and Physical Modeling Study | Bureau of Safety and Environmental Enforcement \(bsee.gov\)](#)

11. The Use of Additive Manufacturing to Investigate Novel surface Geometries for Improved Oil Skimmer Recovery in Thin Oil Slicks

Lead Agency: BSEE.

This project leveraged additive manufacturing (3D printing) to investigate unique and innovative surface geometries that could improve an oleophilic skimmer's oil recovery rate and/or efficiency in thin oil slicks (1/2 inch and less).

[The Use of Additive Manufacturing to Investigate Novel Surface Geometries for Improved Oil Skimmer Recovery in Thin Oil Slicks | Bureau of Safety and Environmental Enforcement \(bsee.gov\)](#)

12. Recovery of Oil Under Solid Ice

Lead Agency: BSEE.

This project designed an ROV mounted tooling skid to detect, inspect, and recover pockets of oil under solid ice, and to scrape and remove oil-laden ice crystals formed on the underside of the ice.

[Recovery of Oil under Solid Ice | Bureau of Safety and Environmental Enforcement \(bsee.gov\)](#)

I. Shore Containment and Recovery (30500) – Research Projects

1. Shoreline Oil Spill Response Gaps and Opportunities Workshop, Shore Containment & Recovery

Lead Agency: BSEE. Collaborator: NOAA.

Intra-agency workshop that brought together Subject Matter Experts (SME) from the spill response community, academia, and industry for the exchange of ideas and the exploration of the current state of the science of shoreline oil spill research. The results of this workshop will help guide Shoreline Research and Technologies (R&T) in fulfillment of BSEE's mission.

<https://www.bsee.gov/shoreline-oil-spill-response-gaps-and-opportunities-workshop>

2. Shoreline Holding Capacity Modeling Study, Shore Containment & Recovery

Lead Agency: BSEE.

The project will include the collection and evaluation of updated information on shoreline holding capacities and associated available models that add understanding to the regulatory and response capabilities of the Bureau of Safety and Environmental Enforcement (BSEE), and its sister agency, the Bureau of Ocean Energy Management (BOEM).

J. Dispersants (30600) – Research Papers

1. The use of dispersants in marine oil spill response (2022, EPA)

Barron, M.G. *Integrated Environmental Assessment and Management*, 18(4): 326-338.

2. Updated Ohmsett Dispersant Effectiveness Test Protocol (2022, BSEE)
McCourt, J., et. al. 44th AMOP Technical Seminar on Environmental Contamination and Response, 2022.
3. Revising the Ohmsett Dispersant Test Protocol. Final Report. (2021, BSEE)
SL Ross Environmental Research Limited, Ottawa, Canada. U.S. Department of the Interior, Bureau of Safety and Environmental Enforcement. Report No. 1123. Contract No. 140E0120C0002. [Revising the Ohmsett Dispersant Test Protocol. Final Report \(bsee.gov\)](https://www.bsee.gov)
4. Advances to the CROSERF protocol to improve oil spill response decision making (2023, BSEE)
Lee, K.; Coelho, G.; Loughery, J.; and de Jourdan, B. *Aquatic Toxicology*, 260, 106580. <https://www.sciencedirect.com/science/article/pii/S0166445X23001832>
5. Setting the Stage to Advance Oil Toxicity Testing: Overview of Knowledge Gaps Recommendations (2023, BSEE)
Loughery, J. R.; Coelho, G. M.; Lee, K.; and de Jourdan, B. *Aquatic Toxicology*, 106581. <https://www.sciencedirect.com/science/article/pii/S0166445X23001844>
6. Adopting a toxic unit model paradigm in design, analysis and interpretation of oil toxicity testing Dispersants (2023, BSEE)
Parkerton, T. F.; French-McCay, D.; de Jourdan, B.; Lee, K.; and Coelho, G. *Aquatic Toxicology*, 106392. <https://www.sciencedirect.com/science/article/pii/S0166445X22003198>

K. *Dispersants (30600) – Research Projects*

1. SMART Dispersant Protocols Document Update
Lead Agency: EPA
ICCOPR members from EPA, NOAA and BSEE are supporting the National Response Team (NRT) Science and Technology (S&T) on updating the SMART monitoring dispersant document to better incorporate advancements in response and detection strategies.
2. Screening for NCP Product Schedule Potential New Reference Oils
Lead Agency: EPA.
Currently, there is a shortage of reference oils for NCP product Schedule Testing. The EPA has been screening oils to select the new reference oils to serve research needs for the next two decades. This is a high-priority project, as reference oils are critical to maintaining the Product Schedule as mandated by OPA 90.
3. Update of the Ohmsett Dispersant Effectiveness Test Protocol

Lead Agency: BSEE.

This project updated the Dispersant Effectiveness (DE) test protocol used at Ohmsett, the National Oil Spill Response Research and Renewable Energy Test Facility.

[Update of the Ohmsett Dispersant Effectiveness Test Protocol | Bureau of Safety and Environmental Enforcement \(bsee.gov\)](#)

4. Surface Water Droplet Size Distribution (DSD) Instruments: Laboratory Validation, Tank Deployment, and Field Evaluation

Lead Agency: BSEE.

This DSD Instrument Evaluation project's objective is to better understand how surface water dispersant monitoring, as specified by the NCP SubPart J Monitoring Rule, can be practically implemented with existing technology. BSEE purchased two instruments, the Towed SilCam from SINTEF and LISST Black from Sequoia Scientific, that measure DSD, fluorescence, depth, and temperature, and can be used in both stationary or towed positions.

[Surface Water Droplet Size Distribution \(DSD\) Instruments: Laboratory Validation, Tank Deployment, and Field Evaluation | Bureau of Safety and Environmental Enforcement \(bsee.gov\)](#)

5. Optimized Underwater Detection of Dispersed Oils Using Scanning Fluorometry

Lead Agency: BSEE.

This Optimizing Fluorometry project's objective is to better understand how to evaluate and collect scientific evidence of the capabilities of existing commercially-off-the-shelf (COTS) fluorometers to detect dispersed oil in relevant field conditions, including shade weathered and photo-oxidized weathered oil.

<https://www.bsee.gov/optimized-underwater-detection-of-dispersed-oils-using-scanning-fluorometry-0>

6. Using Ecology on a Chip ("eChip") to Examine Degradation and Microbial Colonization of Rising Oil and Dispersed Oil Droplets

Lead Agency: BSEE.

Emulate ecologically relevant flow environments by using a microfluidic platform (eChip) to: (1) Simulate environmental conditions of a rising oil droplet using oil droplet arrays to study degradation; and (2) Observe polymeric microbial aggregates "streamers" formed on the rising oil droplets to study the associated hydrodynamic impacts to flow fields and momentum budgets.

<https://www.bsee.gov/using-ecology-on-a-chip-echip-to-examine-degradation-and-microbial-colonization-of-rising-oil-and>

7. Peer Review for AMOG Dispersant Spray Drift Decision Support Tool (DST)

Lead Agency: BSEE.

The objective of this project was a peer review of the Dispersant Spray Tool. This software tool has two key functions: 1) Determine the operability windows for aircraft

dispersant spray missions based upon the rapid evaluation of forecast and/or measured meteorological conditions over the response area; and 2) Determine the maximum extent of dispersant drift based on environmental conditions at the site. At a minimum, the tool needs to be capable of providing input into the decision for establishing the minimum safe setback distances from aerial dispersant operations to protect the safety of workers on response vessels in the field.

<https://www.bsee.gov/research-record/validating-and-expanding-the-dispersant-spray-drift-decision-support-tool>

L. In-situ Burning (30700) – Research Papers

1. Analysis of Emissions and Residue from Methods to Improve Efficiency of at-Sea, In Situ Oil Spill Burns (2021, BSEE and EPA)
Aurell, J.; Holder, A.; Gullett, B.; Lamie, N.; Arsava, K.; Conmy, R.; Sundaravadivelu, D.; Mitchell, W.; and Stone, K. *Marine Poll. Bull.*, 173, 113016.
2. Using Drones to Improve Combustion Source Plume Dispersion Models (2022, BSEE and EPA)
Gullett, B. Presented at the 17th International Congress on Combustion By-Products and Their Health Effects, Preston, United Kingdom, May 10, 2022.
3. Emissions from In Situ, At-Sea Oil Burns and Assessment of Combustion Efficiency (2021, BSEE and EPA)
Gullett, B. Presented at the Ninth Technology Workshop for Oil Spill Response, Office of Spill Prevention and Response (Virtual), CA Dept of Fish and Wildlife and Chevron, USA, Inc., February 22-26, 2021.
4. Characterization of Emissions and Residue from Measures to Improve Efficiency of In Situ Oil Burns (2021, BSEE and EPA)
Gullett, B.K.; Aurell, J.; Holder, A.; Lamie, N.; Arsava, K.; Conmy, R.; Sundaravadivelu, D.; and Stone, K. International Oil Spill Conference (Virtual), May 10-14, 2021.
5. Effects of natural and Forced Entrainment on PM Emissions from Fire Whirls (2022, BSEE)
Sriram Bharath Hariharan, Hamed Farmahini Farahani, Ali S. Rangwala, Elaine S. Oran, and Michael J. Gollner. *Environmental Science & Technology*, 56 (6): 3480-3491. DOI: 10.1021/acs.est.1c07077. <https://pubs.acs.org/doi/10.1021/acs.est.1c07077?ref=pdf>
6. The Tea light candle and the global waste problem (2022)
K. Arsava and A. S. Rangwala. *Advances in Energy and Combustion*, Edited by: A. Gupta, Springer.
7. Computational Fluid Dynamics (CFD) Model for Predicting Wellhead Oil-Burning Efficiency at Bench and Intermediate Scales: Final Report (BSEE)

- Tuttle, S.G.; Fisher, B.T.; Pfutzner, C.J.; Kessler, D.; Skiba, A.W.; and Jacob, R.J.
<https://apps.dtic.mil/sti/citations/AD1158091>
8. Analysis of Emissions and Residue from Methods to Improve Efficiency of at-Sea, In Situ Oil Spill Burns (2021, EPA)
 Aurell, J.; A. Holder, Brian Gullett, N. Lamie, K. Arsava, R.N. Conmy, D. Sundaravadivelu, W. Mitchell, and K. Stone Holder. *Marine Pollution Bulletin*, doi: 10.1016/j.marpolbul.2021.113016.
 9. Freshwater In-Situ Oil Burning Air Monitoring (2022, USCG)
 Adewale, B.S.; Balsley, A.; Wurl, M.A.; Booker, B.; Aurell, J.; and Gullett, B.K. New London, CT, September 2022. <https://apps.dtic.mil/sti/citations/AD1183616>
 10. Remotely Operated Surface Vessel for In-Situ Burns Demonstration (2023, BSEE)
 Pegau, et al. International Spill Control Organization Newsletter #896.
<https://spillcontrol.org/2023/07/02/isco-896-newsletter/>
 11. A Study of thin fuel slick combustion on wavy water (2022, BSEE)
 N. Sauer, G., J. M. Cuendet, and A. S. Rangwala. *Marine Pollution Bulletin*, 182:
<https://www.sciencedirect.com/science/article/abs/pii/S0025326X22006142>
 12. Experimental study of crude oil slick burning on a turbulent water surface (2022, BSEE)
 C. Li and Ali. S. Rangwala. *Combustion and Flame*, 241.
<https://www.sciencedirect.com/science/article/abs/pii/S0010218022001389>
 13. Modeling the influence of immersed objects on pool fire burning (2022, BSEE)
 Nair, S.; Mahnken, G.; Arsava, K. S.; and Rangwala, A. S. *Fire Technology*, 58: 1-25.
<https://www.x-mol.net/paper/article/1507132840082259968>
 14. Burning behavior analysis in meso and large-scale oil slick fires with and without waves using outdoor gas emission sampling (OGES) system (2022, BSEE)
 Ho, H. H.; Arsava, K. S.; and Rangwala, A. S. *Fire Technology*, 58: 1963-1993.
https://scholar.google.com.vn/citations?view_op=view_citation&hl=it&user=3wTI13gA AAAJ&citation_for_view=3wTI13gAAAAJ:aqlVkmm33-oC
 15. Influence of immersed conductive objects on quasi-steady burning behavior of fuel slick in turbulent waters (2023, BSEE)
 Kottalgi, M.; Nair, S.; Chang, L.; and Rangwala, A. S. *Combustion Science and Technology*, pp.1-18.
https://scholar.google.com/citations?view_op=view_citation&hl=en&user=Ms8oolcAAA AJ&citation_for_view=Ms8oolcAAAAJ:2osOgNQ5qMEC

16. Burning of fuel layers on a turbulent water surface with an immersed conductive object (2023, BSEE)
C. Li and A. S. Rangwala. *Combustion and Flame*, 252: 112745.
<https://www.sciencedirect.com/science/article/abs/pii/S0010218023001293>

17. Heat release rate of enhance large-scale open oil slick fires with outdoor gas emission sampling (OGES) system (2023, BSEE)
Ho, H.; Nair, S.; and Rangwala, A. S. *Marine Pollution Bulletin*, 192: 114987.
<https://www.sciencedirect.com/science/article/abs/pii/S0025326X23004198>

18. Burning behavior of an Oil Slick with Waves (2021, BSEE)
Nathaniel G. Sauer, Mahesh Kottalgi, Kemal Arsava, and Ali S. Rangwala. Arctic Marine Oilspill Program (AMOP) technical seminar on environment contamination and response, vol. 43, Jun 2-4, 2021, Edmonton, Alberta, Canada (online via Zoom).

19. Oil Foaming of Crude Oil Fires on Water (2022, BSEE)
Hsin-Hsiu Ho, Nathaniel G. Sauer, Mahesh Kottalgi, Kemal S. Arsava, Karen Stone, and Ali S. Rangwala. Arctic Marine Oilspill Program (AMOP) technical seminar on environment contamination and response, vol. 44, Jun 7-9, 2022 (online via Zoom).

20. Modeling the Effect of Surface Heating on Oil Spread near an Ice Wall (2022, BSEE)
Sharanya Nair, Hamed F. Farahani, and Ali S. Rangwala. Arctic Marine Oilspill Program (AMOP) technical seminar on environment contamination and response, vol. 44, Jun 7-9, 2022 (online via Zoom).

21. Evaporation Behavior of Volatile Fuel in Waves (2022, BSEE)
Nathaniel G. Sauer, Adam Saar, Hsin-Hsiu Ho, Sharanya Nair, Leonard Zabilansky, and Ali S. Rangwala. Arctic Marine Oilspill Program (AMOP) technical seminar on environment contamination and response, vol. 44, Jun 7-9, 2022 (online via Zoom).

22. Burning Capability of the Flame Refluxer under the Influence of Waves (2023, BSEE)
Nathaniel Sauer, Kemal Arsava, and Ali Rangwala. *Proc. Fire Safety Sci.*, Vol. 14, Epochal Tsukuba International Congress Center in Tsukuba, Japan, 2023.

23. Influence of Water Turbulence on Burning Behavior of Dececane Fuel Slick (2023, BSEE)
Mahesh Kottalgi, Sharanya Nair, Li Chang, and Ali Rangwala. *Proc. Fire Safety Sci.*, Vol. 14, Epochal Tsukuba International Congress Center in Tsukuba, Japan, 2023.

24. Influence of Turbulence on Burning Behavior of Fuel Slick on Water (2022, BSEE)
Kottalgi, M.; S. Nair, and A. S. Rangwala. Eastern States Combustion Institute, Spring Technical Meeting, University of Central Florida, Orlando, FL, Mar 6-9, 2022.

25. A Study of Kerosene Pool Burning on Wavy Water (2022, BSEE)
 Sauer, N.G.; H.H. Ho, S. Nair, L. Zabilansky, and A. Rangwala. Eastern States Combustion Institute, Spring Technical Meeting, University of Central Florida, Orlando, FL, Mar 6-9, 2022.

26. Burning Behavior Analysis of Meso-scale Pool Fires using Combustion Product Sampling BSEE (2022, BSEE)
 Ho, H.H.; N. Sauer, M. Kottalgi, K. Arsava, and A. Rangwala. Eastern States Combustion Institute, Spring Technical Meeting, University of Central Florida, Orlando, FL, Mar 6-9, 2022.

27. In-situ Burning with a Floating Flame Refluxer System (BSEE)
 S. Nair, N.G. Sauer, H. Ho, R. Harter, M. Kottalgi, K.S. Arsava, K.P. Trubac, N. Whitehouse, A.S. Rangwala, and K. Stone. IOSC, New Orleans, Louisiana, May 13-16, 2024 (submitted).

28. The Effect of Burn Induced Crude Oil Distillation on Thin-Layer Boilover Behavior and Weber Number. (2023, BSEE)
 Rayna Harter (Spring 2023).
<https://digital.wpi.edu/concern/etds/vt150n77v?locale=en>

29. Impact of Immersed Conductive Objects and Relative Influence of Immersion Depth on Quasi-Steady Burning Behavior of Dodecane Fuel Slick on Turbulent Waters (2023, BSEE)
 Mahesh Kottalgi (Spring 2023)
<https://digital.wpi.edu/concern/etds/fq977z22t?locale=en>

30. Heat Release Rate of Fires Using Point-Based Sampling (2023, BSEE)
 Ho, Hsin-Hsiu. Worcester Polytechnic Institute, 2023.
<https://digitalwpi.wpi.edu/concern/etds/vt150n76k?locale=en>

31. Effects of Natural and Forced Entrainment on PM Emissions from Fire Whirls (2023, BSEE)
 S.B. Hariharan, H.F. Farahani, A.S. Rangwala, E.S. Oran, and M.J. Gollner.
Environmental Science & Technology, 56 (6): 3480-3491.
<https://pubs.acs.org/doi/10.1021/acs.est.1c07077>

32. Experimental Characterization of Enhanced In-situ Burning using Fire Whirls on a Three-wall Structure (2022, BSEE)
 J.L. Dowling, M. Hajilou, and M.J. Gollner. 44th AMOP Technical Seminar on Environmental Contamination and Response (virtual), June 7-9, 2022.

33. The Effect of Enclosure Dimensions on Fire Whirl Formation and Emissions (2023, BSEE)
J.L. Dowling, M. Hajilou, and M.J. Gollner. Western States 2022 Spring Hybrid Meeting of the Western States Section of The Combustion Institute, Stanford, California, March 21-23, 2022.
34. New Boom Design for In Situ Burn (2023, BSEE)
The Ohmsett Gazette. Spring 2023, pp. 1, 5.
[https://ohmsett.bsee.gov/gazette/Ohmsett%20Gazette_Spring%202023%20\(1\).pdf](https://ohmsett.bsee.gov/gazette/Ohmsett%20Gazette_Spring%202023%20(1).pdf)
35. Low-Emission Crude Oil Burner Manual and Specifications (2022, BSEE)
Pfutzner, C.J., and Tuttle, S.G.
36. Peer Review of Interim Report on Computational Fluid Dynamics Model for Predicting Wellhead Oil-Burning Efficiency at Bench and Intermediate Scales (2021, BSEE)
National Academies of Sciences, Engineering, and Medicine, 2021. Washington, DC: The National Academies Press.
<https://www.bsee.gov/sites/bsee.gov/files/research-reports//1063ac.pdf>
37. MPRI Study to Understand Oil-in-Water Emulsions (2023, BSEE)
International Spill Control Organization News, Issue 899, pp. 11-12, July 24, 2023.
<https://spillcontrol.org/2023/07/22/isco-899-newsletter/>
38. MPRI Study to Understand Oil-in-Water Emulsions (2023, BSEE)
The Ohmsett Gazette. Spring 2023, p. 4.
[https://ohmsett.bsee.gov/gazette/Ohmsett%20Gazette_Spring%202023%20\(1\).pdf](https://ohmsett.bsee.gov/gazette/Ohmsett%20Gazette_Spring%202023%20(1).pdf)

M. In-situ Burning (30700) – Research Projects

1. Measurements of In Situ Burn Emissions and Residues
Lead Agency: BSEE. Collaborator: EPA.
The Environmental Protection Agency’s Office of Research and Development (ORD) performs real-time air emissions on BSEE-sponsored, outdoor in situ burn tests to characterize the combustion efficiency. ORD has assessed emissions on multiple BSEE OSRR projects at the U.S. Army Corps of Engineers’ Cold Regions Research and Engineering Lab (CRREL) in New Hampshire and a crude oil combustion study at the Naval Research Laboratory’s (NRL) Chesapeake Beach Detachment in Maryland.
<https://www.bsee.gov/analysis-of-emissions-and-residue-from-methods-to-improve-combustion-efficiency-of-in-situ-oil>
2. Wellhead Combustion Study
Lead Agency: BSEE.
The long-term objective of this effort is to ensure safe and efficient oil spill response and recovery methods (as well as wellhead control measures) are developed and in place for

potential offshore oil spills from man-made gravel islands in the federal waters off of Alaska. The initial objective is to ensure that a thorough understanding of all historical, technical and scientific issues is gained in order to consider the case for using wellhead burning as a response tool to mitigate the effects of a well blowout from a gravel island. (Note: This work is not in-situ burning of oil contained within fire-booms; rather, it is the ignition of an uncontrolled release of oil and gas from an uncontained well directly at the wellhead after pressure control systems have failed.)

<https://www.bsee.gov/research-record/osrr-1063-preliminary-technical-guidance-and-literature-review-assist-evaluation>

3. Efficient Remediation of Oil Spills using Fire Whirls – Phase II

Lead Agency: BSEE.

The objectives of this project are to 1) characterize the ideal configurations and parameters of fire whirl formation; 2) characterize the effects and burning/combustion efficiencies on emissions from different fire whirl configurations, fuels, and slick thicknesses; 3) further understand the fundamental physics contributing to enhancement in the combustion efficiency of fire whirls verses pool fires; and 4) develop a scaled prototype fire whirl generator for use in a large-scale outdoor test facility.

<https://www.bsee.gov/efficient-remediation-of-oil-spills-using-fire-whirls-phase-ii-0>

4. Ignition, Combustion and Atomization of Emulsions during in situ Burning

Lead Agency: BSEE.

Previously, BSEE OSRR Project 1085 found that emulsified HOOPS crude oil at 20% water content yielded increased burn efficiencies. This project will further probe those findings by conducting lab-scale experiments to study how emulsions and weathering impact burn efficiencies of five different types of oil: paraffinic, waxy, naphtenic, asphaltenic, and VLSFO.

<https://www.bsee.gov/ignition-combustion-and-atomizatin-of-emulsions-during-in-situ-burning>

5. Restricted Burning Tongue

Lead Agency: BSEE.

BSEE is pursuing a line of research and plans to conduct full-scale tests of modified boom configurations in the Canadian Multi-Partner Research Initiative Offshore Burn Experiments (MOBE) planned for the summer of 2022. The primary goal of the research is to determine if alternate boom geometries will result in a reduction of particulate matter (PM) and trace pollutants in the plume and reduced amounts of burn residue. The immediate objective of this contract is the simplified acquisition of fire boom materials to create a new technique to improve burn efficiencies from in situ burning of crude oil on water. Optional tasks include the design and fabrication of a fire brake, and sufficient fire boom for testing for MOBE.

<https://www.bsee.gov/restricted-burning-tongue-0>

6. Weathering and Photooxidation of Five MPRI Oils to Create Stable Water-in-Oil Emulsions

Lead Agency: BSEE.

The purpose of this BSEE project is to: (1) study if different emulsion protocols produce emulsions with similar chemical and physical properties; (2) create repeatable, stable oil-in-water emulsions, and better understand the role of UV photooxidation in the stability-of-water in oil emulsions at this operational scale; (3) determine the role of micelle diameter and particle size distribution in emulsion stability; (4) determine the length of time that the emulsions will remain stable in storage without refrigeration; and (5) document color changes of the weathered/photo oxidized oil.

<https://www.bsee.gov/ignition-combustion-and-atomization-of-emulsions-during-in-situ-burning>

7. HYSPLIT - In Situ Oil Burn Plume Characterization and Dispersion: Technology Assessment and Worker/Public Safety.

Lead Agency: BSEE. Collaborator: EPA.

This project will conduct field trials of in situ burns (ISB) to calibrate the NOAA's HYSPLIT air trajectory model by conducting multiple crude oil burns at the Poker Flat Research Range (PFRR) operated by the University of Alaska, Fairbanks with oil handling support by Alaska Clean Seas.

<https://www.bsee.gov/hysplit-in-situ-oil-burn-plume-characterization-and-dispersion-technology-assessment-and>

8. Freshwater In-Situ Oil Burn Research

Lead Agency: USCG. Collaborator: EPA.

Develop and conduct a series of ISBs that evaluate crude oil/tar sands products and fuel oil burn behavior and impacts in fresh water. Efforts provided science-based adaptive management approach information to response planners and Federal on Scene Coordinators (FOSCs) about ISB efficacy and applicability to most likely spill scenarios in the Great Lakes. Work includes plume monitoring and measurement as precursor to SMART protocol improvements.

9. Advancement of Low-Emission Spray Combustor

Lead Agency: BSEE.

The objective of this final phase of research is to transition the Technology Readiness Level of a low-emission, low-pressure atomization and combustor system for emulsified crude oil from 4 to 8 by developing and refining the performance of a half-scale or full-scale flow blurring atomizer spray burner so that the system design can be transferred to a manufacturer.

<https://www.bsee.gov/low-emission-combustor-system-for-emulsified-crude-oil>

10. Herder Burner System Joint Industry Project with Remote Sensing Package

Lead Agency: BSEE.

BSEE will participate in a Joint Industry Project with the Prince William Sound Oil Spill Recovery Institute (OSRI) and ExxonMobil to design and develop a remotely operated uncrewed surface vehicle. This spill response system can jointly apply chemical herders to a spill and ignite the oil once it has been corralled.

<https://www.bsee.gov/herder-burner-system-joint-industry-project-0>

11. Development of the Floating Flame Refluxer™ for Offshore Deployment

Lead Agency: BSEE.

This latest research initiative on Flame Refluxing technology endeavors to advance the technology readiness towards commercialization (TRL 9) by testing floating Flame Refluxers™ in a controlled-oil spill in an offshore environment. The target burning rate per unit area is 2 to 5 times baseline values with an improvement in emissions (30 - 60% reduction in CO/CO₂ ratio) that will reduce black smoke during combustion.

<https://www.bsee.gov/development-of-a-floating-flame-refluxer>

N. *Alternative Countermeasures (30800) – Research Papers*

1. Determination of aquatic hazard concentrations for the oil spill response product class of surface washing agents using species sensitivity distributions (2023, EPA)
Alloy, M.; D. Sundaravadivelu, R.N. Conmy, P. Meyer, and M.G. Barron. *Marine Pollution Bulletin*, doi: 10.1016/j.marpolbul.2023.115063.
<https://pubmed.ncbi.nlm.nih.gov/37302201/>
2. Recommendations for advancing media preparation methods used to assess aquatic hazards of oils and spill response agents (2023, EPA)
Parkerton, T.; M. Boufadel, T. Nordtug, C. Mitchelmore, K. Colvin, and D. Wetzel, et al. *Aquatic Toxicology*, 106518.
3. Comparative toxicity of oil spill herding agents to aquatic species (2022, EPA)
Alloy, M.; D. Sundaravadivelu, E. Moso, P. Meyer, and M.G. Barron. *Environmental Toxicology and Chemistry*, 41(5): 1311-1318.
4. Comparative toxicity of oil spill response agents and crude oils to five species of aquatic test species (2021, EPA)
Barron, M.G.; A.C. Bejarano, R.N. Conmy, D. Sundaravadivelu, and P. Meyer, et al. *International Oil Spill Conference Proceedings*, 1141564.

O. *Alternative Chemical Countermeasures (30800) – Research Projects*

1. Development of a Laboratory Protocol for Effectiveness of Commercial Surface Washing Agents in Cleaning Up Oil Spills on Shorelines.
Lead agency: EPA.
This project aims to develop a standardized and reproducible testing protocol to evaluate the shoreline cleaning efficiency of surface washing agents (SWAs). Oil removal

efficiencies for SWA are being evaluated, as well as dispersibility, because an effective SWA should not disperse oil into water, as per U.S. policy.

P. Oily and Oil Waste Disposal – No Research Papers or Projects

Q. Other – projects that did not align with an existing SRA within the Response Category

1. Creation of a Federal On Scene Coordinator Field Guide for Responding to Oil Spills in an Ice Laden Environment
Lead Agency: NOAA. Collaborator: USCG. Funded by GLCOE.
Consolidation of key scientific results into a Federal On-Scene Coordinator field guide for response to oil in icy waters.
2. Hazardous Substance Pollution Response Technology Analysis (1033)
Lead Agency: USCG. Collaborator: EPA.
This project will help modify current area contingency plan architecture, as well as arm Federal On-Scene Coordinators (FOSCs) with an understanding on what they have available in order to properly respond to an incident.
3. Science for Spills of Opportunity: Transitioning Research into Application for Oil Spill Response and Assessments
Lead Agency: NOAA. Collaborator: USCG. Funded by GLCOE.
Develop a framework for creating a list of science of spills of opportunity projects.
Establish tentative contracts to allow for deployment during and/or following an incident.
Execute and oversee contracts on a spill of opportunity.
4. Research to Support Analysis of OSRPs for Spills on Snow and Solid Ice
Lead Agency: BSEE.
This project developed a calculator tool to facilitate assessment of an operator's oil spill response plan for a well blowout, tank failure, pipeline leak, or other spill that occurs during winter months and results in recovery operations on snow and solid ice using "yellow gear" equipment.
[Research to Support Analysis of Oil Spill Response Plans for Spills on Snow and Solid Ice | Bureau of Safety and Environmental Enforcement \(bsee.gov\)](#)
5. Great Lakes Oil-Spill Response Capabilities Evaluation
Lead Agency: USCG. Funded by: GLCOE.
The USCG Great Lakes Oil Spill Response Capabilities, Capacity, and Gaps Study addresses the scope of current oil spill risks in the region; the roles, capabilities, and capacities of oil-spill response partners; and any gaps and potential mitigation strategies around oil-spill response in fresh water and ice.

IV. INJURY ASSESSMENT AND RESTORATION

A. *Environmental Effects and Ecosystem Recovery (40000) – Research Papers*

1. Improving the design and conduct of aquatic toxicity studies with oils based on 20 years of CROSERF experience (2023, EPA)
Stubblefield, W.A.; M.G. Barron, G. Bragin, M.E. DeLorenzon, and B. De Jourdan, et al. *Aquatic Toxicology*, 261, 106579.
2. Impacts of dispersants on microbial communities and ecological systems (2023, EPA)
Techtmann, S.M.; J. Santo Domingo, R.N. Conmy, and M.G. Barron. *Applied Microbiology and Biotechnology*, 107(4): 1095-1106.
3. Vulnerability assessment in and near Theodore Roosevelt National Park, North Dakota (2021, USGS)
Valseth, K.J. U.S. Geological Survey Scientific Investigations Map 3479, pamphlet 9, p. 1. <https://doi.org/10.3133/sim3479>.
https://pubs.usgs.gov/sim/3479/sim3479_pamphlet.pdf
4. Workshop Report on Data Gaps and Oil Spill Impacts on Dolphins (2022, NOAA)
Greater Houston Area Bottlenose Dolphin Data Gaps. Coastal Response Research Center, February 2022.
<https://scholars.unh.edu/crrc/32>
5. The Open-Ocean Gulf of Mexico After Deepwater Horizon: Synthesis of a Decade of Research (2022, NOAA)
Sutton, Tracey T.; Milligan, Rosanna J.; Daly, Kendra; Boswell, Kevin M.; Cook, April B.; Cornic, Maëlle; Frank, Tamara; Frasier, Kaitlin; Hahn, Daniel; Hernandez, Frank; Hildebrand, John; Hu, Chuanmin; Johnston, Matthew W.; Joye, Samantha B.; Judkins, Heather; Moore, Jon A.; Murawski, Steven A.; Pruzinsky, Nina M.; Quinlan, John A.; Remsen, Andrew; Robinson, Kelly L.; Romero, Isabel C.; Rooker, Jay R.; Vecchione, Michael; Wells, R.; and J. David. *Frontiers in Marine Science*, Vol. 9, 2022.
DOI=10.3389/fmars.2022.753391 ISSN=2296-7745.
<https://www.frontiersin.org/articles/10.3389/fmars.2022.753391>
6. Preparing for Arctic Oil Spills (2022, NOAA)
Wright, Sadie K.; Allan, Sarah; Wilkin, Sarah M.; Ziccardi, Michael; and Tryland, Morten. *Oil Spills in the Arctic*, pp. 159-192. Arctic One Health: Challenges for Northern Animals and People. Springer International Publishing. SN 978-3-030-87853-5.
https://doi.org/10.1007/978-3-030-87853-5_7
<https://response.restoration.noaa.gov/new-publication-book-chapter-oil-spills-arctic>
7. Research on Impacts of Oil on Sand Beaches (2023, NOAA)
Bryand M. Duke, Kyle A. Emery, Jenifer E. Dugan, David M. Hubbard, and Bruce M. Joab. Uptake of polycyclic aromatic hydrocarbons via high-energy water accommodated

- fraction (HEWAF) by beach hoppers (Amphipoda, Talitridae) using different sandy beach exposure pathways. *Marine Pollution Bulletin*, Volume 190, 2023, 114835, ISSN 0025-326X, <https://doi.org/10.1016/j.marpolbul.2023.114835>.
<https://www.sciencedirect.com/science/article/pii/S0025326X23002667>
8. New Publication on Discounting in Natural Resource Damage Assessment (2023, NOAA)
 Eric Horsch, Daniel Phaneuf, Chris Giguere, Jason Murray, Cameron Duff, and Cole Kroninge. Discounting in Natural Resource Damage Assessment. *Journal of Benefit-Cost Analysis*, Volume 14 , Issue 1, Spring 2023, pp. 141-161.
<https://doi.org/10.1017/bca.2022.24>
<https://www.cambridge.org/core/journals/journal-of-benefit-cost-analysis/article/discounting-in-natural-resource-damage-assessment/7D2F8B702FB17D8502A4B5DF98DA9990>
 9. Ecosystem-Service Scaling Techniques to Evaluate the Benefits of Marine Debris Removal (2022, NOAA)
 Domanski, A.; and Lavery, AL. *Environ Manage.* July 2022, 70(1): 64-78.
 doi: 10.1007/s00267-022-01636-5. Epub 2022 Apr 1. PMID: 35359239.
 10. Photochemical formation of water-soluble oxyPAHs, naphthenic acids, and other hydrocarbon oxidation products from Cook Inlet, Alaska crude oil and diesel in simulated seawater spills. (2023, BOEM)
 Harsha, M.L.; Redman, Z.C.; Wesolowski, J.; Podgorski, D.C., and Tomco, P.L. *Environmental Science Advances*, 2(3): 447-461. <https://doi.org/10.1039/D2VA00325B>
 11. Metatranscriptomic shifts suggest shared biodegradation pathways for Corexit 9500 components and crude oil in Arctic seawater. (2023, BOEM)
 Gofstein, T.R.; and Leigh, M.B. *Environmental Microbiology Reports*. 15(1): 51-59.
<https://doi.org/10.1111/1758-2229.13127>
 12. Unique molecular features of water-soluble photo-oxidation products among refined fuels, crude oil, and herded burnt residue under high latitude conditions (2022, BOEM)
 Whisenant, E.A.; Zito, P.; Podgorski, D.C.; McKenna, A.M.; Redman, Z.C.; and Tomco, P.L. *ACS ES&T Water*, 2(6): 994-1002.
<https://doi.org/10.1021/acsestwater.1c00494>
 13. Toxicity of sediment oiled with diluted bitumens to freshwater and estuarine amphipods (2021, EPA)
 Barron, M.G.; E.M. Moso, R.N. Conmy, P. Meyer, and D. Sundaravadivelu. *Marine Pollution Bulletin*, 163, 111941.

B. Environmental Impacts and Ecosystem Recovery (40000) – Research Projects

1. Assessing Oil Bioremediation Agent Efficacy in Flow-through Stream Mesocosms

Lead Agency: EPA.

Project aims to assess the ecological impacts of oil spills in freshwater stream environments using the U.S. EPA Experimental Stream Facility (ESF). Evaluated will be the intrinsic capacity of stream microorganisms to degrade oil compounds in constructed stream mesocosms. Findings will improve the oil spill community's understanding of the ecological effects of oil spills and potential enhanced recovery from oil spills in freshwater streams.

2. Examining the Effects of the Deepwater Horizon Oil Spill on Coastal Marshes

Lead Agency: NOAA.

OR&R scientists were among those conducting a new study that examined the effects of the 2010 Deepwater Horizon oil spill on shoreline erosion of coastal marshes as well as the influences of planting following oiled marsh cleanup. The authors confirmed that marsh erosion at their field sites substantially increased for two years in heavily oiled marshes after the spill.

3. Photo-enhanced toxicity of dispersed and burned crude oil to Arctic mussels.

Lead Agency: DHS.

The project studied oil, dispersants, in-situ burning, and photo-enhanced effects on several physiological, biochemical, and metabolic aspects of a cold-water species of mussel.

[Projects \(arcticdomainawarenesscenter.org\)](http://Projects.arcticdomainawarenesscenter.org)

4. Cetacean Surface Oil Risk Characterization from Inhalation and Aspiration

Lead Agency: NOAA.

A three-part study advancing understanding of surface oil exposure to cetaceans via inhalation and aspiration of droplets and aerosols. This will advance our ability to characterize exposure risk for cetaceans following an oil spill event. The study involves working with trained bottlenose dolphins to study breathing events without oil, replicating these breathing events in a lab with oil and dispersants, and measuring the gradient of oil in the shallow air column above surface slicks.

5. Evaluating How Dolphins Are Impacted By Oil Spills

Lead Agency: NOAA.

In 2022, scientists examined the dynamics of a dolphin's breath at the surface to better understand how much floating material may make it into the animals' lungs. To collect this information, scientists took high-speed videos of dolphins doing what comes naturally to all mammals: breathing air.

6. Baseline toxicity testing of National Contingency Plan (NCP) Product Schedule oil spill control agents

Lead Agency: NOAA.

Acute and chronic toxicity of commercially-available products (chemical herders and surface washing agents) on the NCP Product Schedule using fresh and salt water species (fish and invertebrates) are being evaluated in this project.

7. CROCERF toxicity testing methods evaluation

Lead Agency: EPA.

Interagency, academic and industry effort to evaluate toxicity testing methods.

Publications from the effort were published in 2023.

8. Enhance tribal capacity to prepare and respond to inland oil spills in the Pacific N.W. - Pre/post spill fish health and water quality assessments.

Lead Agency: USCG.

This project will enhance tribal technical capacity to prepare for and respond to inland oil spills in the Pacific Northwest. We are developing a training manual /standard operating procedures or pre-spill ecological baseline characterization and post-spill impact characterizations against which the baseline can be compared.

9. Biodegradability of crude oil exposed to Surface Washing Agents and Chemical Herders at Two Temperatures

Lead Agency: EPA.

Biodegradation rates of oil exposed to NCP Products that may remain in the environment after use are being evaluated. Such information is useful during oil spill response efforts and for fate and transport models.

10. Baseline aquatic risk assessment study for Theodore Roosevelt National Park

Lead Agency: USCG.

This project developed a GIS tool to aid in response to spills at a National Park using LIDAR data.

https://d9-wret.s3-us-west-2.amazonaws.com/assets/palladium/production/atoms/files/York_Spill_Tool_THRO_final.pdf

11. Comprehensive Synthesis of Effects of Oil and Gas Activities on Marine Mammals on the Alaska Outer Continental Shelf, Volume 1

Lead Agency: BOEM.

This study provides potential direct, indirect, and cumulative effects of oil and gas resource development on marine mammals in the U.S. Arctic (the Alaskan Beaufort and Chukchi seas and Cook Inlet) for the period 2000 - 2020.

https://espis.boem.gov/Final%20Reports/BOEM_2022-009_V1.pdf

12. Comprehensive Synthesis of Effects of Oil and Gas Activities on Marine Mammals on the Alaska Outer Continental Shelf, Volume 2

Lead Agency: BOEM.

This study provides potential direct, indirect, and cumulative effects of oil and gas resource development on marine mammals in the U.S. Arctic (the Alaskan Beaufort and Chukchi seas and Cook Inlet) for the period 2000 - 2020.

https://espis.boem.gov/Final%20Reports/BOEM_2022-009_V2.pdf

13. Comprehensive Synthesis of Effects of Oil and Gas Activities on Marine Mammals on the Alaska Outer Continental Shelf, Appendices

Lead Agency: BOEM.

This study provides potential direct, indirect, and cumulative effects of oil and gas resource development on marine mammals in the U.S. Arctic (the Alaskan Beaufort and Chukchi seas and Cook Inlet) for the period 2000 - 2020.

https://espis.boem.gov/Final%20Reports/BOEM_2022-009_A.pdf

14. Comprehensive Synthesis of Effects of Oil and Gas Activities on Marine Mammals on the Alaska Outer Continental Shelf, Bibliography

Lead Agency: BOEM.

This study provides potential direct, indirect, and cumulative effects of oil and gas resource development on marine mammals in the U.S. Arctic (the Alaskan Beaufort and Chukchi seas and Cook Inlet) for the period 2000 - 2020.

https://espis.boem.gov/Final%20Reports/BOEM_2022-009_B.pdf

15. Hydrocarbon Oxidation Products in Cook Inlet: Formation and Bioaccumulation in Mussels

Lead Agency: BOEM.

This study will reveal an oil weathering pathway, Hydrocarbon Oxidation Products formation and bioaccumulation, to provide a framework to assess impacts from accidental oil spills.

https://www.boem.gov/sites/default/files/documents/FE_AK-19-02-12_5.pdf

16. From Beaufort to Bering Seas: Analyzing Relationships of Communication and Risk-sharing in Anticipation of Increased Hydrocarbon Traffic off Alaska's Northern Coasts

Lead Agency: BOEM.

Researchers will study risks from, potential impacts of, and capacity to respond to shipping traffic in the region through a multi-site, communication network analysis of key regulatory, legal, and managerial individuals and entities.

https://www.boem.gov/sites/default/files/documents/SS_AK-19-02-18_0.pdf

17. Determining carcass scavenging rates on major rivers for oil spill response and NRDAR

Lead Agency: USGS.

This project addresses deficiencies in inland bird mortality models. The objective is to establish pre-disaster carcass scavenging rates that can serve as baselines for estimating the magnitude of avian injury following future oil spills along two major rivers.

18. In-Situ Bioassay Testing at Oil Spill Site

Lead Agency: NOAA.

The assessment tool combines components of 2 previously developed systems, the sediment ecotoxicity assessment ring (SEA Ring) and the drifting particle simulator.

19. Assessing baseline contaminants in the 1002 Area of the Arctic National Wildlife Refuge in Alaska

Lead Agency: USFWS.

U.S. Geological Survey project to assess baseline contaminant levels and types in biotic and abiotic matrices in the coastal plain of the Arctic National Wildlife Refuge prior to oil and gas exploration and development activities. Results to be used for development impact assessments; addressing subsistence concerns; evaluating water quality.

C. Environmental Restoration Methods and Technologies (40100) – No Research Papers or Projects

D. Human Safety and Health (40200) – No Research Papers or Projects

E. Sociological and Economic Effects (40300) – No Research Papers or Projects

Appendix B: ICCOPR 2022-2027 R&T Plan Standing Research Areas (SRAs) and Subcategories

PREVENTION (10000 Series)	
SRA	Subcategories
Human Error Factors	None
Offshore Facilities and Systems	<ul style="list-style-type: none"> • Met-Ocean Effects • Surface Systems and Umbilicals
Onshore Facilities and Systems	<ul style="list-style-type: none"> • Tank/Piping Inspection, Operations, Design and Data • Emerging Issues
Waterways Management	None
Vessel Design	None
Drilling	<ul style="list-style-type: none"> • Deepwater Drilling/Technology • Reservoir Characterization
Rail and Truck Transportation	None
Pipeline Systems	<ul style="list-style-type: none"> • Threat/Damage Prevention • Leak Detection • Anomaly Detection/Characterization
Geohazards	<ul style="list-style-type: none"> • Monitoring • Identification & Characterization
Subsea Systems Automation and Reliability	None

PREPAREDNESS (20000 Series)	
SRA	Subcategories
Pre-Spill Baseline Studies	<ul style="list-style-type: none"> • Habitats and Species Baselines • Oceanographic/Geologic Baselines • Environmental Baseline Planning
Response Management Systems	None
Renewable Energy Systems	None

RESPONSE (30000 Series)	
SRA	Subcategories
Structural Damage Assessment and Salvage	None
At Source Control and Containment	None
Chemical and Physical Modeling and Behavior	<ul style="list-style-type: none"> • Arctic Behavior and Modeling • Oil Behavior Models • Transport Models • Oceanographic Models

	<ul style="list-style-type: none"> • Emerging Crude • Sinking Oil and Marine Oil Snow (MOS) Sedimentation and Flocculent Accumulation (MOSSFA)
Oil Spill Detection and Surveillance	<ul style="list-style-type: none"> • Remote Detection • Monitoring • Submerged Oil Detection
In- and On-water Containment and Recovery	<ul style="list-style-type: none"> • Control and Recovery Technology • Recovery Operations and Testing
Shore Containment and Recovery	None
Dispersants	<ul style="list-style-type: none"> • Cold Water and Ice Conditions • Behavior • Environmental Effects • Efficacy and Effectiveness • Fate • Subsurface
In-situ Burning	<ul style="list-style-type: none"> • Effectiveness and Impacts • Planning and Technology
Alternative Countermeasures	None
Oily and Oil Waste Disposal	None
Bioremediation	None

INJURY ASSESSMENT AND RESTORATION (40000 Series)	
SRA	Subcategories
Environmental Effects and Ecosystem Recovery	<ul style="list-style-type: none"> • Species Impacts • Toxicological and Sublethal Impacts • Sunken and Submerged Oil Impacts • Ecosystem and Habitat Impacts • Recovery • Risk Assessment and Impact Metrics
Environmental Restoration Methods and Technologies	None
Human Safety and Health	<ul style="list-style-type: none"> • Safety • Human Exposure
Sociological and Economic Effects	<ul style="list-style-type: none"> • Community and Economic Impacts • Human Impacts