OIL SPILL PREPAREDNESS DIVISION
OIL SPILL RESPONSE RESEARCH (OSRR)

Karen Stone
Chief, Response Research Branch

March 28, 2023

The **Oil Spill Preparedness Division** *mitigates the impact of offshore facility oil spills by ensuring energy producers are trained, resourced, and ready to respond; performing cutting-edge research and development; and by supporting the National Response System.*

BSEE

BSEE OSPD – RESPONSE RESEARCH BRANCH

OIL SPILL RESPONSE RESEARCH (OSRR)

	Project No.	Title	Organization	COR
M	1072	Skimmer Testing in Diminishing Slick Thicknesses	BSEE	Kristi
I	1096	Measurements of In Situ Burn Emissions and Residues	EPA	Karen
R	1097	Slick Thickness Characterization Based on Low Noise, Polarized Synthetic Aperture Radar	NASA/Jet Propulsion Laboratory	Jay
I	1106	Advancement of Low-Emission Spray Combustor	Naval Research Lab (NRL)	Karen
D	1109	Development of Response Info ACPs	RPS Group, Inc	Steve P
I	1116	Herder Burner System Joint Industry Project with Remote Sensing Package	Prince William Sound Oil Spill Recovery Institute (OSRI)	Karen/Jay
M	1119	Development of a Recovery Efficiency Sensor Phase II	Battelle Memorial Institute	Kristi
R	1121	Oil Detection and Thickness Estimation Under/In Ice Based on	American University of Beirut (AUB)	Jay

	Project No.	Title	Organization	COR
		Electrical Capacitance Tomography (ECT)		
I	1124	Efficient Remediation of Oil Spills using Fire Whirls – Phase II	University of California, Berkeley	Karen
R	1126	Remote Sensed Data into Gnome ('1140 GNOME Anywhere' added as task)	NOAA	Jay
M	1127	Development of an Advancing Skimmer Test Protocol	SL Ross	Kristi
M	1128	Development of the Testing of Oil Spill Technologies (TOST) Program	BSEE	Kristi
R	1131	Advancement of MARINE SCOUT	Qinetiq, Inc.	Jay
R	1132	LiDAR Oil Characterization and Advancement	NRL	Jay
I	1133	Ignition, Combustion, and Atomization of Emulsions During In Situ Burning	NRL	Karen
I	1134	Restricted Burning Tongue	BSEE	Karen
M	1137	Oil Spill Boom Computational Fluid Dynamics and Physical Modeling Study	Serco Inc.	Kristi

	Project No.	Title	Organization	COR
M	1142	Research to Support Analysis of OSRPs for Spills on Snow and Solid Ice	Nortech, Inc.	Kristi
M	1144	Enhancements to Ohmsett's Testing Capabilities in a Drift Ice Environment	Applied Research Associates	Kristi
I	1147	Multi-Partner Research Initiative (MPRI) Emulsions Protocol Study at Ohmsett	BSEE/ARA	Karen
I	1148	In Situ Oil Burn Plume Characteri- zation and Dispersion: Technology Assessment and Worker/Public Safety "HYSPLIT"	EPA	Karen
I	1149	Development of the Floating Flame Refluxer™ for Offshore Deployment	Worcester Polytechnical Institute (WPI)	Karen
M	1150	Advancing the BOWHEAD Vessel Ice Management System	Serco, Inc.	Kristi
C	1151	eChip Microbial Colonization	TAMU	Ann
S	1153	Shoreline Response Gaps and Opportunities Workshop	NOAA	Steve
C	1154	Optimized Detection of Dispersed Oils via Scanning Fluorometry	NJIT	Ann
R	1155	Oil spill detection under ice and on seafloor	SL Ross	Jay

	Project No.	Title	Organizatio	COR
C	1156	Surface Water Droplet Size Distribution (DSD) Instrument Evaluation	NJIT	Ann
M	7012	Mechanical Recovery of Chemically Treated, Undispersed Oil	BSEE	Kristi
M	7022	Boom Testing at Ohmsett	BSEE	Kristi

D	Decision-making	1
C	Chemical Treatments	3
I	In-situ Burning / Combustion	9
R	Remote Sensing / Detection	6
M	Mechanical Recovery / Containment	10
S	Shoreline	1
O	Other	0

RECENTLY COMPLETED PROJECTS OF INTEREST

- BSEE Burner
- Restricted Burning Tongue

LOW-EMISSION SPRAY COMBUSTOR

“BSEE BURNER”

VIDEO

Low-Emission Crude Oil Burner

Oil Spill Cleanup in the Field

Tested Conditions: **Sea State 2**
Burner Height: **11 ft**
Dry Weight: **850 lb**
Max Burn Rate: **640 bbl/day**

CO: **2 ppm***

PM2.5: **3-40 g/kg***

Emulsions: **40% Water**

Collapsible design with small footprint allows easy transport and storage.

Versatile uses offshore, including Gulf of Mexico, Arctic, fast-water, near coasts, and leaking wrecks.

Burn at variable flowrates or run multiple burners in parallel to remove the spill onsite.

Runs day or night.

Achieves over 99% efficienct burn, 75% lower emissions than in-situ burning.*

Shielding protects personnel.

Works with off-the-shelf pumps and equipment.

Tested on waves and with up to 40% seawater.

No moving parts.

Research funded by US Department of Interior, Bureau of Safety and Environmental Enforcement. Performed by the US Naval Research Laboratory.

BSEE

U.S. NAVAL RESEARCH LABORATORY

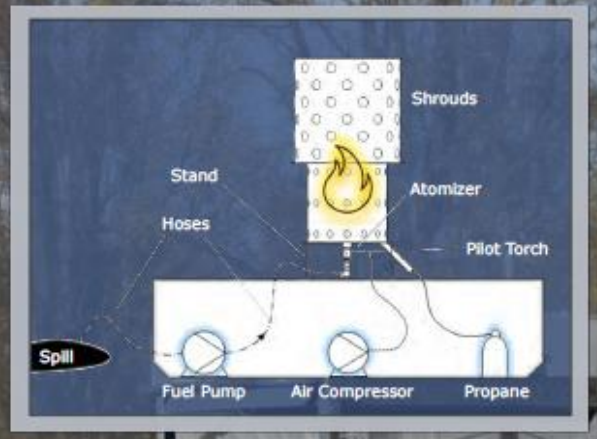
Auxiliary Equipment Requirements

Air Compressor
minimum 250 SCFM
45 psig

Fuel Pump
minimum 3 GPM
viscosity requirements vary with oil type

Pilot Torch Fuel (Propane)
0.2 SCFM

Hoses, Air Regulator, Shut-Off Valves



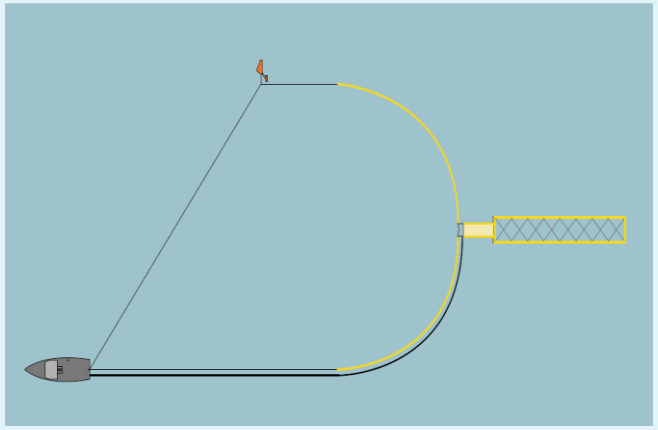
Contact:
Karen.Stone@bsee.gov

* Depends on oil type and amount of seawater

BSEE OSRR #1134 – Restricted Burning Tongue

- Elastec
- PI: Mark Hilliard
- BSEE PM/COR: Karen Stone

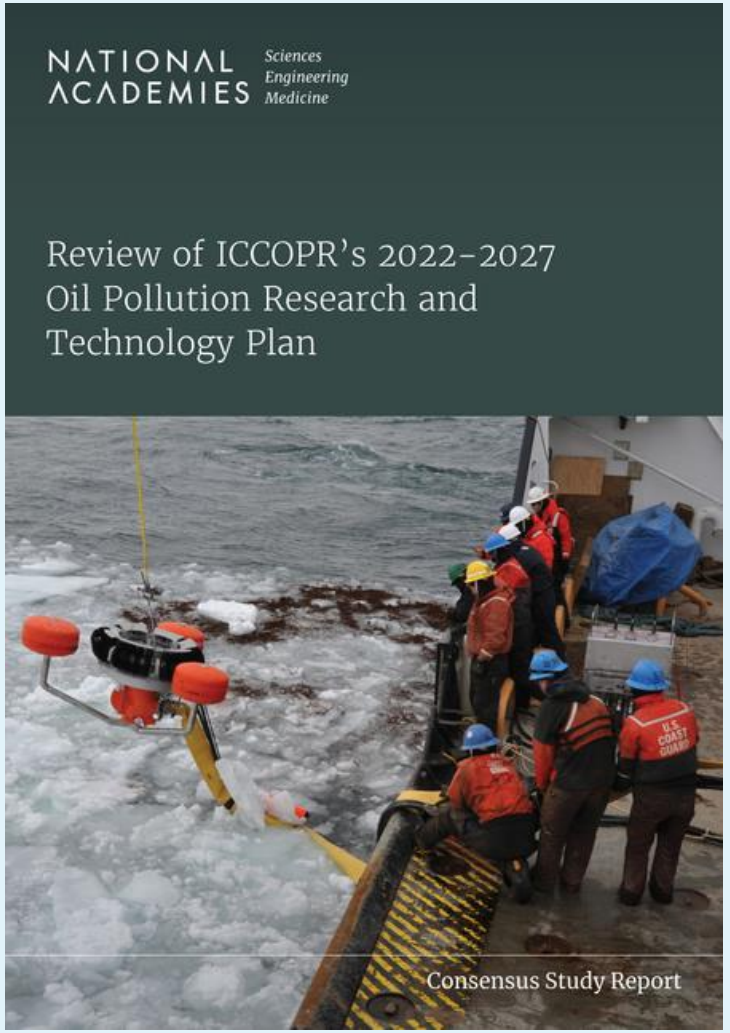
The overall objective of this project is to create a combined, towed boom system in a wine glass formation.



(Left) boat and boom vane assembly with apex gate and linear boom; (Center) wine glass configuration with gate; (Right) Burn test at CRREL.

CURRENT RESEARCH

- Boom CFD Modeling for Scaling
- HYSPLIT Calibration
- AUV LiDAR Field Testing
- Shoreline Response Workshop
- JIP JET SKI (NOMAD)
- DSD Instrument Evaluation
- Testing Oil Spill Technology (TOST)



BSEE OSRR #1137 – Oil Spill Containment Boom Computational Fluid Dynamics and Physical Modeling Study

- PI: Dr. Gregory Johnson, Serco, Inc.
- BSEE PM: Kristi McKinney

Objective: Assess how physical scaled model testing and computational fluid dynamics (CFD) modeling results compare to full-scale boom tests

- Conduct systematic **physical scaled model testing** of several boom designs at multiple scales at Ohmsett to assess consistency of test results

- Conduct **CFD modeling** for each boom design, and compare results obtained to the physical test results

Full Scale

75% Scale

50% Scale

25% Scale

BSEE OSRR #1148 – HYSPLIT - In Situ Oil Burn Plume Characterization and Dispersion: Technology Assessment and Worker/Public Safety.

- EPA PI: Brian Gullett
- BSEE PM/COR: Karen Stone

Objective: Measuring carbon monoxide (CO) as a plume "tracer" to provide data for model calibration. Test results will also be used to inform the current updates to the ISB SMART Protocols.

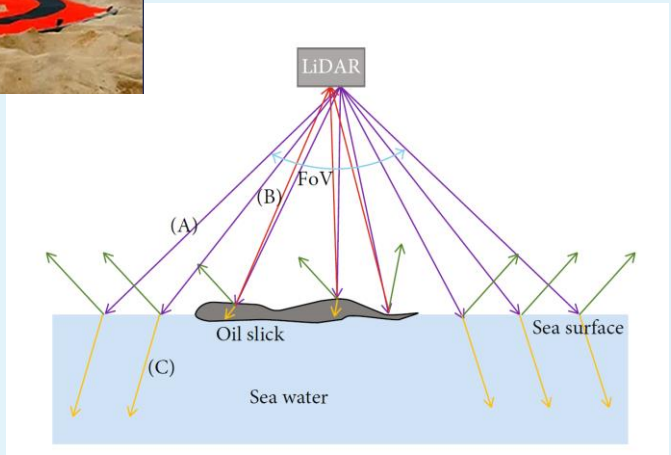
BSEE OSRR #1155 – UAV LiDAR field testing

- The Bureau of Safety and Environmental Enforcement
- BSEE PM: Jay Cho

Objective: Demonstrate the capability of Uncrewed Aerial Vehicles (UAV) Light Detection and Ranging (LiDAR) system to detect and measure oil slick thickness using a low-power LiDAR on UAV in the Great Lakes

Research Questions

- How can LiDAR discriminate oil from water and ice?
- What's the added value of LiDAR compared to other remote sensing technologies?
- What strategies can be used/developed to discriminate and provide features of interest (ice/water/oil) and characterize features for oil thickness measurements?



LiDAR return (Moon and Jung, 2020)

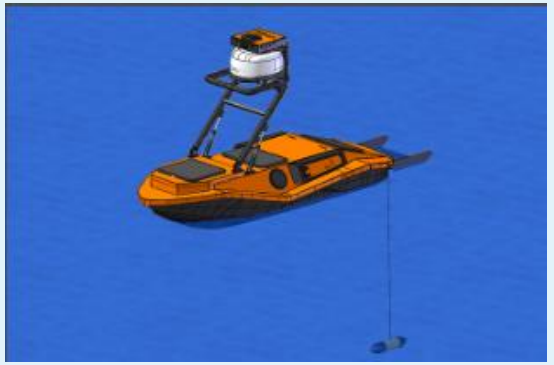
BSEE OSRR #1153 –Shoreline Response Gaps and Opportunities Workshop

- National Oceanic and Atmospheric Administration (NOAA)
- PI: Lisa DiPinto/Troy Baker
- BSEE PM/COR: Steve Buschang

Objective. Convene a technical meeting of experts to inform the oil spill research community on shoreline related gaps in technologies and oil spill science. The workshop will focus on shoreline impacts of oils from offshore facilities including traditional oil and gas exploration and production (E&P) and renewable energy (RE) facilities but will have applicability to many other spill scenarios.

BSEE OSRR #1116 – Herder Igniter Joint Industry Program – “NOMAD”

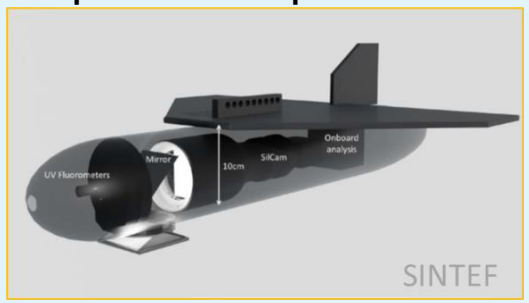
- Prince William Sound Oil Spill Research Institute (OSRI)
- PI: Scott Pegau
- BSEE POCs: Karen Stone & Jay Cho



BSEE OSRR #1156 – Surface Water Droplet Size Distribution (DSD) Instrument Evaluation

- PI: Dr. Michel Boufadel (NJIT)
- BSEE PM/COR: Ann Slaughter

Objective: BSEE Response Research Branch is undertaking a project designed to better understand how surface water dispersant monitoring, as specified by the NCP SubPart J Monitoring Rule, can be practically implemented with existing technology – specific emphasis on DSD range detection of oil and dispersed oil droplets in depths of 1 to 5 meters.



Left: Concept image for Towed SilCam (Source: SINTEF)
Right: Image of the LISST-Black (Source: Sequoia)

Three Phases in 2023:

I. Laboratory validation of instrument detection
II. Wave tank deployment at Ohmsett
III. Field evaluation during the Canadian Field Trial

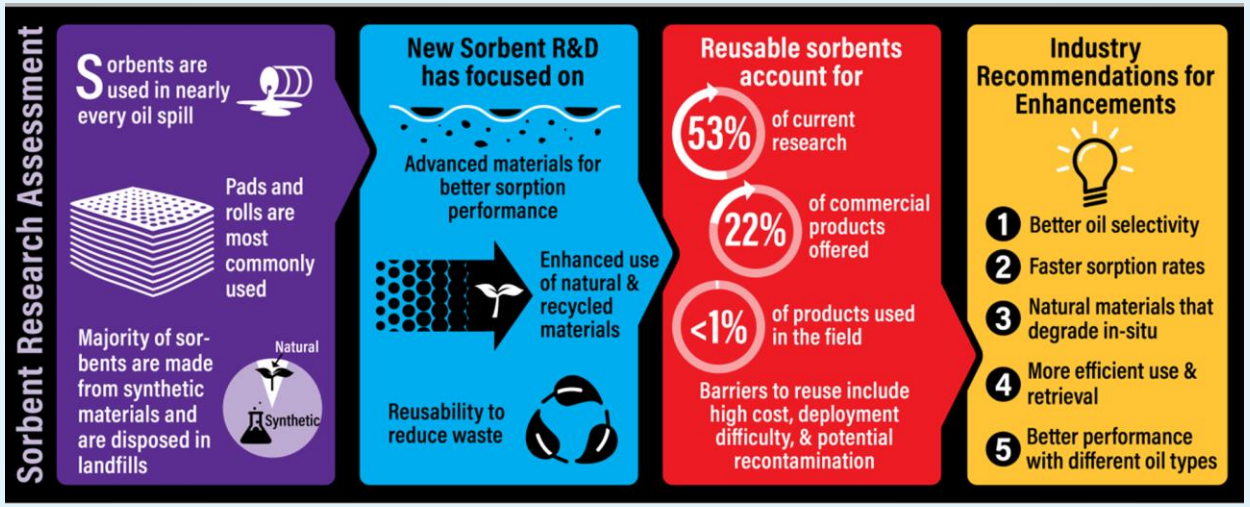
BSEE OSRR #1128 – Testing of Oil Spill Technologies (TOST)

- The Bureau of Safety and Environmental Enforcement
- BSEE PM: Kristi McKinney

Develop TOST Initiative to test new and existing oil spill response technologies

FY22

Joint BSEE/ USCG RDC testing of innovative sorbents

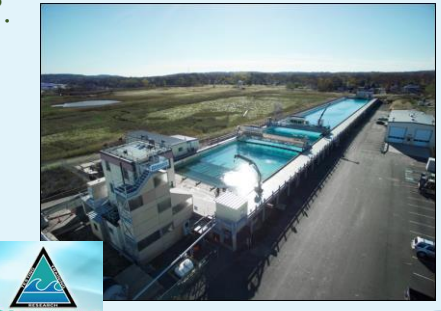


FY23

Anticipated joint project with USCG RDC

OPA 90, Section 7001 c.3.A Text

The Oil Pollution Act of 1990 (OPA) Title VII Section 7001.c.3.A mandates that "the (research and development) program…shall provide for oil pollution prevention and mitigation technology evaluation including" "the evaluation and testing of technologies developed independently of the research and development program established under this subsection".



Karen Stone

karen.stone@bsee.gov

703-787-1810

BSEEWebsite:
www.bsee.gov

@BSEEgov

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and Environmental
Enforcement

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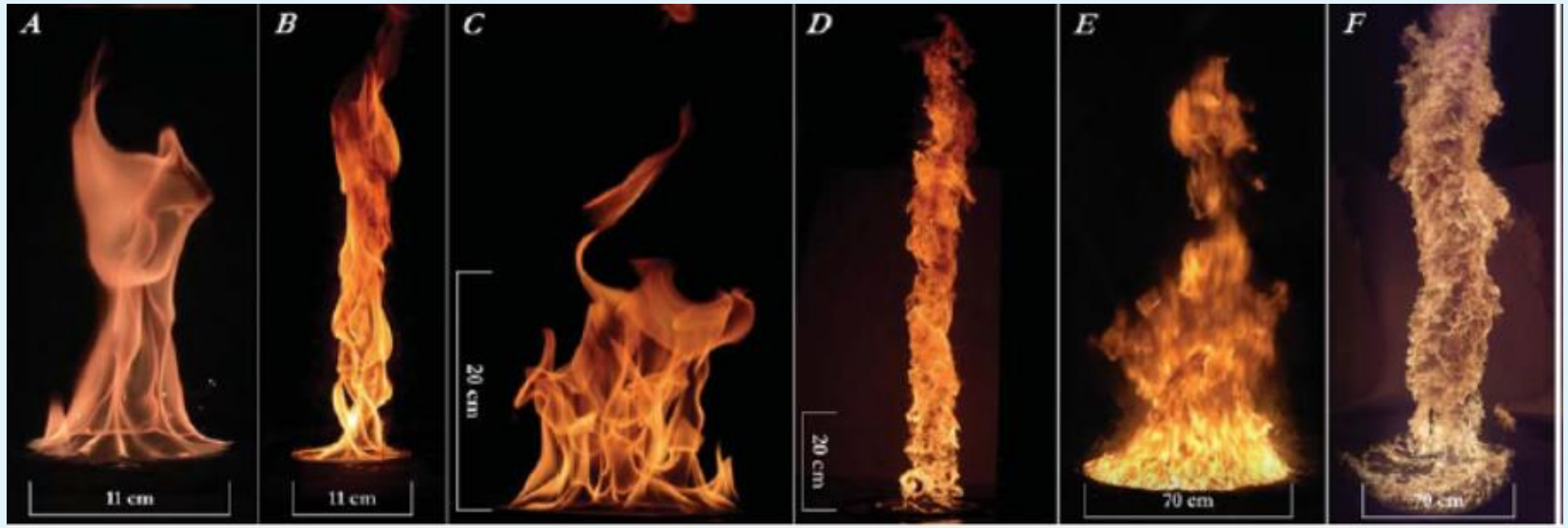
BSEE OSRR #1124 – Fire Whirl - II

- University of California, Berkeley
- PI: Dr. Michael Gollner
- BSEE PM/COR: Karen Stone

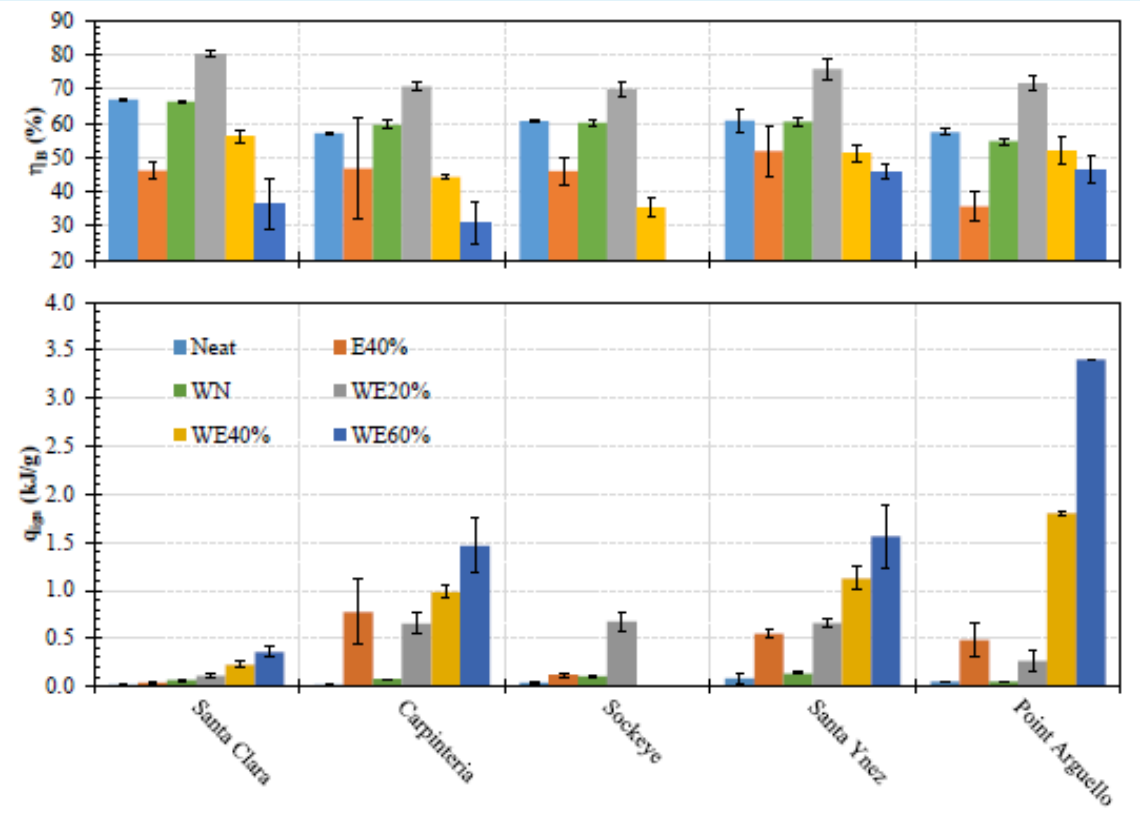
Objective: Characterize ideal configurations and parameters for fire whirl formation including the burning /combustion efficiencies on emissions form different configurations, fuels, and slick thicknesses to further understand the fundamental physics contributing to combustion enhancements.



Pool fires and fire whirls at 11 cm, 20 cm, and 70 cm diameter. With the 70 cm diameter fire whirl reaching 4.5 meters high.

BSEE OSRR #1133 – Ignition, Combustion, and Atomization of Emulsions during in situ Burning

- Naval Research Laboratory
- PI: Steven Tuttle
- BSEE COR: Karen Stone



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.

Burn efficiency (top left) shows an increase in burn efficiency for 20% emulsions for the five California crude oils tested. Increased ignition energy (bottom left) is required as the water content of the emulsions increases.