Coastal Response Research Center (CRRC)
Center for Spills and Environmental Hazards (CSE)

Nancy E. Kinner
University of New Hampshire

ME/NH Area Committee Meeting
December 3, 2020

Coastal Response Research Center (CRRC)

- Partnership between NOAA's Office of Response and Restoration and the University of New Hampshire
- Since 2004
  - UNH co-director – Nancy Kinner
  - NOAA co-director – Ben Shorr

Center for Spills and Environmental Hazards (CSE)

- "Sister" center to CRRC
- Receives non-NOAA funding
  - e.g., US DHS Arctic Domain Awareness Center funding for Arctic oil spill modeling path forward
- Since 2004
  - Director – Nancy Kinner

Mission of CRRC and CSE

- Conduct and Oversee **Basic** and **Applied** Research and Outreach on Spill Response and Restoration
- Transform Research **Results into Practice**
- Serve as **Hub for Oil & Environmental Spill R&D**
  - ALL Stakeholders: Federal, State, NGOs, Academia, Industry
- **Facilitate Collaboration** on R&D Among Stakeholders
- Application to All Hazards
- **Educate** new generation regarding oil spill/disaster response

ICCOPR Science &Technology Plan 2022- 2028

ICCOPR S&T Plan 2022-2028

- **Interagency Coordinating Committee on Oil Pollution Research (ICCOPR)**
  https://www.dco.uscg.mil/ICCOPR/
- **Membership Representation includes:**

USCG	USACE
BSEE	PHMSA
EPA	DOE
BOEM	NOAA

ICCOPR S&T Plan 2022-2027

- Define common research themes related to oil pollution research
- Identify knowledge gaps for common research themes and recommend research priorities
- Link with strategic Federal research plans and reports
- Transfer research achievements between government, the public and other stakeholders

Response Oil Assay

Response Oil Assay (C. Barker) (Funded by Canada's Ocean Protection Program)

- **Over Project Goal:**
  - **Develop software and collect data for new database of oil physio-chemical properties to support oil spill response decision-making**

Response Oil Assay (C. Barker) (Funded by Canada's Ocean Protection Program)

- 4 Working Groups with lots of government, industry and academic input
  - Response Oil Assay Contents
  - Lab Methods
  - Responder's Data Sheet
  - Data Model
- Most will be completing their tasks in 2021

Marine Mammal NRDA Exercises

Marine Mammal NRDA Exercises

- Marine Mammal NRDA Tabletop Exercise
  - 4 regions (Gulf Coast, Alaska, Northeast, West Coast)
  - Review of marine mammal assessment guidelines, small working groups will use a spill scenario(s) to develop skeleton NRDA plan/budget
  - Outcome of this exercise will be a template NRDA workplan to assist in future planning focused on each region's particular need

Hurricane Preparedness Summit

https://crrc.unh.edu/workshop/crrc/nos-hurricane-summit

Hurricane Summit Focus

- **Summit I:** NOAA and its people and communication: (lessons learned, path forward, etc.) **Amid Pandemic**
- **Summit II:** What are best practices for preparedness and response to reduce risk to NOAA or partner facilities, people, and resources to hurricanes during the pandemic response
- **Summit III:** Understand the challenges to NOAA's ability to support state and federal partners' field response missions during the 2020 season. (ESF 3 & 10)

Arctic Maritime Spill Modeling (AMSM)

https://crrc.unh.edu/workshop/AMSM_virtual_2020

ADAC Funded Project

- Oil Spill Modeling for Improved Response to Arctic Maritime Spills: The Path Forward
- Create knowledge product that will detail:
  - Needs/questions for Arctic oil spill response models
  - Current state-of-the-art Arctic models
  - Assess their usefulness in response modeling
  - Research efforts to improve current models
- How to model oil mixed into broken ice, under ice and encapsulated in ice

Flume Projects

- Sunken Oil Transport
- Use of Snare in Spill Monitoring

Flume Experiments to Predict the Re-suspension of Sunken No.6 Heavy Fuel Oil

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Coastal Response Research Center
University of New Hampshire
9/11/2020

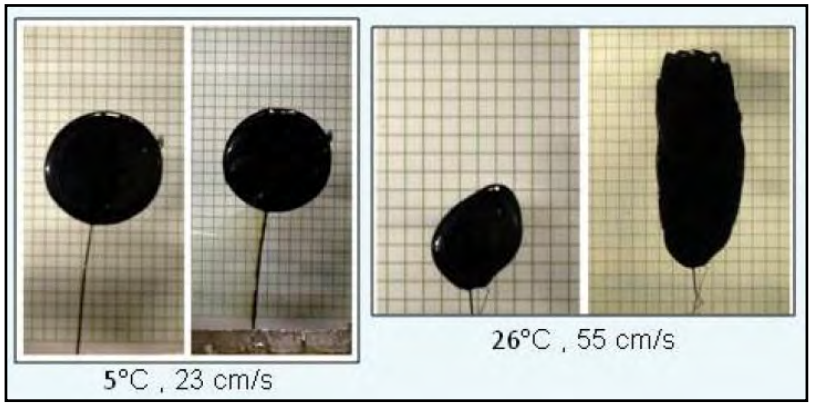
Research Motivation

- 2004: M/T Athos 1 Spill in Delaware River
- 2005: T/B DBL 152 in Gulf of Mexico
- 2006: CRRC/NOAA/USCG Submerged Oil Workshop
- 2007: Proposed Method for Computing Re-suspension of Submerged Oil[1]
  - One paper, Cloutier et al., (2002) using artificially weathered Hibernian crude oil (API=33.6)[2]
  - Need research on critical shear stress (CSS) for wider range of oils
- 2012: CRRC's annular flume is operational
- 2015: CRRC begins oil CSS experiments using Alberta bitumen (API = 8.5)[4]
  - Temperature and velocity statistically significant factors, salinity was not.

The DBL 152, shown here on November 13, 2005 shortly before capsizing, ended up discharging nearly 2 million gallons of a thick slurry oil, which sank to the floor of the Gulf of Mexico.
Photo Credit: NOAA OR&R

Research Motivation

- 2015: CRRC supported response – ran sunken oil experiments for *Barge Apex 3508* incident
- 2015: How "bottom substrate dynamics might affect submerged oil fate and behavior".[3]
- 2017: The MacFarlane flume is operational

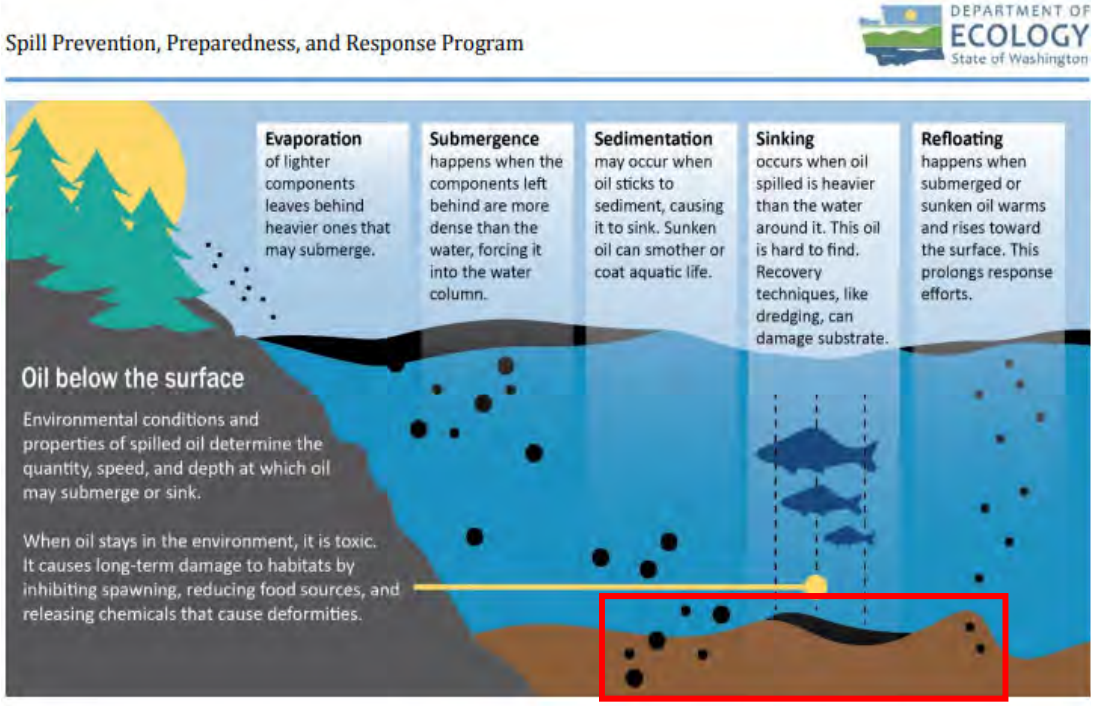


UNH/CRRC oil CSS experiments using Alberta bitumen under varying temperatures and water velocities. Lengthening of oil over time was a measured response used to identify CSS thresholds. Photo Credit: Watkins Thesis, 2015


MacFarlane
Flume
Coastal Response
Research Center
Center for Spill and
Environmental Hazards

The Fate of Spilled Oil – Nomenclature

- Floating oil – oil that remains on the water's surface
- Submerged oil – neutrally buoyant oil that remains in the water column
- Sunken oil – negatively buoyant oil that sinks to the bottom



https://fortress.wa.gov/ecy/publications/documents/1808002.pdf

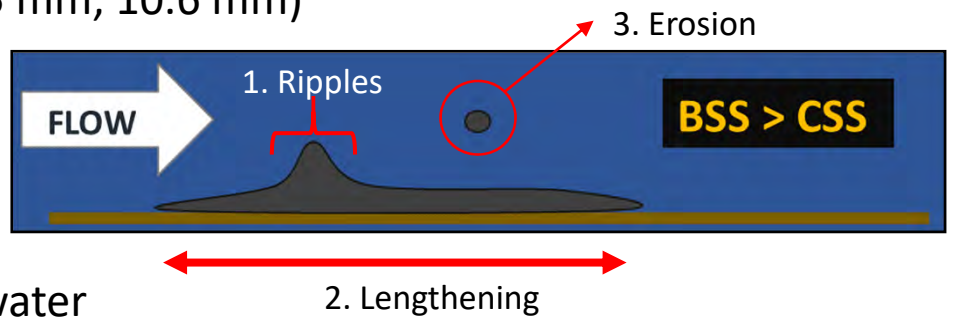
Scope of Research

Determine Critical Shear Stress of No. 6 HFO as a function of:

1. Water velocity (0 to 1.04 m/s in ~0.07 m/s intervals)
2. Water temperature (10°C, 17.5°C, 25°C)
3. Bottom roughness (d_{50} = 0.42 mm, 6.5 mm, 10.6 mm)
4. Oil condition (fresh vs. weathered)

Measured Responses:

1. Ripple formation on the oil's surface
2. Lengthening of oil along the bottom
3. Resuspension of sunken oil into the water column (i.e., erosions)



Experiments: Oil Preparation & Properties

To create sunken oil, all samples contain:

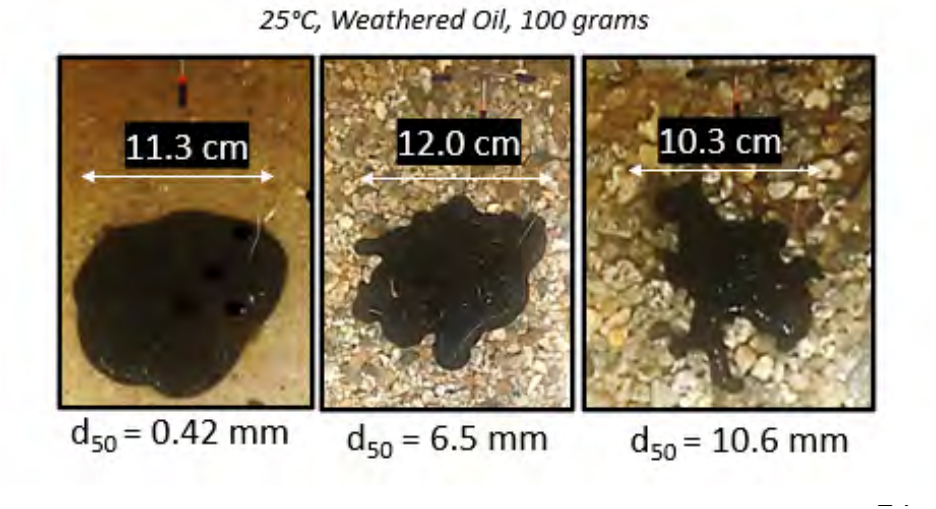
- 24% by weight, kaolinite clay:oil
- Note: mixture contains > 40% oil: "Oily-SOM" [9]

Size range, 100 grams of oil:

- 10 cm to 1 m
- Sediment-Oil Patty (SOP)[10]

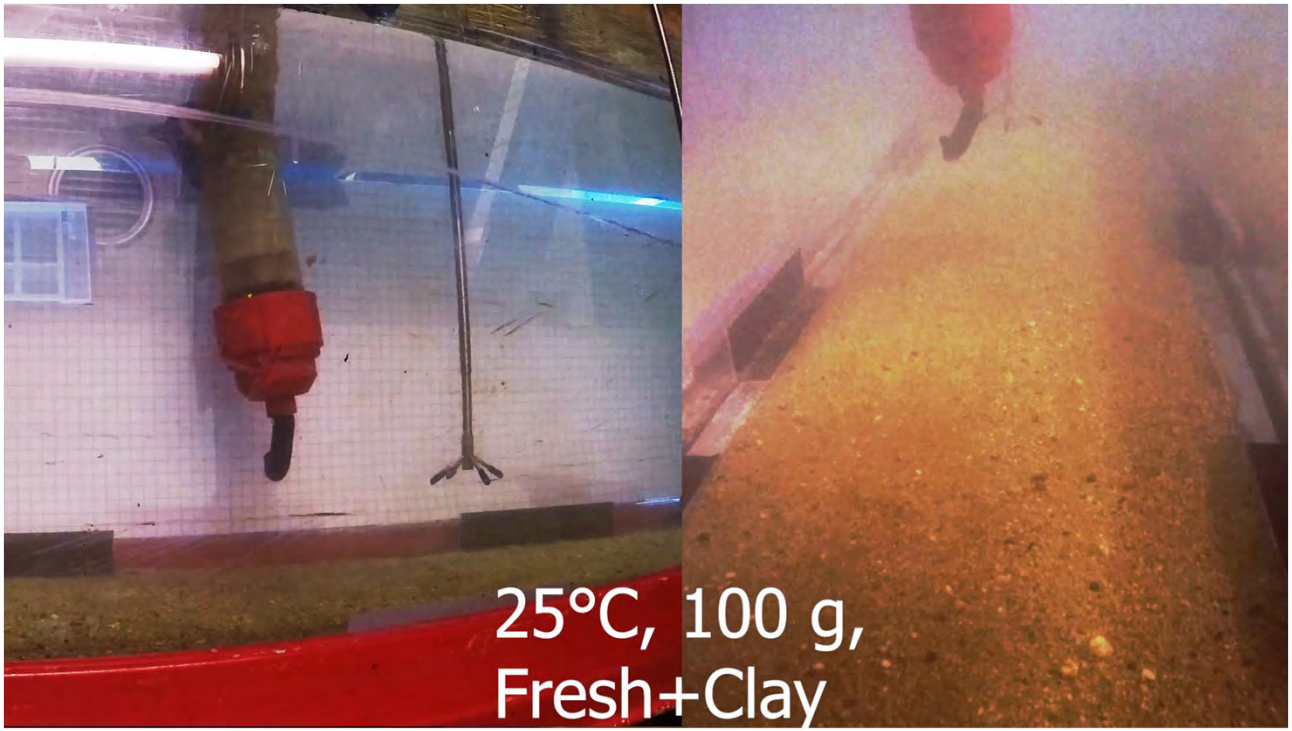
- Classified as: "Oily-SOP"

Oil Condition	Density at 15°C (g/cm^3)	API at 15°C (°)	Kinematic Viscosity at 15°C (cSt)
Fresh + Clay	1.12	-5.2	~16,000
Weathered + Clay	1.13	-6.3	~ 35,500



Experimental Protocol

- Used light to indicate a velocity increase
- 100 grams of oil injected into quiescent water
- Sat for 2 minutes then increased velocity to 0.06 m/s
- 15-minute intervals



Fresh Oil, 25°C, 0.2 m/s

D50 = 0.42 mm

D50 = 6.5 mm

D50 = 10.6 mm

Weathered Oil, 25°C, 0.2 m/s

D50 = 0.42 mm

D50 = 6.5 mm

D50 = 10.6 mm

Fresh Oil
Substrate D50: 0.42mm
Eroded minute 15 of 15
Critical Velocity: 0.54 m/s
to 0.61 m/s

Weathered Oil
Substrate D50: 0.42mm
Eroded minute 8 of 15
Critical Velocity: 0.54 m/s

Thank You for Listening

Questions???

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