Oil Spill Recovery – Threats and Challenges that Contaminated Sediments Pose to Navigation Dredging

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The Oil Spill Timeline

- April 20, 2010– explosion and fire on the Deepwater Horizon drilling rig
  - 11 workers killed and 17 others injured
- Over a period of 3 months 200 million gallons of oil released to the Gulf
  - Volume roughly equivalent to 400 Olympic-sized swimming pools
- 16 June, 2010– construction begins on sand berms off LA coast
- 15 July15, 2010– leak stopped by capping wellhead
- 19 September, 2010– relief well process completed
  - The well is declared “effectively dead”

NASA’s Terra satellite image May 24, 2010

Gulf Oil Engineering Solutions (GOES) Tiger Team

- 9 June 2010, ASA(CW) commissions effort
  - HQ asks ERDC to lead development of technical strategy
- 14-18 June 2010, GOES Tiger Team convenes at ERDC
  - Impacts and technical solutions relevant for near- (3-6 months), mid- (6-18 months) and long-term (>18 months), with emphasis on the mid- to long-term
- 25 June 2010, delivered final report to HQ

Gulf Oil Engineering Solutions Tiger Team

Dr. Beth Fleming, SES Lead
Dr. Todd Bridges, GOES Technical Chair
Ms. Julie Marcy, Facilitator

Bachman, Brenda	NWS	Jarvis, Jessie	ERDC-EL	Schilling, Fred	MVN
Barras, John	ERDC-EL	Jones, Steve	MVD	Schroeder, Paul	ERDC-EL
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Bishop, Tom	SAW-ON	Keil, Karen	LRB-TD-EIT	Shadie, Chuck	MVD
Brasfield, Sandra	ERDC-EL	Killgore, Jack	ERDC-EL	Smith, Dave	ERDC-EL
Bridges, Todd	ERDC-EL	King, Jeffrey	SAS-RD	Smith, JB	NAP
Brown, Gary	ERDC-CHL	Kleiss, Barb	MVD	Smith, Heather	ERDC-EL
Burns, Marie	NAB-OP	Leahy, Larry	SWD-PDC	Stanley, Bob	ERDC-CHL
Constance, Troy	MVN	Linkov, Igor	ERDC-EL	Steevens, Jeff	ERDC-EL
Crock, Jenny	LRP-EE	Lorentz, Warren	ERDC-EL	Wakeman, John	NWS
Crocker, Fiona	ERDC-EL	Marcy, Julie	ERDC-EL	Welp, Tim	ERDC-CHL
Curtis, Bill	ERDC-CHL	Miller, Greg	MVN	Wiggins, Eddie	ERDC-CHL
Davico, Gus	ERDC-EL	Moore, Jim	HQ	Wright, Lenora	SWD
Deliman, Pat	ERDC-EL	Morton, John	MVN	Yost, Sally	ERDC-EL
Demirbilek, Zeki	ERDC-EL	Newman, Steve	ERDC- CRREL	Zabilansky, Len	ERDC-CREE
Dickerson, Dena	ERDC-EL	Parson, Larry	SAM-PD-EC		
Dickerson, Ginny	ERDC-EL	Pollack, Cheryl	SAJ		
Ebersole, Bruce	ERDC-CHL	Pope, Joan	HQ		
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Gailani, Joseph	ERDC-EL	Ruff, Greg	MVD-PD-N		
Goodman, Melanie	MVN-PM	Ruiz, Carlos	ERDC-EL		
Gust, Kurt	ERDC-EL	Russo, Edmond	ERDC-EL		
Gutierrez, Jorge	SWD	Sabol, Bruce	ERDC-EL		

64 participants representing:
3 ERDC Labs: EL, CHL, CRREL
12 Districts/Divisions and HQ: HQ, LRB, LRP, MVD, MVN, NAB, NAP, NWS, SAJ, SAM, SAS, SAW, SWD

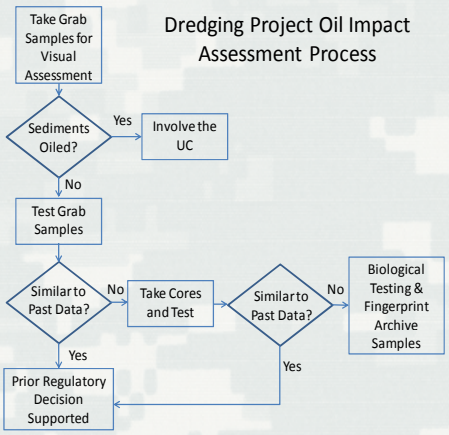
Engineered Remediation, Restoration and Recovery (ER^3)

- A system-scale approach to implementing sustainable solutions
- Deployment of a synchronized network of different technologies and approaches to remediate and restore
- Sustained commitment to address a problem that will change over time
- Focused use of adaptive management to configure technologies over time

Dredging Program Technical Workshop: Addressing the Deepwater Horizon Oil Spill

- Purpose: address questions relevant to developing a short- and long-process for evaluating dredged material
  - 10-11 August, 2010 in Vicksburg
  - 25 USACE and USEPA staff
- Issues:
  - Nature of oil contamination and dispersants
  - Sampling, analytical chemistry, screening values
  - Biological evaluations
  - Managing contaminated sediment

Dredging Project Oil Impact Assessment Process



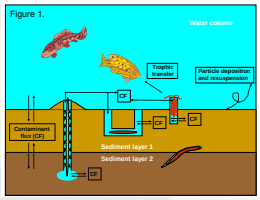
http://el.erdc.usace.army.mil/oilspill.cfm

Field Screening Test Kit

- Hexane extraction of oil produces colored liquid solution
  - Colorimetric screening for heavy oil
  - Extraction based on Method 1664, Oil and Grease (HEM)
- Modifications for 'Light Sweet' Crude
  - Fluorescence Detection (5 mg/L)
  - Deployed by MVN and SAM in 2010

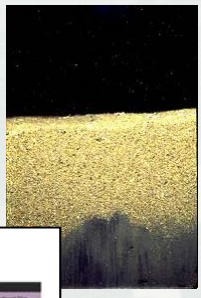
Relevance to Navigation Dredging in the Gulf

- >100 navigation dredging projects in the Northern Gulf
  - The bulk of the US program's ocean disposal (60M yd^3/yr)
- Management costs for contaminated sediment range from $20 to >$100 per yd^3
  - Compared to <$5 for open water disposal
- Restrictions on beneficial uses of dredged material
  - Restoration of wetlands or coastal features



Management Options for Contaminated Sediment

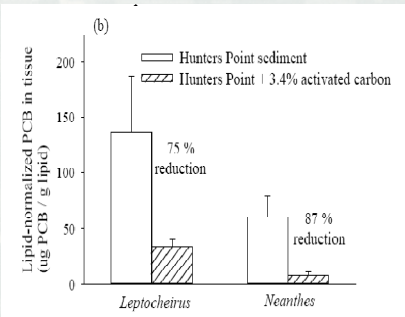
- *In situ* alternatives
  - Monitored Natural Recovery (MNR)
  - Capping
  - Enhanced MNR
- *Ex situ* alternatives
  - Dredging
    - Containment
    - Treatment



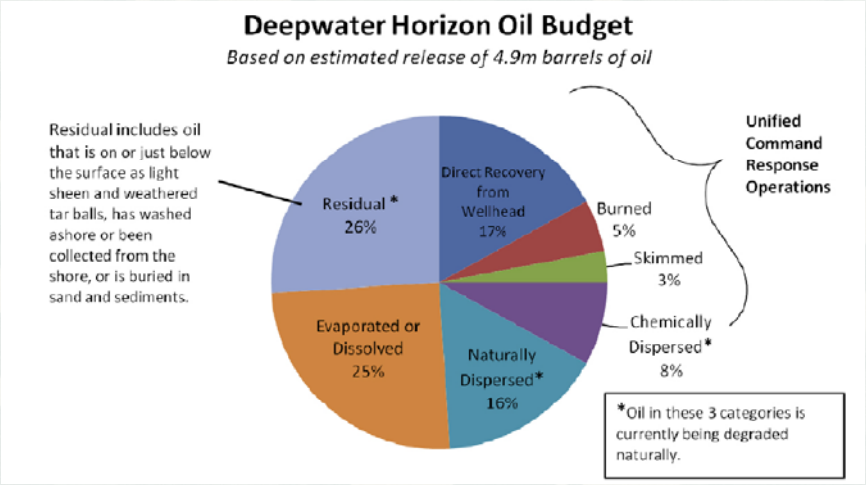
DoD 2009 *Technical guide: Monitored natural recovery at contaminated sediment sites.* ESTCP-ER-0622.
http://www.epa.gov/superfund/health/conmedia/sediment/documents.htm

Treatment Options for Contaminated Dredged Material

- Separation/isolation methods
  - Oil-water separators
  - Solids separation
- Treatment
  - Use of sorbents, e.g., activated carbon



R. N. Millward, T. S. Bridges, U. Ghosh, R. J. R. Zimmerman ,G. Luthy,. 2005. Addition of activated carbon to reduce PCB bioaccumulation by a polychaete (*Neanthes arenaceodentata*) and an amphipod (*Leptocheirus plumulosus*). *Environmental Science and Technology* 39:2880-2887.



"BP Deepwater Horizon Oil Budget: What Happened To the Oil?", DOI and NOAA report released 4 August 2010.

Potential for Evolving, Long-Term Challenges?

140 nm SE, no visible oil

Near shore, 20 nm from Gulfport thin (5 mm) sedimented oil

16 nm NE, >3 cm oil floc

Source: Dr. Samantha Joye, UGA Department of Marine Sciences
http://gulfblog.uga.edu/

Gulf Coast Ecosystem Restoration Task Force

- Established by Executive Order on October 5, 2010
- Objectives:
  - "…address the damage caused by the BP Deepwater Horizon Oil Spill, address the longstanding ecological decline, and begin moving toward a more resilient Gulf Coast ecosystem"
  - "…Federal efforts be efficiently integrated with those of local stakeholders and that particular focus be given to innovative solutions and complex, large-scale restoration projects."
    - Science-based
  - "…coordinate intergovernmental responsibilities, planning, and exchange of information so as to better implement Gulf Coast ecosystem restoration and to facilitate appropriate accountability and support throughout the restoration process."
- Membership
  - Multiple Federal agencies, the 5 States, etc.
    - Chaired by Administrator of USEPA (Lisa Jackson)
    - Staff headed by an Executive Director (John Hankinson)
- Deliverable
  - Produce a "Strategy that proposes a Gulf Coast ecosystem restoration agenda" within 1 year

http://www.whitehouse.gov/the-press-office/2010/10/05/executive-order-gulf-coast-ecosystem-restoration-task-force

Concluding Thoughts

- Navigation dredging in the Northern Gulf is vulnerable to disruptions caused by contamination
  - Large volumes of sediment are continuously dredged
  - Limited availability of management options for contaminated sediment
    - The time to develop options is before you need them
  - Regulatory process for DM is inefficient, i.e., slow decisions
    - E.g., IHNC, Barge DM932 #6 fuel oil spill in 2008
- Building resilience into the "system"
  - Navigation projects
    - Engineering approaches to reduce vulnerability to contaminants
    - Readily deployable technologies to manage contaminants
  - Restoration projects
    - Using restoration projects to develop multi-hazard resilience for inland and coastal systems