Draft Oil Spill Research Strategy

Presentation to the Science Advisory Board Panel
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Presentation Outline

- EPA's/ORD's response to Deepwater Horizon
- History of federal research on oil spills
- Draft strategy development
- Draft strategy elements
- Next steps

DWH Spill: Response

- On April 22, the Deepwater Horizon rig capsized and sank – 11 workers died.
- Following that human tragedy has been an environmental and economic disaster.
  - More than **600** miles of shoreline have been impacted in five states;
  - More than **80,000** square miles of federal fishing waters have been shut down; and
  - **36** National Wildlife Refuges have been threatened.
- This unprecedented disaster has been met by our unprecedented response.

DWH Oil Spill: Response

- More than 45,000 responders.
  - At the height of the response, EPA had more than 40 workers dedicated to the response in our DC-based Emergency Operation Center each with reach back to their home offices and about 190 working in our regional offices along the Gulf.
- The US Coast Guard has led the federal response.
  - Coordinating federal agencies, include: EPA, DOI, DOE, DHS, NOAA, SBA.
  - Working closely with state and local governments.
  - Primary EPA role in monitoring air, water, and sediments

ORD's Role: Science to Support the Response

- ORD provided scientific expertise to support EPA's response efforts and decision-making
  - Rapid "deployment" of science team
  - Participation in Emergency Operations Center to support response and address questions
  - Identification of issues or challenges that might arise
- Air sampling of oil burns at sea
  - Adapted research capability to sample for dioxin
- On board vessel support
  - EPA research scientists provide on board technical expertise on ships sampling and monitoring for oil and dispersants

ORD's Role: Science to Support the Response

- Established an EPA website to solicit suggested solutions for use in response to the oil spill.
  - Received and reviewed more than 1,800 suggestions, some of which were provided to BP
- Participated in the Interagency Alternative Technology Assessment Program (**IATAP**), under the purview of the USCG
  - EPA received over 100 submissions for review (of 4000 total)
- Hosted an Alternative Coastal Protection and Cleanup Technology Forum in New Orleans
- Participated in outreach sessions with academic institutions and communities in the Gulf

ORD's Role: Science to Support the Response

- Toxicity Testing of Dispersants on NCP Product List
  - EPA's research provided critical and timely information on the toxicity of the chemical dispersants
  - Tests were conducted on eight of the dispersants listed on the National Contingency Plan Product Schedule.
    - High throughput screening tests for endocrine disrupting chemicals
    - In vitro tests for endocrine disrupting chemicals
    - Whole animal toxicity tests
      - The results of standard toxicity tests on sensitive aquatic organisms found in the Gulf indicate the eight dispersants are similar to one another.
      - The results confirm that Corexit 9500A, the dispersant used in response to the oil spill in the Gulf, is generally no more or less toxic than the other available alternatives.
- Chemical Analyses
  - EPA's research identified the unique chemical signature to enable detection of DWH dispersants and develop a method of detection
- Dispersant Effectiveness Tests
  - EPA conducted tests on the efficiency of eight of the dispersants listed on the National Contingency Plan Product Schedule.

ORD's Role: Science to Support the Response

- ORD received $2 million in Supplemental funding in FY2010 for grants. Solicitation open now
  - Science to Achieve Results (STAR) solicitation is open through 6/22/11focused on:
    - Technology development for remediation, physical, biological, or chemical
    - Dispersant s/agents/measures with reduced environmental impact
    - Ecosystem impacts
- ORD began developing a research strategy

Oil Spill Research History

- Research is authorized by the Oil Pollution Act of 1990, passed following the Exxon Valdez spill, as amended
  - Establishes the Interagency Coordinating Committee on Oil Spill Research (ICCOPR)
  - Provides roles for Departments of Commerce, Energy, Interior, Transportation, Defense, Homeland Security; and EPA and NASA
  - Authorizes research funding subject to appropriation
  - Assigns responsibility for some of the research to a particular organization

Agency Roles

Agency	Responsibilities
U. S. Coast Guard	Coastal On-Scene Coordinator (OSC). Develop and enforce marine prevention regulations.
Environmental Protection Agency	Inland OSC. Prepare National Contingency Plan (NCP). Manage NCP Product Schedule.3 Develop and enforce inland prevention regulations.
Minerals Management Service (now BOEMRE)	Develop and enforce prevention and contingency plan regulations for offshore oil and gas operations. Develop offshore response technology.
NOAA (Dept. of Commerce)	Scientific Support Coordinators. Resource trustee for coastal areas. Key participant in NRDA process in coastal regions.

Agency Roles

Agency	Research Focus
U. S. Coast Guard	Prevention (particularly in advanced navigation, crew training and evaluation, vessel inspection, and human factors). Spill planning and management (all areas). Countermeasures and cleanup (particularly surveillance, at-source countermeasures, in situ burning, mechanical recovery). Regional Grants and Port Demonstrations.
Environmental Protection Agency	Prevention (for facilities). Planning and management (particularly training/readiness and DSS development). Countermeasures and cleanup (particularly dispersant and in situ burn protocols, and bioremediation).
Minerals Management Service (now BOEMRE)	Prevention technology (for offshore facilities and pipelines). Oil spill behavior and trajectory modeling. Countermeasures and cleanup (particularly surveillance, mechanical recovery, in situ burning, and dispersants). Maintain and operate OHMSETT facility.
NOAA (Dept. of Commerce)	Spill planning and management (DSS development, trajectory and behavior models, and health and safety). Long-term fate, effects, monitoring, and restoration.

Agency Roles

Agency	Responsibilities
Army Corps of Engineers	Support OSC by providing technology, systems, and operational assistance.
U.S. Fish and Wildlife Service	Resource trustee. Key participant in NRDA process in inland areas.
Maritime Administration (DOT)	Support maritime industry with guidance and technology in implementing equipment, systems, and operations to prevent spills.
U.S. Navy	Provide prevention and response capability to fleet and facilities. Augment national response capability.
NIST (Dept. of Commerce)	Provide support for technology development.
DOT Office of Pipeline Safety	Develop regulations for pipeline spill prevention. Develop pipeline technology.

Agency Roles

Agency	Research Focus
Army Corps of Engineers	Countermeasures and cleanup (particularly in satellite and aircraft surveillance, trajectory modeling, and mechanical recovery).
U.S. Fish and Wildlife Service	Fate and effects research focusing on birds and inland habitats. Development of NRDA technologies.
Maritime Administration (DOT)	Prevention technology (particularly advanced navigation, crew training, and evaluation, and human factors).
U.S. Navy	Countermeasures and cleanup (particularly development, testing, and evaluation of mechanical recovery technologies).
NIST (Dept. of Commerce)	*In situ* burning research.
DOT Office of Pipeline Safety	Prevention (particularly pipeline failure studies and leak detection systems).

Oil Spill Research History

- Interagency planning through ICCOPR
  - 1992 – Oil Pollution Research and Technology Plan
    - 1993 – Marine Board Review–First Report
    - 1994 – Marine Board Review–Final Report
  - 1997 – Oil Pollution Research and Technology Plan
  - 2011 – Third OPRTP in preparation; discussed on quarterly teleconference, 3/9/11

http://www.iccopr.uscg.gov

Oil Spill Research History

- EPA planning since1998
  - Research Strategy – reviewed by SAB
  - Multi-year plans – reviewed by SAB, BOSC
    - Contaminated Sites 2003
    - Land Research 2007
    - Sustainable & Healthy Communities 2012
    - *Oil spills section planned directly with Office of Emergency Management*

http://www.epa.gov/landscience

Oil Spill Research Results

- Interagency
  - ICCOPR biennial report to Congress
    - http://www.iccopr.uscg.gov/iccopr/i/files/Biennial%20rpt_FY08%20and%2009_DEC2009.pdf
- EPA
  - Agency reports
  - Journal articles
  - Incorporation in Agency rules, policies, etc.
- National and international meetings

Examples of Collaboration

- Collaborating with NIEHS on Gulf long-term follow-up study for oil spills clean-up workers and volunteers
- Assessing loss of ecosystems services due to DWH oil spill with National Resources Damage Assessment (NRDA), including NOAA and National Park Service
- Wave tank studies to quantify the toxicity of dispersant oil on fish and invertebrates (collaborating & leveraging with the Canadian Government).
- EPA and Canadian Department of Fisheries and Oceans – FY2011 testing of dispersants in Arctic waters
- EPA and Natural Resource Trustees evaluation of continued biodegradation of residual oil from the Exxon Valdez

Draft Strategy Development

- National Program Director for Land organized four cross-disciplinary teams
  - Dispersants
  - Shoreline/coastal/inland effects
  - Innovative processes/technologies
  - Human health impacts
- Focus on EPA responsibilities, with knowledge of other agencies' activities and the broader scientific community
  - Subsequently link to ICCOPR's revision of research plan
  - Continuing to be informed by findings from the Gulf spill: Mabus report; Commission report; Gulf Task Force

Ongoing/Anticipated Collaboration

Dispersants

EPA	Toxicity Fate & transport
FDA and NOAA	Bioaccumulation
ATSDR	Human health impacts
NIOSH	Toxicity research

Shoreline/Coastal/Inland

NOAA*	NRDA
USGS*	NRDA
EPA*	Improved methods research Supports NRDA Assessing changes in human well-being Long-term ecosystem impacts
USFWS	Acute death of animals
Gulf of Mexico Alliance	Long-term impacts on Gulf region

* Members of Ecosystem Restoration Task Force

Innovative Processes/Technologies

DOI BOEMRE	Offshore response technology
EPA	Develop response technology and support regulations
NOAA	Support technology development
NIST	Support technology development
Gulf of Mexico Alliance	Technology development for offshore oil spills

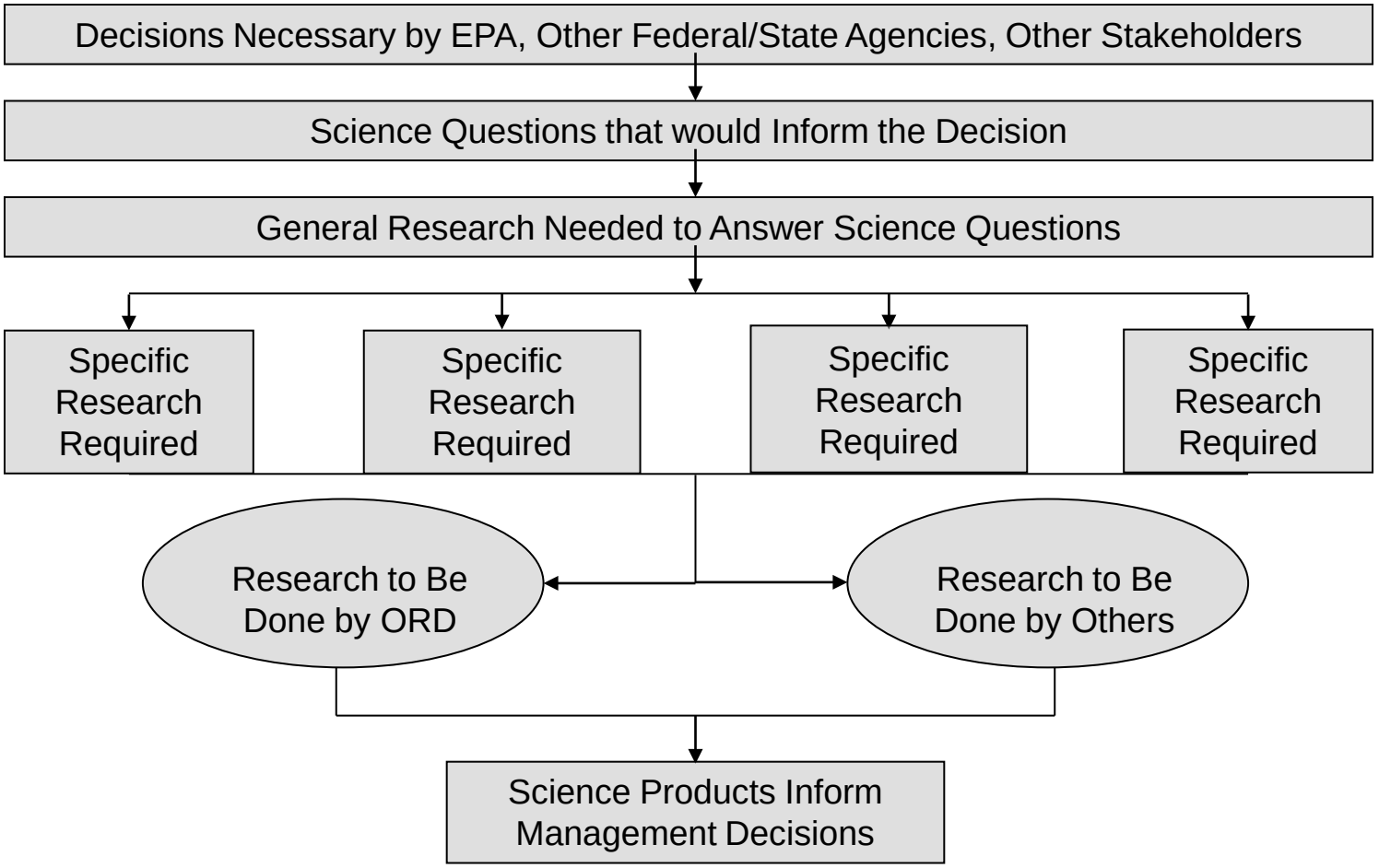
Human Health Impacts

NIEHS and NIEHS-NTP	GuLF worker cohort study Toxicity studies
OSHA	Worker safety
FDA and NOAA	Food source contamination
ATSDR	Human exposure impacts
EPA	Risk assessment/ communication to communities Support NIEHS-NTP
NIOSH	Toxicology studies

Draft Strategy Design

- Driven by the decision making needed to prepare for or respond to a release
  - What is the decision?
  - What science questions could inform the decision?
  - If the questions are answered, how would decision making be improved?

Generic Problem Formulation



Dispersants Theme

- Research Areas
  - Efficacy
  - Fate, transport, and bioaccumulation
  - Adverse ecological effects
  - Green chemistry

Dispersant Efficacy

Decision Context (What question is the decision-maker asking?)	Key Science Questions (What research will answer that question?)	Anticipated Outcomes (How will this research inform the overall decision?)
Which dispersants are the most efficacious for particular situations?	When is the use of dispersants most effective and what are the key parameters under which spilled oil is dispersible, such as temperature, mixing energy?	Inform Subpart J regulatory actions. Inform selection of the most effective dispersant on a spill-by-spill basis.
What regulatory actions under Subpart J are needed for dispersants?	What alternative dispersants are available? How effective are they? How toxic are they?	Inform Subpart J regulatory actions.

Commission Recommendation C5 – EPA should update and periodically review its dispersant testing protocols for product listing or pre-approval, and modify the pre-approval process to include temporal duration, spatial reach, and volume of the spill.

Dispersant Eco Effects

Decision Context	Key Science Questions	Anticipated Outcomes
Will oil dispersant products be toxic to aquatic species when injected at the surface or underwater to mitigate spill impacts from deep sea blowouts?	What are the ecotoxicological effects of dispersants in surface and deep sea injection exposures?	Research will be used in ecological risk assessments to inform management decisions for deploying the least toxic dispersants for mitigating oil spills.
Will the effective use of dispersants reduce the impacts of the spill to shoreline and water surface resources ***without*** significantly increasing impacts to water-column and benthic resources? (NRC, 2005)	What are the comparative ecotoxicological effects of dispersants in surface and deep sea injection exposures versus shoreline?	The dispersant ecological risks will be compared to coastal ecological risks from oil spills in a variety of scenarios. This comparative assessment will address key questions on dispersant use.

Shoreline/Coastal/Inland Theme

- Research Areas
  - Exposure assessments
  - Toxicity characterization
  - Ecological systems effects
  - Risk characterization
  - Ecological, ecosystem services, health, and well-being in Gulf Coast communities
  - Remediation and restoration of the DWH oil spill on shoreline and coastal ecosystems

Ecological Systems Effects

Decision Context	Key Science Question	Anticipated Outcome
Research to address this question will inform Federal decisions related to estimation of damages to natural resources and implementation of ecosystem-level restoration.	What ecological impacts have occurred in sensitive coastal ecosystems because of the DWH oil spill?	Understanding the direct and indirect effects of oil exposure on, for example, seagrass habitats and other vital habitats will contribute to the NRDA by quantifying impacts on a vital nursery habitat for fishery species.
What remediation options have minimal impact on coastal and inland ecosystems?	What effects do activities (e.g., dredging, construction of shoreline protection structures) have on sensitive coastal ecosystems that were impacted by the DWH oil spill?	Determining the impacts of oil remediation technologies on coastal and inland ecosystems will enable decision-makers to choose the most appropriate remediation options based on scientifically sound information.

Remediation/Engineering and Restoration of Shoreline and Coastal Ecosystems

Decision Context	Key Science Question	Anticipated Outcome
What is the most effective suite of remediation/cleanup technologies/options?	What innovative tools will be developed for oil spill cleanup to enhance the effective suite of remediation/cleanup options?	This research will provide important information to decision-makers when selecting remediation options for local wetlands, beaches, or coastal waters.
What is the most effective suite of restoration technologies/options?	What innovative tools will be developed for restoration after an oil spill to enhance the effective suite of remediation/cleanup options?	This research will provide important information for decision-makers in determining whether to actively restore a specific impacted location or to let natural processes restore the area.

Innovative Processes & Technology Development Theme

- Research Areas
  - Deep/open water treatment technologies/ processes
  - Inland spill mitigation technologies
  - Green technology
  - Evaluation process for technologies
  - Technology transfer

Inland Spill Mitigation

Decision Context	Key Science Question	Anticipated Outcome
What new or enhanced technologies are effective for inland spills?	How effective is the technology and does it have any environmental side effects?	Better or faster responses to inland spills.
Are these technologies applicable to non-petroleum oils, notably alternative fuels?	Do alternative fuels behave differently when spilled and do they respond to the same remediation approaches?	Better preparedness for spills as alternative fuels become more significant in inland transportation.

Green Technology

Decision Context	Key Science Question	Anticipated Outcome
What short-term and long-term environmental costs are associated with production and use of the response technology?	What metrics can be used to assess and compare the environmental footprints of innovative response approaches? How can the response technology be changed to reduce its environmental footprint? Can waste streams be minimized or managed more effectively?	Government and industry decision makers will take into account environmental harm as well as remediation performance. Technology developers will consider life cycle factors in designing their products.
How can green chemistry/technology principles be applied to oil spill remediation technologies?	What innovative cleanup methods can be developed using green chemistry/technology approaches, incorporating a life cycle approach?	Development of effective technologies with a limited cost to the environment and human health.

Human Health Theme

- Research Areas
  - Follow-up epidemiological studies
  - Toxicology of oil/dispersants
  - Human health risks and risk communication

Epi Studies

Decision Context	Key Science Questions	Anticipated Outcome
Are there health effects associated with exposure of cleanup workers or gulf residents to the DWH oil spill?	Can any long-term health effects be identified in the cleanup workers who may have been exposed to very high concentrations of volatile compounds for short periods of time? Can any long-term health effects be identified in Gulf Coast residents who may have been exposed to oil, oil/dispersant emulsions, or emissions from the burning of oil?	NIEHS is leading a Gulf Coast Cohort study. Completion of this research will alert affected populations to potential health problems they may encounter in time for them to seek medical assistance, or to employ preventive measures prior to exposure in the future.
Do stressors related to the oil spill exacerbate health effects associated with exposure to oil spill related components?	What is the interaction between added stressors (e.g., heat, anxiety) and health effects caused by direct exposure to oil spill related components?	This research will help policy makers decide on community protective measures, such as evacuation of locations with potential exposures, in future oil spills.

Acute Respiratory and Dermal Effects

Decision Context	Key Science Questions	Anticipated Outcome
Does burning of unprocessed oil in open water cause acute cardiovascular effects in cleanup workers or nearby residents?	What are the cardiovascular effects associated with exposure to smoke plumes from burning oil?	Completion of this research will allow a comparison of the toxicity of PM derived from burning oil with other forms of combustion-related PM whose cardiovascular effects are well understood.
Does dermal contact of oil or volatile emissions from oil cause skin problems in cleanup workers or nearby residents?	Does dermal contact with oil cause irritant contact dermatitis, allergic sensitization or delayed-type hypersensitivity?	Completion of this research will determine whether cleanup workers and residents need to wear protective clothing to minimize dermal contact with oil or oil emissions.

Next Steps

- Respond to SAB Panel report
- Work with ICCOPR, other organizations to plan complementary and collaborative research
- Implementation consistent with resource levels