Deepwater Horizon Dispersant Data Webinar
July 13, 2010

Report Issued by:
Coastal Response Research Center
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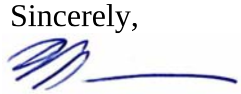
FOREWORD

On July 13, 2010, the Deepwater Horizon (DWH) Interagency Solutions Group (IASG) sponsored a webinar meeting focusing on the data available regarding the effectiveness and effects of surface and subsurface application of dispersants at the DWH spill. The Coastal Response Research Center (CRRC), in the Environmental Research Group at the University of New Hampshire, facilitated the webinar. The meeting, titled "Deepwater Horizon Dispersant Data Webinar", was attended by over 70 participants including: responders, scientists, planners and coordinators from the NRT's federal and state partners including the: U.S. Coast Guard (USCG), Environmental Protection Agency (EPA), National Oceanic and Atmospheric Administration (NOAA), Department of Energy (DOE), Department of the Interior (DOI), Louisiana Oil Spill Coordinator's Office, Mississippi Department of Environmental Quality, and Florida Bureau of Emergency Response. The ultimate goals of this meeting were to: (1) determine what data are available on the effectiveness and effects of surface and subsurface dispersant application for the DWH oil spill; (2) determine whether the data available are sufficient to support any conclusions on the effectiveness and effects of dispersant application at the DWH oil spill; (3) identify inconsistencies in the available data; and (4) identify significant data gaps.

This report contains the following: sources, location, accessibility, and type of data presented during the webinar; conclusions formulated during group discussion; identified inconsistencies associated with the data presented; and significant data gaps identified. Included in the appendices are the meeting agenda, participant list, and slide presentations, and a glossary of acronyms. This report was reviewed by the presenters and representatives of the IASG prior to its distribution.

Sincerely,



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I. INTRODUCTION

The purpose of this webinar was to determine what data are available on the effectiveness and effects of subsurface and surface dispersant application in the context of the efficacy and safety of dispersant use in the DWH response. Sharing available information is essential to successfully coordinating a plan to continue data collection by all response partners.

II. MEETING ORGANIZATION AND STRUCTURE

This meeting was organized and planned by members of the IASG and the Coastal Response Research Center (CRRC) starting in late June 2010. The webinar commenced at 1030 h and ended at approximately 1500 h on July 13, 2010. A webinar framework was used to share presentations and documents with the 70+ participants (Appendix A, Participant List). There were participants that joined the webinar late and were not counted in the original introductions/roll call.

The webinar began with a presentation of the meeting framework and goals by the facilitator Nancy Kinner (CRRC) and NRT representatives Bob Pond (USCG) and Roberta Runge (EPA). The agenda is located in Appendix B. This was followed by nine presentations of data available on the effectiveness and effects of dispersant application at the DWH oil spill. Copies of the presentation slides are in Appendix C. After each presentation, participants were allowed to ask clarifying questions. After all presentations were completed, a discussion occurred among the participants addressing three questions:

(1) Are the data sufficient to support any conclusions regarding the effectiveness and effects of surface and subsurface application of dispersants?
(2) Are there inconsistencies in the data and can these be addressed?
(3) Are there significant data gaps?

This meeting was <u>NOT</u> a discussion on policy, strategy, or risk assessment related to dispersant use. This report was reviewed by representatives of the IASG and the presenters before distribution to the participants and will not be posted on the CRRC website.

III. DATA PRESENTATIONS

Each presentation given is summarized below. Table 1 contains the following information for all the data categories reported: source, contact/presenter, location, accessibility and any issues noted. Appendix D contains a glossary of acronyms used in the presentations.

i.) Flow Rate Data, Mark Sogge, USGS

Mark Sogge, Deputy Chief for the National Incident Command Flow Rate Technical Group (FRTG), presented data on the flow of oil being released. The FRTG is using various methods to estimate the extent of the release. These methods include: mass balance; plume analysis; and nodal and reservoir analyses. The mass balance approach uses remote sensing information and data about the amount of oil removed via skimming, burning, and other techniques; it was noted that this method gives results for the lower end of the flow range. Plume analysis uses Particle Image Velocimetry (PIV) to estimate a volume and rate based on video from the damaged well. The reservoir analysis investigates oil field characteristics and the nodal analysis uses this information to model flow from the well. The current estimate of released oil is 35,000 – 60,000 barrels per day (BPD). A final report produced by the FRTG is forthcoming.

ii.) Oil Budget Tool, Lt. Amy McElroy, USCG

Lt. Amy McElroy of the U.S. Coast Guard presented an overview of a new oil budget tool developed for the DWH incident, which is currently undergoing beta testing. This tool uses a mass balance approach to estimate the amount of oil evaporated, recovered and dispersed. The Oil Budget Tool was developed by the USGS in conjunction with NOAA and the FRTG. Five variables are updated with data reported from the spill: volume of oil burned; volume of oil collected; volume of oily/water mixture collected; and the volumes of dispersant applied at the surface and subsurface. There are several gaps associated with the tool, but it gives a gross estimate of the ratios of oil in various states, which is useful from an operational perspective.

iii.) Surface Dispersant Data, Craig Carroll and Marc Greenberg, EPA

Craig Carroll, (EPA) RRT VI Co-Chair, presented data on the surface application of dispersants. As of July 12, there have been 404 sorties and approximately 975,000 gallons (cumulative) of dispersants applied over 305 mi^2. There have been 508 water samples taken and analyzed for dispersant analytes (e.g., 2-butoxyethanol) and all have been non-detect. Air samples have also been collected and analyzed for dispersant-related compounds and all results were non-detect. The majority of the sampling has been along the Louisiana shoreline (Appendix C, page C-19). He also presented Tier II/III Special Monitoring of Advanced Response Technologies (SMART) fluorometry data (Appendix C, page C-21). Background natural dispersion and chemical dispersion have been assessed with SMART fluorometry. The results from this support EPA's expectations of the effectiveness of the surface application of dispersants. [N.B., The SMART Tier I, II and III protocols are described in Appendix E.]

Marc Greenberg presented information on EPA's toxicity studies (June 30, 2010) on dispersants. There were three recent toxicity studies released by EPA; the URL for each can be found in Appendix C. The three studies were a: (1) 48 hour acute toxicity test of 8 dispersants on a Gulf of Mexico (GOM) Mysid shrimp (Table 2); (2) 96 hour acute toxicity test of 8 dispersants a on GOM inland (estuarine) Atlantic Silverside fish (Table 3); and (3) *in vitro* testing with a battery of mammalian cell lines for potential endocrine-related activity and cytotoxicity. In general, EPA's toxicity studies show low toxicity of the 8 tested dispersant products, and no significant estrogenicity and/or rogenicity. Corexit 9500A, the primary dispersant being used in the DWH incident, was found to be "slightly toxic" using ranking categories established by EPA (Table 2), and have low toxicity in human cell line assays.

Table 2: Results of 48 hour acute toxicity tests of 8 dispersants to the GOM Mysid shrimp

Results of 48 hour acute toxicity tests of 8 dispersants to the Gulf of Mexico invertebrate, mysid shrimp (*Americamysis bahia*)

Dispersant	This Study LC50 (ppm) [95% CI]	Toxicity Category	NCP Product Schedule LC50 (ppm) [95% CI]
Dispersit SPC 1000	12 [10-14]	Slightly Toxic	16.6 [14.1-19.6]
Nokomis 3-AA	30 [27-34]	Slightly Toxic	20.2 [17.4-22.8]
Corexit 9500A	**42 [38-47]**	**Slightly Toxic**	**32.2 [26.5-39.2]**
Nokomis 3-F4	42 [38-47]	Slightly Toxic	32.2 [28.4-36.5]
ZI -400	55 [50-61]	Slightly Toxic	21.0 [17.9-24.5]
Sea Brat #4	65 [57-74]	Slightly Toxic	14.0 [±10.4]
Saf-Ron Gold	118 [104-133]	Practically Non-Toxic	63.0* [52.9-75.1]
JD-2000	788 [627-946]	Practically Non-Toxic	90.5* [76.1-108]

* Classified as slightly toxic according to values provided in NCP Product Schedule

http://www.epa.gov/bpspill/dispersants-testing.html

Table 3: Results of 96 hour acute toxicity tests of 8 dispersants to the GOM inland silverside

Results of 96 hour acute toxicity tests of 8 dispersants to the Gulf of Mexico fish, inland silverside (*Menidia beryllina*)

Dispersant	This Study LC50 (ppm) [95% CI]	Toxicity Category	NCP Product Schedule LC50 (ppm) [95% CI]
Dispersit SPC 1000	2.9 [2.5-3.2]	Moderately Toxic	3.5 [3.1-4.0]
Nokomis 3-F4	19 [16-21]	Slightly Toxic	29.8 [24.0-35.4]
Nokomis 3-AA	19 [17-21]	Slightly Toxic	34.2 [29.2-37.95]
ZI -400	21 [18-23]	Slightly Toxic	31.8 [28.7-35.1]
Saf-Ron Gold	44 [41-47]	Slightly Toxic	29.4 [25.2-34.3]
Sea Brat #4	55 [49-62]	Slightly Toxic	30.0 [±16.2]
Corexit 9500A	**130 [122-138]**	**Practically Non-Toxic**	**25.2* [13.6-46.6]**
JD-2000	>5,600	Practically Non-Toxic	407 [330-501]

* Classified as slightly toxic according to values provided in NCP Product Schedule

http://www.epa.gov/bpspill/dispersants-testing.html

iv.) Subsurface Dispersant Data, Greg Wilson, EPA

Greg Wilson (EPA) presented data on subsurface dispersant application. The available data on this topic are: conductivity, temperature and depth (CTD); fluorometry; dissolved oxygen; rotifer toxicity; laser in situ scattering and transmissometry (LISST) particle counts; total petroleum hydrocarbon (TPH) concentrations; volatile organic analysis (VOA) and UV-fluorescence testing. This data is reported daily by EPA and is available on epaosc.net website in zip files. The link can be found in Appendix C, page C-29.

The Joint Analysis Group (JAG) for surface and subsurface oceanography, oil and dispersant data whose members are from EPA, NOAA, USGS and the Office of Science and Technology Policy (OSTP) analyze the data collected by BP, NOAA and academic scientists. The JAG has reported on the data collected by the R/V Brooks McCall between May 8 and 25 (Appendix C, page C-30) and is currently working on other more recent sampling data. This will also be available online at http://ecowatch.ncddc.noaa.gov/JAG/.

v.) Operational Data, Jordan Stout, NOAA ORR/SSC

Jordan Stout, a NOAA Scientific Support Coordinator, outlined the operational data being collected pre and post dispersant application. Scientific Monitoring of Advanced Response Technologies (SMART) Tiers I, II, and III are used to investigate the effectiveness and effects of dispersant application. SMART I includes primary tactical feedback and qualitative measure of effectiveness (e.g., visual observation, aerial photography). SMART II and III include fluorometry data and chemical analysis. LISST data, chemical and acute toxicity data are also being collected.

vi.) Natural Resource Damage Assessment (NRDA) Generated Data, Debbie French-McCay, ASA

Debbie French-McCay (Applied Science Associates) presented data being collected by the NRDA team that are relevant to the effectiveness and effects of subsurface dispersant application. Sampling locations were determined using a transport model (SIMAP) to model the distribution of oil droplets by size (100- 5,000 µm diameters). LISST, Shadowed Image Particle Profiling and Evaluation Recorder (SIPPER), Holocam and Digital Automatic Video Plankton Recorder (DAVPR) were the methods used to analyze droplet size distribution in water samples collected from the model predicted locations. Water samples at various depths were also collected and analyzed for dissolved and particulate phase measurements of polycyclic aromatic hydrocarbons (PAHs). There are limitations to some of the methods used to measure droplet size. LISST-100 on discrete samples can only measure droplets smaller than 100 um and LISST *in situ* and SIPPER are only useful in surface waters. However, Holocam may be deployed to full ocean depth and DAVPR may be used in waters up to 1200 m.

vii.) Seafood Safety, John Stein, NOAA NWFSC

John Stein, from the Northwest Fisheries Science Center (NWFSC), presented seafood safety information. The data collected to insure tainted or contaminated seafood does not reach the market include sensory (smell) and analytical (PAH concentration) evaluations. He noted that the Food and Drug Administration (FDA) has concluded that dispersants have a low potential for bioaccumulation in seafood and there is minimal health risk from consumption. Further development of monitoring methods for dispersants in seafood is needed for the DWH spill. Initial studies on Corexit 9500 on brown shrimp are being used to develop testing methods. Additional exposure studies with fish are planned.

viii.) Plume Science, Samuel Walker, NOAA IOOS

Samuel Walker, from NOAA's Integrated Ocean Observing Systems (IOOS) program, presented data to characterize the distribution of oil in the subsurface. The data can be used to validate transport and fate models. Methods used to collect this data include: gliders (subsurface), air-dropped profilers (subsurface), acoustic doppler current profilers (ADCP) (subsurface), acoustic profilers (subsurface), high frequency radar (surface), drifting and moored buoys (surface), and remote sensing (surface). Analyses provided include: fluorescence and LISST. Measured parameters are: temperature, conductivity, salinity, dissolved oxygen, particle size, and TPH. Some of the data can be accessed on the IOOS and EPA websites. These links can be found in the slide presentations in Appendix C and Table 1. Sophisticated visualization techniques are being used to display the data in 3 and 4 dimensions (e.g., x, y, z, and time).

ix.) *Microbial Data, Terry Hazen, DOE, Lawrence Berkeley National Laboratory*

Terry Hazen, DOE, presented microbial data. He was a late addition to the agenda to replace Ann Hayward Walker because she had response operation commitments. He did not have slides to present. The data collected by the Lawrence Berkeley National Laboratory include: nutrient, iron, natural organic matter (NOM) and dissolved oxygen concentrations, microbial community structure (using molecular techniques) and biodegradation rates. Information on these studies can be found here: https://vimss.lbl.gov/horizonwiki/index.php/Main_Page. The results of these studies point towards supporting the conclusion that microbes degrade chemically dispersed oil faster than oil alone.

Table 1: Surface and subsurface dispersant effectiveness and effects data for the DWH incident.

Data Category	Source	Contact/ Presenter	Location	Access	Issues Noted
Surface Effectiveness					
Flow Rate • Mass balance approach • PIV • Reservoir characteristics • Nodal model	NIC FRTG	Mark Sogge, USGS	http://pubs.usgs.gov/of/2010/1132/	Public	
Oil Budget	USGS	Lt. Amy McElroy, USCG		Federal agents only	
Dispersant Analytes (water samples) • 2-Butoxyethanol • 2-Ethylhexanol • Dioctlylsulfosuccinate sodium salt	EPA	Craig Carroll	http://www.epa.gov/bpspill/dispersants-testing.html	Public	
Air Samples • TAGA analyzed for dispersant related compounds • PUF analyzed for SVOCs	EPA	Craig Carroll	http://www.epa.gov/bpspill/dispersants-testing.html	Public	
Fluorometry	EPA	Craig Carroll, EPA			

Fluorometry, SMART Tier II/III	USCG/ NOAA BP	Jordan Stout, NOAA	www.epaosc.org NOAA sftp site	Presently, not public	
Imagery • Photos	USCG/ NOAA	Jordan Stout, NOAA	www.epaosc.org NOAA sftp site	Presently, not public	
Laser In-Situ Scattering and Transmissometry (LISST) • Particle size	BP	Jordan Stout, NOAA	www.epaosc.org NOAA sftp site	Presently, not public	
Total Petroleum Hydrocarbons (TPH)	USCG/ NOAA BP	Jordan Stout, NOAA	www.epaosc.org NOAA sftp site	Presently, not public	
Polycyclic Aromatic Hydrocarbon (PAH) concentrations	BP	Jordan Stout, NOAA	www.epaosc.org NOAA sftp site	Presently, not public	
Benzene, Toluene, Ethylbenzene, Xylene (BTEX)	BP	Jordan Stout, NOAA	www.epaosc.org NOAA sftp site	Presently, not public	
Water Column Parameters • Temperature • Conductivity • Dissolved oxygen	BP	Jordan Stout, NOAA	www.epaosc.org NOAA sftp site	Presently, not public	
Subsurface Effectiveness					
Dispersant Injection Rate	EPA	Greg Wilson, EPA	http://www.epa.gov/bpspill/epa.html		
Water Column	EPA	Samuel			

Parameters • Temperature • Conductivity • Dissolved oxygen • Salinity	NOAA	Walker, NOAA			
Laser In-Situ Scattering and Transmissometry (LISST) • Particle size	EPA NOAA	Samuel Walker, NOAA			
Total Petroleum Hydrocarbons (TPH)	EPA NOAA	Samuel Walker, NOAA			
Total Polycyclic Aromatic Hydrocarbons (TPAH)	EPA NOAA	Samuel Walker, NOAA			
Volatile Organic Analysis (VOA)	EPA NOAA	Samuel Walker, NOAA			
Currents	EPA NOAA	Samuel Walker, NOAA			
Imagery • Video • Holographic Imagery	ASA	Debbie French-McCay, ASA	NRDA Database, to become part of Administrative Record [not yet organized or complete enough to become publically available]	NRDA data to be public	
Laser In-Situ Scattering and Transmissometry (LISST) • Particle size	EPA ASA	Greg Wilson, EPA Debbie French-McCay, ASA	http://www.epa.gov/bpspill/dispersants.html#bpdata http://ecowatch.ncddc.noaa.gov/JAG NRDA Database, to become part of Administrative Record [not yet organized	EPA-public NOAA-? ASA-?	

			or complete enough to become publically available]		
Total Petroleum Hydrocarbons (TPH)	EPA	Greg Wilson, EPA	http://www.epa.gov/bpspill/dispersants.html#bpdata http://ecowatch.ncddc.noaa.gov/JAG	Public	
Volatile Organic Analysis (VOA)	EPA	Greg Wilson, EPA	http://www.epa.gov/bpspill/dispersants.html#bpdata http://ecowatch.ncddc.noaa.gov/JAG	Public	
Polycyclic Aromatic Hydrocarbon (PAH) concentrations	ASA	Debbie French McCay, ASA	NRDA Database, to become part of Administrative Record [not yet organized or complete enough to become publically available]		
Water Column Parameters • Temperature • Conductivity • Dissolved oxygen • Salinity	EPA	Greg Wilson, EPA	http://www.epa.gov/bpspill/dispersants.html#bpdata http://ecowatch.ncddc.noaa.gov/JAG	Public	DO not done w/ Winkler method
Colored Dissolved Organic Matter (CDOM) Fluorometry	EPA	Greg Wilson, EPA	http://www.epa.gov/bpspill/dispersants.html#bpdata http://ecowatch.ncddc.noaa.gov/JAG	Public	
Plume Monitoring • Ocean gliders • Air-dropped profilers • Acoustic Doppler Current Profilers (ADCP) • Acoustic profilers	NOAA, IOOS	Samuel Walker, NOAA	https://www.st.nmfs.noaa.gov/confluence/display/OOP/Home	Public/Agency only	

Surface and Subsurface Effects					
Seafood Tainting • PAH concentrations, GC/MS	NOAA	John Stein, NOAA			
Toxicity Studies • Rotifer toxicity • Microtox • *in vitro* studies with marine organisms	EPA	Marc Greenberg, EPA	http://www.epa.gov/bpspill/dispersants-testing.html	Public	Dispersants tested: Dispersit SPC Nokomis 3-AA Corexit 9500A Nokomis 3-F4 ZI-400 Sea Brat #4 Saf-Ron Gold JD-2000
Toxicity Studies • Marine algae • Invertebrates • Fish • biodegradation	BP				

IV. DISCUSSION/SYNTHESIS

The data presented here are indicative that subsurface application of dispersants has been effective at dispersing the spilled oil. The data provide multiple lines of evidence in this regard. However, further data analysis is needed to quantify effectiveness (e.g., units of oil dispersed/unit of dispersant applied).

The data relating to effectiveness of subsurface dispersant application are less complete than for the surface. However, the dispersant: oil ratio for the subsurface application is more easily quantified than the surface because dispersants are injected directly into the plume.

A major conclusion from this webinar is that there are data gaps with respect to effects of dispersants or dispersed oil. There are more effects data available for short-term exposure durations, which are applicable to operational considerations, but further studies should also address chronic and long-term impacts to the environment.

Potential data gaps, identified during this webinar are as follows:

- An unknown white foam material has been observed on the water's surface after dispersant applied.
- Some birds observed appeared to be unable to waterproof themselves, even when no visual oiling was observed.
- The effect of dispersant application on the surface tension at the oil/water interface should be quantified.
- The effectiveness of sensors (e.g., acoustics, fluorometry, Holocam) must be determined, so they can be used as quantitative measures of dispersant effectiveness.
- The potential usefulness for portable mass spectrometry for determining dispersant effectiveness should be evaluated.
- Conclusions on microbial activity and its effectiveness with respect to oil biodegradation cannot be made at this time.
- OSHA data on airborne VOCs should be correlated with dispersant effectiveness (airborne data are important for human health and safety).
- No data are available on how dispersants affect the efficiency of mechanical removal of oil from surface waters. The natural weathering of oil may also render dispersants less effective.
- Conclusions regarding chronic effects of various dispersant and oil mixtures on Gulf of Mexico relevant species cannot be made at this time.
- Conclusions on effects of dispersed oil on other ecological receptors, such as sediment biota, deep-sea corals, and chemosynthetic communities cannot be drawn at this time.

- A data comparison between fluorometry and toxicity point estimates (e.g., "No Observable Effects Concentration" [NOEC]), specifically for rotifer toxicity kits, and standardized laboratory toxicity tests, might be useful.
- Most laboratory studies do not accurately simulate deep sea conditions (e.g., pressure during dispersant toxicity testing).
- Uncertainties associated with the data should be quantified.

APPENDIX A:

Participant List

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APPENDIX B:

Agenda

DEEPWATER HORIZON DISPERSANT DATA WEBINAR

JULY 13, 2010

AGENDA

Tuesday, July 13, 2010		
10:20 EST	Begin calling in	
10:30	Welcome, Ground Rules, Participant Introductions	**Nancy Kinner, CRRC (Facilitator)**
10:50	Background and Meeting Goals	**CDR Geoffrey Warren, USCG** **Roberta Runge, EPA**
11:00	SubSurface	**Greg Wilson, EPA**
11:15	Surface	**Craig Carroll, EPA**
11:30	NRDA Data	**Debbie French McCay, ASA; Bob Haddad, NOAA**
11:45	Response Data	**Jordan Stout, NOAA**
12:00	**BREAK**	
12:15	Seafood Safety	**John Stein, NOAA, NMFS**
12:30	"Plume" Science	**Sam Walker, Bob Pavia, NOAA**
12:45	Seafood Safety Data	**Steve Murawski, NOAA, NMFS**
13:00	Oil Budget Tool	**Amy McElroy, USCG**
13:15	Response Operation	**Charlie Henry, Ed Levine, NOAA**
13:30	Flow	**Mark Sogge, USGS**
13:45	Other Data, Microbial Data	**Terry Hazen, DOE**
14:00	Discussion/Synthesis 1) Is this data sufficient to support any conclusions regarding the effectiveness and effects of: (a) surface and (b) subsurface application of dispersants? 2) Are there inconsistencies in the data that need to be addressed? 3) Are there significant data gaps that need to be filled? Can they be filled?	
14:30	**Closing Remarks**	**CDR Geoffrey Warren, Roberta Runge, Nancy Kinner**

APPENDIX C:

Presentations

WELCOME

Deepwater Horizon Dispersant Data Webinar

Hosted by NRT and Coastal Response Research Center

July 13, 2010

Deepwater Horizon
Dispersant Data Webinar

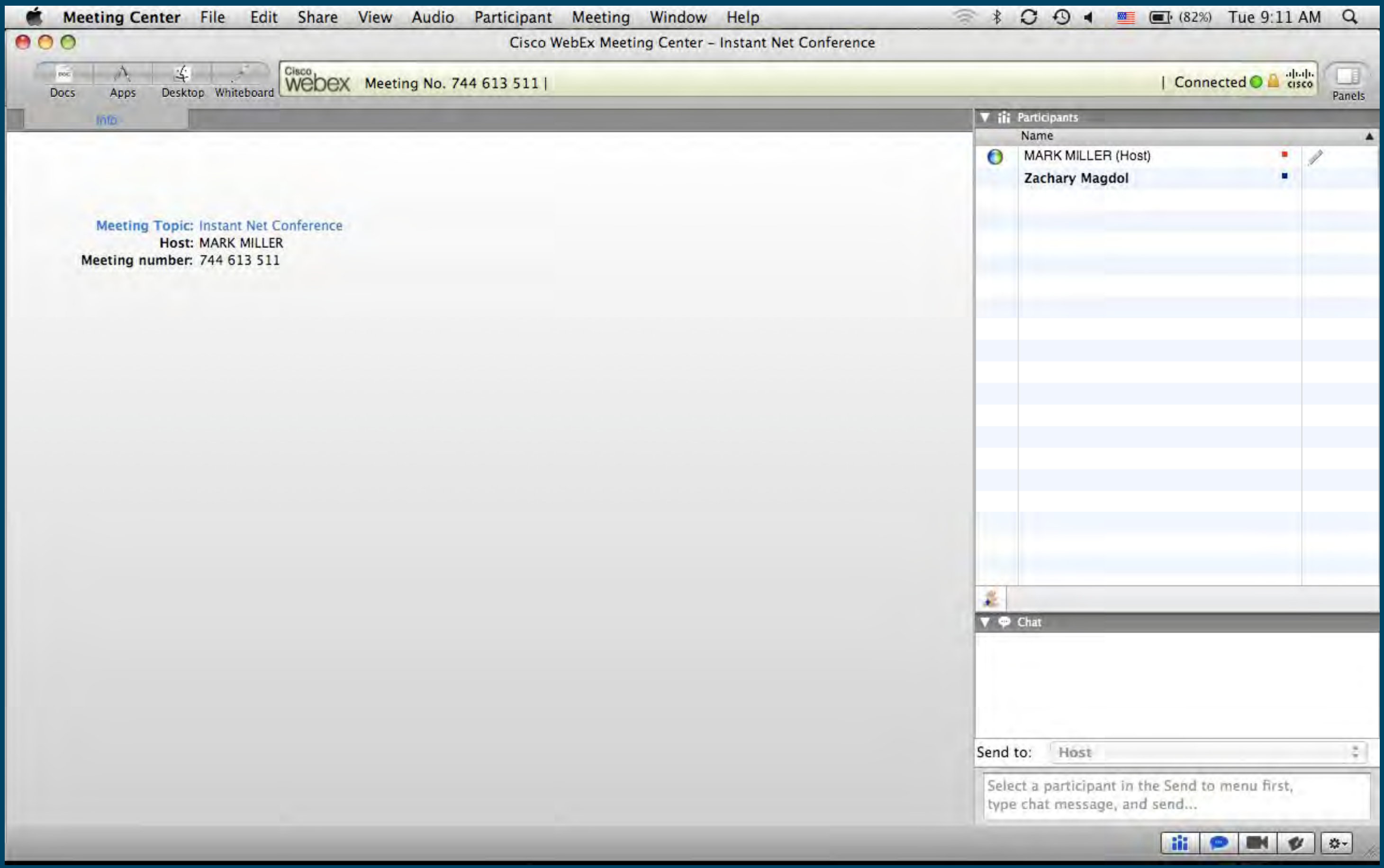
July 13, 2010

Nancy E. Kinner, Facilitator
Coastal Response Research Center
(CRRC)
UNH Co-Director

LOGISTICS

- <u>MUTE PHONE</u>
- <u>DO NOT PUT PHONE ON HOLD</u>
- Goal to keep meeting within 4 hours
  - If operational demands limit participation and you must drop off line, report will be available in early August
- One 15 minute break; working through lunch

WEBINAR DISPLAY



PARTICIPANT INTRODUCTIONS

- Name
- Affiliation
- Current location

- Nancy Kinner, Coastal Response Research Center, Coast Guard HQ

PARTICIPANT REPRESENTATION

- **Diverse group participating:**
  - **Responders**
  - **Scientists**
  - **Planners**
  - **Coordinators**
- **Federal and state partners**
- **Focus of webinar is on data and NOT response operations**

CRRC ROLE IN TODAY'S MEETING

- CRRC Facilitation Experience
- CRRC History With Dispersants R&D
- CRRC Leadership of DWG
- CRRC: Independent and Honest Broker
  - NH not oil-producing state
  - UNH independent academic affiliation
  - Strong record of peer review
  - Known for bringing all stakeholders into discussions

KEY PERSONNEL

- Facilitator: Nancy Kinner, CRRC Co-Director
- Assistant facilitator: Zachary Magdol, CRRC Research Engineer
- Logistics POC: Kathy Mandsager, CRRC Program Coordinator, kathy.mandsager@unh.edu, 603-498-8010
- Note takers: CRRC Staff and Students at UNH

MEETING PURPOSE

- Determine **data available** on:
  - Effectiveness
  - Effects
- For **surface and subsurface dispersant application**
- Context is efficacy and safety of dispersant use for Deepwater Horizon (DWH) response
- Goal is data coordination from all response partners

DATA AVAILABILITY

- **What data exist? (e.g., data of dispersant effectiveness)**
- **Who has that data?**
  - **Where do the data reside?**
  - **Who has access to the data? (e.g., Agency X, FTP Site Y, All members of the Unified Command)**
- **What type of data is it? (e.g., LISST droplet size distribution data)**
- **What is the spatial and temporal extent of the data?**
- **Are there any data gaps or inconsistencies with this data? (e.g., due to poor weather, one location (x,y,z coordinates) could not be sampled on June 20, 2010)**

MEETING GOALS

1. What data are available regarding the effectiveness and effects of the surface application of dispersants?
2. What data are available regarding the effectiveness and effects of the subsurface application of dispersants?
3. Are there any issues with the data (e.g., spatial or temporal inconsistencies)?
4. Are there significant gaps in the data?

Webinar will NOT involve discussion of policy, strategy, or risk assessment related to dispersant use.

MEETING GOALS

- **Is data sufficient to support conclusions regarding effectiveness and effects of: (a) surface and (b) subsurface application of dispersants?**
- **Can inconsistencies in data be addressed?**
- **How can data gaps be filled?**

MEETING REPORT

- Report will be produced by CRRC
- Report will include:
  - Source, location, access and type of data
  - Inconsistencies associated with data
  - Data gaps
  - Summary of discussion/synthesis
  - Appendices:
    - Agenda, Participants, Presentations
- Report will not be posted on CRRC website

MEETING REPORT

- Report will be produced by CRRC
- Report will be reviewed by the presenters and the DWH Interagency Solutions Group (representing the NRT)
- Report will be distributed to all participants
  - Via email as PDF
- Anticipated release early August

AGENDA

10:30	**Welcome**	**Nancy Kinner, CRRC (Facilitator)**
10:35	Comments from NRT Agency Leads	**Bob Pond, USCG** **Roberta Runge, EPA**
10:45	Ground Rules, Participant Introductions	**Nancy Kinner**
11:00	Flow Rate Data	**Mark Sogge, USGS**
11:15	Oil Budget Tool	**Lt. Amy McElroy, USCG**
11:20	Surface Dispersant Data	**Marc Greenberg, EPA** **Craig Carroll, EPA/RRT 6 Co-Chair**
11:40	Subsurface Dispersant Data/Toxicity Data	**Greg Wilson, EPA**
12:00	***BREAK***	

AGENDA

12:15	**Operational Data**	**Jordan Stout, NOAA/ORR/SSC**
12:35	NRDA Generated Data	**Debbie French McCay, ASA**
12:50	Seafood Safety	**John Stein, NOAA/NWFSC**
13:05	"Plume" Science	**Sam Walker, NOAA/IOOS**
13:20	Other NOAA Data	**Ann Hayward-Walker, SEA**
13:35	**Other Data Sources**	

AGENDA

13:45	**Discussion/Synthesis** 1) Is this data sufficient to support any conclusions regarding the effectiveness and effects of: (a) surface and (b) subsurface application of dispersants? 2) Are there significant data gaps that need to be filled? Can they be filled? 3) Are there inconsistencies in the data that need to be addressed?	
14:30	Closing Remarks	Bob Pond, USCG Roberta Runge, EPA Nancy Kinner, CRRC

QUESTIONS ABOUT MEETING FORMAT AND GOALS?

GROUND RULES

- <u>Use the mute button</u>
- One person speaking
- Introduce yourself each and every time you start speaking
- Minimize distraction and background noise
- Mobile phones are not preferred (but we understand sometimes necessary)

AGENDA

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12:00	***BREAK***	

PRESENTATIONS

Flow Rate Data

Mark Sogge, USGS

USGS

science for a changing world

Science for Decisions: National Incident Command Flow Rate Technical Group

Mark Sogge, Deputy Chief , NIC Flow Rate Technical Group

July 12, 2010

U.S. Department of the Interior
U.S. Geological Survey

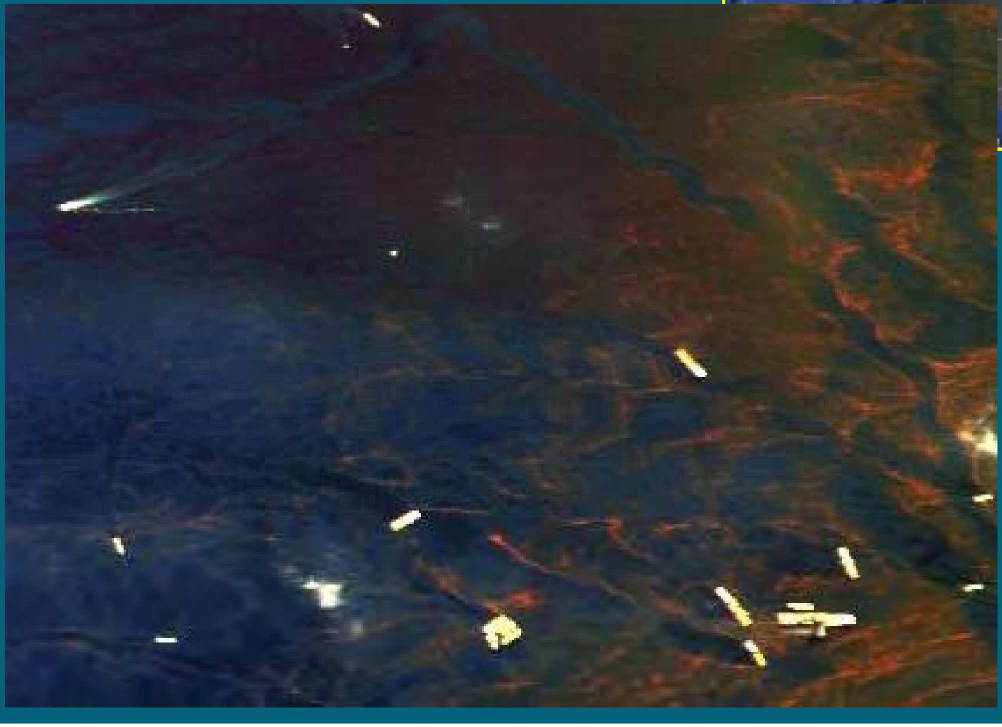
Flow Rate Technical Group

- Chartered by the National Incident Command
- Federal scientists, independent experts, university representatives
- Four independent teams developing best methods to estimate oil spill flow
  - Mass Balance Team
  - Plume Analysis Team
  - Reservoir Analysis Team
  - Nodal Analysis Team
- BP provided some raw data
- Providing preliminary and updated assessments since May 27

USGS

Flow Rate Technical Group

Mass Balance Team



USGS

Mass Balance – Discharge Rate Calculation

- Start with a measured sea-surface oil volume
- Add collected, burned, skimmed, evaporated, dispersed, etc.
- Divide by number of days of oil discharge

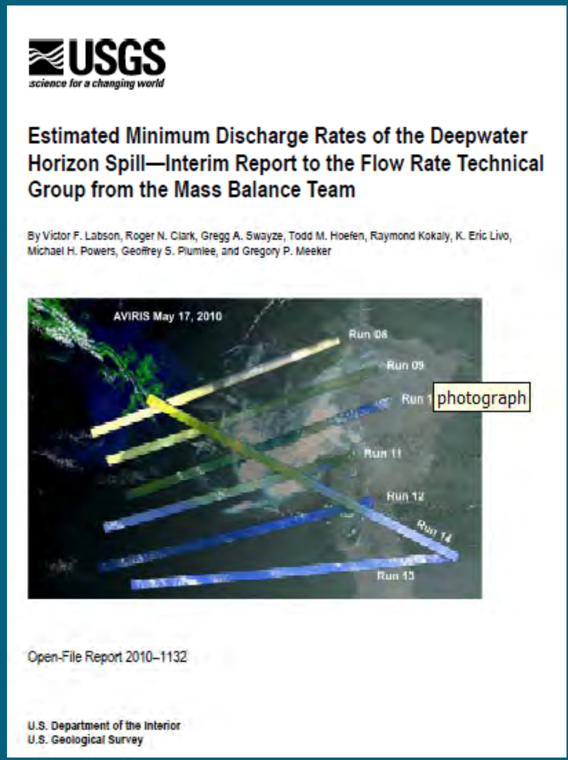
RESULT = Average Daily Discharge Rate

Flow Rate Technical Group

Mass Balance Team Preliminary Results

- Assessment formed from data collected May 17
- Calculated average minimum flow:

  12,600 to 21,500 barrels a day
- Report peer reviewed and published http://pubs.usgs.gov/of/2010/1132/


USGS
science for a changing world

Estimated Minimum Discharge Rates of the Deepwater Horizon Spill—Interim Report to the Flow Rate Technical Group from the Mass Balance Team

By Victor F. Labson, Roger N. Clark, Gregg A. Swayze, Todd M. Hoefen, Raymond Kokaly, K. Eric Livo, Michael H. Powers, Geoffrey S. Plumlee, and Gregory P. Meeker

Open-File Report 2010–1132

U.S. Department of the Interior
U.S. Geological Survey

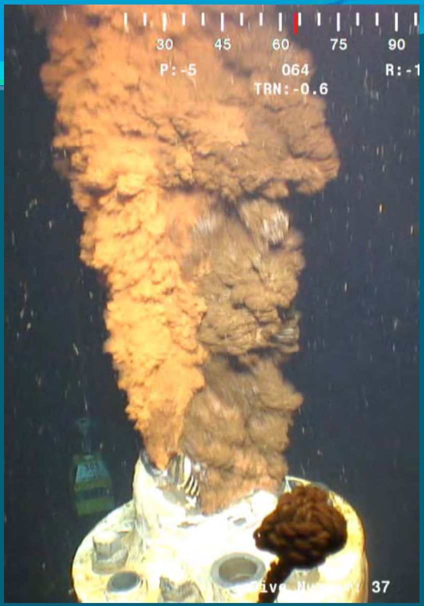
USGS

Flow Rate Technical Group

Plume Analysis Team

- Analyze video provided by BP
- Modeled via

  Particle Image Velocimetry (PIV)



A flow model for the reservoir can be constructed using the radial single phase (liquid) version of Darcy's Law shown as equation (1).

$$\frac{q}{p_e - p_{wf}} = \frac{k_o h}{141.2 B_o \mu_o \left[\ln\left(\frac{r_e}{r_w}\right) + s \right]} \quad \text{.........} (1)$$

$q =$ liquid flow rate (STB/day)

$p_e =$ reservoir boundary pressure = 11,856 (psia)

$p_{wf} =$ flowing pressure inside, but at the bottom of the well (psia)

$k_o =$ permeability to reservoir fluid (md)

$h =$ net reservoir thickness (ft)

$B_o =$ liquid formation volume factor = 2.367 (reservoir bbl/STB)

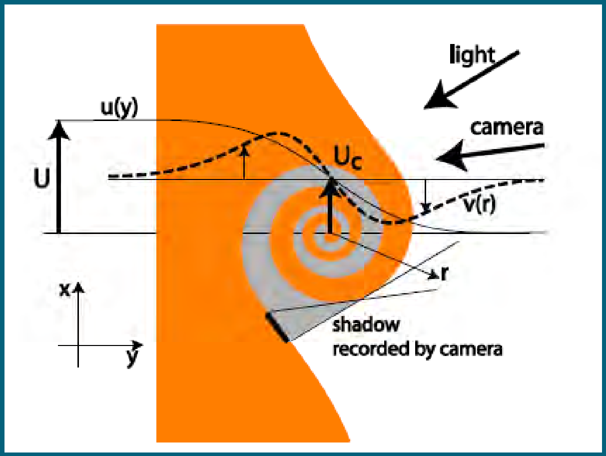
$\mu_o =$ viscosity of reservoir fluid = 0.165 (cp)

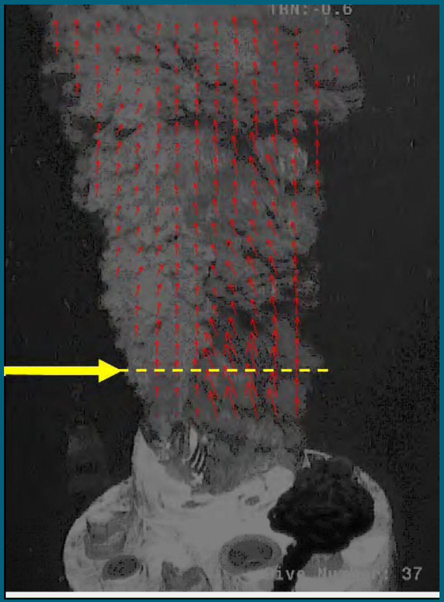
$r_e =$ radius to the well drainage boundary = 4,560 (ft)

$r_w =$ well bore radius = 0.254 (ft)

$s =$ reservoir skin damage = 0 (dimensionless)

$$\frac{q}{p_e - p_{wf}} = \frac{223.7(95.5)}{141.2(2.367)0.165 \left[\ln\left(\frac{4,560}{0.254}\right) + 0 \right]} = 39.5 \text{ STB/day/psia} \quad \text{.........} (2)$$





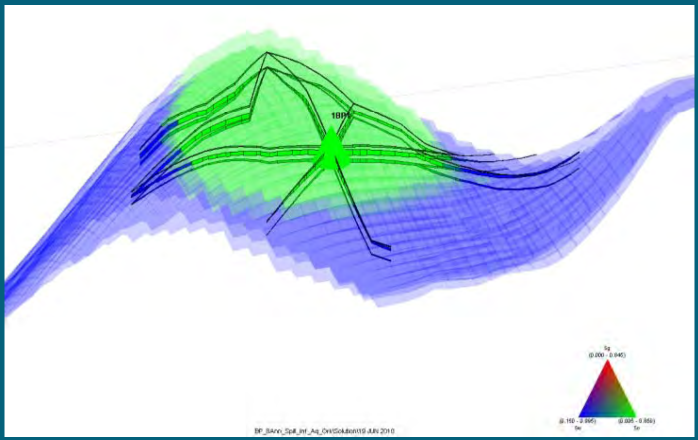
USGS

Flow Rate Technical Group

Nodal and Reservoir Teams

- Reservoir Team investigate characteristics of oil field/reservoir

- Nodal Team uses Reservoir Team and other data to model potential flow from well



1.1.2 Static Pressure Changes Across Sudden Enlargement

The static pressure drop for two-phase flow through an enlargement from area A_0 to area A_1 is:

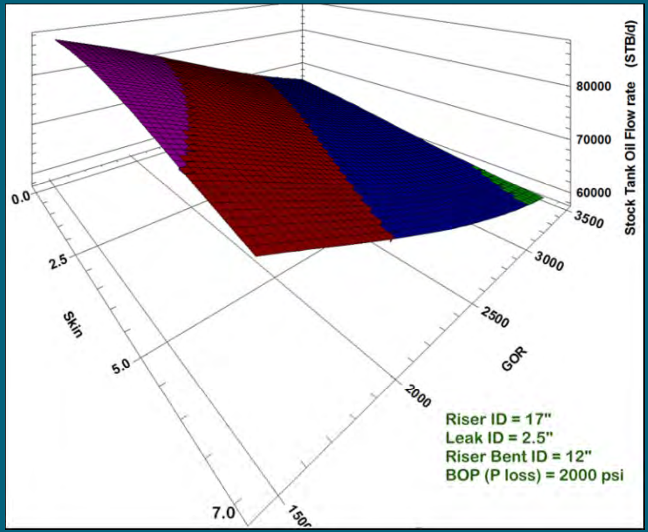
$$p_1 - p_0 = G_0^2 \frac{A_0}{A_1}\left(1-\frac{A_0}{A_1}\right)v_f\left[1+\frac{v_{fg}}{v_f}\frac{x_0+x_1}{2}\right] \qquad (8)$$

where gas quality is averaged across the expansion. This equation has been found satisfactory for two-phase flow through expansions at high pressure (82.6 bar) and high mass flux (G>2700 kg/m^2-s).

1.1.3 Static Pressure Changes Across Sudden Contraction

The change in static pressure at a sudden contraction from area A_0 to area A_1 is:

$$p_0 - p_1 = \frac{G_1^2}{2}v_f\left[\left(\frac{1}{(A_c/A_1)}-1\right)^2+\left(1-\frac{1}{(A_0/A_1)^2}\right)\right]\left[1+\frac{v_{fg}}{v_f}\frac{x_0+x_1}{2}\right] \qquad (9)$$



Current Government Flow Estimate

- Based on updated Plume Team analyses and collaboration with DOE science team
- Estimate released to public June 15
- Flow rate estimated at 35,000 – 60,000 BPD

Next steps:

- Finalize analyses and estimates
- Produce FRTG Final Report

USGS

Oil Budget Data

Lt. Amy McElroy, USCG

Deepwater Horizon MC252 Gulf Incident Oil Budget

High Flow Scenario (60,000 barrels/day) - Through July 11 (Day 83) Print

	Cumulative	July 11 (83)
Discharged	4,980,000	60,000
Recovered via RITT and Top Hat	775,800	8,235
Dispersed Naturally	796,426	9,178
Evaporated or Dissolved	1,296,726	14,522
Available for Recovery	2,111,048	28,065
Skimmed	84,461	3,665
Burned	247,165	0
Chemically Dispersed	324,634	5,874
Dispersant Used	34,392	367
Remaining	1,454,789	18,526

* All units in barrels. Click row label for more information.

Cumulative Disposition of Oil | Cumulative Remaining

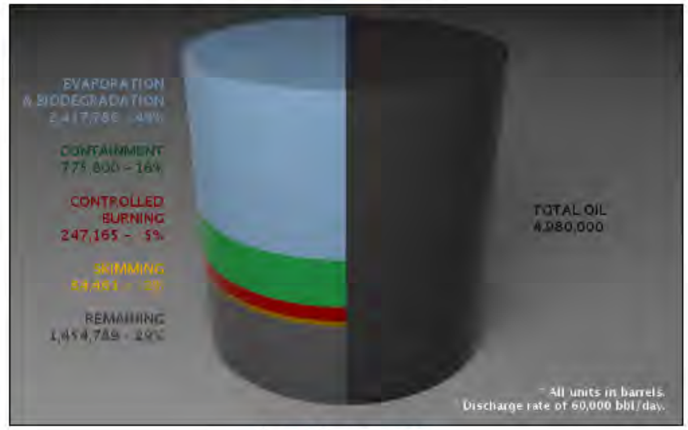


Chart Information (Edit)

Low Flow Scenario (35,000 barrels/day) - Through July 11 (Day 83) Print

	Cumulative	July 11 (83)
Discharged	2,905,000	35,000
Recovered via RITT and Top Hat	775,800	8,235
Dispersed Naturally	381,426	4,178
Evaporated or Dissolved	619,668	6,322
Available for Recovery	1,128,106	16,265
Skimmed	84,461	3,665
Burned	247,165	0
Chemically Dispersed	324,634	5,874
Dispersant Used	34,392	367
Remaining	471,846	6,726

* All units in barrels. Click row label for more information.

Cumulative Disposition of Oil | Cumulative Remaining

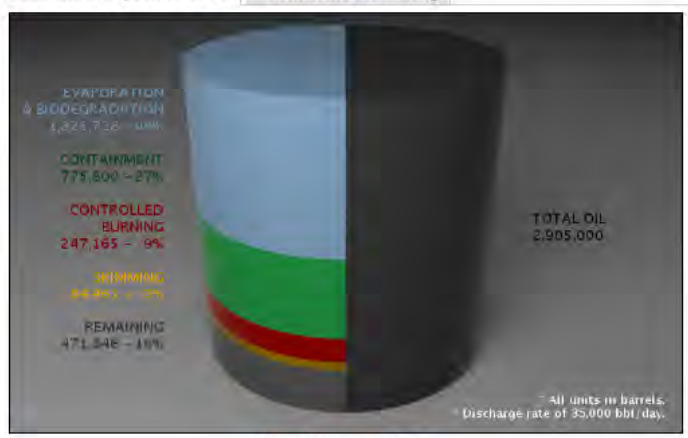


Chart Information (Edit)

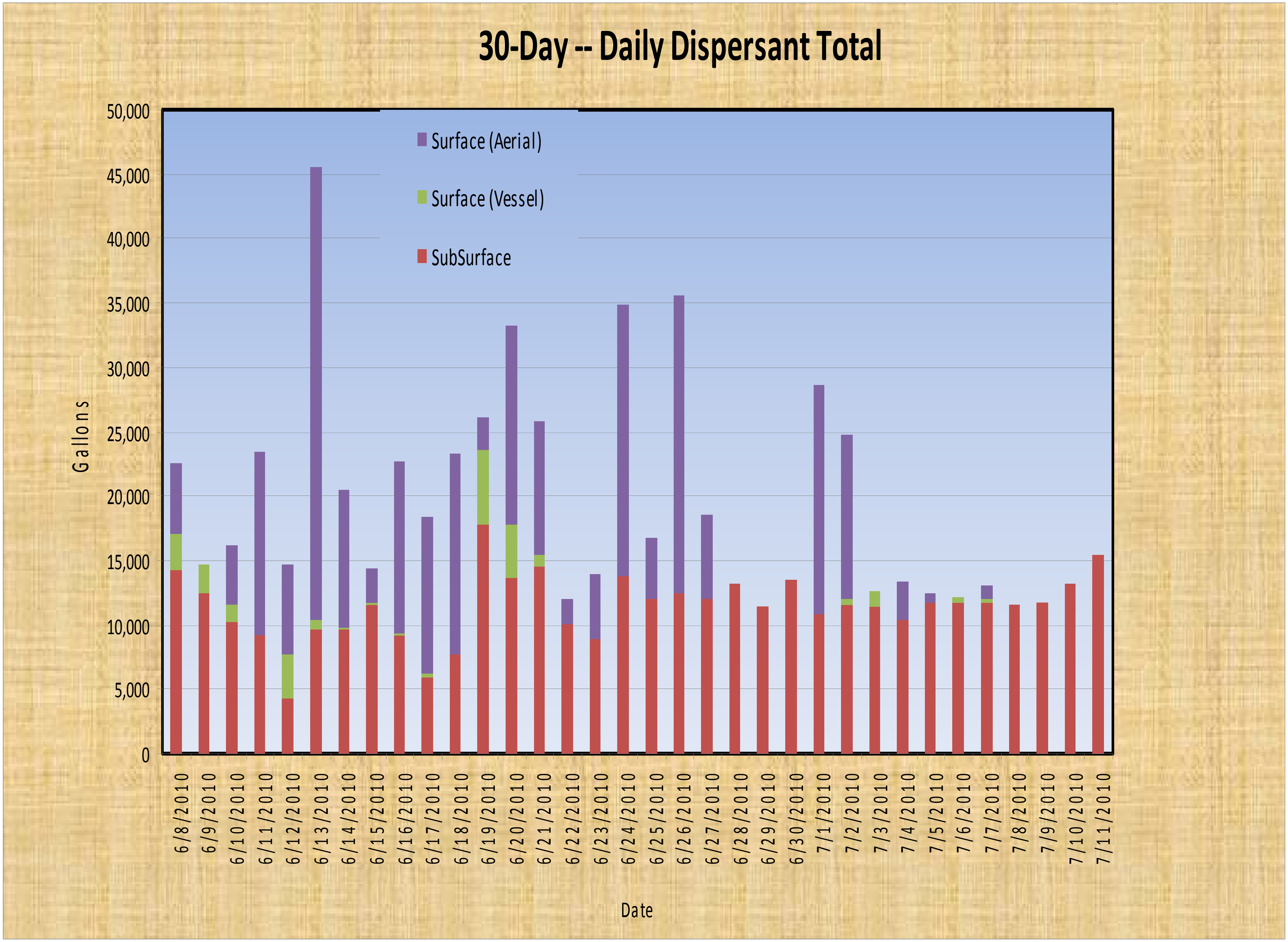
Surface Dispersant Data

Marc Greenberg, EPA
Craig Carroll, EPA/RRT 6 Co-Chair

EPA Presentation on
Surface Applied Dispersant

Surface Dispersant Application

- Per RRT guidance application occurs >3 miles offshore and water depth of > 10 meters
- Applied primarily via aircraft
- As of 07/12/10
  - 404 sorties flown
  - 975,038 gallons sprayed
  - 305 sq miles covered (195,008 acres)



30-Day -- Daily Dispersant Total
Surface (Aerial)
Surface (Vessel)
SubSurface
Gallons
50,000
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
6/8/2010
6/9/2010
6/10/2010
6/11/2010
6/12/2010
6/13/2010
6/14/2010
6/15/2010
6/16/2010
6/17/2010
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6/23/2010
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7/1/2010
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7/7/2010
7/8/2010
7/9/2010
7/10/2010
7/11/2010
Date

Surface Water and Air Monitoring and SMART Data

Data availability:

- Summary results: http://www.epa.gov/bpspill/dispersants-testing.html
  http://www.epaosc.net/deepwatersmart
  ftp://sftp.orr.noaa.gov

Data issues: none

Surface Water Sampling and Monitoring

- Initiated 05/21/10 to date
- To date 508 samples have been tested for dispersant analytes
  - 2-Butoxyethanol
  - 2-Ethylhexanol
- In addition, over 50 of these have been tested for Dioctlylsulfosuccinate sodium salt (DOSS)
- Standard water quality parameters also measured.
- All samples to date have returned as Non-Detect for all analytes

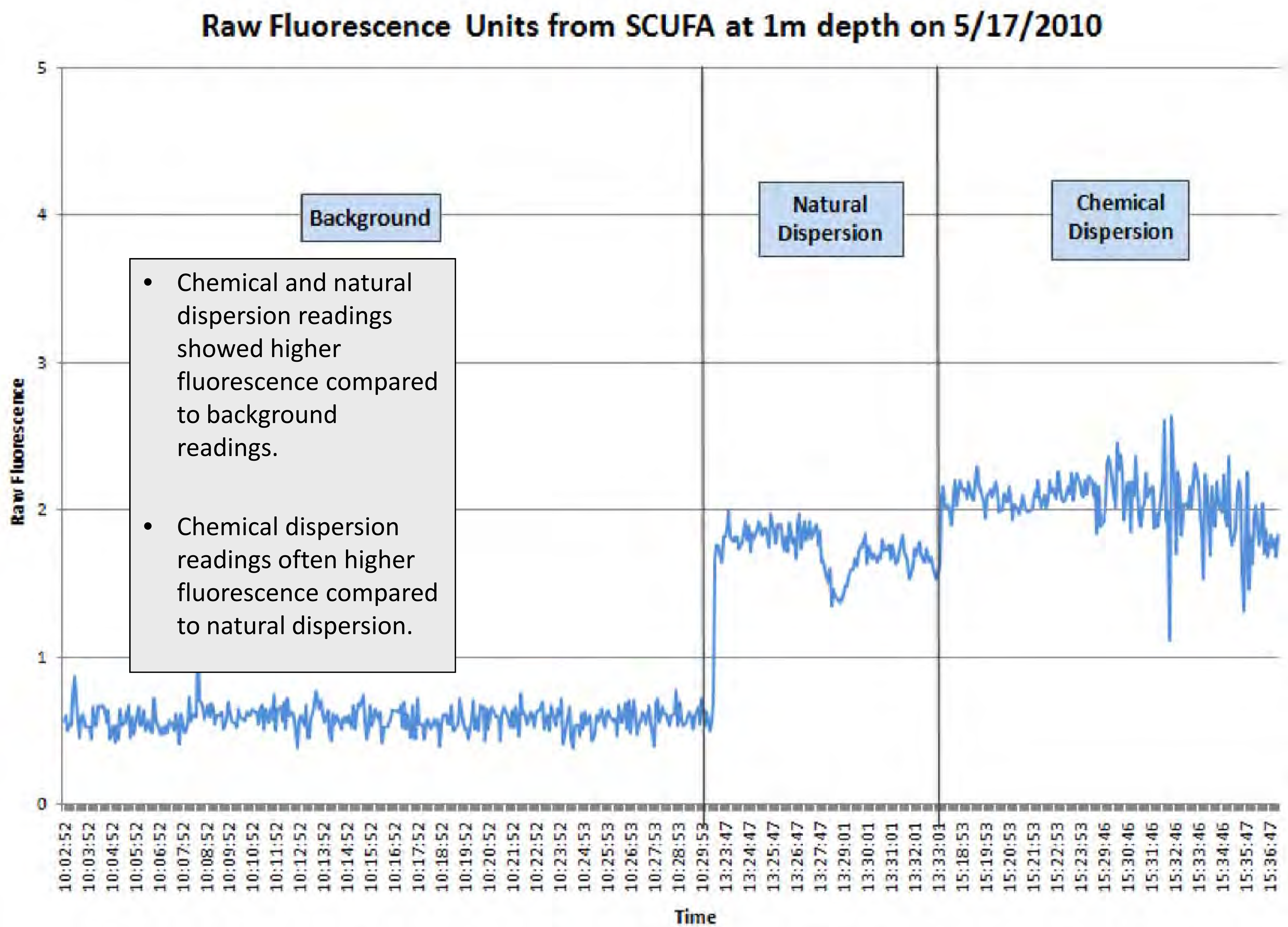
Air Sampling

- TAGA analyzed for dispersant-related compounds on May 18, 2010 through June 10, 2010. No Dispersant-related compounds were detected.
- 101 PUF samples were analyzed for SVOCs since June 3, 2010. No dispersant-related compounds were found.

SMART Tier II/III Fluorometry

- 22 SMART monitoring sampling events from April 28 to June 13, 2010 were reviewed.

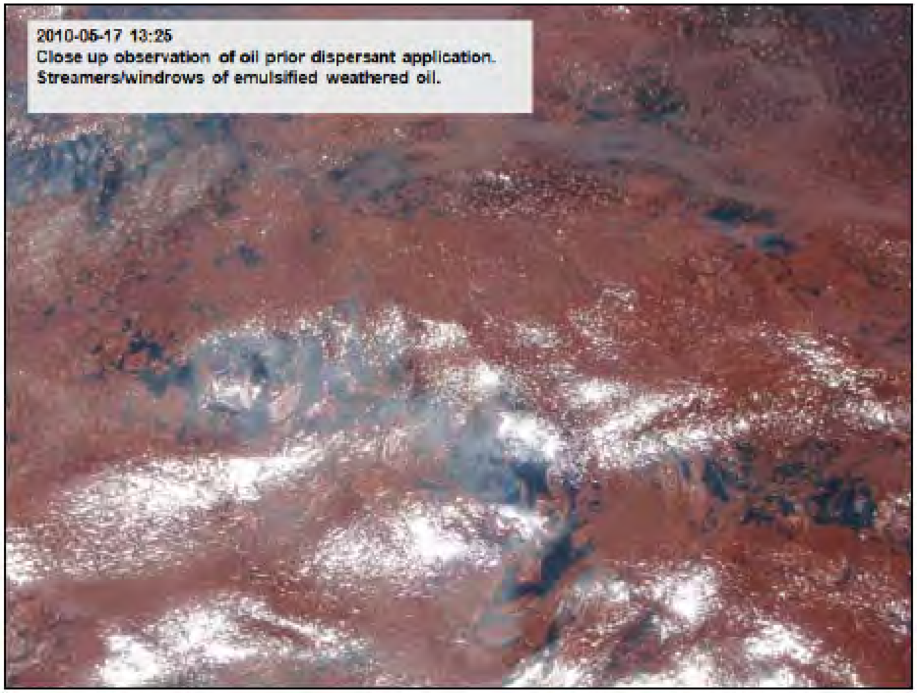
- SMART Teams measured background, natural dispersion, and chemical dispersion using fluorometry.



Raw Fluorescence Units from SCUFA at 1m depth on 5/17/2010
Raw Fluorescence
Time
Background
Natural Dispersion
Chemical Dispersion
• Chemical and natural dispersion readings showed higher fluorescence compared to background readings.
• Chemical dispersion readings often higher fluorescence compared to natural dispersion.
0
1
2
3
4
5
10:02:52 10:03:52 10:04:52 10:05:52 10:06:52 10:07:52 10:08:52 10:09:52 10:10:52 10:11:52 10:12:52 10:13:52 10:14:52 10:15:52 10:16:52 10:17:52 10:18:52 10:19:52 10:20:52 10:21:52 10:22:52 10:23:52 10:24:53 10:25:53 10:26:53 10:27:53 10:28:53 10:29:53 13:23:47 13:24:47 13:25:47 13:26:47 13:27:47 13:29:01 13:30:01 13:31:01 13:32:01 13:33:01 15:18:53 15:19:53 15:20:53 15:21:53 15:22:53 15:23:53 15:29:46 15:30:46 15:31:46 15:32:46 15:33:46 15:34:46 15:35:47 15:36:47

SMART Tier II/III Fluorometry

- Within each measurement category (*i.e.,* back-ground, natural dispersion, chemical dispersion) fluctuations in fluorescence were observed
- No depth trends were observed upon visual inspection of the fluorescence readings
- No time trends were observed upon visual inspection of the fluorescence readings



Data to date show dispersant effectiveness is consistent with our expectations

Summary of EPA Toxicity Studies on Dispersants

Comparative Toxicity of 8 Dispersants

Tests completed with 8 dispersants:

- acute toxicity tests were conducted with two Gulf of Mexico species
- *in vitro* endocrine activity and cytotoxicity were tested using mammalian cell lines

Data availability:

- Summary results: http://www.epa.gov/bpspill/dispersants-testing.html

Data issues: none

Future testing:

- oil only tests are being conducted with Louisiana Sweet Crude with two Gulf species
- oil+dispersant tests are currently being conducted with 8 dispersants with two Gulf species

Results of 48 hour acute toxicity tests of 8 dispersants to the Gulf of Mexico invertebrate, mysid shrimp (*Americamysis bahia*)

Dispersant	This Study LC50 (ppm) [95% CI]	Toxicity Category	NCP Product Schedule LC50 (ppm) [95% CI]
Dispersit SPC 1000	12 [10-14]	Slightly Toxic	16.6 [14.1-19.6]
Nokomis 3-AA	30 [27-34]	Slightly Toxic	20.2 [17.4-22.8]
Corexit 9500A	**42 [38-47]**	**Slightly Toxic**	**32.2 [26.5-39.2]**
Nokomis 3-F4	42 [38-47]	Slightly Toxic	32.2 [28.4-36.5]
ZI -400	55 [50-61]	Slightly Toxic	21.0 [17.9-24.5]
Sea Brat #4	65 [57-74]	Slightly Toxic	14.0 [±10.4]
Saf-Ron Gold	118 [104-133]	Practically Non-Toxic	63.0* [52.9-75.1]
JD-2000	788 [627-946]	Practically Non-Toxic	90.5* [76.1-108]

* Classified as slightly toxic according to values provided in NCP Product Schedule

http://www.epa.gov/bpspill/dispersants-testing.html

Results of 96 hour acute toxicity tests of 8 dispersants to the Gulf of Mexico fish, inland silverside (*Menidia beryllina)*

Dispersant	This Study LC50 (ppm) [95% CI]	Toxicity Category	NCP Product Schedule LC50 (ppm) [95% CI]
Dispersit SPC 1000	2.9 [2.5-3.2]	Moderately Toxic	3.5 [3.1-4.0]
Nokomis 3-F4	19 [16-21]	Slightly Toxic	29.8 [24.0-35.4]
Nokomis 3-AA	19 [17-21]	Slightly Toxic	34.2 [29.2-37.95]
ZI -400	21 [18-23]	Slightly Toxic	31.8 [28.7-35.1]
Saf-Ron Gold	44 [41-47]	Slightly Toxic	29.4 [25.2-34.3]
Sea Brat #4	55 [49-62]	Slightly Toxic	30.0 [±16.2]
Corexit 9500A	**130 [122-138]**	**Practically Non-Toxic**	**25.2* [13.6-46.6]**
JD-2000	>5,600	Practically Non-Toxic	407 [330-501]

* Classified as slightly toxic according to values provided in NCP Product Schedule

http://www.epa.gov/bpspill/dispersants-testing.html

In Vitro Testing for Potential Endocrine Related Activity and Cytotoxicity

Battery of mammalian cell line assays:

- Endpoints included cytotoxicity and the potential interaction with estrogen and androgen receptors

All dispersants showed cytotoxicity at concentrations between 10-1000 parts per million (ppm)

None of the 8 dispersants tested displayed biologically significant endocrine disrupting activity

Similar results to ecotoxicology tests

- generally low toxicity

References: Judson et al. (2010) "Analysis of Eight Oil Spill Dispersants Using Rapid, In Vitro Tests for Endocrine and Other Biological Activity" *Environmental Science and Technology* (http://pubs.acs.org/doi/abs/10.1021/es102150z

Subsurface Dispersant Data/Toxicity Data

Greg Wilson, EPA

Subsurface Dispersant Data for the DWH OIL SPILL

U. S. Environmental Protection Agency

July 13, 2010

What EPA is doing

- Collecting samples along the shoreline and beyond for chemicals related to oil and dispersants in the air, water and sediment
- Closely monitoring the effects of dispersants in the subsurface environment
- http://www.epa.gov/bpspill/epa.html

EPA's Dispersant Monitoring and Assessment Directive for Subsurface Dispersant Application

- Directive (May 10) requires BP to implement a monitoring and assessment plan for subsurface and surface applications of dispersants as part of the BP oil spill response
- Addendum 1 (May 14) provides for additional data collection and reporting requirements.
- Addendum 2 (May 20) addresses dispersant toxicity and effectiveness
- Addendum 3 (May 26) requires BP to limit the total amount of surface and subsurface dispersant applied each day to the minimum amount possible
- http://www.epa.gov/bpspill/dispersants.html#directives

Data Collection – What data exist?

- Type of dispersant
- Rate of dispersant injection
- CTD – Conductivity, Temperature, and Depth
- CDOM Fluorometer
- Dissolved Oxygen (e.g., SBE 43, handheld probes)
- Rototox toxicity

Data Collection – What data exist?

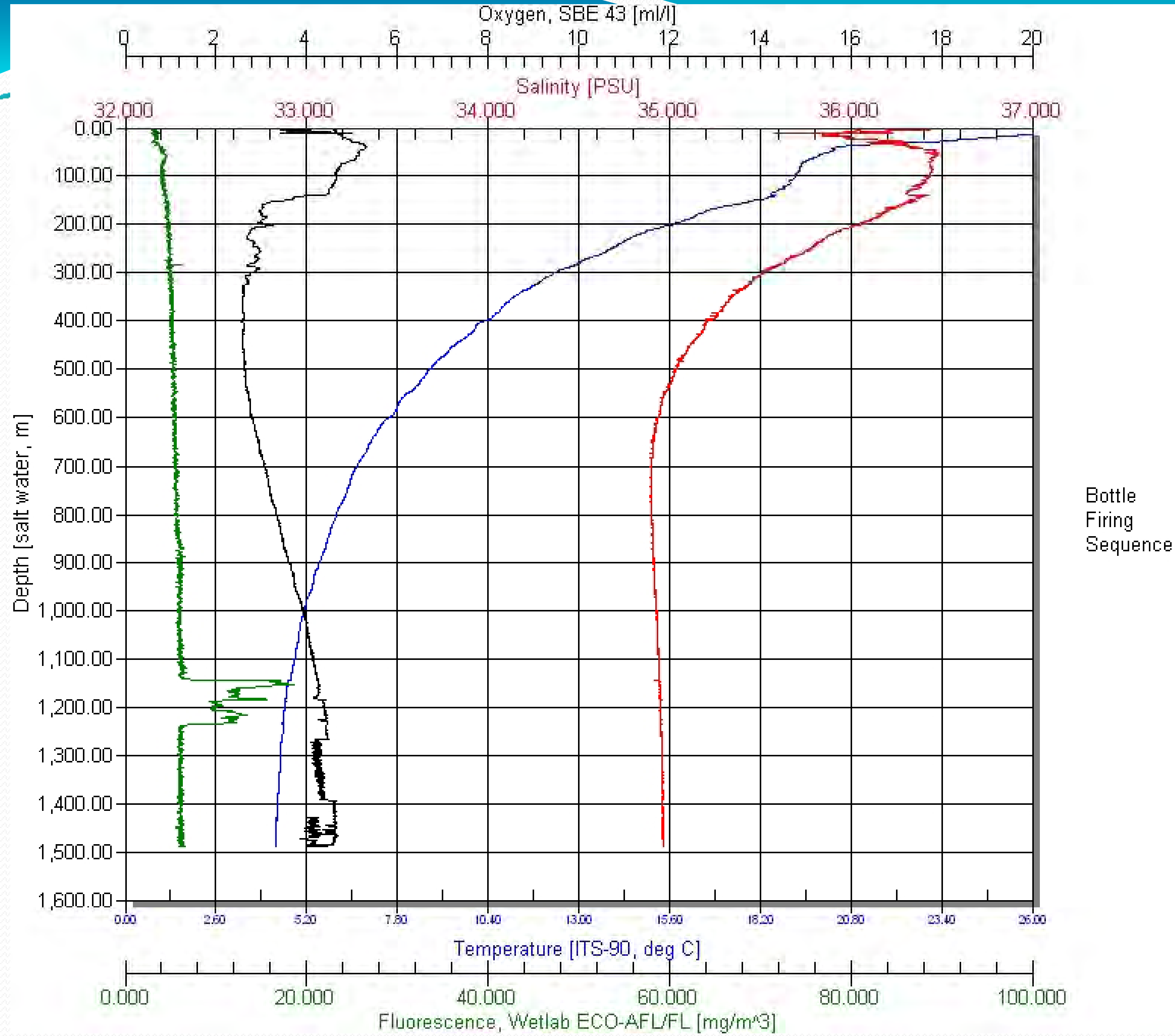
- Laser In-Situ Scattering and Transmissometry (LISST)
  - Particle Analysis (2.5 – 60 microns)
- Total Petroleum Hydrocarbons (TPH)
- Volatile Organic Analysis (VOA)
- UV-Fluorescence testing
- http://www.epa.gov/bpspill/dispersants.html#bpdata

Daily reports

- Examples of daily cruise reports EPA receives
  - Brooks McCall, Ocean Veritas (BP or BP contract vessels)
  - Thomas Jefferson, Gordon Gunter, Nancy Foster (NOAA)
- Typical Brooks McCall cruise report may include:
  - Sample locations (distance and direction from the wellhead)
  - Number of casts
  - Type of data collected (e.g., TPH, VOA, CTD fluorometry, dissolved oxygen and LISST analysis) and number of samples
  - Visual observations
  - Preliminary assessment of CDOM fluorescence signals, dissolved oxygen
  - Operational issues (e.g., equipment malfunction)

Data Website for Subsurface Dispersants

- EPA OSC - Deepwater Subsurface Data
  - http://www.epaosc.org/site/doc_list.aspx?site_id=6077
  - ZIP files uploaded daily to epaosc.org website
  - Brooks McCall, Ryan Chouest, Delaware II, Endeavor, Ferrel, Jack Fitz, Nancy Foster, Gordon Gunter, Thomas Jefferson, Ocean Veritas, Walton Smith
- Typical Brooks McCall/Ocean Veritas zip file contains:
  - Daily report cruise report
  - CTD Raw data image file
  - Excel Spreadsheet with sample ID, location, depth, time, date, sample team, field description.
  - Daily report for tracking dispersed oil using particle size distribution measurements and fluorescence intensity ratios
  - Rototox data



Oxygen, SBE 43 [ml/l]
0 2 4 6 8 10 12 14 16 18 20
Salinity [PSU]
32.000 33.000 34.000 35.000 36.000 37.000
Depth [salt water, m]
0.00 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00 900.00 1,000.00 1,100.00 1,200.00 1,300.00 1,400.00 1,500.00 1,600.00
0.00 2.60 5.20 7.80 10.40 13.00 15.60 18.20 20.80 23.40 26.00
Temperature [ITS-90, deg C]
0.000 20.000 40.000 60.000 80.000 100.000
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]
Bottle
Firing
Sequence

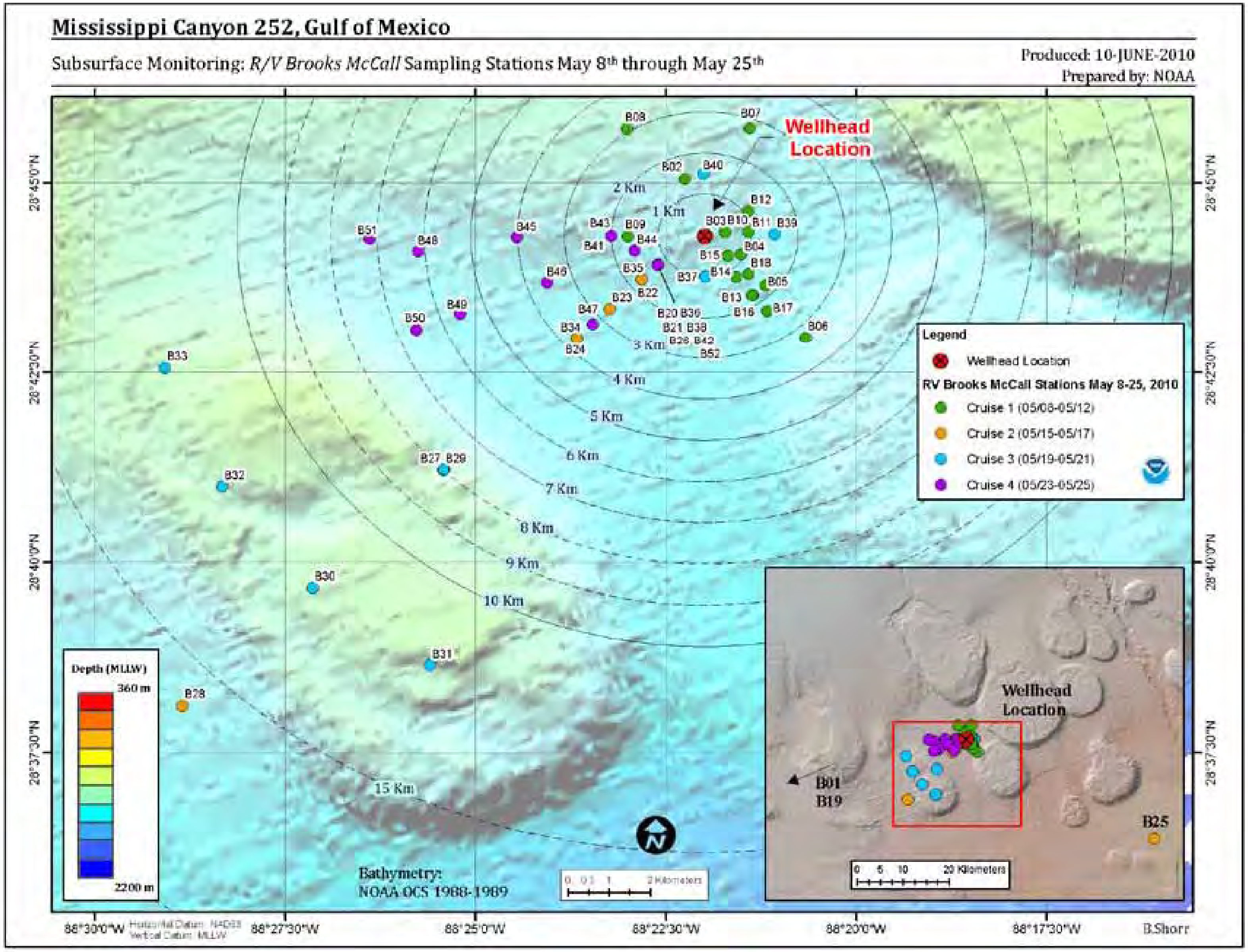
Joint Analysis Group (JAG) for Surface and Subsurface Oceanography, Oil, and Dispersant Data

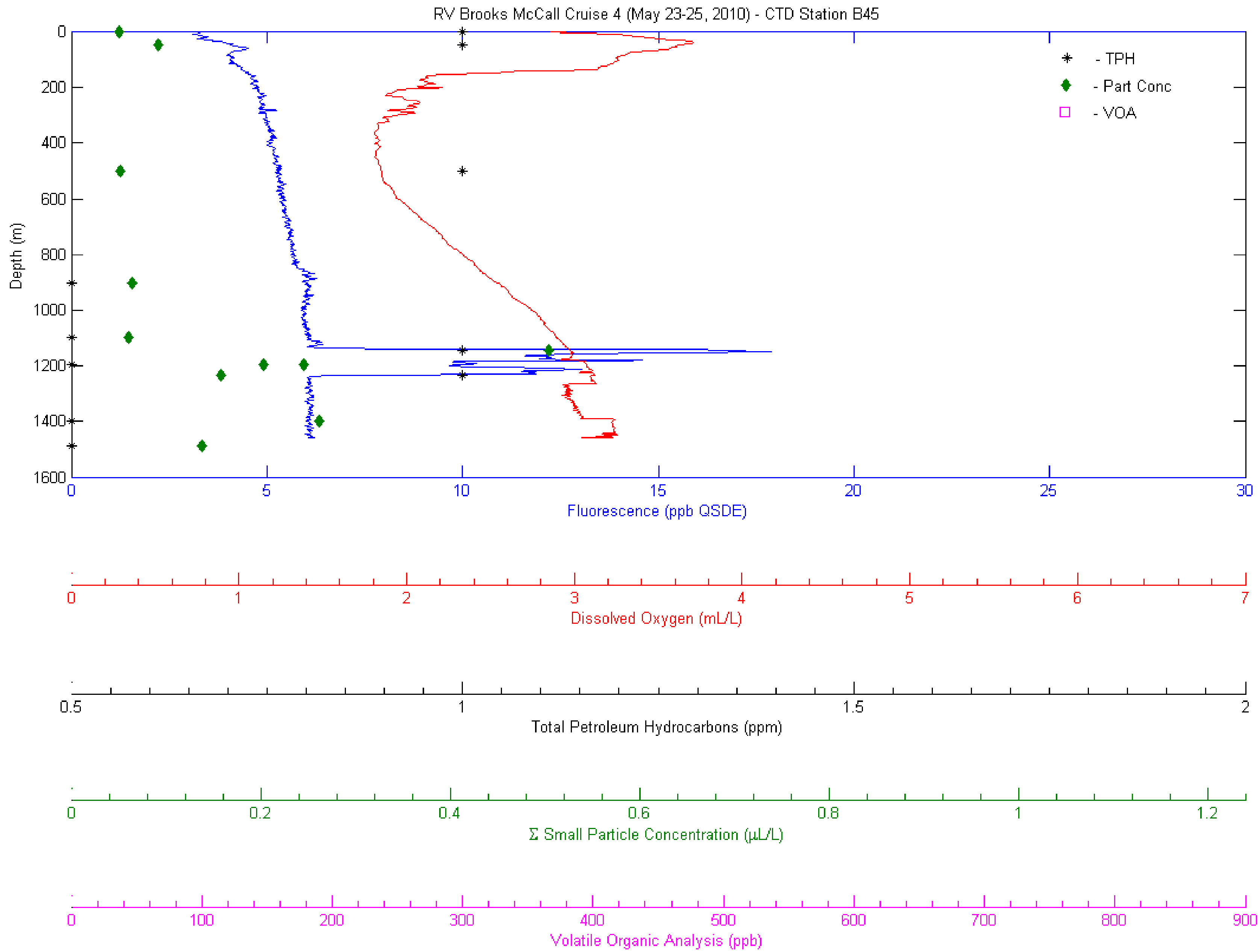
- Joint working group among EPA, NOAA, USGS and the Office of Science and Technology Policy (OSTP)
- Analyze an evolving database of sub-surface oceanographic data being derived from the coordinated sampling efforts of vessels contracted for or owned by BP, NOAA and academic scientists
- Near term actions:
  - Integrate the data spatially and temporally to allow their visualization and analysis
  - Analyze the data to describe the distribution of oil and the oceanographic processes affecting its transport
  - Issue periodic reports to the National Incident Command (NIC), the Unified Command, the public and other researchers that includes visualization, analysis, and synthesis products

Joint Analysis Group (JAG) for Surface and Subsurface Oceanography, Oil, and Dispersant Data

- Review of *R/V Brooks McCall* Data to Examine Subsurface Oil
  - The report presents a preliminary analyses of data collected by the R/V *Brooks McCall* near the site of the Deepwater Horizon MC252 (DWH-MC252) wellhead between May 8 and May 25, 2010
  - http://ecowatch.ncddc.noaa.gov/jag/JAG_report_1.pdf
  - Includes consideration of the spatial and temporal data
- JAG group is currently working on other data products that consider other ships and cruises with more recent data

Sample locations of *R/V Brooks McCall* Data in first JAG report





RV Brooks McCall Cruise 4 (May 23-25, 2010) - CTD Station B45
- TPH
- Part Conc
- VOA
Depth (m)
0
200
400
600
800
1000
1200
1400
1600
0
5
10
15
20
25
30
Fluorescence (ppb QSDE)
0
1
2
3
4
5
6
7
Dissolved Oxygen (mL/L)
0.5
1
1.5
2
Total Petroleum Hydrocarbons (ppm)
0
0.2
0.4
0.6
0.8
1
1.2
Σ Small Particle Concentration (µL/L)
0
100
200
300
400
500
600
700
800
900
Volatile Organic Analysis (ppb)

Future Analyses for Consideration

- Cruise coordination with other monitoring vessels
- Improved sampling methods
- Data visualization analysis
- Glider and AUV data
- Biological sampling
  - Subsurface oil degraders

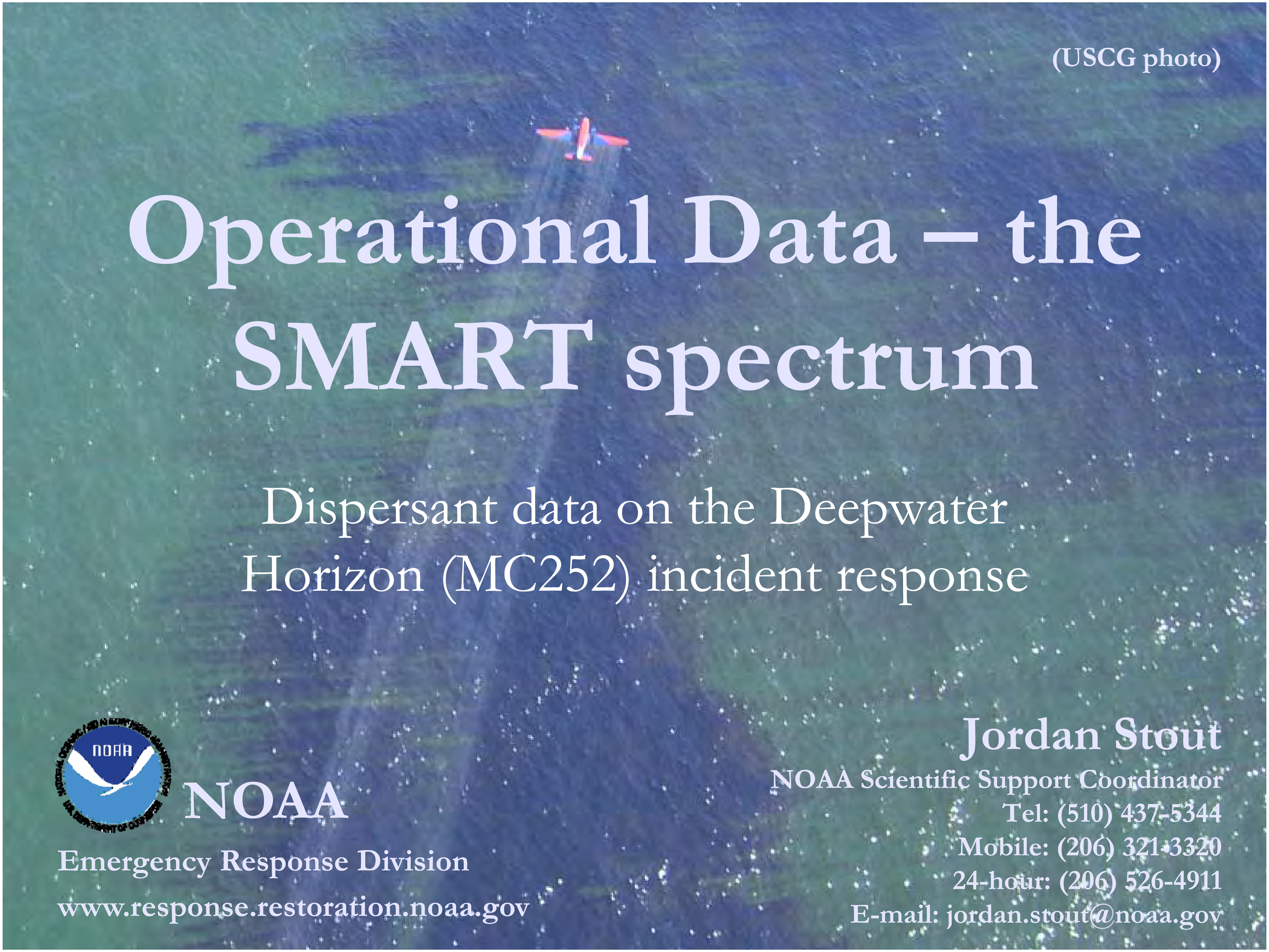
BREAK

AGENDA

12:15	**Operational Data**	**Jordan Stout, NOAA/ORR/SSC**
12:35	NRDA Generated Data	**Debbie French McCay, ASA**
12:50	Seafood Safety	**John Stein, NOAA/NWFSC**
13:05	"Plume" Science	**Sam Walker, NOAA/IOOS**
13:20	Other NOAA Data	**Ann Hayward-Walker, SEA**
13:35	**Other Data Sources**	

Operational Data

Jordan Stout, NOAA/ORR/SSC



(USCG photo)

Operational Data – the SMART spectrum

Dispersant data on the Deepwater Horizon (MC252) incident response

NOAA
Emergency Response Division
www.response.restoration.noaa.gov

Jordan Stout
NOAA Scientific Support Coordinator
Tel: (510) 437-5344
Mobile: (206) 321-3320
24-hour: (206) 526-4911
E-mail: jordan.stout@noaa.gov

SMART Overview

- Key operational feedback for effectiveness
- Normally a USCG mission
- Pre & post treatment observation
- Aerial (observations) & on-water (sampling)
- Fluorometry below un-oiled areas as well as untreated & treated oil
- Chemical analysis
- 1 & 10 meter depths

USCG Missions

- SMART I
  - Primary tactical feedback (same day)
  - Qualitative measure of effectiveness
  - Photos & descriptions (via helo)
  - Occurring throughout aerial applications
- SMART II & III
  - Secondary feedback (days)
  - Fluorometry (qualitative; see posters)
  - Chemical analysis (quantitative)
  - Occurred thru early June

Other Operations

- Dispersant Assessment Group
- Alternative dispersant evaluation
- Aboard the *M/V International Peace*
  - Boat & aerial spray monitoring
  - Fluorometry, chemistry & toxicity testing
    - Continuation of SMART posters
    - Acute tests w/fish, shrimp, algae (May report)
    - Acute fish, chronic shrimp & algae (June report in draft)
  - Current mission includes: dual fluorometers, particle size (LSST) & viscosity

Other Operations (cont'd)

- Nearshore water sampling for oil & dispersant constituents
- IH monitoring for aerial & boat spray operations
- Biodegradation just started

NRDA Generated Data

Debbie French-McCay, ASA

DEEPWATER HORIZON OIL SPILL: NRDA DATA RELATED TO SUBSURFACE DISPERSANT EFFECTIVENESS AND EFFECTS

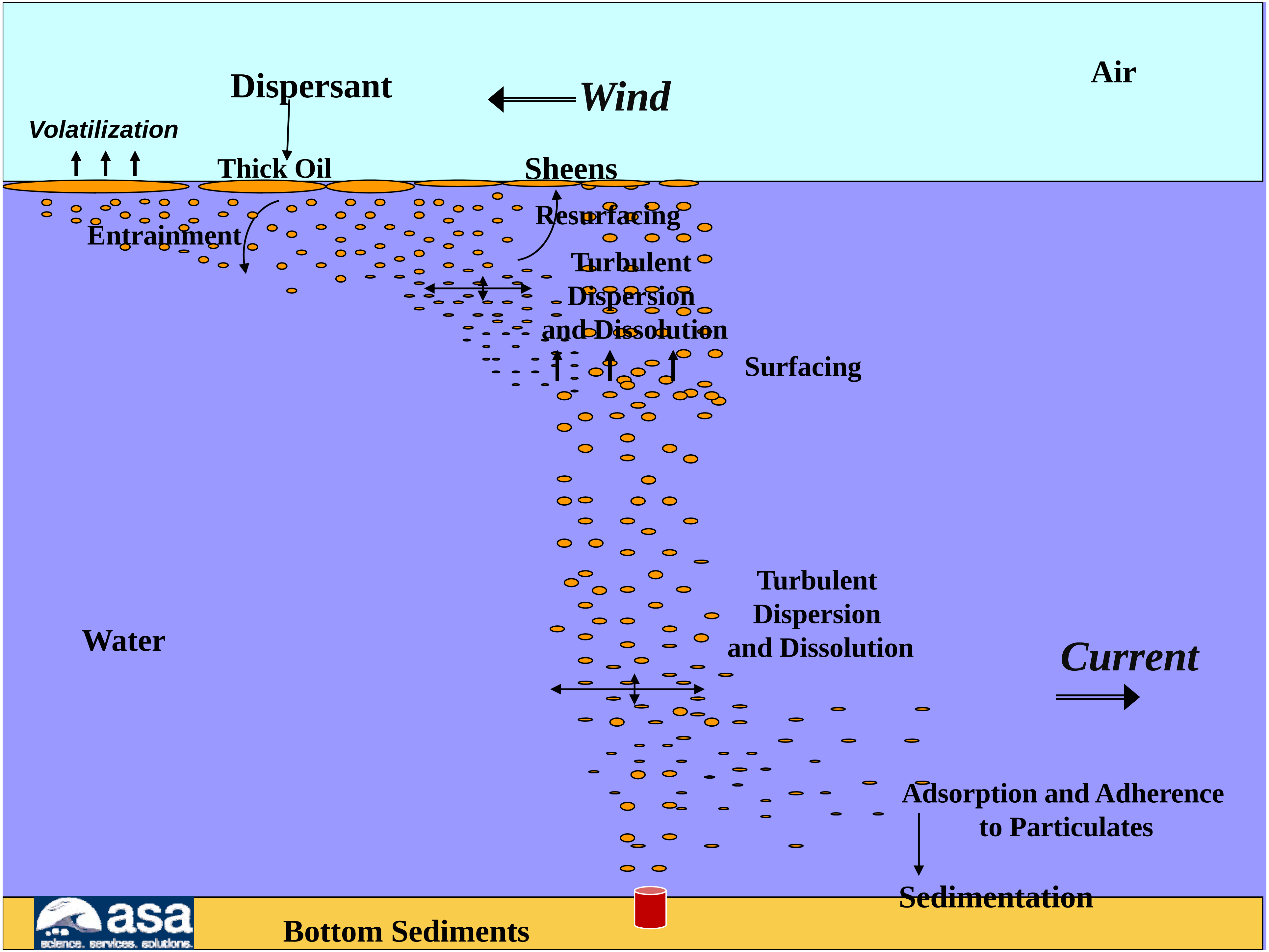
Deborah French McCay, PhD

Applied Science Associates

South Kingstown, RI, USA

dfrenchmccay@asascience.com

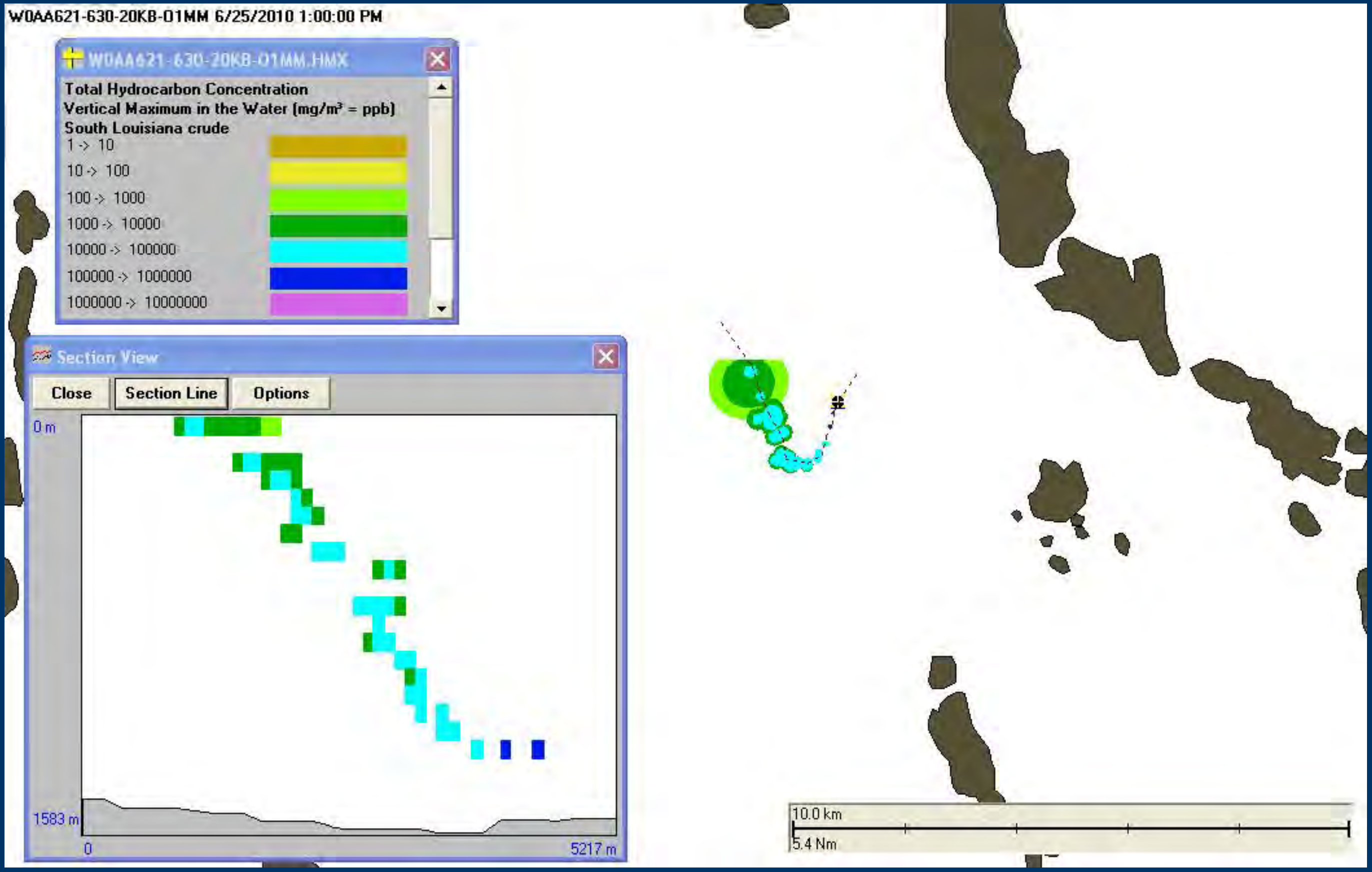
www.asascience.com


Air
Dispersant
Wind
Volatilization
Thick Oil
Sheens
Resurfacing
Entrainment
Turbulent
Dispersion
and Dissolution
Surfacing
Turbulent
Dispersion
and Dissolution
Water
Current
Adsorption and Adherence
to Particulates
Sedimentation
Bottom Sediments
asa
science. services. solutions.

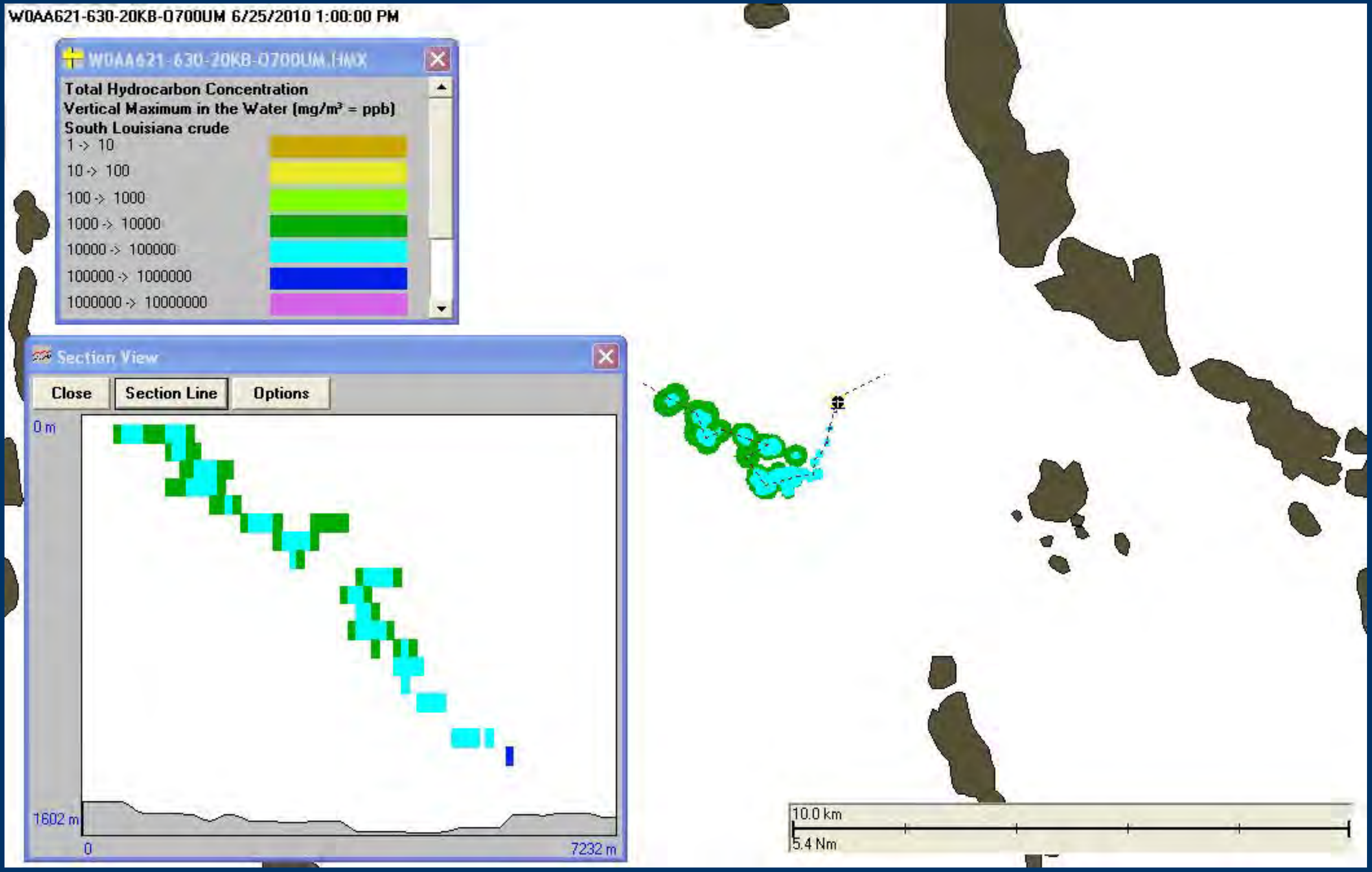
Sampling Strategy

- On Jack Fitz cruises 1, 2, and 3
- Sampling locations (x, y, z) determined by use of transport modeling (SIMAP)
  - Currents = f(depth, time) as measured by the ADCP at the Wellhead
  - Modified Stokes Law for droplet rise rate
  - Rise rate = f(droplet size) – larger rise faster
- Determine direction from wellhead where
  - Various droplet sizes should occur
  - Dissolved BTEX and PAHs should be highest

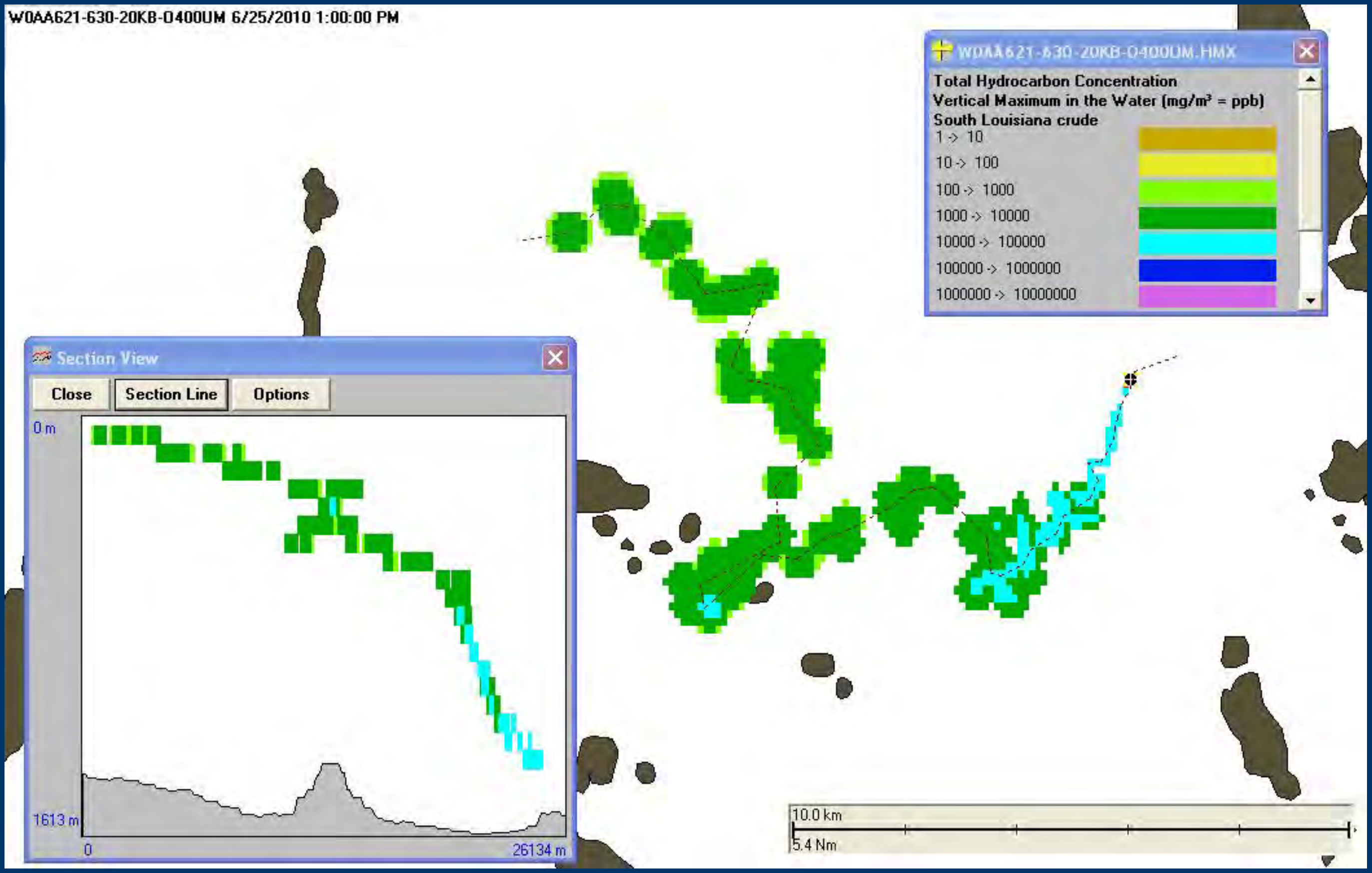
Example: Jun 25 – 1 mm



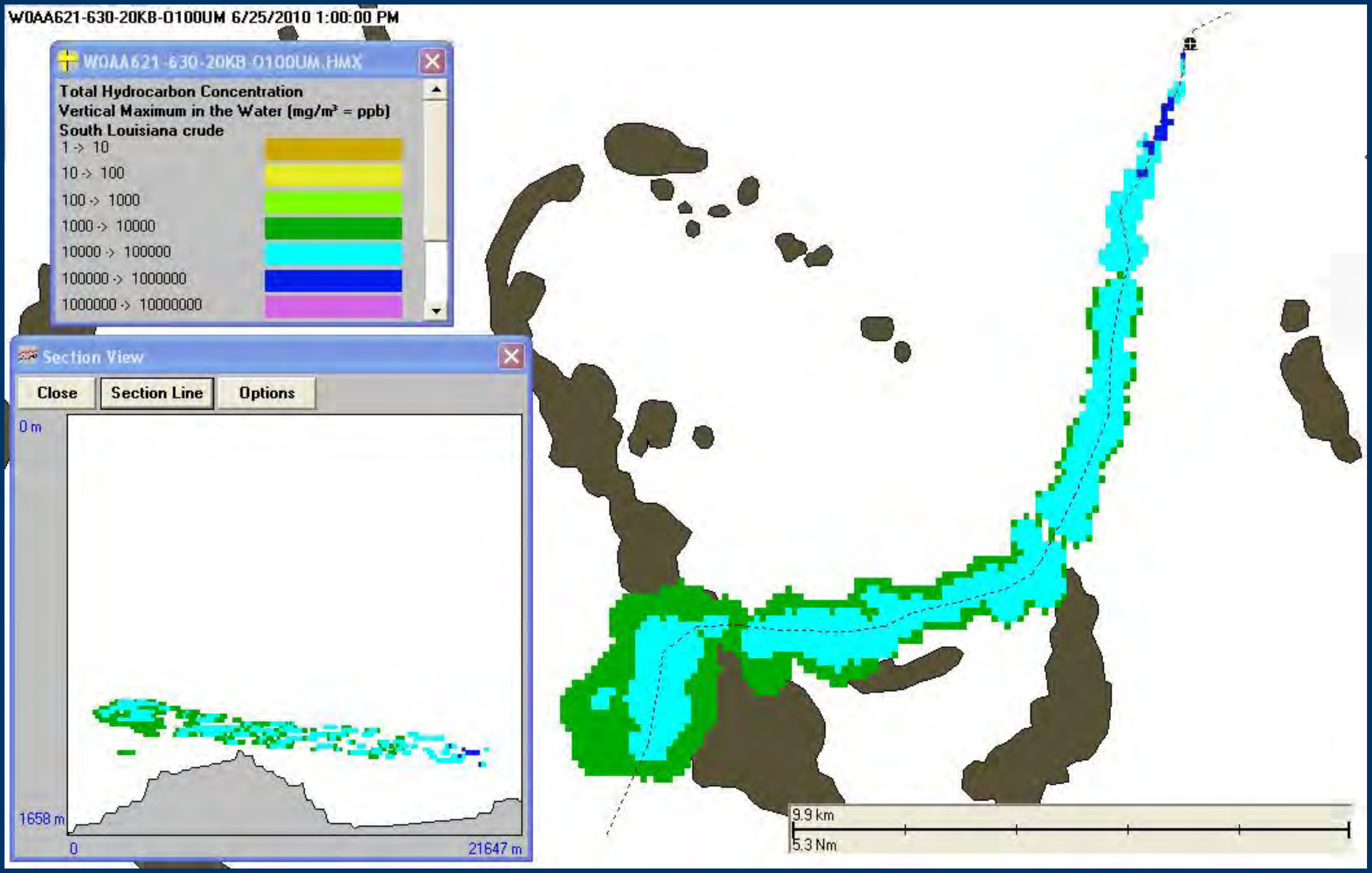
Example: Jun 25 – 700 um



Example: Jun 25 – 400 um



Example: Jun 25 – 100 um



Measurements of Droplet Size: LISST-100

- All LISSTs used can only measure < 250 – 500 um droplets
- Discrete samples – measure on deck on a water sample brought up from depth
  - Takes >1 hour to bring up and take sample
  - Only droplets <100 um measured

Droplet Diameter	Rise Rate (m/hour)
100	2
200	7
500	35
1000	93
5000	430

Measurements of Droplet Size Frequency Distribution (Jack Fitz 2)

- In situ LISST-100 for < 500 um droplets in surface waters (Y. Kim, ASA)
- DIPSTIC – high definition video in surface samples captured in situ, image analysis (Y. Kim, ASA)
- ROV video (in situ): TV camera with UV/Black Lights and BFDFOQMark oil grid (Payne et al.)
  - UV/Black light made oil fluoresce and visible
  - Oil droplets impinged on horizontal plate
  - Used grid to estimate sizes (>0.5mm)
- Water samples filtered for dissolved and particulate/oil phase measurements of PAHs (J. Payne)

Measurements of Droplet Size Frequency Distribution (Jack Fitz 3)

- In situ LISST-100 for < 500 um droplets (Kim)
- DIPSTIC (Kim)
- ROV video for > 500 um droplets (Payne et al.)
- Holocam – Holographic image (C. Davis, WHOI)
  - Entire size spectrum
  - Can identify particles: oil, marine snow, oil-suspended particulate matter aggregates
- Water samples filtered for dissolved and particulate/oil phase measurements of PAHs (Payne)

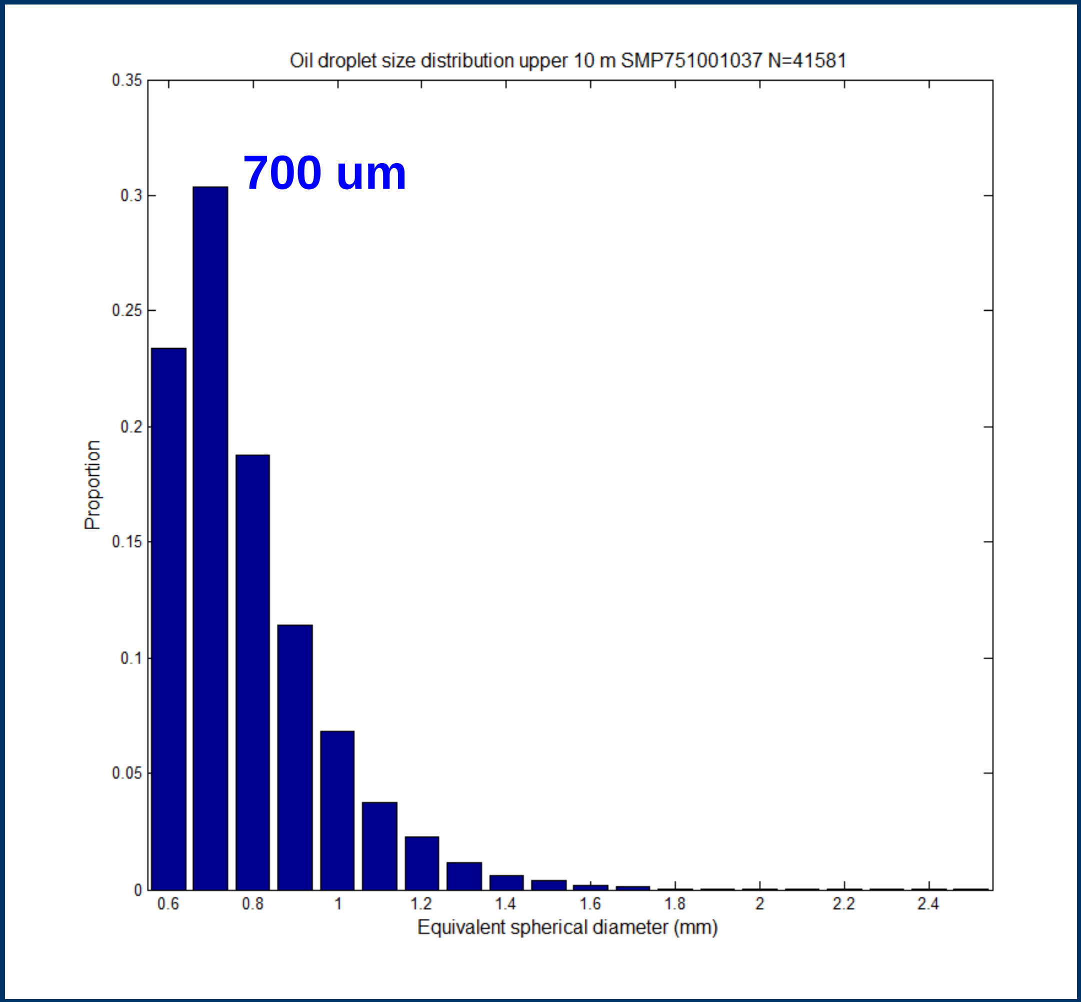
Measurements of Droplet Size Frequency Distribution – Image Analysis Systems

- SIPPER = Shadowed Image Particle Profiling and Evaluation Recorder – Andrew Remsen (USF)
  – in-situ suspended particle imaging system
  – Oil droplets > ~300 um
  – Towed – transects
  – Weatherbird II
- Holocam (Davis) on Ocean Veritas and American Diver cruises
- Digital-Automatic Video Plankton Recorder (DAVPR) – Cabell Davis (WHOI)
  – Size range of 50 microns to several cm
  – American Diver cruises

Preliminary Results – Droplet Sizes

- Environment Canada confirmed the presence of <100um chemically-dispersed oil droplets [Brooks McCall and Ocean Veritas cruises]
- ROV TV/video camera confirmed droplets >500 um rising to surface up to ~4km from wellhead
- Holocam on Jack Fitz 3 – preliminary, counting visible sizes by eye:
  - 3307 ft: mean 393um, sd 99 um
  - 3413 ft: mean 212um, sd 99 um
  - 3507 ft: mean 169um, sd 60 um

SIPPER, Weatherbird II, May 15



- Measuring >500 um
- Peak at 700 um
- All <2mm

- May 15 operational subsurface dispersant operations began

Limitations – Droplet Size Measurements

- LISST-100 on discrete samples
  - Only droplets <100 um
  - Useful to indicate oil was dispersed
- LISST-100 in situ
  - Only droplets <500 um
  - Useful in surface waters
- SIPPER, DAVPR, DIPSTIC
  - Useful in surface waters
  - One SIPPER cruise to date
  - DIPSTIC samples from 2 Jack Fitz cruises
- No deepwater LISST measurements to date
- Holocam
  - Samples full depth range and complete size range
  - Just one cruise to date

Data Needs

- Measure
  - Droplet Sizes
  - Dissolved vs Particulate Oil (toxicity implications)
- Surface waters
  - In rising plume to indicate size distribution of release
    - No dispersant added
    - With injected dispersant (at wellhead)
  - Measure droplet sizes after aerial dispersant applications (no measurements to date)
- Deep waters
  - In released oil plume
  - In subsurface layers of oil advecting away from wellhead (smallest droplets at depth)

Seafood Safety

John Stein, NOAA/NWFSC

Science, Service, Stewardship

Seafood Safety Program

John Stein
NMFS Seafood Safety Program
Northwest Fisheries Science Center

NOAA FISHERIES SERVICE

NOAA
FISHERIES
SERVICE

NMFS Seafood Safety Program

- **Purpose:** To ensure that tainted or contaminated seafood does not reach the marketplace.
- Seafood collected in the Gulf of Mexico is assessed by both sensory and analytical methodologies
  - Sensory—olfactory evaluation of seafood
  - Analytical—evaluation of polycyclic aromatic hydrocarbons (PAHs) concentrations by GC/MS
- Seafood samples that pass BOTH the sensory and analytical tests are considered safe
- Results are used to make decisions on reopening areas in the Gulf of Mexico

NOAA FISHERIES SERVICE

Dispersants

- FDA has concluded that dispersants have a low potential for bioaccumulation in seafood and there is minimal health risk from consumption
- Development of methods to monitor dispersants is under development.

There is concern over the use of dispersants following the Deepwater Horizon incident.

NOAA
FISHERIES
SERVICE

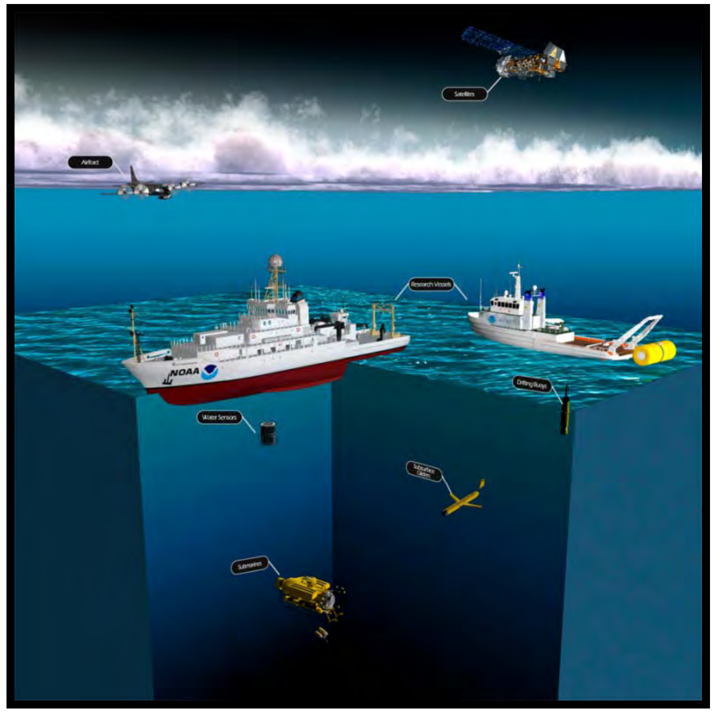
Current research on dispersants

- For seafood safety, NMFS is investigating the uptake, distribution, and clearance (depuration) of dispersants in the edible tissues of shellfish and finfish
- Studies are underway to expose animals to dispersants
  - NWFSC currently developing methods to analyze dispersants, including HPLC MS/MS and GC/MS
  - Initial studies on Corexit 9500 with brown shrimp. To provide samples for method development
  - Additional exposure studies are planned for fish

“Plume” Science

Sam Walker, NOAA/IOOS

Integrated Sub-Surface Monitoring of the Deepwater Horizon Release



Deepwater Horizon Dispersant Data Webinar

13 July 2010, Durham, NH

Samuel Walker and Robert Pavia

NOAA IOOS Program and NOAA OR&R

Objectives and Responsibilities

In support of the Unified Command response:

1. Characterize and determine the distribution of any subsurface oil beyond the immediate area of the release;
   - Presence/Absence (Where/Extent)

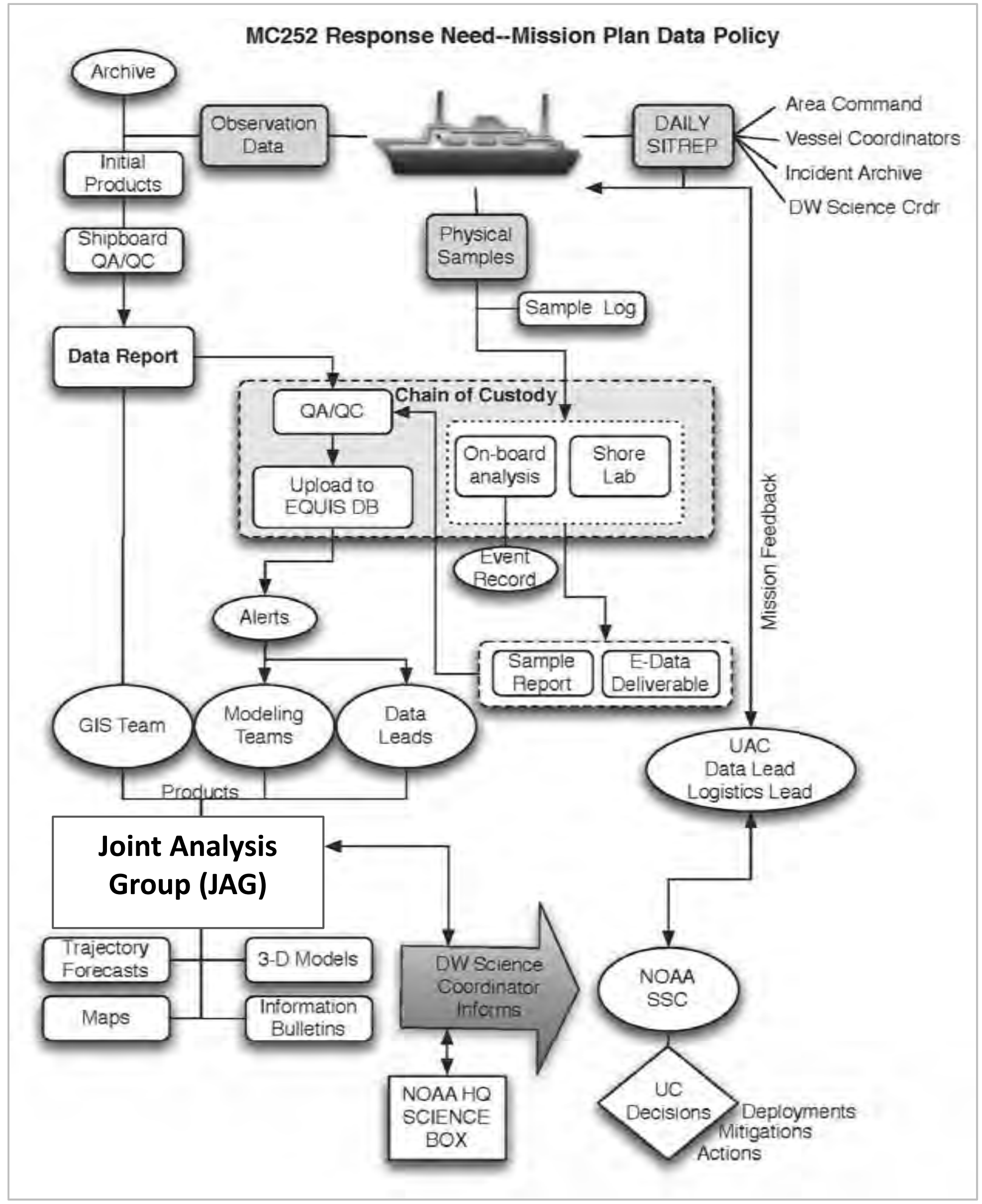
2. Identify changes in oil characteristics and transport associated with response measures at the release point;
   - Characteristics (What/Source)

3. Support verification of oil fate and transport models; and
   - Fate/Transport (When/Forecast)

4. Provide context for longer-term integrated ecosystem assessment of oil spill impacts.
   - Impacts/Assessment

Composition and Operations

- Direct representation from NOAA, USCG, EPA, ASA on operational team
- Team centered in Houma, LA
- Using a NOAA-support wiki to manage (very dynamic) effort
- Daily sitreps (internal), vessel calls, SIMOPS call participation, NOAA operations call
- Feedback loop with NOAA modeling team to drive missions
- Data management and integration
- Mission guidance and information relay to Joint Analysis Group (JAG)



Principal Monitoring Assets

Sub-surface assets:

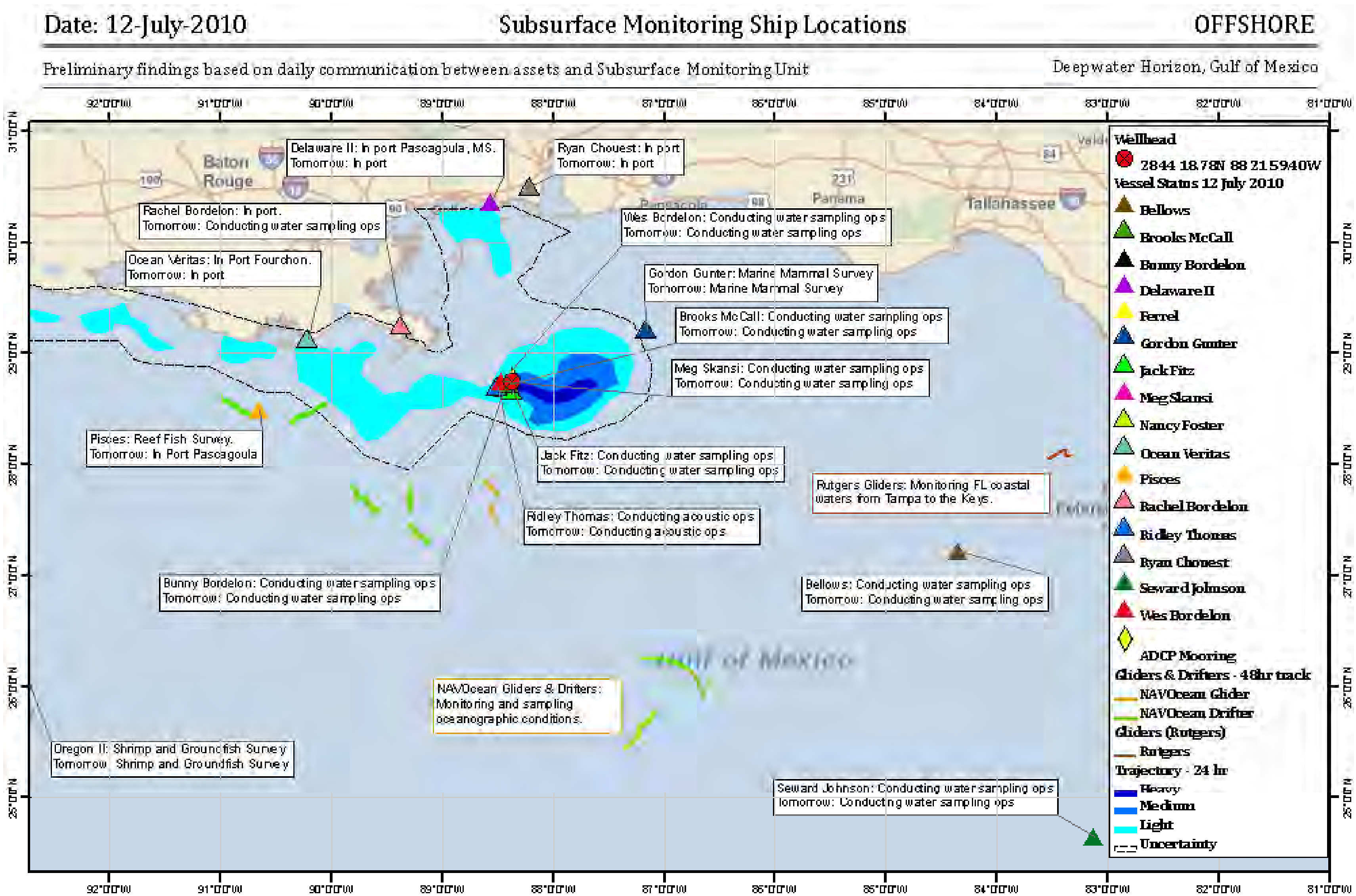
- Surface vessels
- Ocean gliders
- Air-dropped profilers
- ADCPs
- Acoustic profilers

Surface assets:

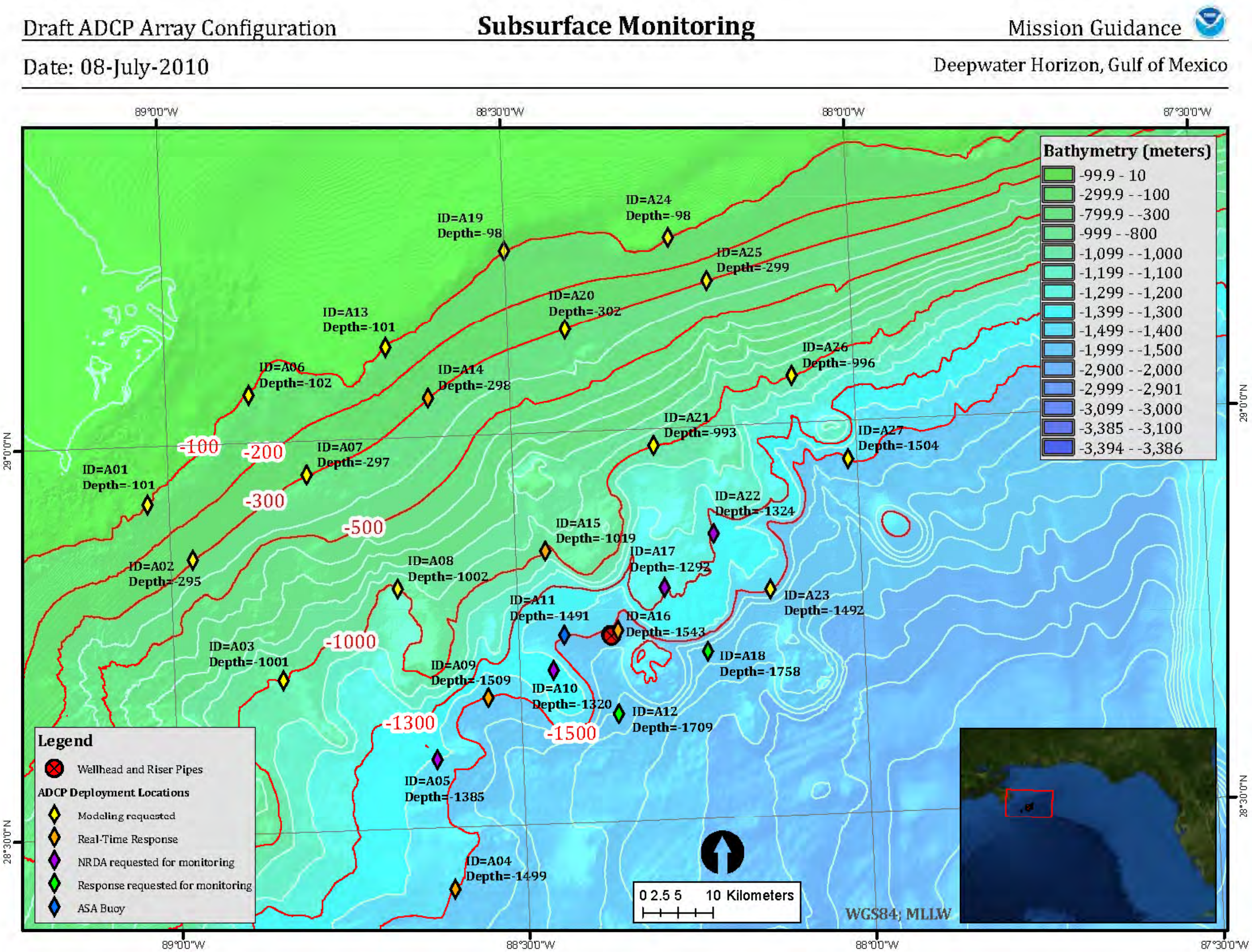
- High frequency radar
- Drifting buoys
- Remote sensing
- Moored buoys

- Fluorescence
- Temperature
- Conductivity/Salinity
- Dissolved Oxygen
- LISST Particle Sizing
- TPH, TPAH, VOA

Disposition of Sampling Assets

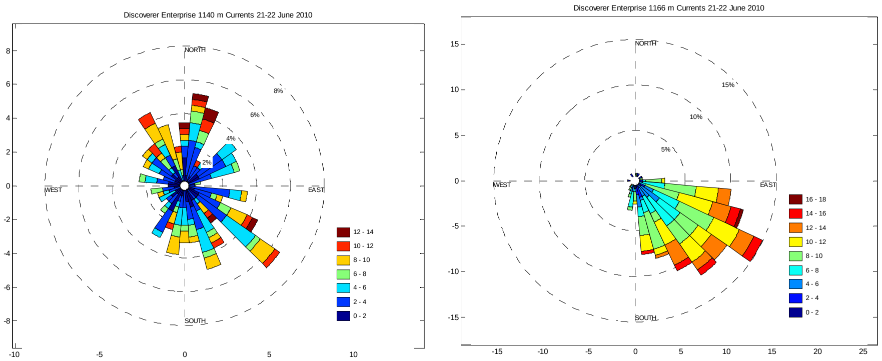


Phased ADCP Deployment

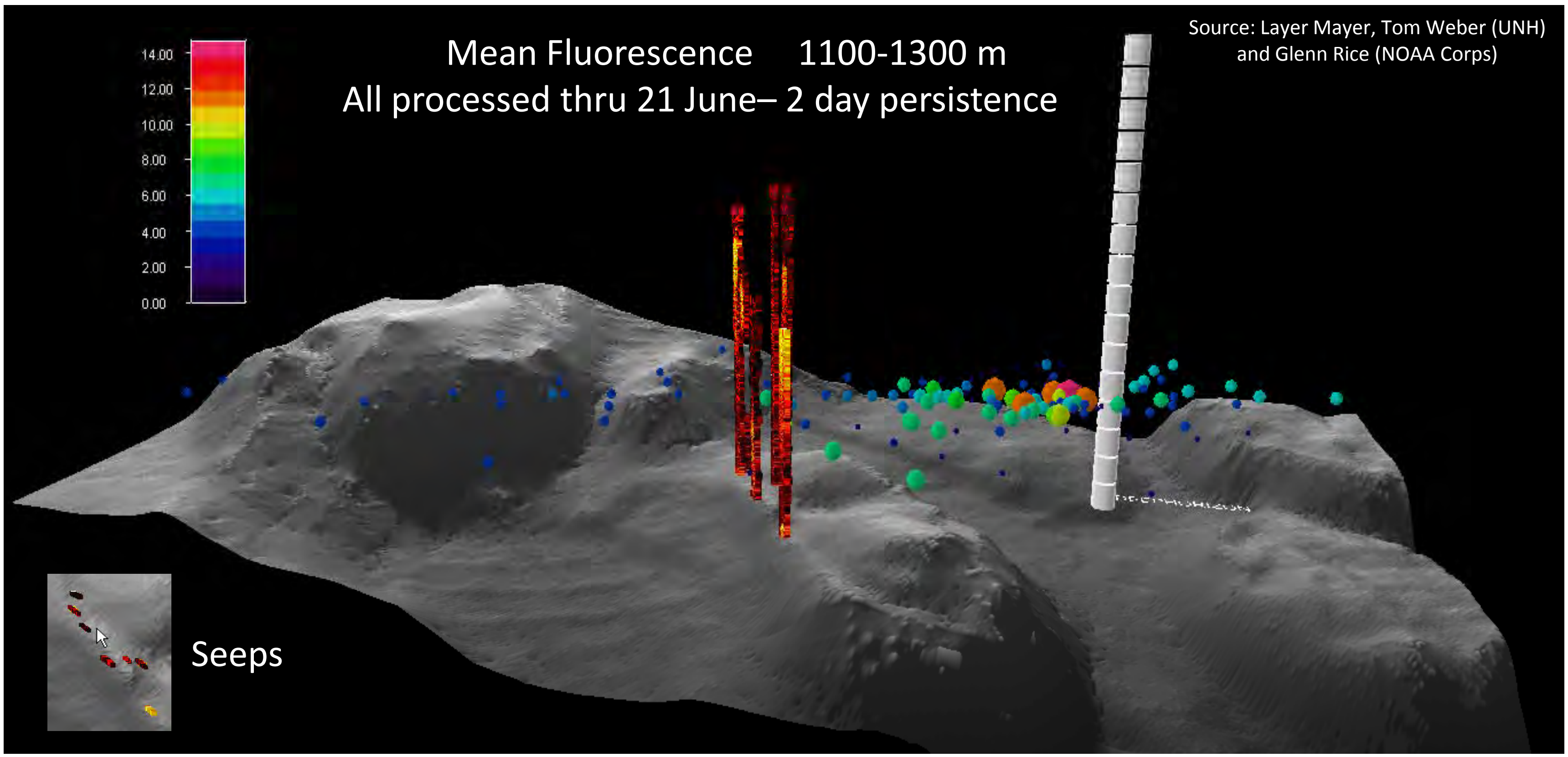


Products and Information

- Focus is on Actionable Information for the UC and other stakeholders
- Visualizations from NCDDC, OR&R, NDBC, and UNH
- Increased 3- and 4-D renderings



Discoverer Enterprise (wellhead)1134m and 1166 m



Key Resources

Sub-Surface Monitoring Branch Wiki:

https://www.st.nmfs.noaa.gov/confluence/display/OOP/Home

NOAA Staff: Use your NOAA LDAP credentials to access

(Partners may use: username: oilspill.response and pword: WikiWelcome!)

IOOS Community Activities Site:

http://rucool.marine.rutgers.edu/deepwater/

EPA OSC Data Access Site:

http://www.epaosc.org/site/login.aspx

POCs:

Samuel Walker, PhD – UAC Liaison (sam.walker@noaa.gov, 803-807-1189)

CAPT. Mark Ablondi– ICP-Houma (chief.smu@noaa.gov, 301-787-5799)

Other Data Sources
Microbial Data

Terry Hazen, DOE

Other Data Sources

Discussion and Synthesis

AGENDA

13:45	**Discussion/Synthesis** 1) Is this data sufficient to support any conclusions regarding the effectiveness and effects of: (a) surface and (b) subsurface application of dispersants? 2) Are there significant data gaps that need to be filled? Can they be filled? 3) Are there inconsistencies in the data that need to be addressed?	
14:30	Closing Remarks	**Bob Pond, USCG** **Roberta Runge, EPA** **Nancy Kinner, CRRC**

DISCUSSION/SYNTHESIS

- Is data sufficient to support conclusions regarding effectiveness and effects of: (a) surface and (b) subsurface application of dispersants?
- Can inconsistencies in data be addressed?
- How can data gaps be filled?

Webinar will <u>NOT</u> involve discussion of policy, strategy, or risk assessment related to dispersant use.

MEETING REPORT

- Report will be produced by CRRC
- Report will include:
  - Source, location, access and type of data
  - Inconsistencies associated with data
  - Data gaps
  - Summary of discussion/synthesis
  - Appendices:
    - Agenda, Participants, Presentations
- Report <u>will not</u> be posted on CRRC website

MEETING REPORT

- Report will be produced by CRRC
- Report will be reviewed by the presenters and the DWH Interagency Solutions Group (representing the NRT)
- Report will be distributed to all participants
  - Via email as PDF
- Anticipated release early August

Coastal Response Research Center Website

www.crrc.unh.edu

APPENDIX D:

Glossary of Acronyms

Glossary of Acronyms

ADCP – Acoustic Doppler Current Profilers
CDOM – Colored Dissolved Organic Matter
CTD – Conductivity Temperature Depth
DAVPR – Digital Automatic Video Plankton Recorder
DWH – Deepwater Horizon
FRTG – Flow Rate Technical Group
GC-MS – Gas Chromatography - Mass Spectrometry
GOM – Gulf of Mexico
IASG – Interagency Solutions Group
IOOS – Integrated Ocean Observing Systems
JAG – Joint Analysis Group
LISST – Laser In-Situ Scattering and Transmissometry
NOM – Natural Organic Matter
NRDA – Natural Resource Damage Assessment
NRT – National Response Team
NWFSC – Northwest Fisheries Science Center
OSHA – Occupational Safety and Health Administration
PAH – Polycyclic Aromatic Hydrocarbons
PIV – Particle Image Velocimetry
RRT – Regional Response Team
SIPPER – Shadowed Image Particle Profiling and Evaluation Recorder
SMART – Special Monitoring of Applied Response Technologies
TPAH – Total Polycyclic Aromatic Hydrocarbons
TPH – Total Petroleum Hydrocarbons
VOA – Volatile Organic Analysis
VOC – Volatile Organic Carbon

APPENDIX E:

Overview of SMART Tier I, II, and III Protocols

Overview of SMART Protocols:

Special Monitoring of Applied Response Technologies (SMART) is a cooperatively designed monitoring program for in situ burning and dispersants. SMART relies on small, highly mobile teams that collect real-time data using portable, rugged, and easy-to-use instruments during dispersant and in situ burning operations. Data are channeled to the Unified Command.

To monitor the efficacy of dispersant application, SMART recommends three options, or tiers:

Tier I: A trained observer, flying over the oil slick and using photographic job aids or advanced remote sensing instruments, assesses dispersant efficacy and reports back to the Unified Command.
Tier II: Tier II provides real-time data from the treated slick. A sampling team on a boat uses a fluorometer-monitoring instrument to continuously monitor for dispersed oil 1 meter under the dispersant-treated slick. The team records and conveys the data to the Scientific Support Team, which forwards it, with recommendations, to the Unified Command. Water samples are also taken for later analysis at a laboratory.
Tier III: By expanding the monitoring efforts in several ways, Tier III provides information on where the dispersed oil goes and its fate.

(1) Two fluorometers are used on the same vessel to monitor at two water depths.
(2) Monitoring is conducted in the center of the treated slick at several water depths, from 1 to 10 meters.
(3) A portable water laboratory also provides data on water temperature, pH, conductivity, dissolved oxygen, and turbidity.