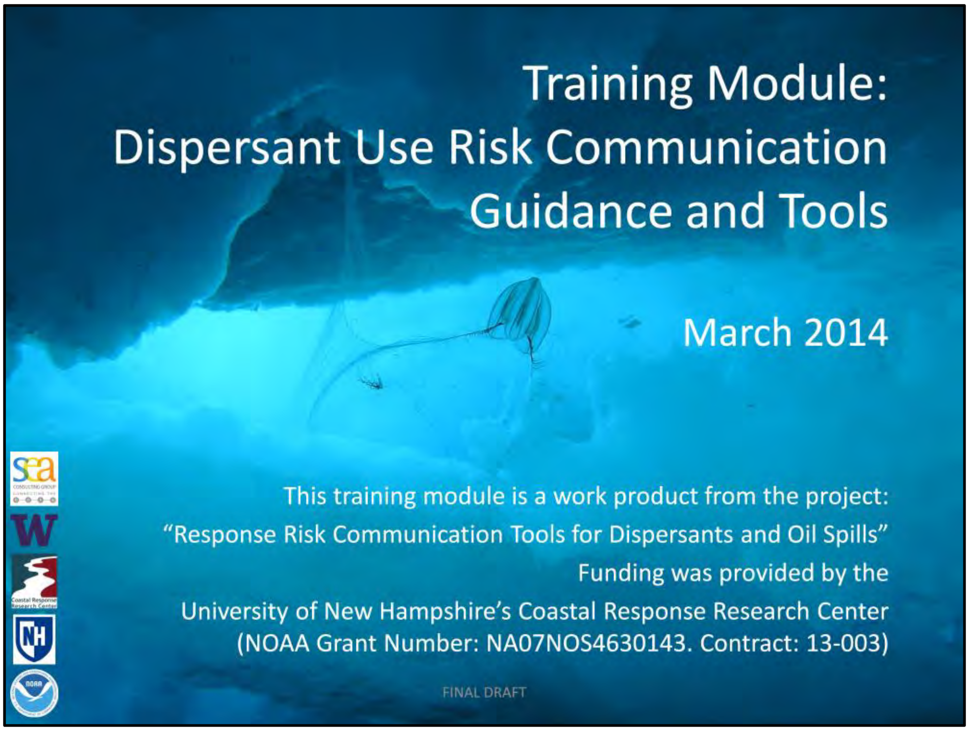


Dispersant use during the Deepwater Horizon, more than any other response technology, generated huge public concern and criticism, yet most responders viewed dispersants as a critical and highly successful tool. Efforts were made to inform the public and stakeholder groups about the rationale for dispersant use, including environmental and health risks, benefits, and trade-offs, but it remains highly contentious. Dispersant experts convened by NOAA and CRRC at the 2011 Mobile, AL *Future of Dispersant Use in Spill Response* workshop agreed that research was necessary to improve risk communication and improve understanding of the human dimensions of spill response.

This project was funding to improve risk communication and understanding of the human dimensions about spill response, particularly with regard to dispersants. This project looks to the interactive aspects of communication, e.g., engaging oil spill stakeholders at all levels in dialogue and two-way communications, in addition to traditional outreach which is often one-way communications, i.e., get the message out. The content for this training was derived from 5 unpublished white papers prepared by the contributors which are the basis for several articles being submitted to peer-review journal, e.g., Ecology and Society, and articles accepted fro publication in the 2014 International Oil Spill Conference:

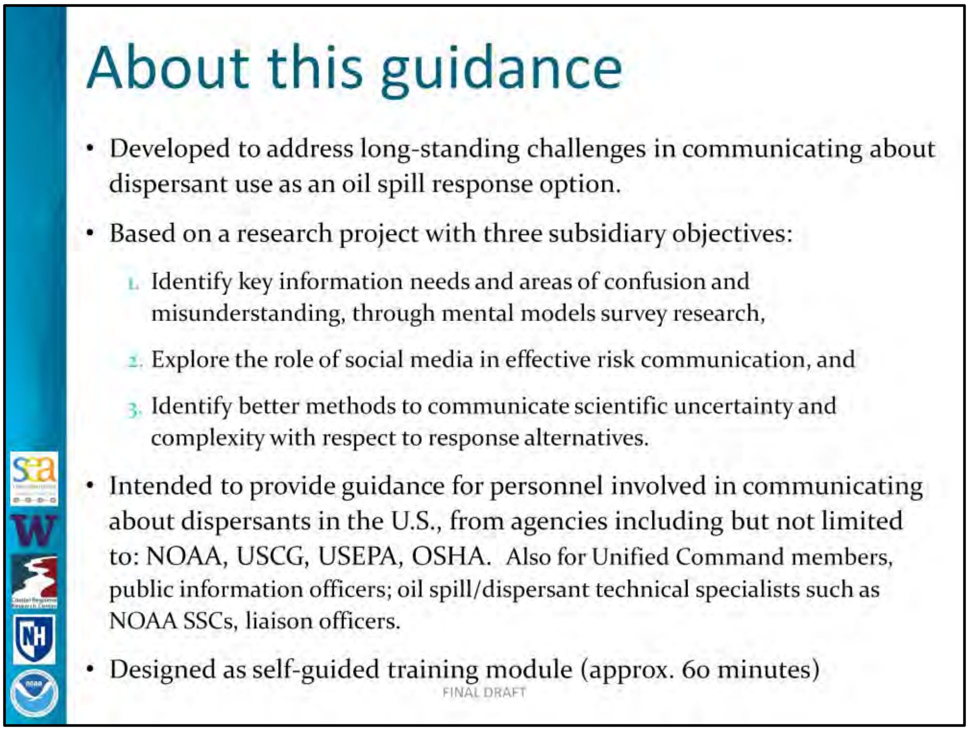
- Walker, A.H. and A. Bostrom. 2014 (in press). Stakeholder Engagement and Survey Tools for Oil Spill Response Options. In: *Proceedings 2014 International Oil Spill Conference* (IOSC). Will be available online from: www.ioscproceedings.com.
- Walker, A.H., G. Ott, and D. Scholz. 2014 (in press). Local Level Stakeholder Coordination and Communications to Support Oil Spill Preparedness and Response. In: *Proceedings 2014 International Oil Spill Conference* (IOSC). Will be available online from: www.ioscproceedings.com.
- Walker, A.H., D.K. Scholz, J.H. Kucklick, and R.G. Pond. 1999. Government and Industry Partnering: Nationwide Progress in Pre-authorization Agreements since 1994. In: *Proceedings 1999 International Oil Spill Conference* (IOSC), Paper ID# 271. 6 pages. Available online from: www.ioscproceedings.com.

In addition the final report is available from CRRC at: http://www.crrc.unh.edu/center-funded-projects

NOTE: Credit for picture on cover and transition slides: Hidden Ocean 2005 Expedition: NOAA Office of Ocean Exploration. Photographer: Elisabeth Calvert. Image ID: expl0411, Voyage To Inner Space - Exploring the Seas With NOAA Collect. Location: Alaska, Beaufort Sea, North of Point Barrow. Category: Ocean exploration/Invertebrates/Zooplankton/

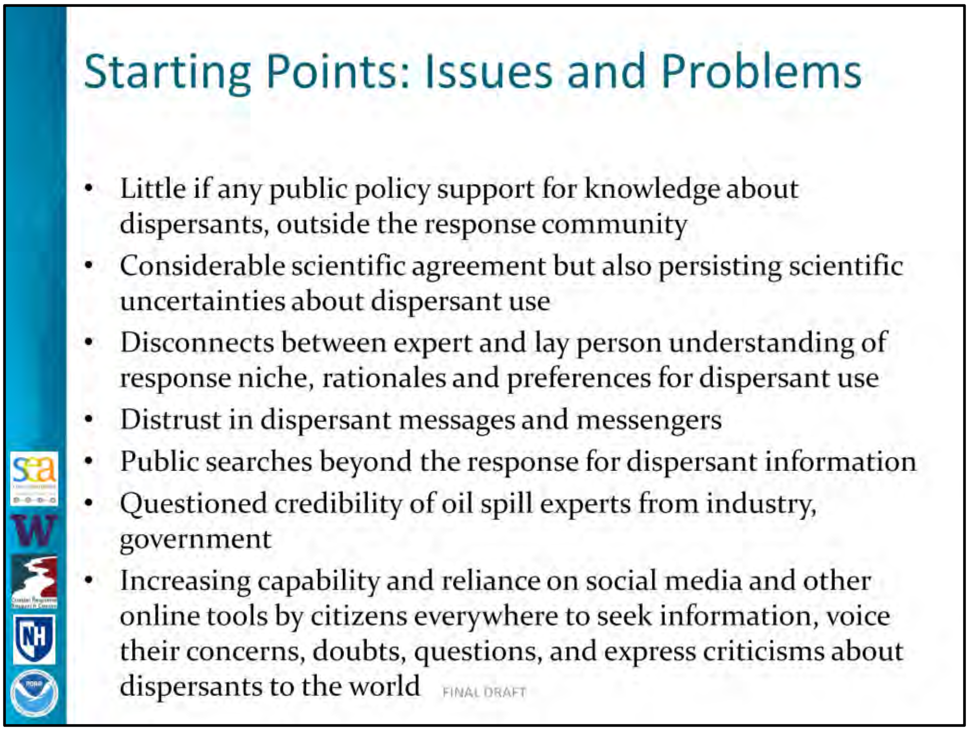
The contributors to this training module are the members of a multi-disciplinary team. This work is informed by current research (Ann Bostrom and Kate Starbird), prior research by all, extensive literature review by all, and response experience by Ann Hayward Walker and Robert Pavia, up to and including the Deepwater Horizon (DWH) incident, on scene (Walker) and in the Joint Analysis Group (Pavia).

- Ann Hayward Walker – specializes in stakeholder coordination and providing technical support, including risk communication on dispersants, to Unified Command.
- Robert Pavia focuses on the role of science in management and its use in preventing and mitigating adverse environmental effects of human activities
- Ann Bostrom's research focuses on mental models of hazardous processes (how people understand and make decisions about risks. She has co-directed the Decision Risk and Management Science Program at the National Science Foundation, served on the National Research Council, Institute of Medicine, U.S. EPA Science Advisory Board and Board of Scientific Counselor reports.
- Thomas Leschine's research interests include environmental decision making, long-term institutional management of long-lived hazards; marine environmental policy, coastal environmental restoration, marine pollution policy and management. He currently chairs the National Research Council.
- Kate Starbird's research looks at the use of social media in crisis events, specifically studying the mechanics of information diffusion and massive collaboration within connected crowds



Communications shortfalls and areas of improvement identified following the DWH largely focus on the traditional areas of crisis communications, public affairs and communications technology (National Commission, 2011 and USCG, 2011) and also note the impact of political influence on external communications. The role of risk communication and engagement is absent in these recommendations. However, the need for "whole of government" approach for messaging is noted (USCG, 2011), with a recommended solution being through improvements in public affairs and crisis communications. Past concerns in the US about the use of dispersants were related primarily to ecological effects. However, during DWH communities along the Gulf of Mexico expressed the concerns about human health risks from aerial applications of dispersants and concerns about seafood safety from exposure to both aerial and subsea applications of dispersants (Greiner, et al, 2013,). Such concerns also were expressed by the academic community, representing both environmental and public health scientists (IOM, 2010, Fryhofer, 2013).

The functioning of the Incident Command System (ICS) and Joint Information Center (JIC) model has limitations in communicating information under conditions of risk and uncertainty, especially as social media has strained the ability of the ICS to control the timing and content of messages about the incident. "Coordinative systems are more appropriate for dealing with disagreement, controversy, and integrating multiple divergent perspectives, while command systems such as ICS remain useful for the organization and completion of predictable agreed upon tasks by formal agencies." The networks developed during preparedness and pre-spill agreements could leverage and expedite engagement during response between the ICS organization and communities. With the flexibility in ICS, the response organization can and become more responsive to external drivers in addition to executing operational plans, through additions to the written guidance and training.

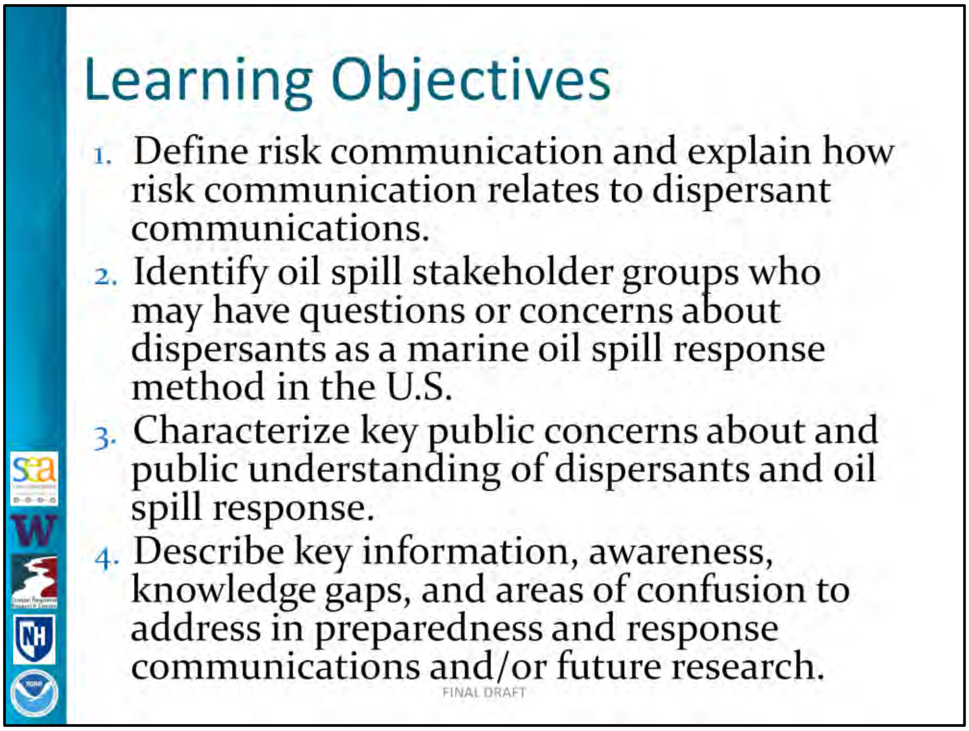


The bullet points on this page convey some of the issues and problems which underlie communications about dispersants; all were evident during DWH. These issues provide a context for the project research. This training aims to improved the readings understanding about the interconnectivity of these issue, to provide new insight about them, and suggest ways to address them during preparedness and response through improved communication about dispersants as a response option.

Walker (2012) notes that informing the media and stakeholders about aspects of oil spill response which involve controversial issues like dispersants requires integrating crisis communications with risk communication through constant, real-time coordination and a collaborative effort to exchange information first within the incident command organization, and then through engagement with affected communities to address their emerging risk perceptions, questions and concerns. This real-time coordination and collaboration is necessary, both to learn about stakeholder and community risk perceptions about the incident, and to assess the situation in relation to those perceptions. Those working on the spill in the ICS organization possess the oil spill technical knowledge to address incident-specific risk perceptions during response by developing the information content to share through external communications and engagement.

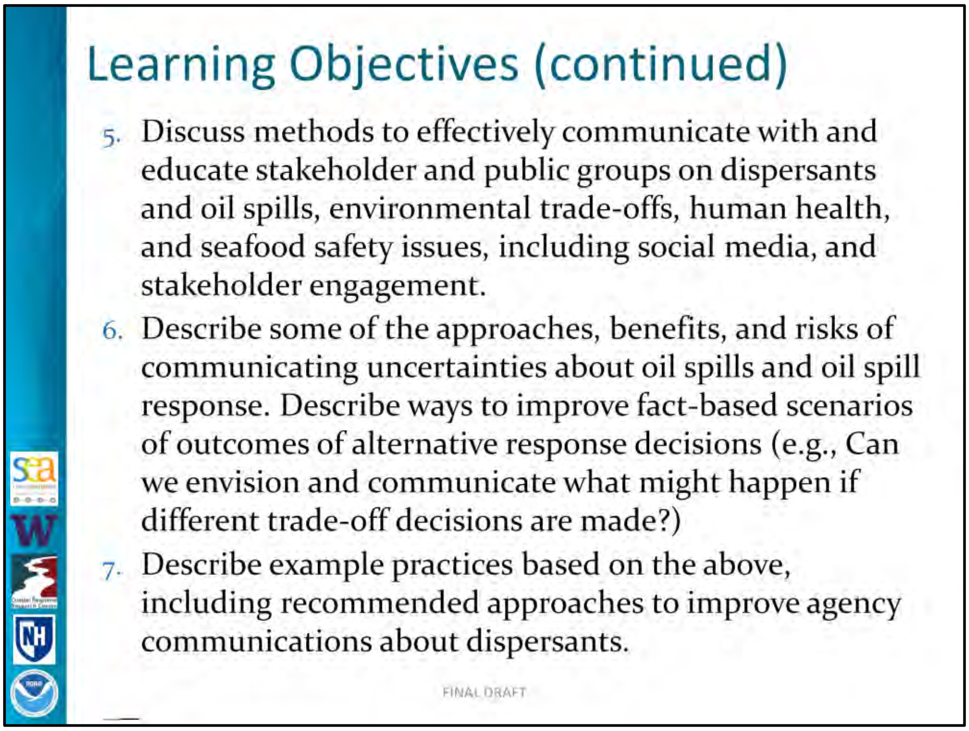
It is worth noting that oil spill communication missteps were observed following the Prestige oil spill off the coast of Spain in 2002. Eight specific problems related to risk communications were identified in the *European Concerned Action to foster prevention and best response to Accidental Marine Pollution (AMPREA)* 2007 Report: "Risk Communication in Accidental Marine Pollution."

Many of these findings also are relevant to dispersant and oil spill communications in the US.



The project team identified eight learning objectives. At the end of this module, the participants you will be able to:

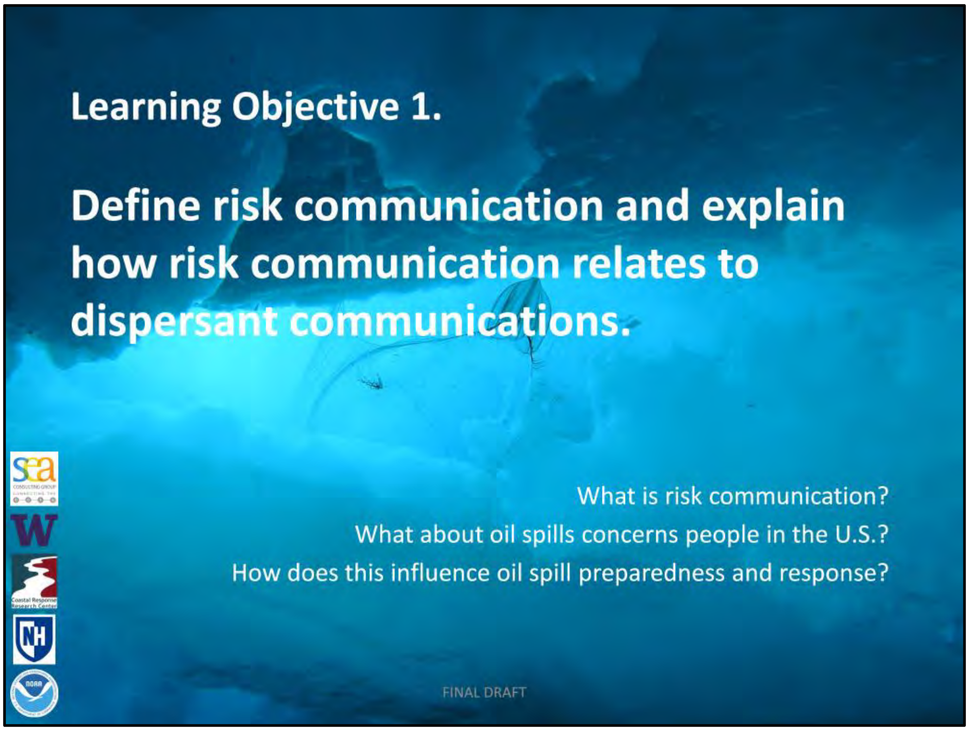
1. Define risk communication and explain how risk communication relates to dispersant communications.
2. Identify oil spill stakeholder groups who may have questions or concerns about dispersants as a marine oil spill response method in the U.S.
3. Characterize key public concerns about and public understanding of dispersants and oil spill response.
4. Describe key information, awareness, knowledge gaps, and areas of confusion to address in preparedness and response communications and/or future research.



Additional learning objectives include:

5. Discuss methods to effectively communicate with and educate stakeholder and public groups on dispersants and oil spills, environmental trade-offs, human health, and seafood safety issues, including social media, and stakeholder engagement.
6. Describe some of the approaches, benefits, and risks of communicating uncertainties about oil spills and oil spill response.
7. Describe ways to improve fact-based scenarios of outcomes of alternative response decisions (e.g., Can we envision and communicate what might happen if different trade-off decisions are made?)
8. Describe example practices based on the above, including recommended approaches to improve agency communications about dispersants.

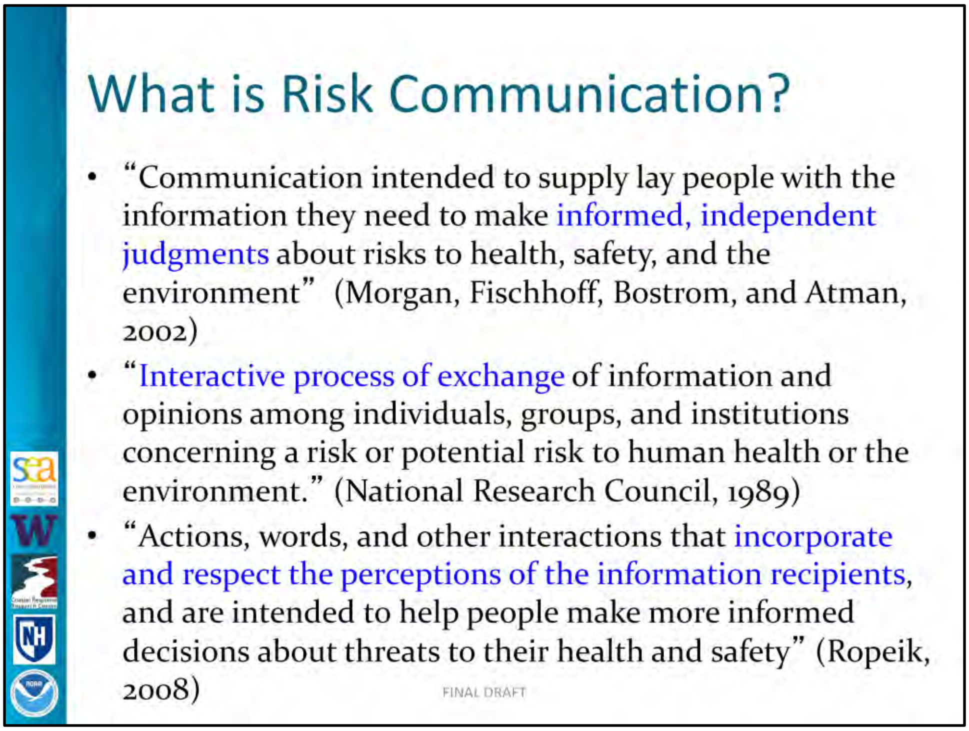
This training is intended to support your participation in dispersant communications work during oil spill preparedness and response activities.



Responding to oil spill involving making choices to mitigate their actual and perceived, ecological and socio-economic risks. Some potential risks are to areas used for public recreation, like beaches, and for recreational and commercial fishing.

Citizens do not like risks imposed on them, especially without their consultation. People like to make choices themselves, rather than being told what to choose. Advice from experts should reflect the best available technical knowledge based on research and practical experience. Experts can provide information about the costs and benefits of various choices or options, the probability of success, and the probability of adverse side effects. In some cases, people need and want to more than numbers. They need to know how a risk is created and how it can be controlled. This kind of information allows them to monitor their own surroundings, identify risky situation, and devise appropriate responses.

Successful risk management and risk communication depend on knowledge of fears, needs, and values of intended audiences ahead of crafting and delivering risk communication messages (Levine and Picou 2012). While causal beliefs are only one component of risk perceptions and communications, they can be a critical element of decisions and preferences (de Bruin and Bostrom, 2013).



There are multiple definitions for and approached to risk communication. Three definitions are provided here which are relevant to oil spill preparedness and response. Notice that these definitions talk about exchanging information and enabling responders, lay people such as citizens and elected officials, to process the information and form their own opinions.

This is different from crisis communications, which functions as a kind of screen leading our attention in a specific direction for the purpose of persuading people to believe one-way messages delivered through the media or communications campaigns (Alexander 2013).

Comparisons of lay and expert risk perceptions, together with research on the effects of risk communication**, indicate that expertise and information can have large effects on risk perceptions**. Risk perceptions influence judgments, opinions, fears, beliefs, and decisions regarding:

–Will a perceived risk cause me harm?

–And, ultimately, response actions, claims and lawsuits

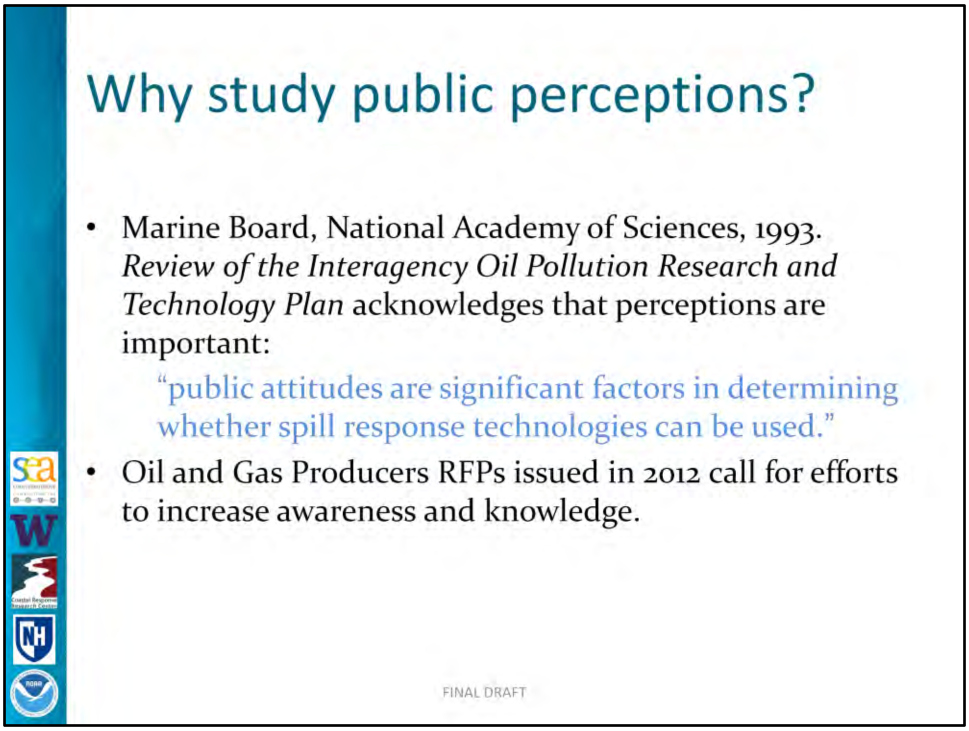
Risk communication is informed by technically assessing potential risks and addressing specific stakeholder questions during an incident

–Best assessed by oil spill technical specialists

–In the absence of a fact-based risk assessment, stakeholders informally assess their *perceived* risks

Dialogue is essential to understand their perceptions of risk; engagement enables dialogue. Also, **s**ystematic surveys can be used to identify specific concerns that arise during a response. Methods for initiating kind of systematic information gathering should be incorporated into spill response plans.

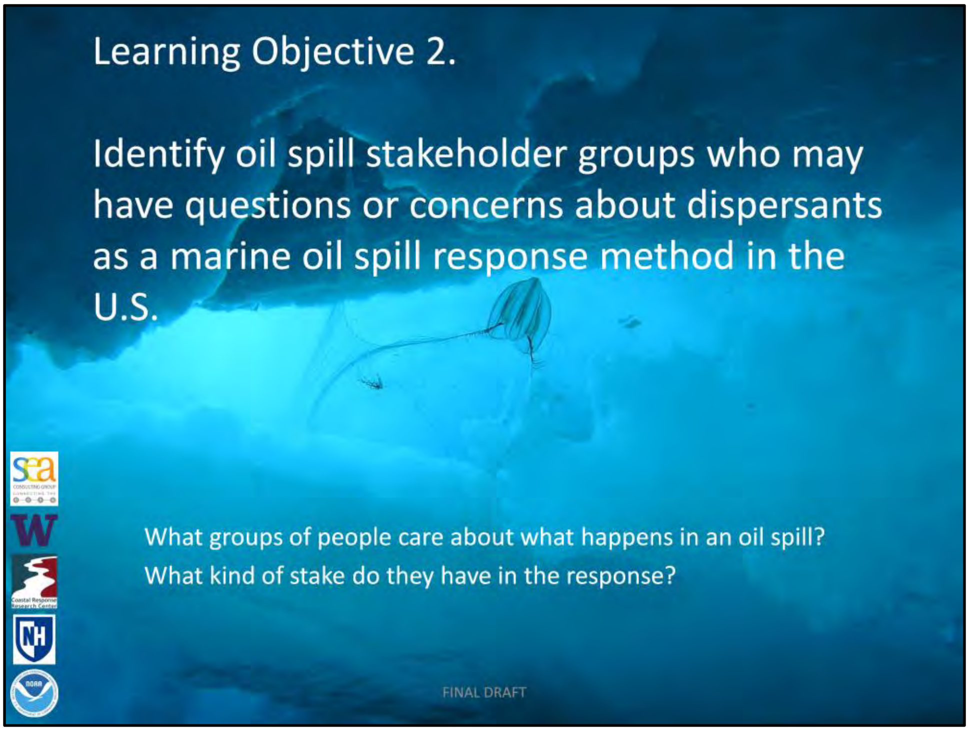
Picture Credit: Pressure cleaning rocks on intertidal zone. Image ID: line1532, NOAA's America's Coastlines Collection. Location: Prince William Sound area, Alaska
Credit: EXXON VALDEZ Oil Spill Trustee Council; Category: Coastline/Alaska South Central/



Public perceptions reflect their understanding of and concerns about a situation. Public perceptions have long influenced responder choices. Public perceptions also can drive the media and political leaders, which in turn impacts responder work on scene, and after the spill. Differences in perceptions depend on goals, values and preferences, as well as the science and politics of oil spill response.
Past communication approaches have not succeeded in resolving the differences between responder and public perceptions, nor satisfactorily answered questions raised by the public about complex topics such as dispersants.

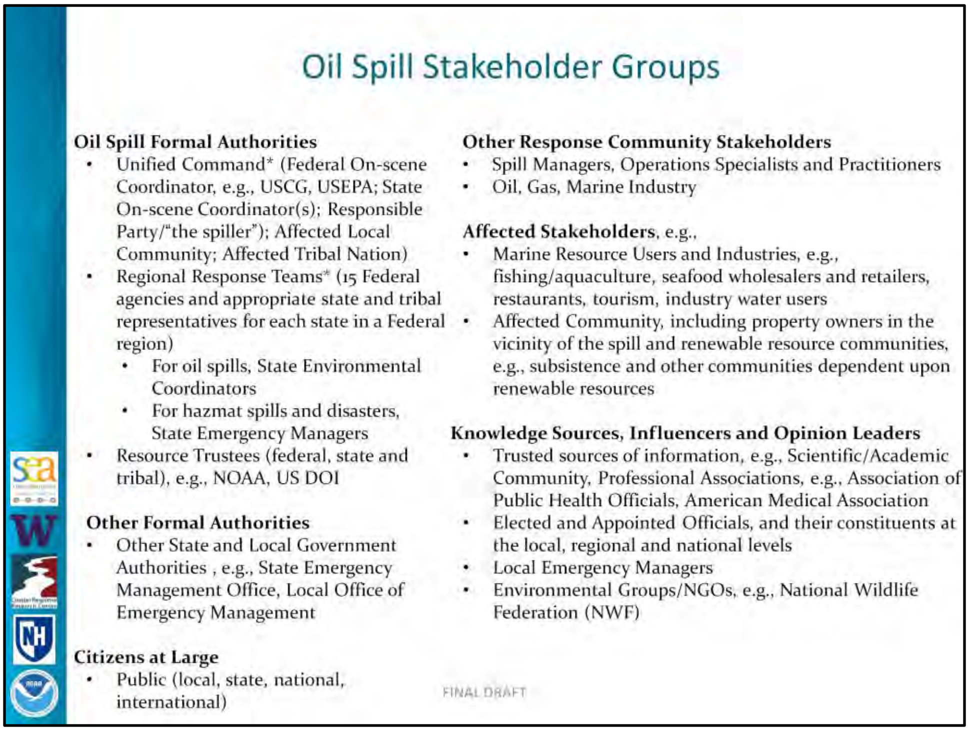
There is strong interest in addressing public perceptions, with some responders wanting to "correct misperceptions." We need to acknowledge that even expert and professional stakeholders have differing knowledge (they have expertise in their own narrow areas, generally), and may have conflicting views. Even addressing knowledge differences, gaps and, where they exist, misperceptions, is not likely to resolve conflicts in views about dispersant use, however. To create a constructive dialogue requires respecting people's perceptions, and giving them the information they need to make informed judgments.

It is also important to acknowledge scientific uncertainty (and disagreement) around spills and clean up. Scientific uncertainties about oil spill impacts and dispersant use may be a focal point for public perceptions.



Stakeholders are broadly defined as those groups that have a stake/interest/right in an issue or activity, e.g., an oil spill, and those that will be affected either negatively or positively by decisions made about the issue or activity.

Oil spill stakeholders are composed of groups of people, some who have decision making and assigned responsibilities during response; others have a stake in the outcomes of those decisions and the consequences of the spill. Another way to view oil spill stakeholders is to consider those inside the response community, e.., oil spill responders, and those outside the response community, e.g., conce3rned citizens and non-governmental organizations (NGOs).



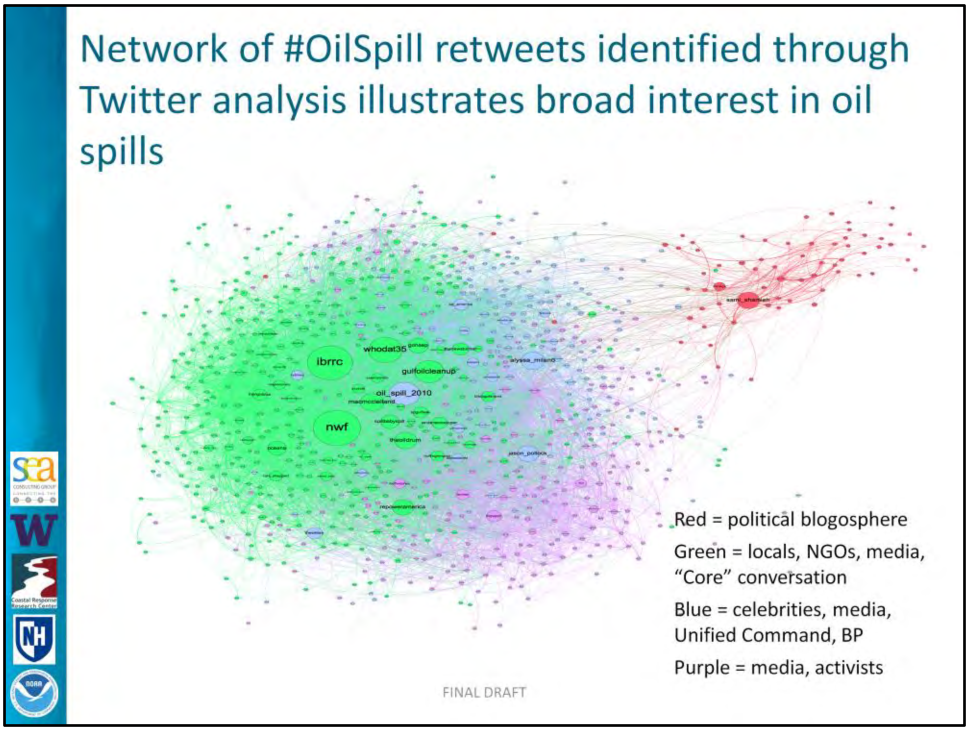
Oil Spill stakeholders are many and varied. The risk perceptions of stakeholder also can be varied and differ from one another. This groping of oil spill stakeholders has been compiled from several sources.

Federal regulations, such as the Oil Pollution Act of 1990 and the National Oil and Hazardous Substances Contingency Plan (NCP) define the responsibilities of the oil spill formal authorities listed above during preparedness and response.

An oil stakeholder analysis from a local perspective can be found in the report "Snohomish County Oil Spill Preparedness and Response" (http://www.snocomrc.org/uploads/Oil%20Spill%20Project/Oil%20Spill%20Final%20Report_compressed_3-15-11.pdf) This offers a model for local stakeholder planning which could be carried out by the Area Committee, the result of which could then be reflected in the Area Contingency Plan (ACP). The ACP could need to then also explore how to best communicate among the identified stakeholders. This process can also scale up, to a regional and/or national level.

Oil spill stakeholders who could be affected by preparedness and response decisions, also include the public at large and knowledge sources, influencers and opinion leaders.

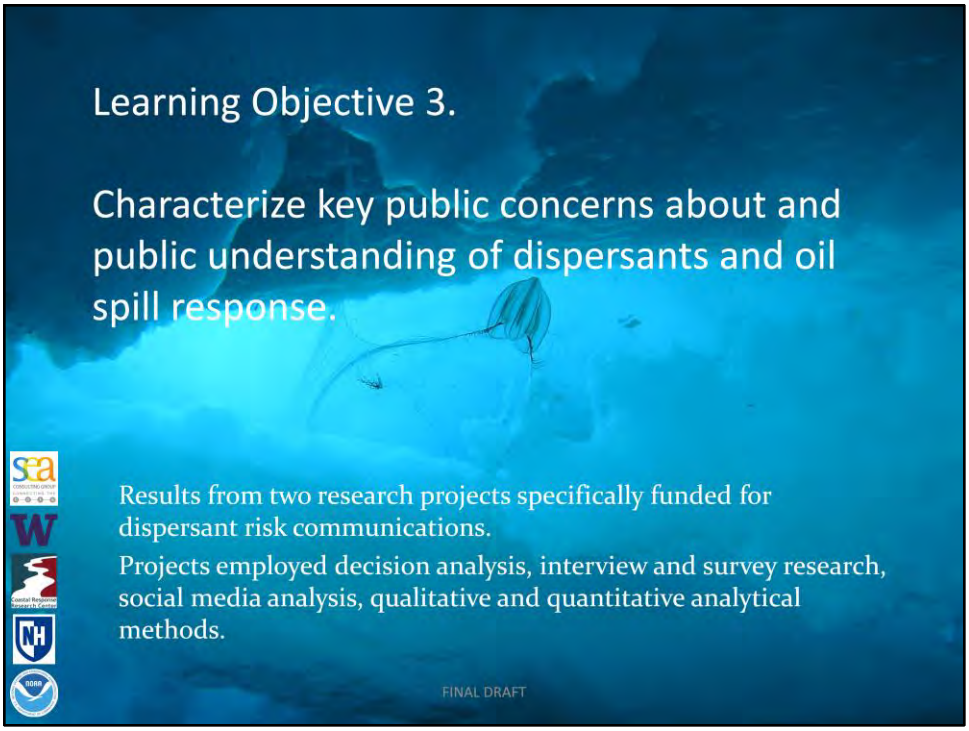
Engagement can be a fundamental accountability mechanism that obliges formal authorities and the community to identify, understand, and respond to concerns about issues of concern to stakeholders (adapted from AccountAbility, 2011).



Monitoring social media can increase situational awareness for responders, and empirical research shows that platforms like Twitter contain a significant amount of situational awareness information during and after disasters (Vieweg et al., 2010). Hughes and Palen (2012) report that social media use is disrupting the work of response professionals who serve as Public Information Officers (PIOs), repositioning them as translators of information, rather than gatekeepers.
Starbird and her team collect DWH tweets in the period from May 9, 2010 (~3 weeks after the spill began) to August 4, 2010 (~3 weeks after the well was capped). The collection captured 693,409 tweets sent by 132,075 different Twitter users.

This slide presents a network graph and shows the connections made by each retweet. Retweets, replies and URL links within tweets play important roles in information flow within Twitter and across the broader information space of the Internet. Accounts in this graph are grouped into and subsequently colored by "clusters"—nodes in the graph that have similar sets of connections to other nodes. This graph how board interest in oil spills by locals, NGOS, media, activities, celebrities, Unified Command and BP, and the political blogosphere.

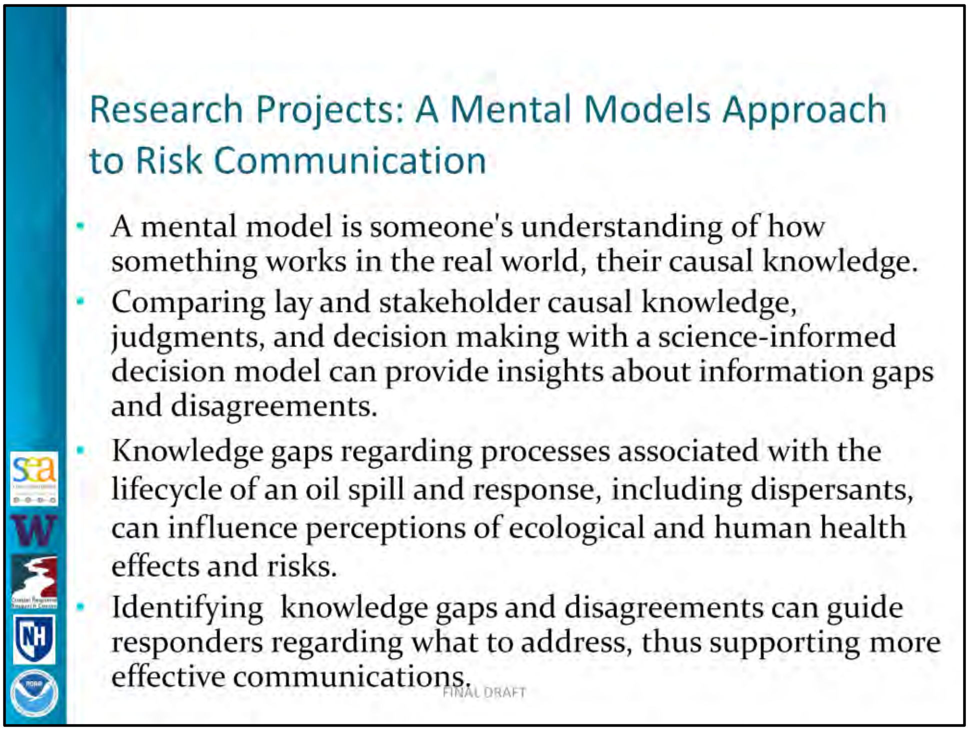
The largest cluster of twitter conversation was by locals and NGOs (In green). The biggest node – most influential retweeters – were the National Wildlife Federation (NWF) and the International Bird Rescue R3hbiliation Center (IBRRC), now known just as International Bird Rescue. Personnel from IBR were part of the response organization during DWH, but tweeted as a NGO. The biggest node shown in the political blogosphere (red) is a right-leaning blogger; the second biggest node is the Heritage Foundation.



Two risk communication research projects studies questions, concerns, and understanding about dispersants for decision makers (MSRC-funded project in the 1990s) and for the public at large (CRRC project in 2013). The analyses in these projects define and characterize information needs for future risk communications about dispersants.

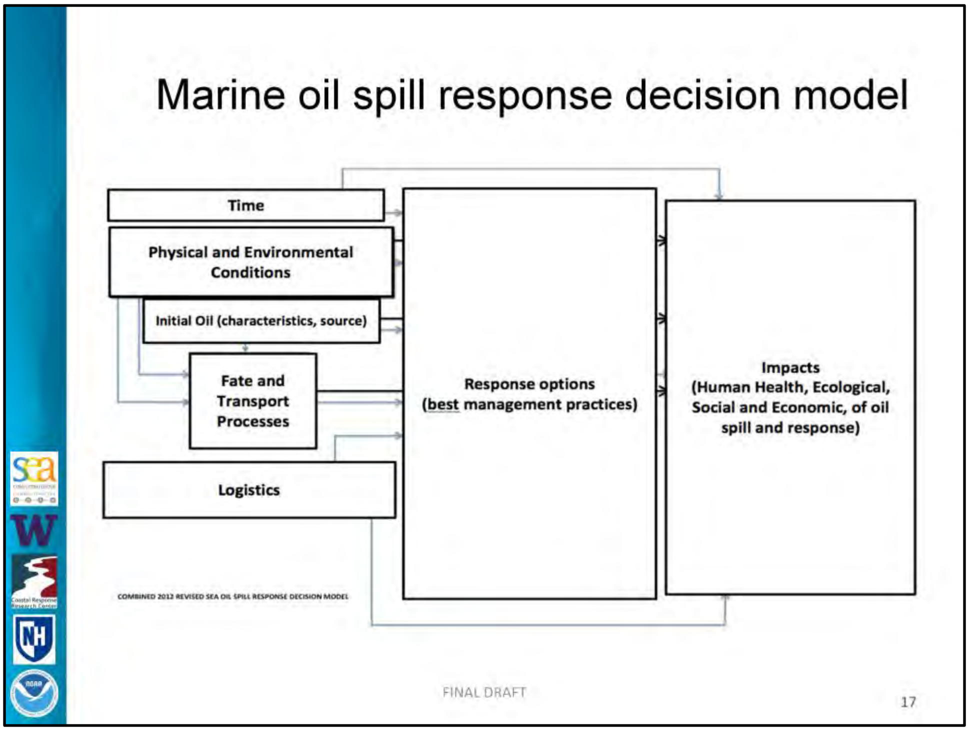
The approach used for both projects is a mental models approach. The most recent project, combined the mental models approach to risk communication, leveraged a decision model for science-informed oil spill response, analyzed Twitter data from the Gulf Oil Spill, surveyed coastal communities nationally, examined the use of scenarios and the communication of uncertainty in oil spill response decision making, and reviewed oil spill response issues.

The findings point to recommended practices that, if adopted and successfully implemented in future spill preparedness and response, may lead to a better prepared response community and better educated communities.



The dispersant risk communication research for both projects has been conducted using the mental models approach. A mental model is someone's understanding of how something works in the real world.

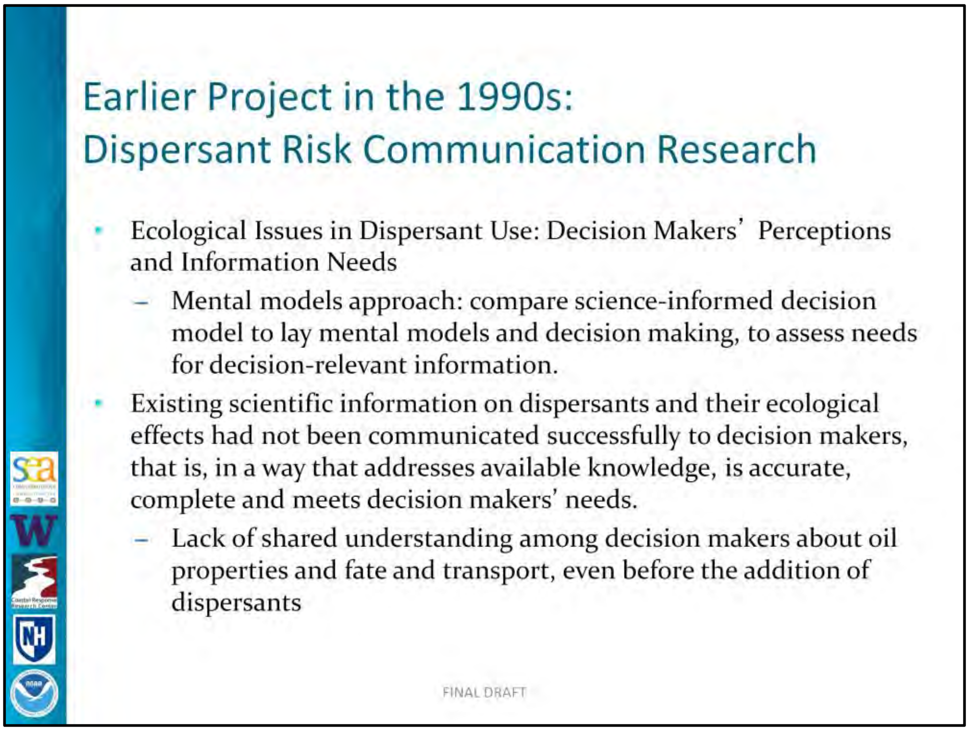
A mental models-based approach is well suited to elicitation of local community expertise on the workings of the local marine environment to produce valued goods and services, how pollutants affect that production, how best to deal with pollution, perceptions regarding environmental tradeoffs, e.g. opportunities and limitations (or risks and benefits), and associated preferences and tradeoffs regarding dispersant use in event of a spill. This approach reflects both the natural and engineering sciences of how risks are created and controlled, and the social, behavioral and decision sciences of how people comprehend and respond to such risks (Morgan et al., 2002).



The mental models approach entails developing a decision-focused model of dispersant and oil spill processes that reflects the best relevant available science and expertise, in order to identify correct causal beliefs as well as misperceptions that might influence oil spill response decisions. Comparing lay causal beliefs, judgments and decision making with this type of expert decision model can provide insights about information gaps and misunderstanding, which in turn help identify knowledge areas to address, thus supporting more effective communications.

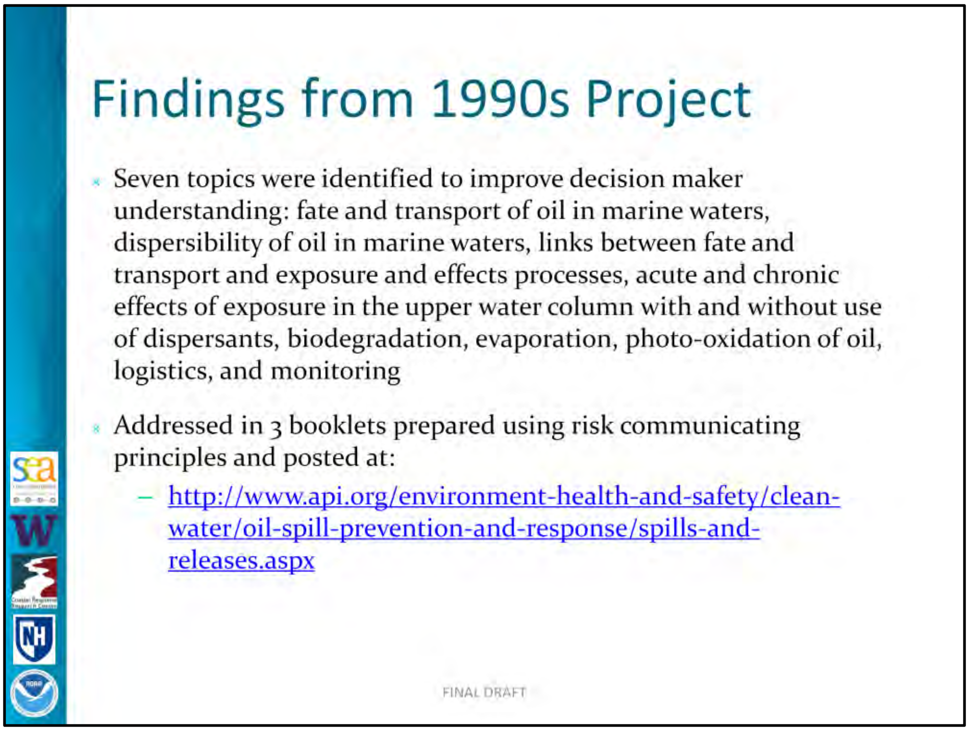
Members of the research team developed a qualitative decision model for dispersant use in oil spill response through expert elicitation workshops. The initial model for dispersants was developed in the late 1990s (Bostrom et al 1997); this initial model was updated and expanded in a second workshop in 2012 (Walker and Bostrom 2014), which was supported as part of the API JITF (Joint Industry Task Force) D-1 effort on dispersant communication tools. Both workshops elicited knowledge from those in the nation most expert in the sciences of oil spill response, and also recruited their assistance directly in constructing the decision model.

This model shows a high level view of the kinds of issues that stakeholders, experts and the public might care about in oil spill response decisions. This is a (science-informed) decision model rather than a mental model, because it represents an analysis of the information people might need to make good response decisions (and not any one person's mental model of oil spill response processes).



Two projects have been funded to specifically look at dispersant risk communications. The first was initially funded by Marine Spill Response Corporation (MSRC) R&D program in 1995, then carried on by the Marine Preservation Association and completed by API. The following publications resulted from this project.

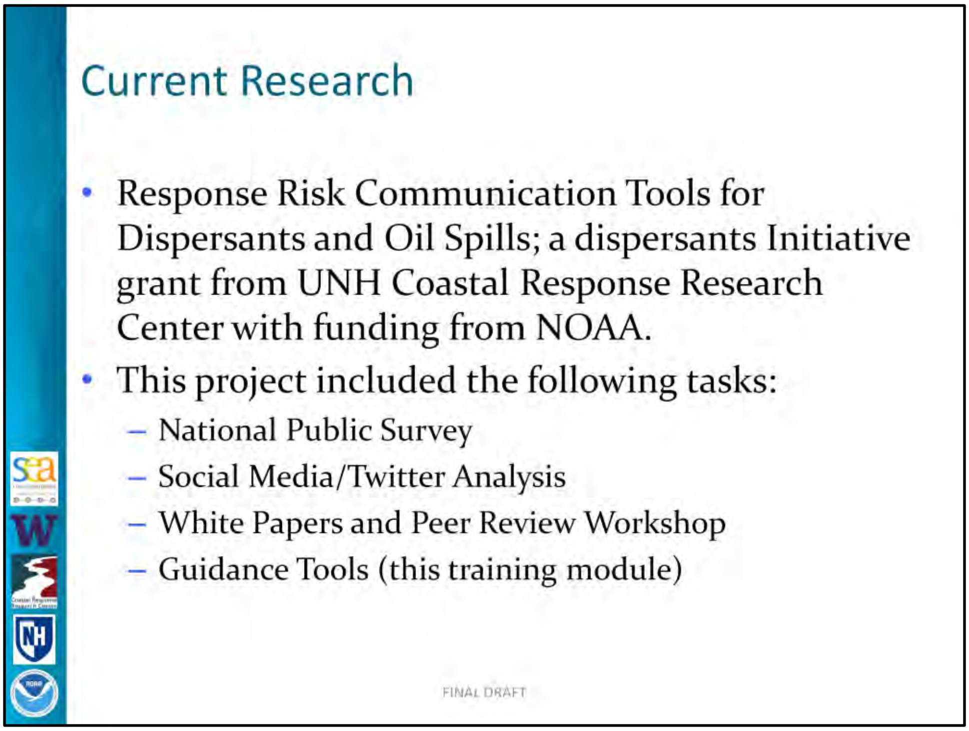
1. Bostrom, A., P. Fischbeck, J.H. Kucklick, and A.H. Walker. 1995. A Mental Models Approach for Preparing Summary Reports on Ecological Issues Related to Dispersant Use. Marine Spill Response Corporation, Washington, DC. MSRC Technical Report Series 95-019, 28 p.
2. Bostrom, A., P. Fischbeck, J.H. Kucklick, R. Pond, and A.H.Walker. 1997. Ecological Issues in Dispersant Use: Decision-Makers' Perceptions and Information Needs. Scientific and Environmental Assoc. Inc., for the Marine Preservation Association. Washington DC, Oct 31, 1997.
3. Boyd, J.N., D. Scholz, and A.H. Walker. 2001. Effects of Oil and Chemically Dispersed Oil in the Environment. In: Proceedings of the 2001 International Oil Spill Conference, Tampa, FL. American Petroleum Institute, Washington, DC.
4. Scholz, D., A.H. Walker, J.H. Kucklick (eds.). 2001. Environmental Considerations for Marine Oil Spill Response. Prepared by Scientific and Environmental Associates, Inc., Cape Charles, VA. Prepared for the Marine Manual Update Workgroup, American Petroleum Institute, Washington, DC.
5. Boyd, J.N., J.H. Kucklick, D. Scholz, A.H. Walker, R. Pond, and A. Bostrom. 2001. Effects of Oil and Chemically Dispersed Oil in the Environment. Prepared by Scientific and Environmental Associates, Inc., Cape Charles, VA. Prepared for the American Petroleum Institute, Washington, DC. 49 p.
6. Scholz, D.K., A.H. Walker, J.H. Kucklick, R.G. Pond. 1999. Aligning Expectations and Reality: A Summary of Dispersant Risk Communication Issues. In: Proceedings of the 1999 International Oil Spill Conference, Seattle, WA. American Petroleum Institute, Washington, DC. 6 p.
7. Scholz, D.K, J.H. Kucklick, R. Pond, A.H. Walker, D. Aurand, A. Bostrom, and P. Fischbeck. 1999. A Decision-maker's Guide to Dispersants: A Review of the Theory and Operational Requirements. Prepared by Scientific and Environmental Associates, Inc., Cape Charles, VA. Prepared for the American Petroleum Institute, Washington, DC. API Publ. 4692. 37 p.
8. Scholz, D.K, J.H. Kucklick, R. Pond, A.H. Walker, A. Bostrom, and P. Fischbeck. 1999. Fate of Spilled Oil in Marine Waters: Where Does It Go, What Does It Do, and How Do Dispersants Affect It? Prepared by Scientific and Environmental Associates, Inc., Cape Charles, VA. Prepared for the American Petroleum Institute, Washington, DC. API Publ. 4691. 43 p.



Based on this work, researchers learned that decision makers clearly had different understanding and beliefs about toil and dispersed oil fate. This divergence of basic fate and transport process knowledge needed to be addressed to provide decision makers with a common and correct foundation for evaluating dispersant use issues. Other topics included in the summary reports (e.g., oil chemistry) provided general background information needed for understanding discussions later in the report.

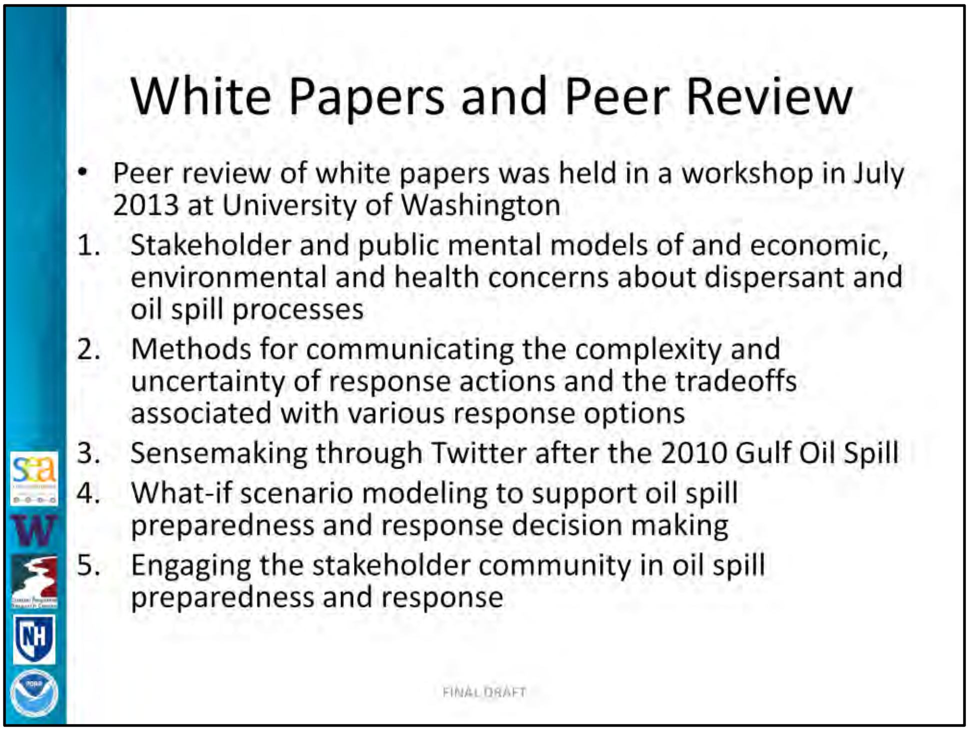
To address the identified information needs three booklets were developed from 1999-2001 and which can be downloaded in the link above. Using risk communication principles, the booklets describe:

1. **Fate and transport of oil in marine waters.** This topic was chosen as the basis of one of the summary papers because the research results of Phase Ð clearly indicated that spill response decision makers have an incomplete view of the fate and transport processes involved when oil is spilled on water and how dispersants impact these processes. This information is essential to decision maker evaluation of the tradeoff of environmental effects between dispersant use and non-use.
2. **Dispersibility of oil in marine waters and logistics of dispersant use.** These two topics were combined into a single summary report because of the overlapping information associated with these issues. Decision makers have varying, incomplete, and sometimes inaccurate knowledge of chemical dispersant mechanisms and the specifics regarding the application process.
3. **Links between fate and transport and exposure and effects processes.** This report builds on the first two topics and explains how the use of dispersants relates to a resource exposure, and how an exposure relates to ecological effects.



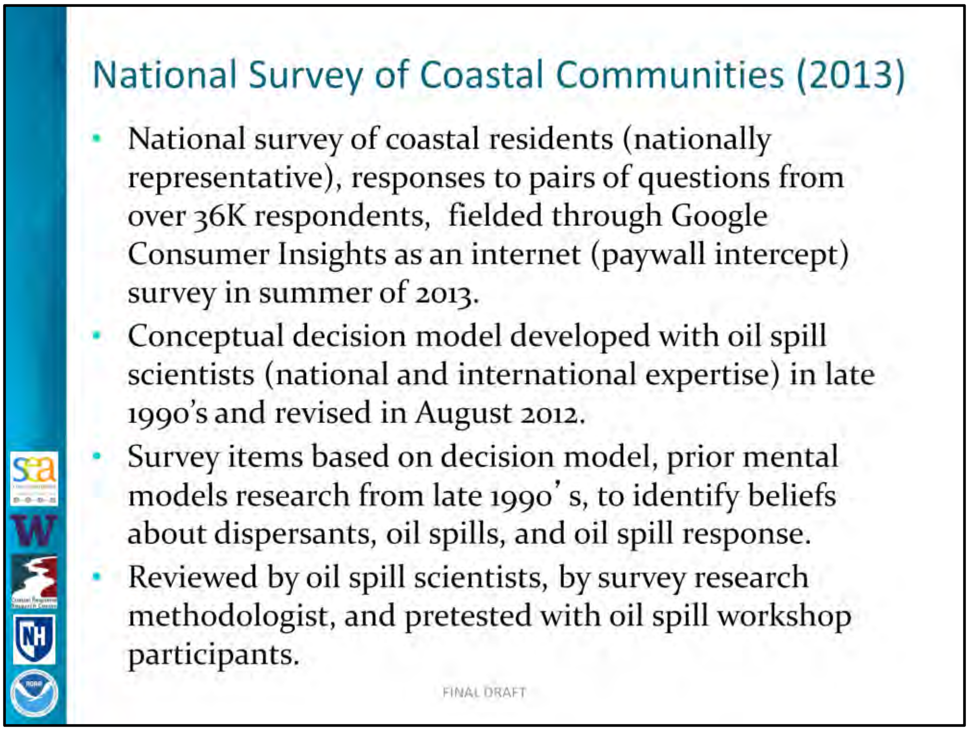
This project implemented an integrative approach – conducted new research, leveraged other survey research and decision analysis, and integrated relevant social and natural science research from the literature, as well as practitioner experience from oil spills pre-dating the Exxon Valdez up through and including DWH.

- **National Public Survey**
- The team developed and conducted a public survey of coastal areas nationally in order to characterize public knowledge, concerns, desire for information, and information gaps, and to provide insight into values for future science and policy investments related to oil spills.
- **Social Media/Twitter Analysis**
- The team assessed social media use during oil spill response in an effort to improve communication strategies by increasing our understanding of how crisis-related information diffuses through a social media platform and how influential users shape this movement. In addition to improving future communication around dispersant use, these findings could inform real-time computational tools that enable response agencies to identify and address information gaps during an event.
- **White Papers, Peer Review Workshop, and Guidance Tools**
- The team identified empirically-tested, practical approaches to content creation, audience targeting, means of information exchange and dissemination, and mechanisms for analytics and feedback and incorporated these findings along with research findings into five topical white papers and related guidance to be used in oil spill preparation and response communications. In addition, the team conducted a peer-review workshop in July 2013, and invited experts in both social and natural sciences to participate in a review and discussion of findings. The white papers were revised accordingly as the input for articles to be submitted to peer-review journals, therefore, the white papers are not publicly available.

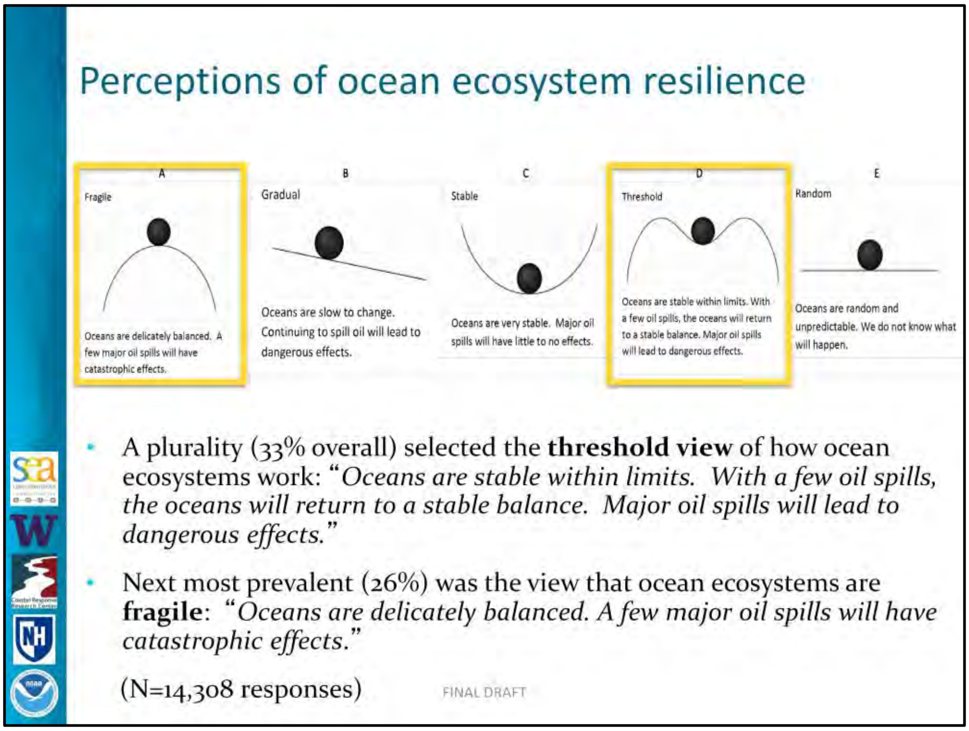


The peer reviewers who comments on the five white papers and participated in the 2013 workshop were:

- Jeannette Sutton, Senior Research Scientist, Trauma, Health and Hazard Center, University of Colorado
- Emma Spiro, Assistant Professor, Information Scholl, University of Washington
- Richard Sheehe, CDC/Sheehe Group
- Seth Tuler, Research Fellow, Social and Environmental Research Institute
- Susan Joslyn, Assistant Professor, Department of Psychology, University of Washington
- Keeley Belva, NOAA Communications and External Affairs, National Ocean Service
- Jeffrey Wickliffe, Assistant Professor, School of Public Health and Tropical Medicine, Department of Global Environmental Health Sciences , Tulane University
- Debbie Payton, Chief Emergency Response Division, NOAA Office of Response and Restoration
- Debbie Scholz, Environmental Specialist, SEA Consulting Group
- Bob Pond, Senior Oil Spill Advisor (ret.), USCG HQ
- Amy Merten, Spatial Data Branch Chief, NOAA Office of Response and Restoration
- Vicki Loe, Communications Coordinator, NOAA Office of Response and Restoration
- Glen Watabayashi, Supervisory Scientist, NOAA Office of Response and Restoration
- Tyler Scott, Doctoral Student, Daniel J. Evans School of Public Affairs, University of Washington
- Dharma Dailey, Doctoral Student, Human Centered Design & Engineering,



The survey was fielded as a paywall intercept survey, two questions at a time, developed based on a decision model and yes, survey development was informed by input from early twitter analysis findings



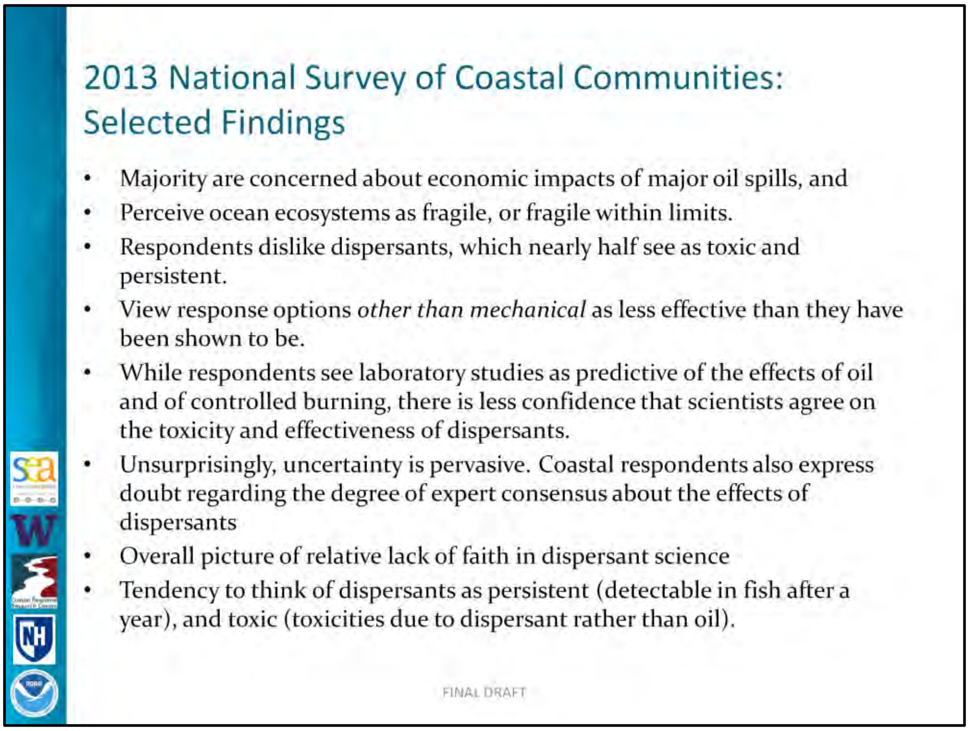
The initial questions for the project derive from mental models research with oil spill responders and stakeholders in the late 1990s. These were revised during survey toolkit development in 2012, through three workshops. An analysis of 2012 workshop responses to earlier versions of the candidate survey questions was used to select initial sets of items whose content and structure would be of interest. The team worked with Google Insights, with the aim to apply a novel multiple matrix survey design in order to elicit perceptions, beliefs and preferences that are representative of coastal residents nationally using the above-mentioned survey items. Given Google's two-question constraints, some questions were used to introduce a context for other questions, including this question regarding ocean ecosystem resilience, adapted Holling's 1979 myths of ecological stability.

Overall, we received 36,978 responses to pairs of questions, and several thousand additional responses from individuals who did not answer the second question in the pair they were presented or who were asked debriefing questions instead. Response numbers are provided with each question analyzed.

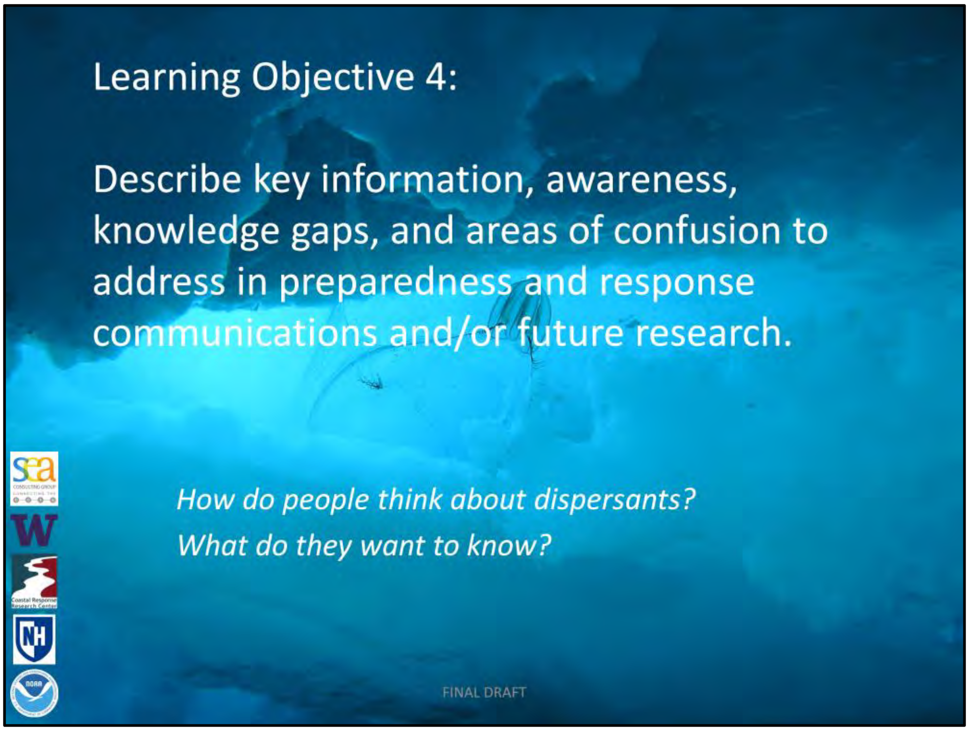
Responses show that people think that ocean ecosystems are vulnerable to large oil spills - people see ocean ecosystems as somewhat resilient but potentially vulnerable to the cumulative effects of major oil spills

Responses to the question "What comes to mind first when you think of using chemical dispersants to respond to marine oil spills?" paint a general picture of a response technology that people dislike and equate with pollution, characterizing dispersants as equally polluting or worse than spilled oil. These responses are from individuals who first received the ocean ecosystem resilience context-building question. When grouped by sentiment, neutrals (don't know) dominate, but negatives sentiments greatly outweigh positive sentiments.

There is a great deal of uncertainty about the use of chemical dispersants on oil spills, but negative reactions also outweigh positive reactions (by far).



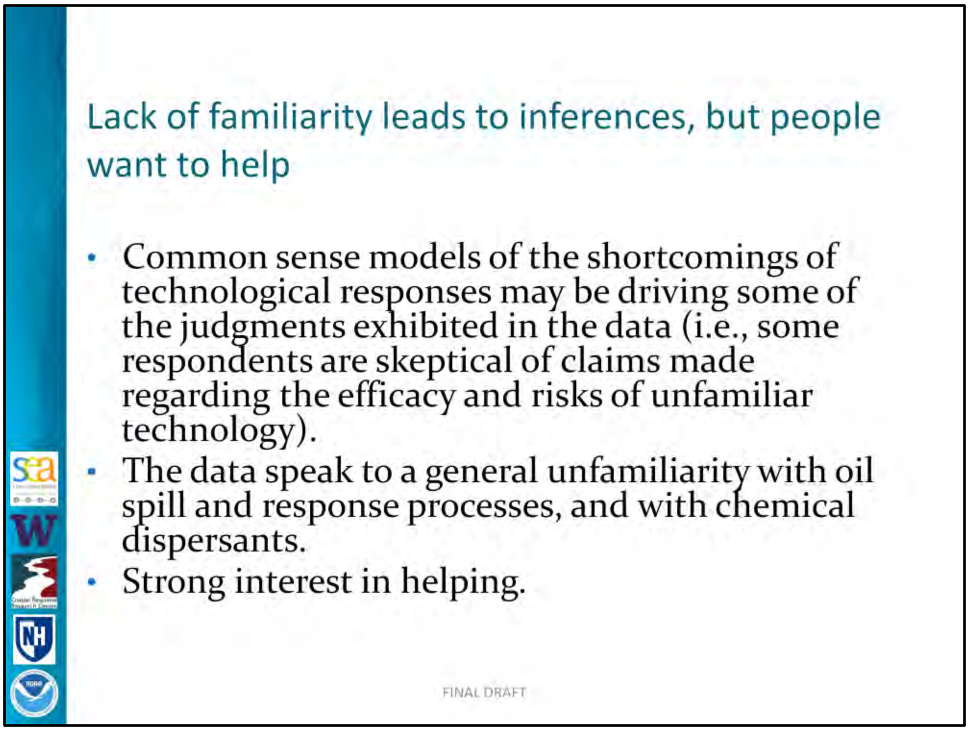
These points summarize the key findings from the national survey, characterize public perceptions of dispersant use on marine oil spills in the context of oil spill response, and provide core material to address the next learning objective as well.



Preliminary results suggest that coastal respondents have limited knowledge and interest in oil spill response, but a plurality think a major oil spill in their region would have major effects on the economic well-being of their household, and are negatively disposed toward dispersant use on oil spills.

Coastal respondents also express doubt regarding the degree of expert consensus about the effects of dispersants. Most respondents do not feel they know whether there is scientific agreement on the effectiveness or toxicity of chemical dispersants, but a majority of those responding to date have a tendency to think of dispersants as persistent (detectable in fish after a year), and toxic (toxicities due to dispersant rather than oil).

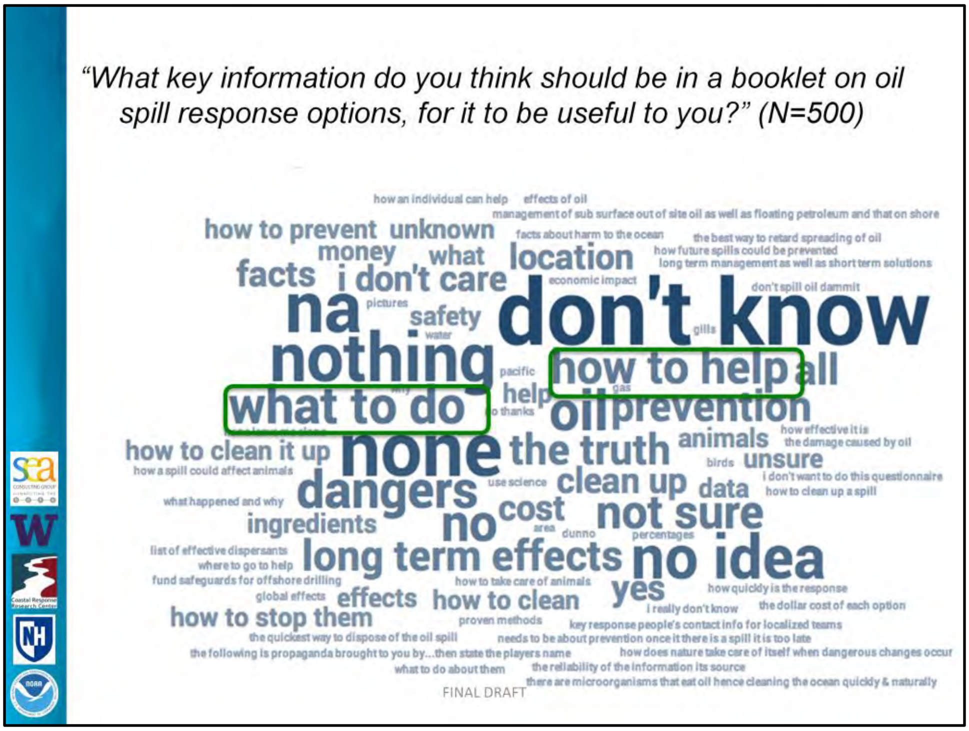
The majority of respondents find it either very important or essential to know the four kinds of information suggested (1-ingredients of the available dispersant; 2-relative toxicities of the chemical dispersant and the oil; 3-avaiality of equipment and personnel to restore and rehabilitate impacted areas; and 4-prespill ecological baseline). The belief in knowing about the dispersant ingredients also was suggested by the twitter analysis underway, as well as by the specialists who helped develop the decision model because they knew from experience that it was important to others.



At the heart of the expert decision model are elements of the response decision itself, including baseline information, anticipated effectiveness of response options, preferences for different response options, and ways of monitoring the effectives of responses once they are implemented. However, the pattern of missing knowledge and conceptions of fate and transport processes suggests an opening for developing a deeper appreciation of the tradeoffs made in oil spill response decisions. Part of the challenge appears to be that respondents (understandably) seem to view all things oil-spill related in a negative light.

Common sense models of the shortcomings of technological responses may be driving some of the judgments exhibited in these data (i.e., respondents are skeptical of claims made regarding the efficacy and risks of unfamiliar technology). Unsurprisingly, the data also speak to a general unfamiliarity with regards to the technical aspects of oil spills and chemical dispersants.

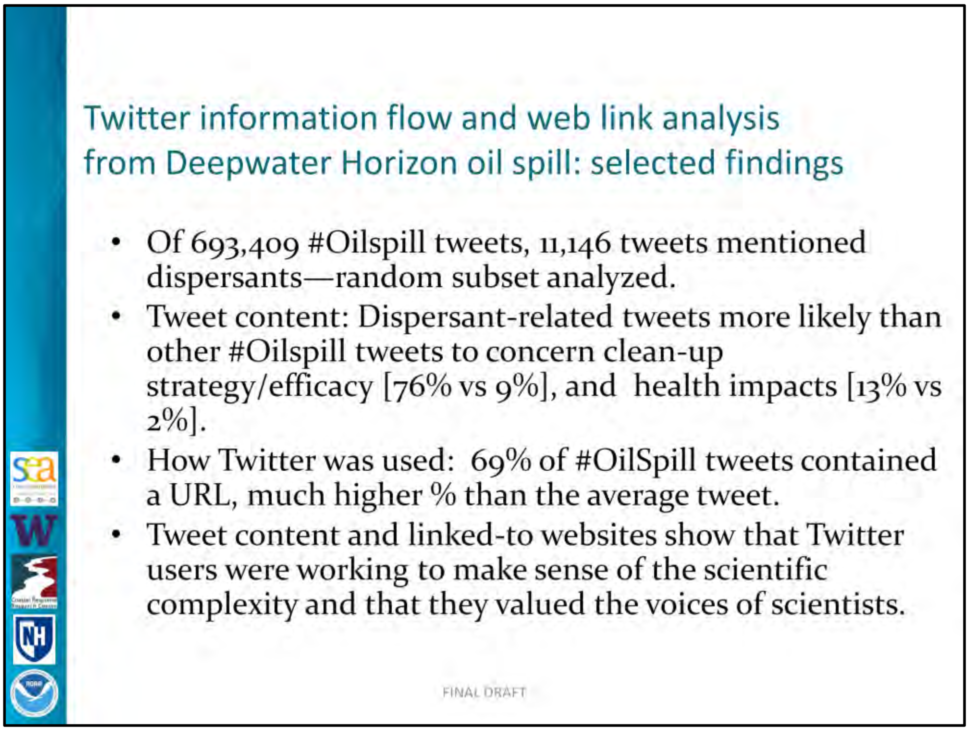
Dispersant use and controlled burning are more likely to be judged as never appropriate than as always appropriate, although a plurality of respondents select the middle option, *sometimes appropriate*. Responses are similar across coastal regions. With respect to persistence and toxicity of oil and dispersant, a majority (50.1%) think that dispersed oil at low concentrations (54.5%) and the dispersant ten hours after application (50.3%) are toxic. Judgments are split regarding whether ecological effects are due primarily to the dispersed oil or the dispersant, after application of dispersants (28.3% True/Maybe true; 27.8% False/Maybe false, 44% Don’t know), while oil spill scientists strongly agree with this statement.



In all questions related to the perceptions lay respondents hold with regards to the toxicological effects of chemical dispersants, the modal response is "Don't Know." However, respondents who express a negatively oriented view towards dispersant toxicology outweighed those who express a positive orientation in every case.

Aside from those who chose "Don't Know," the next most common response regarding whether scientists agree about the efficacy or toxicity of dispersants is "False." Viewed in conjunction, these results speak to a hearty skepticism amongst coastal respondents towards chemical dispersants generally. This is interesting in light of the fact that the questions for which "Don't Know" is chosen most frequently are those addressing the mechanisms and means by which dispersants work; thus, negative opinions about the effects of chemical dispersants are disproportionate to respondents who believe (whether accurately or not) that they have knowledge about how dispersants work or what they do.

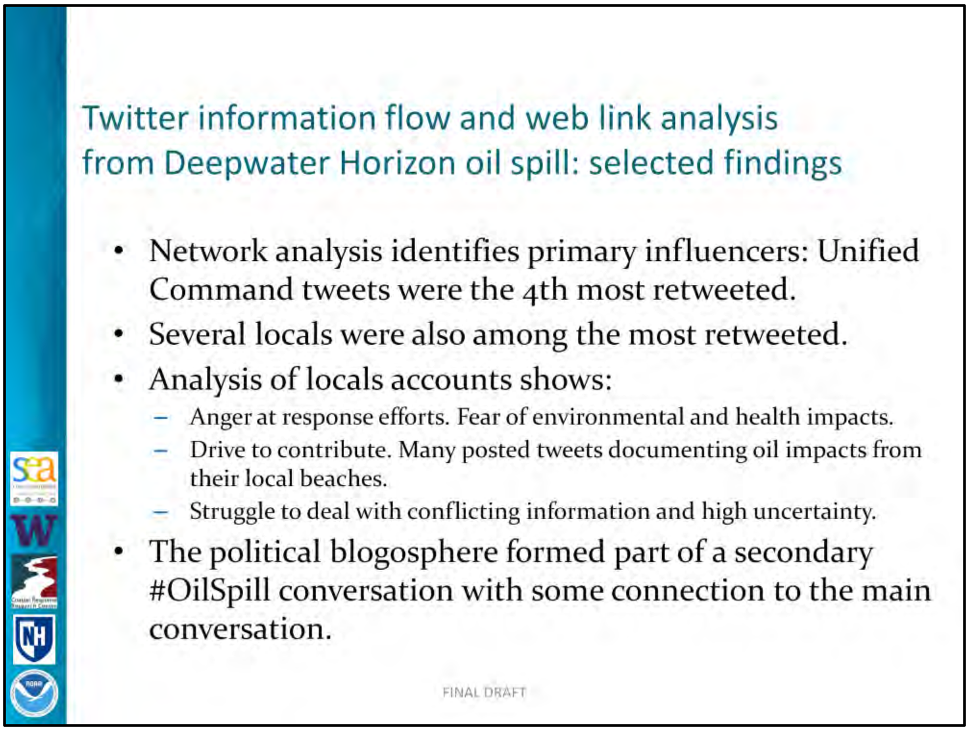
Survey responses also suggest unwarranted optimism about the effectiveness of mechanical strategies relative to other response strategies



Dispersant-related tweets focused around the following set of themes. 76% related to the clean up strategy, including aspects of the risks and benefits of dispersant use. 15% dealt with environmental impacts and 13% were focused around health impacts. Significantly, dispersant-related tweets were much more likely to refer to human health impacts than tweets that did not mention dispersants (13% to 2%). This suggests that while the social media crowd talked about the oil itself as an environmental disaster, **dispersant use brought up more concerns around human health effects**.

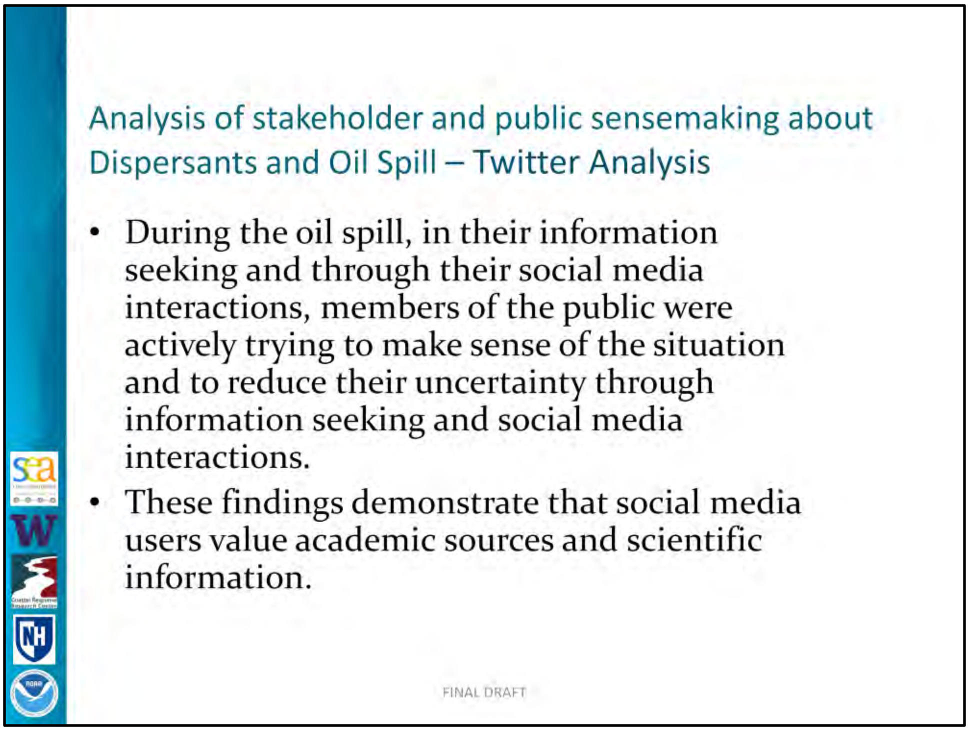
An interesting theme that emerged during preliminary analysis involved tweet content that questioned who was in charge of response efforts, often with criticism of the U.S. Government and Coast Guard for not exerting control over BP. 6.5% of dispersant-related tweets contained this theme.

Links in tweets demonstrate Twitter users sharing information and trying to make sense of a broad and complex information space – links and tweet content also show that. Twitter users valued the voices of scientists. They often included scientifically dense content in their tweets and in the sources they linked to.



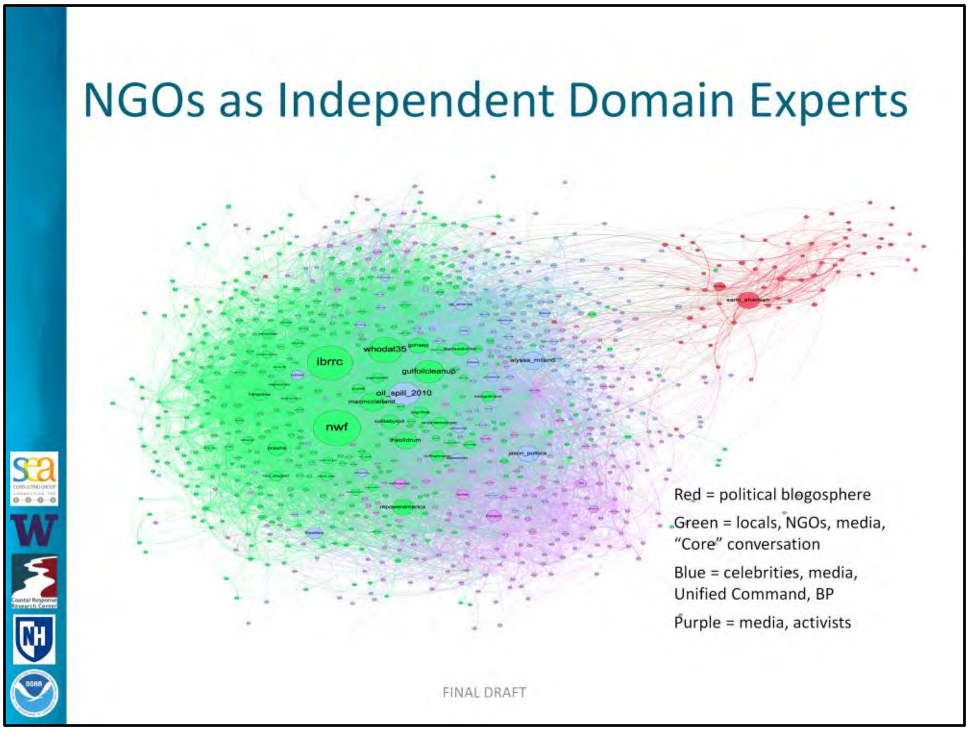
Local Twitterers were influenced by a different set of actors; different kinds of influence prevailed; celebrities' reach was broad but shallow, while some locals had a deep influence among other locals. Though these graphs can be useful for understanding information flow during an event, investigators may need to keep in mind that how they define that network may shape what they see. For instance, a graph created by following relationships for everyone who participated in the #OilSpill conversation would look far different than one created from retweets of highly retweeted accounts.

Tweets that were not related to dispersants contained a wide range of themes. 18% of these tweets were simply about the state of the spill. 15% dealt with environmental impact. 12% focused on liability issues, with many of these suggesting that BP be held accountable. About 10% were calls to action, including requests to sign petitions or join in volunteer activities. Commentary on how the oil spill was being communicated by official sources, including accusations of a cover-up, constituted about 10% of tweets in the broader conversation. Another 10% of tweets contained remarks on drivers of the event, including environmental and commercial policy. Political impact was a primary theme in 7.5% of non-dispersant tweets.



Though we identified mental health impacts as a potential theme from existing literature on oil spill affected communities (Lyons et al., 1999; Palinkas et al., 1993) and through interpretation of the emotional tone of tweets during preliminary analysis, the tweet coding did not show Twitter users talking explicitly about mental health impacts in the public #OilSpill conversation. In other words, though we perceived that mental health impacts were, for some users, manifesting within their tweets, none of the 500 tweets in our sample referred to them directly. Also surprising, economic impacts were rarely a primary theme of tweets in our sample.

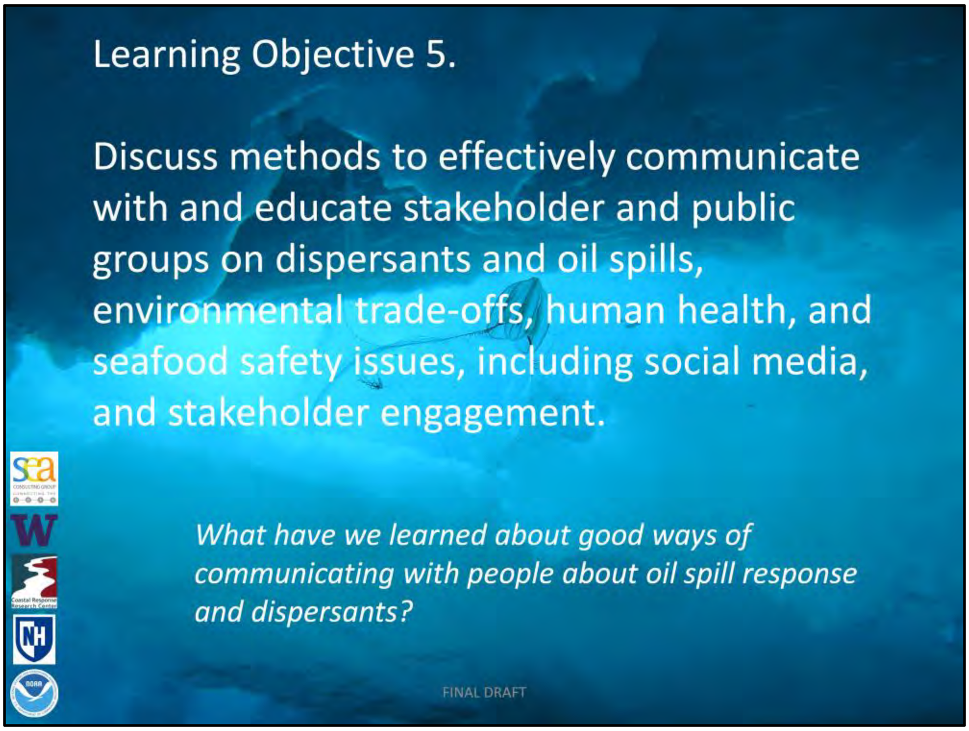
Twitter users often cited sources that make explicit mention of the viewpoints of scientists, and some even brought highly technical documents like published scientific studies and Material Safety Data Sheets into the conversation. This sophisticated sensemaking behavior may have design implications for future communication strategies around oil spills and oil dispersants. Citizens in the era of connected, online media have access to information like never before, and they are developing new skill sets and expectations around this access.



This network graph shows the National Wildlife Federation (@NWF) and the International Bird Rescue (@IBRRC) to be by far the most-retweeted in the *Total #OilSpill Tweet Collection*. These two accounts are also both somewhat central in our network graph and found to be in the same cluster (in light green). Both organizations are NGOs that focus on the environment and on wildlife protection and rescue, and both existed prior to the 2010 BP Deepwater Horizon Oil Spill.

The NWF is a non-profit organization that promotes conservation education and advocacy efforts in the United States. During the Oil Spill, their Twitter account was retweeted 7,677 times by 4,103 different Twitter users, suggesting a broad impact and likely reflecting a high number of followers interested in their commentary on the event. In recent years, the NWF has been particularly attentive to its use of social media for promoting the organization’s work (e.g. see http://www.slideshare.net/danielle.brigida/nwf-staff-intro-to-social-media), and their highly-retweeted status during this event may be a by-product of approaching their social media communications with intentionality. They sent 256 #OilSpill tweets during the event, receiving nearly 30 retweets per tweet, the most of any highly-retweeted account in our dataset. 236 of their tweets (92%) contained a link to a webpage, often to a blog on their own website or to a source in the mainstream media. Blog entries often provided deeper analysis of topics—e.g. EPA’s approach to air quality monitoring during the event. @NWF sent only 36 retweets (14%) and five of those were of tweets authored by @IBRRC, indicating a connection between the accounts of these two highly-recommended organizations. Evidence suggests that NWF’s tweets impacted the conversation about dispersants. Though they sent only four tweets referring to dispersant use, those tweets—which were critical of BP’s strategy for deploying dispersants—were retweeted 111 times.

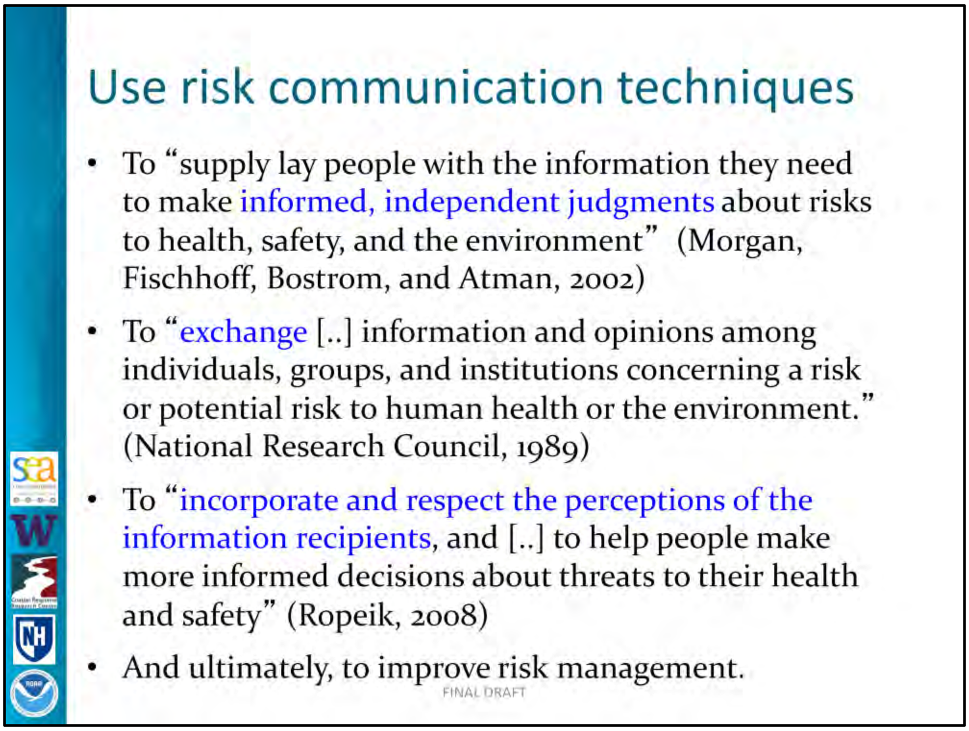
The IBRRC is an organization of veterinarians and scientists who specialize in cleaning birds after oil spills. They tweeted 1209 #OilSpill tweets during the event, often with links to photos or articles on their own site that described their clean-up efforts. Though the IBRRC was retweeted almost as much as the NWF within the #OilSpill conversation, a deeper analysis shows the crowd interacting with their account in a different way. IBRRC was retweeted 7327 times by 2291 difference Twitter users, which means that far fewer users retweeted them, but these users were more likely to retweet them multiple times.



A starting point for this section is to think about communications as much more than “get the message about first and fast. This aspect of response communications is necessary but offers a partial solution at best, especially with 24/7 news coverage, advances in communication technology, and increasing usage of social media.

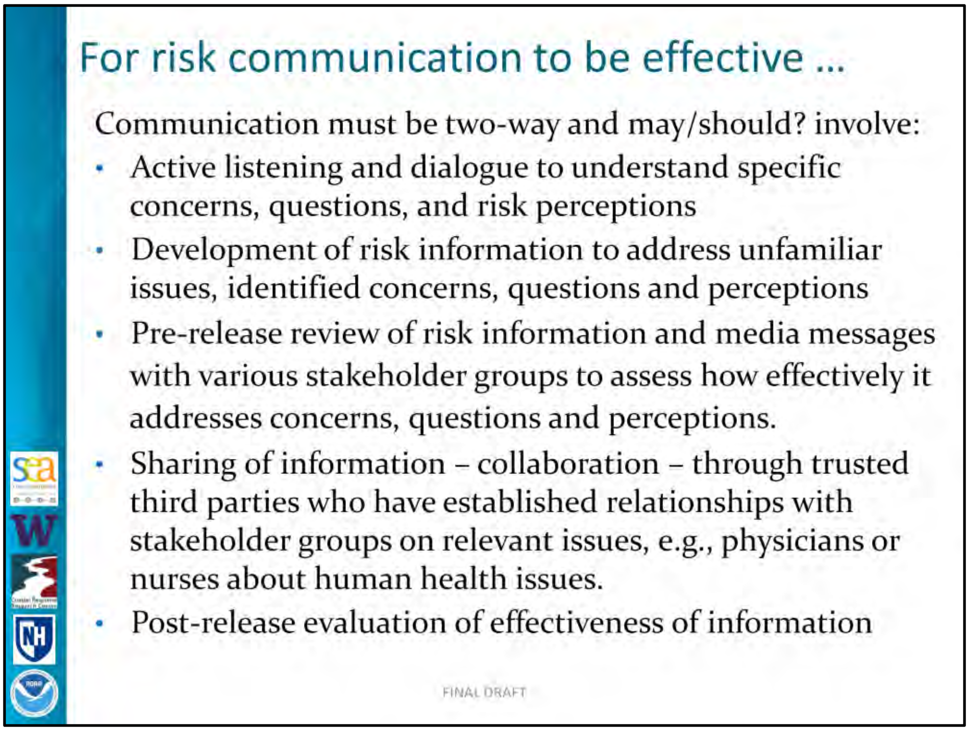
Engagement represents an opportunity for preparedness and response organizations to learn about the risk perceptions and concerns of stakeholders and communities, share technical information, and establish constructive relationships and dialogue about oil spills and response options, such as dispersants. Stakeholder Engagement is a process used by an organization to engage relevant stakeholders for a *clear purpose* to achieve *accepted outcomes*. Also, engagement can benefit communities in various ways, such as building community resilience. Community resilience is the capacity of people to cope with a serious event that: impacted them, they did not cause, and is managed by outside entities like government, insurance, and experts.

Cheong (2012) noted the importance of external linkages to government officials and others to access assistance, and further concluded that provision of external resources and knowledge is necessary for communities to adapt to environmental changes caused by oil spills. She further notes that belief in the validity and trustworthiness of expert knowledge and government-disseminated information hinges upon appropriate knowledge transfer, which occurs over time. Developing and sustaining external linkages should begin during preparedness and actively used during response.



Another starting point is to recognize and accept that citizens want to understand complex topics , will search for information to make sense of complex topics, and are capable of understanding complex science if they have access to information that is accurate, openly addresses uncertainty, and is credible. Effective risk communication is capable of meeting the information needs of stakeholders in ways that are useful to them. Since most people view oil spills and dispersants as hazardous in some way to environmental and human health and safety, improving how we understand the way they think about potential risks and providing information to address their perceptions, concerns and questions is a positive strategy.

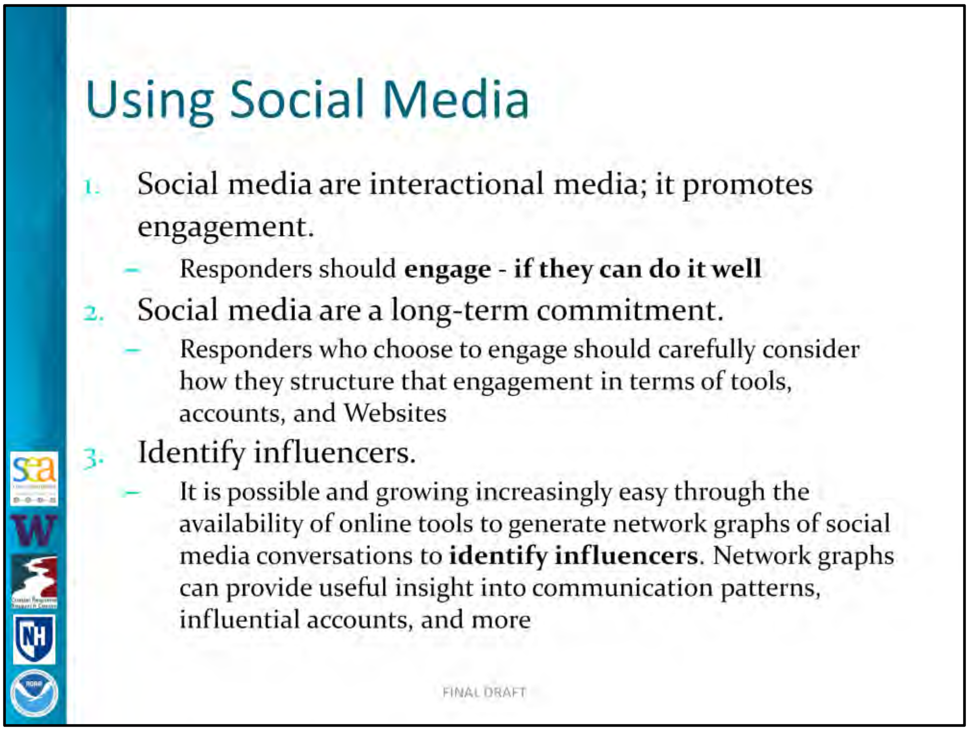
However, as the definitions above imply, effective risk communication involves greater coordination with stakeholders than mass media messages. In this aspect, providing communications about dispersants requires a deliberate investment of effort during preparedness and response. Trust and credibility are both important to effective risk communications, and both are associated with building relationships, especially at the local level. The Area Contingency Planning process, which is required by OPA 90 regulation, is an ideal avenue to develop such relationships through the Area Committees (ACs). However, traditionally the ACs are comprised of members of the response community, and not other oil spill stakeholders such as elected officials, interested citizens, NGOs, academia, and others who could be impacted by an oil spill, such as fishermen and tourism businesses. Developing relationships with such stakeholders by engaging them in local area contingency planning can help develop a foundation for effective risk communication about oil spills and controversial response options, like dispersants.



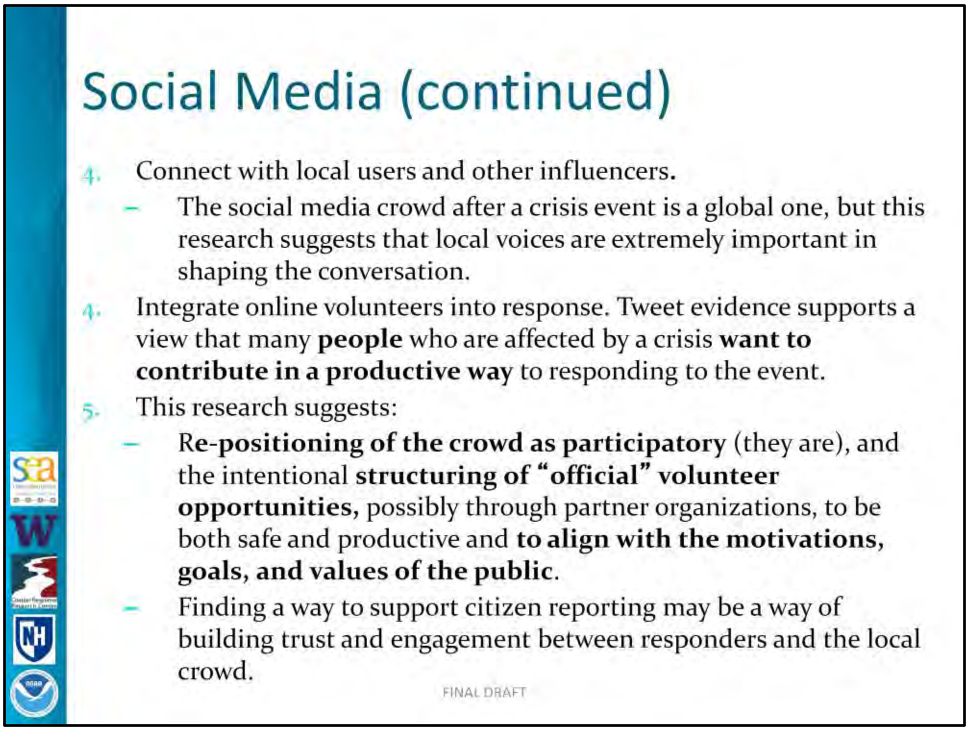
Since engagement with the general public and communities is essentially omitted as an oil spill regulatory purpose, or driver, during preparedness, external engagement has been overlooked during response. In 2013 the National Response Team (NRT) published an ICS-based model for collaborative communications, however, this is a media/mass communications model oriented toward collaboration among multiple governmental levels of ICS within the incident management team, rather than collaboration through engagement with communities, external stakeholders, or trusted sources of information outside the response organization.

In ICS, the Public Information Officer (PIO) is assigned the primary responsibility for communicating with the public, media, and/or coordinating with other agencies. The Liaison Officer, who is the contact for assisting and/or cooperating with Agency Representatives, also has limited responsibility in ICS for external communications. Engagement represents an opportunity for preparedness and response organizations to learn about the risk perceptions and concerns of stakeholders and communities, share technical information, and establish constructive relationships and dialogue about oil spills and response options, such as dispersants (Walker et al., 2013).

Engagement can benefit communities in various ways, such as building community resilience. Community resilience is the capacity of people to cope with a serious event that: impacted them, they did not cause, and is managed by outside entities like government, insurance, and experts.



1. Engagement: Social media is interactional media. Responders should **engage - if they can do it well.** Establishing a social media account in the response space opens up a new communication channel that people will assume they can use. If their messages to responders go ignored, or if they feel disrespected by the responders, then the work to engage could be counterproductive. The operator of the account will be expected (by other users) to interact in near real-time, and therefore, if an organization chooses to use a social media account, the operators of that account will need the capacity and possibly the authority to generate new content 24-7.
2. Social media is a long-term commitment: Responders who do choose to engage should carefully consider how they structure that engagement in terms of tools, accounts, and websites. In assessing their capacity for establishing event-specific accounts and websites, they should consider whether they have the resources to keep these alive when the event has ended. In this event, after the well had been capped, Unified Command cancelled their @Oil_Spill_2010 account, and at some point after that another account took over that name and began tweeting information that was critical of both BP and the government response. Unified Command also shut down their websites, which led to claims by some that they were covering up information about the response.
3. Identifying influencers: It is possible and growing increasingly easy through the availability of online tools to generate network graphs of social media conversations to **identify influencers**. Network graphs can provide useful insight into communication patterns, influential accounts, and more: i.e. local Twitterers were influenced by a different set of actors; different kinds of influence prevailed; celebrities' reach was broad but shallow, while some locals had a deep influence among other locals. Though these graphs can be useful for understanding information flow during an event, investigators may need to keep in mind that how they define that network may shape what they see. For instance, a graph created by following relationships for everyone who participated in the #OilSpill conversation would look far different than one created from retweets of highly retweeted accounts.

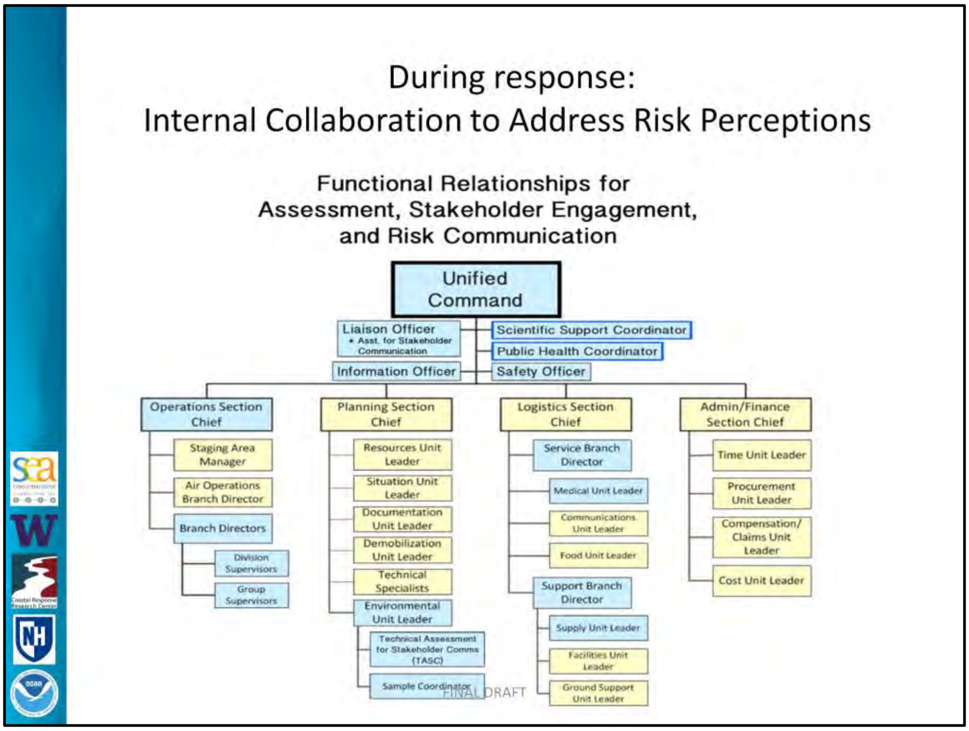


4. Connecting with local users and other influencers**.** The social media crowd after a crisis event is a global one, but this research suggests that local voices are extremely important in shaping the conversation. This research shows many locals to be both eager to engage and to have their voices heard. One recommendation is to spend some time searching for local and otherwise influential accounts—finding the most highly retweeted accounts is one way to do this—and then engage with these accounts in a way that demonstrates respect both for their fears and for their drive to be informed.
5. Integrating online volunteers: Tweet evidence supports a view that many **people** who are affected by a crisis **want to contribute in a productive way** to responding to the event. This phenomenon extends from the long recognized phenomenon of spontaneous volunteerism, and these crowd contributions can manifest in various ways—e.g. as citizen reports of impacts, as ad-hoc clean-up expeditions, and as activism designed to affect change in policies and response efforts. It may be possible to use social media and other ICT to help shape volunteer contributions through coordinated efforts that bridge responders, influential and trusted NGOs and media, and affected citizens. This research suggests a **re-positioning of the crowd as participatory** (they are), and the intentional **structuring of "official" volunteer opportunities,** possibly through partner organizations, to be both safe and productive and **to align with the motivations, goals, and values of the public**. In particular, finding a way to support citizen reporting may be a way of building trust and engagement between responders and the local crowd.
6. Communicating scientific complexity: During the oil spill, in their information seeking and through their social media interactions, members of the public were actively trying to make sense of the situation and to reduce their uncertainty. They often cited sources that make explicit mention of the viewpoints of scientists, and some even brought highly technical documents like published scientific studies and Material Safety Data Sheets into the conversation. This sophisticated sensemaking behavior may have design implications for future communication strategies around oil spills and oil dispersants. Citizens in the era of connected, online media have access to information like never before, and they are developing new skill sets and expectations around this access.

Communications shortfalls and areas of improvement identified following the Deepwater Horizon oil spill largely focus on the traditional areas of crisis communications, public affairs and communications technology (National Commission, 2011 and USCG, 2011) and also note the impact of political influence on external communications. The role of risk communication and engagement is absent in these recommendations. However, the need for "whole of government" approach for messaging is noted (USCG, 2011), with a recommended solution being through improvements in public affairs and crisis communications. The contrast between the NCP (federal government/top down management of pollution incidents) and (National Response Framework (NRF)/Stafford Act (local government/bottom up management of declared disasters) approaches is also noted but without a suggested resolution on how to align these two institutional frameworks. Especially for spills that are perceived by communities as technological disasters, such as the DWH and Exxon Valdez oil spills, the need for collaboration, or engagement, has been reported in the literature (Tierney, 2009). Even for spills which are not viewed as disasters, social media now gives a global voice to communities in the vicinity of a spill and the general public, as noted following the 2010 DWH, "*we all have to understand that there will never again be a major event … that won't involve public participation*" (Allen, 2011).

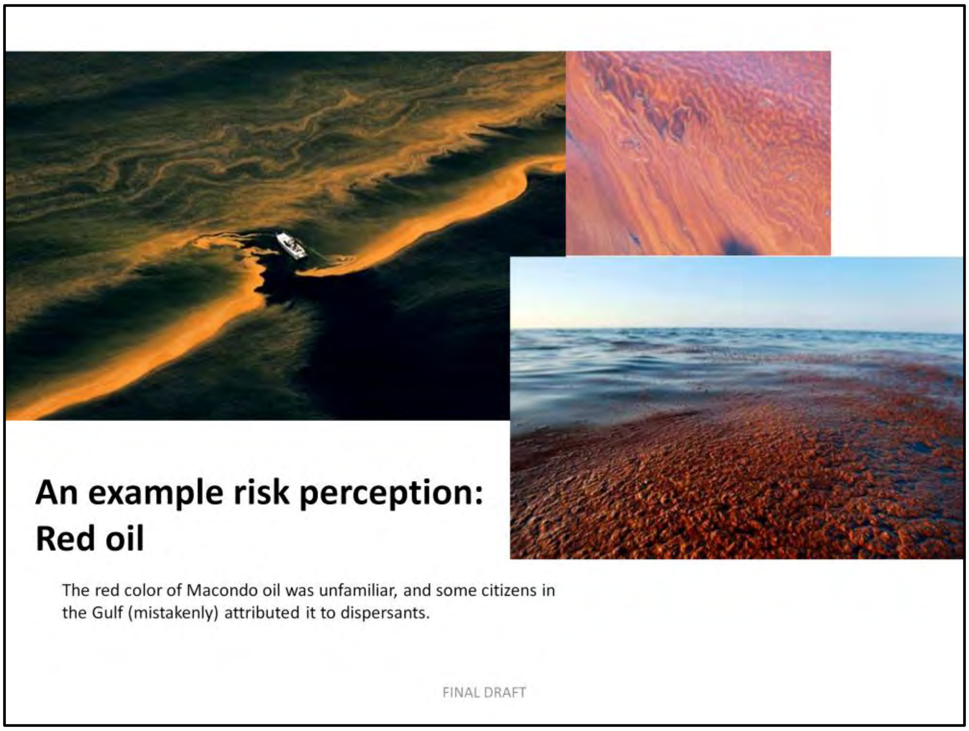
The Area Contingency Planning process is an existing regulatory framework which can be adapted to include collaboration with stakeholders at the local level who are outside the response community, such as academic researchers and community health workers. Local emergency response officials have developed networks of relationships at the local level to help prepared for natural disasters, which can be helpful for building a stronger local foundation for oil spill response at the local level. Through the ACP process, response processes and roles can be presplit identified and documented in the ACP. For example, Advisory Science Boards and membership could be identified in the ACP> Constructive dialogue through engagement in meaningful preparedness can contribute to improved communications during response.

When a significant oil spill occurs, media coverage will begin to spotlight and comment on the situation. Depending on the situation, local communities could be impacted almost immediately, especially, for example, if fishing areas are closed or oil threatens public beaches during the tourist season. It will be possible to address the questions and concerns, and risk perceptions, of affected communities, if arrangements to collaborate with relevant representatives have been defined in the ACP. Such prespill arrangements help set shared, realistic expectations about response options, and what people can do during response to help. These arrangements will also help develop a capacity for community resilience following a significant oil spill.

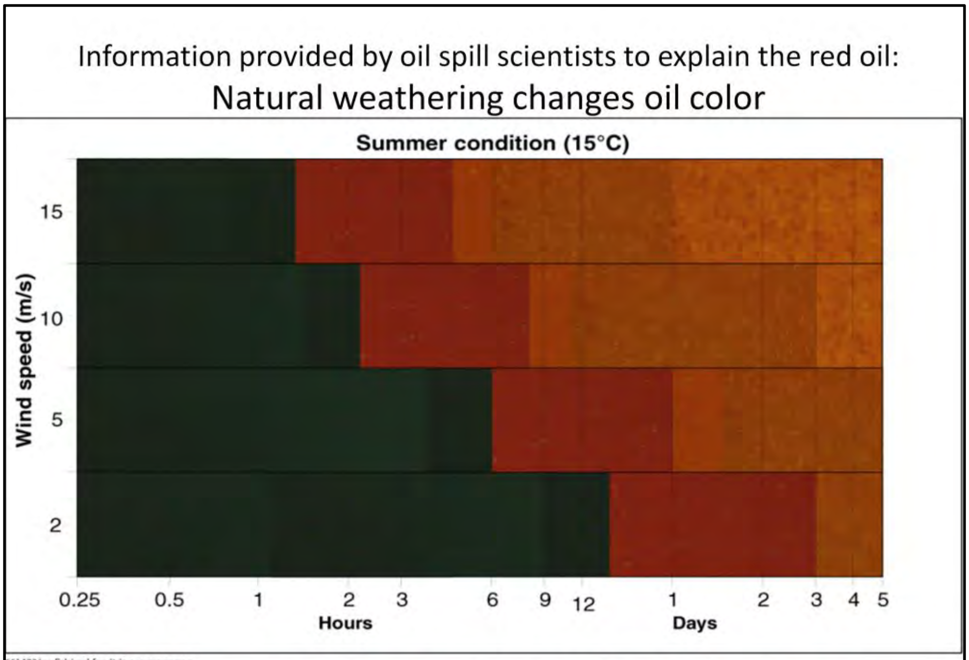


Every oil spill is different, and pre-spill knowledge often must be updated to make sense of an actual spill situation. From initial notification of an incident, little is known about the situation, and our understanding of the situation evolves. In this respect responders too must deal with uncertainty. They begin working immediately to understand the implications of the situation, to make sense of what is going on. suggests a way to adapt the ICS organization to integrate scientific knowledge within the command organization, and assign responsibility for engagement activities to address risk perceptions, questions and concerns through interactions with knowledge sources, influencers and opinion leaders to inform communications with the public at large and Unified Command decisions.

This figure depicts some new functions, through the addition of an Assistant Liaison Officer for Stakeholder Communication, Technical Assessment for Stakeholder Communications (TASC) function in the Environmental Unit and a public health coordinator to the Command Staff, supported by internal information sharing among the highlighted boxes. Stronger horizontal collaboration can occur by activating Science Advisory Boards, implementing social media activities into multiple levels of the ICS to further increase responder situational awareness, assessment and external coordination on environmental and human/public health issues of concern. Response funds to enable such horizontal collaboration at the local level can be expedited if such roles are defined in the ACP and if approved by the Federal On-scene Coordinator. Some example practices to improve response communications are described in the Section 8 of this module.



This is an example of an incident-specific perception by the public stakeholders in the affected area. This oil did not resemble oil – tarballs – that they have seen before. The response organization had to understand that many in the public attributed the unfamiliar color as being caused by the dispersants they heard reported in the media. Then to address questions at community meetings, for example, the response organization needed to prepare materials to address this risk perception with relevant scientific knowledge.



From SINTEF: Documented change in appearance with time on the sea surface for a light North Sea crude. Higher wind speed indicates higher wave action.

This information was generated through laboratory weathering studies by Sintef, located in Trondheim, Norway prior to DWH. Sintef scientists worked on-scene for a time during DWH and were able to collaborate and share this information with other response scientists in response organization to address emerging risk perceptions by community stakeholders.

While some information can be pre-developed to address generic questions about oil spills, additional information may be needed to address incident-specific conditions.   NOAA and ITOPF have developed generic oil spill fact sheets and information papers (http://www.itopf.com/information-services/publications/technical-reports/), but incident-specific questions about actual spill behavior may necessitate developing incident-specific fact sheets and information. An example from DWH was the “oil plume.”

Another example of incident-specific risk perceptions about oil, dispersants, dispersed oil

Roadside Sign: Grand Isle, LA, 2010

During DWH as illustrated in this roadside sign in Louisiana, some terms that were used that were unfamiliar to the public and caused concern to citizens in communities affected by the DWH oil spill. Terms such as submerged oil, oil plume, subsurface oil were used almost interchangeably. Generic information developed before this incident about submerged oil was not applicable because the conditions of this oil spill caused the oil to behave in novel way. It took time:

- for responders to appreciate how concerned people were about this oil,
- to understand and characterize this oil behavior,
- to improve how the response organization was communicating about it,
- to reach consensus among oil spill scientists who were studying the oil, and
- to develop communication materials (such as those in the next slide) to address public risk perception.

Fact Sheets developed to address stakeholder perceptions and questions about subsurface and submerged oil

Deep Sea Subsurface Oil Assessment

September 2010

Subsurface oil refers primarily to offshore and deepwater oil that was released near the sea floor and is suspended in very small droplets below the water's surface. This includes chemically-dispersed oil from subsea injection and/or aerial application of dispersants on the water's surface. These droplets of oil typically are too small to be seen and do not sink. These oil droplets stay suspended in the water column or rise very slowly because of density differences, physical processes at sea, or because they mix with suspended particulates. Subsurface oil has an extremely low potential to land on the shore or in marshes.

Overview

The detection and monitoring of subsurface oil is a joint effort that includes NOAA, BP, EPA, academics and others, and is coordinated by the Subsurface Monitoring Unit (SMU) based in the Unified Area Command. Both federal and contracted vessels are currently sampling along grids for indicators of the subsurface oil. The data collected by onboard scientists are transmitted to shore, and the results and modeling are used to plan future areas to be sampled. Samples are analyzed on board, and additional water samples are sent to EPA labs for analysis.

Looking for indicators of subsurface oil

One of the most useful tools in the search for dispersed oil underwater is the CTD (conductivity-temperature-depth), which is attached to a rosette containing Niskin bottles used to collect water. As the CTD rosette is lowered to depths as great as a mile or more, it records several important parameters: temperature, salinity, dissolved oxygen, and fluorescence. As it returns to the surface, the Niskin bottles are programmed to collect water samples at certain depths. The water samples are sent to onshore labs for analysis of the presence of oil, rate of natural degradation and whether it is from the Deepwater Horizon (DWH) wellhead or from another source such as naturally occurring seeps of oil from the ocean floor. These take a few weeks to analyze, but other results can be used more immediately to determine if oil might be present and to guide further sampling.

Things You Should Know About Deep Sea Oil

1. There is not a "river of oil" under the surface.

Presently most of the concentrations of submerged oil being found are less than 1 part per million (ppm)

2. The oil that is still present is a "cloud" of microscopic particles that are constantly changing.

This submerged oil is dispersed and rapidly changing in size and extent due to natural processes such as microbial and chemical degradation, diffusion, and dissolution. It is no longer present in concentrations that can be cleaned or removed at sea.

FINAL DRAFT

RestoreTheGulf.gov

Near Shore Submerged Oil Assessment

September 2010

In the context of the BP Deepwater Horizon (DWH) oil spill in the Gulf of Mexico, submerged oil refers to near shore oil which has picked up sediments and become heavier than water and sunk. Without the addition of these sediments, extensive laboratory study has shown that this particular oil will not sink. The oil can be visible to the naked eye, but is not always easy to locate as it may be covered by sand and sediment, or in deeper water. Although it is common to use the terms submerged and subsurface interchangeably, they are actually distinct and result from very different physical and chemical processes.

In this spill, the oil was released more than 5,000 feet below the surface and some was either naturally or chemically dispersed in the process of degrading. Some of it rose to the surface and formed "slicks" and a smaller amount of it remained dispersed in the water column in the deep ocean as tiny droplets, most too small to be seen by the naked eye, to be consumed by naturally occurring bacteria. This remaining oil is referred to as subsurface oil. The rest of this fact sheet is about submerged oil and reflects sampling results to date.

Things You Should Know About Submerged Oil

1. Submerged oil is relatively uncommon: DWH oil is a light crude oil that floats. In some cases, weathered oil encounters sand or other types of sediment and organic debris that weigh it down and it sinks to the bottom in the very near shore and surf zone.
2. Submerged oil can be difficult to find: it can be covered by sediments; it can be in deeper or cloudy water and there are many things that look like submerged oil which are not, for example, sea grasses or organic matter.
3. Submerged oil can be difficult to recover: it requires significant skill to remove without risking response personnel and additional environmental impact.

Submerged oil is mostly in very near shore areas and the sampling to date confirms that DWH oil has been submerged only after be mixed with sand or other types of sediment or organic matter heavier than seawater. This is usually a result of waves moving oil over sandy areas.

Weathered oil (oil that has been exposed to the elements for days or weeks) can become sticky and is more susceptible to picking up small particles, adding enough weight to sink the oil. During the DWH spill response, as with most spills, there have been many reports of submerged oil, many of these end up being false, due to things like sargassum, algae and diatom blooms, being mistakenly thought to be submerged oil. Accurately identifying oil has always been a challenge during oil spills.

DWH Programs to Detect Submerged Oil

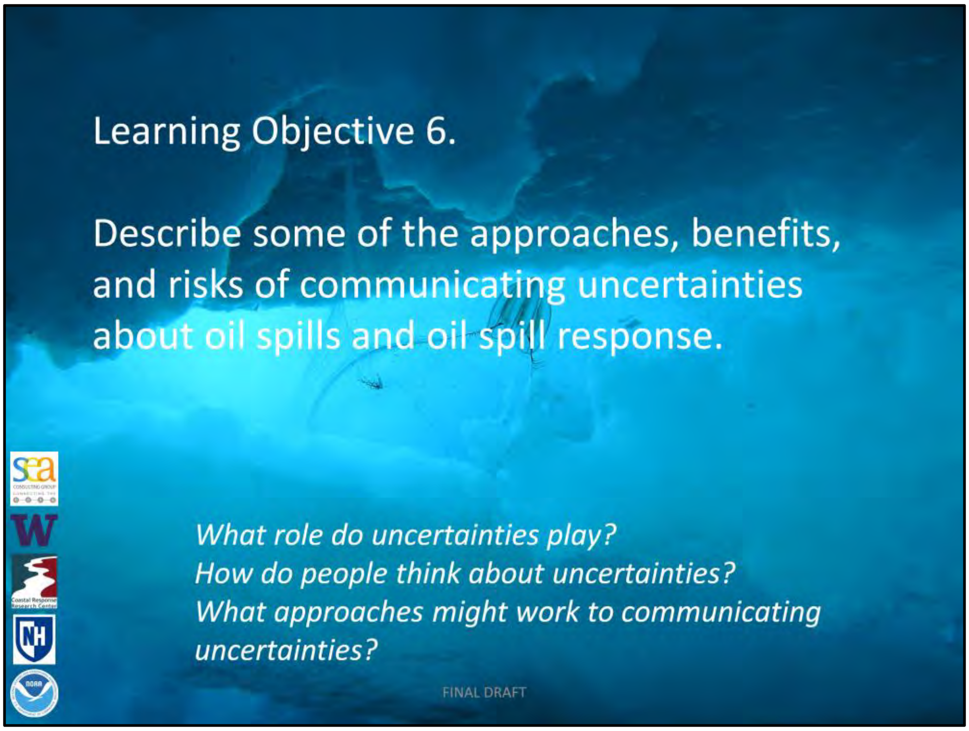
To address ongoing concerns about submerged oil, the Unified Area Command has implemented sampling, in the nearshore (depths of less than 200 ft deep) and in the deep water. The sampling has been carried out by NOAA, EPA, BP, and academic and consultant scientists, directed by the Unified Area Command, using both research vessels and vessels of opportunity.

Sampling teams are towing nets to detect and capture tar balls, taking water column and sediment samples at a variety of depths, placing sorbent material in the water column to detect any oil that might be carried toward land by currents and even deployed teams of skin divers to survey in the shallow water. Such measures are necessary because submerged oil can be very difficult to locate. However, because of the intensity and variety of sampling, we are becoming more confident that we understand the conditions under which this oil will submerge, the location we expect it to happen and extent it has happened.

Report Oil (866) 448-5816

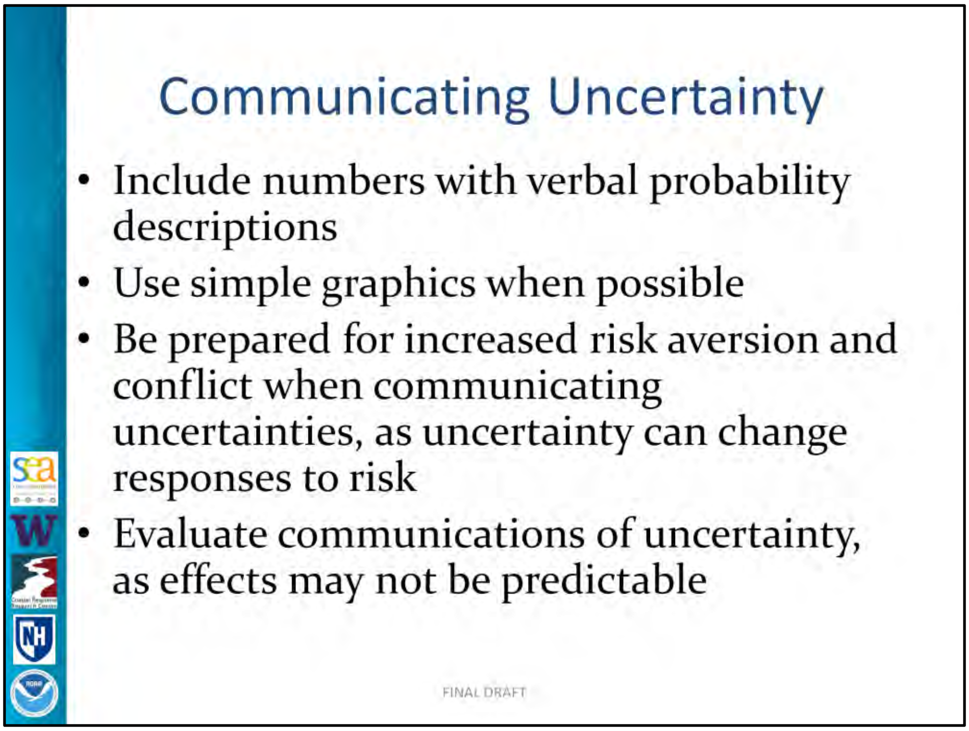
RestoreTheGulf.gov

These fact sheets were drafted in 2010 in the Louisiana Incident Command Post, by specialists who had responsibility for technical assessment for risk communications. They were developed once there was consensus internally to address external risk perception, These fact sheets were developed in accordance with good risk communication practice, such as, define the terms, use lay language, use graphics to illustrate important aspects of the information, and provide summary points to convey what is most important. In recognition of the evolving knowledge about this situation, materials should note that they information is current as of the date of their preparation.



Making decisions about the use of dispersants to mitigate the threat of oil spills as a response option and developing plans for such use requires communicating the complexity, uncertainty and tradeoffs associated with response options with stakeholders and concerned communities. Communicating about oil spills and oil spill responses involves conveying not only the logistics and politics of response decisions and actions, but also the science of oil spills and response options And like all science, the science of oil spills and spill response is inherently uncertain. The complex mix of incident-specific variables and unknown information amplifies these scientific uncertainties in spill situations, especially during the initial emergency phase. Tackling this as a risk communication task means acknowledging the uncertainties and complexities. Tackling this as a decision support task means providing actionable information.

While considering both pros and cons is nearly universally considered an essential element of thoughtful decision making, advising someone to consider the pros and cons of action in a crisis may lead to confusion rather than protective or risk reducing action. The conflict between simplicity on the one hand and information accuracy and sufficiency on the other is a signature of crisis and emergency communications. Any focus on actions requires an assessment of the context; what choices are there and what do decision makers need to know in order to act effectively? Oil spill responders face technical decisions and occupational health challenges, in contrast to consumers who face economic and personal health choices. Even within such categories, levels of expertise and knowledge needs will range widely, with corresponding variation in prior knowledge information processing capacity (Ericsson and Lehmann, 1996) and ability to handle uncertainty and complexity in decision making (Parker and Fischhoff, 2005).



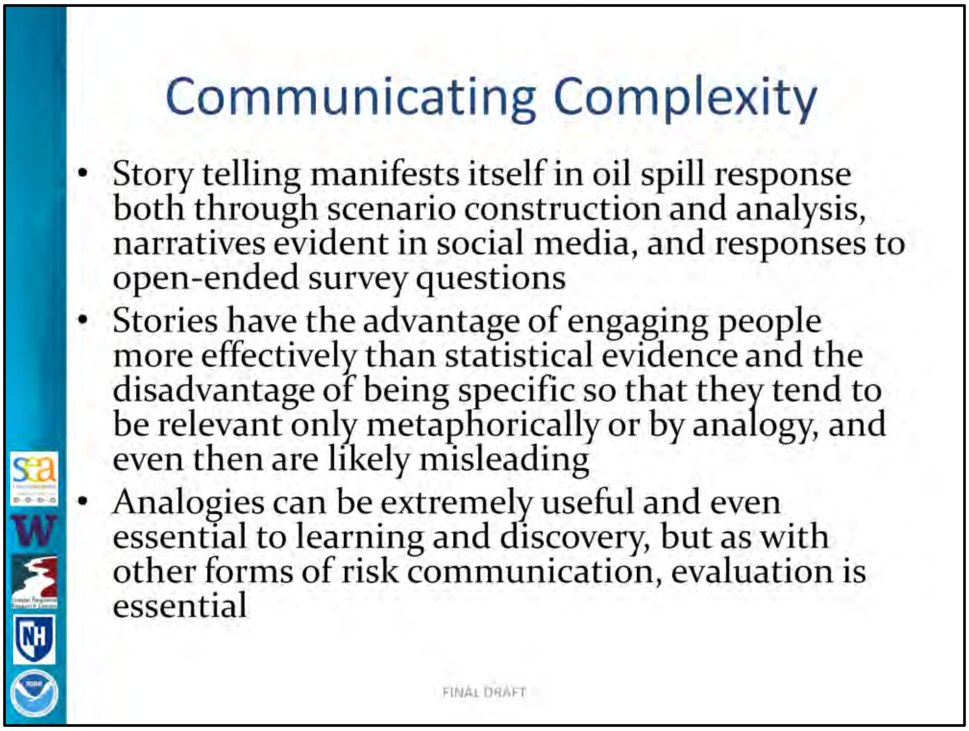
Uncertainty encompasses a wide range of states, including lack of knowledge (epistemic or model uncertainty fall into this category), natural variability, ambiguity (lack of precision or clarity), and ignorance. While experts in the field sometimes distinguish carefully among these (or types of uncertainties in other taxonomies, e.g., NRC 1994), responses to them share some common features. Aversion to ambiguity and uncertainty is a common finding; people try to avoid it. A consequence of this is that people may prefer point estimates even when they can be construed as misleading, for example in the case of providing worst estimates that have extremely low likelihoods.

There is a rich body of empirical evidence regarding how to communicate uncertainties around numerical estimates that is applicable to oil spill response. Oil amounts, distances, transport rates—many numerical parameters are of interest to oil spill responders and publics concerned about potentially exposed ecosystems, fisheries, or human populations. In oil spills, communicating uncertainty about oil movement, a topic in which the public has a great interest, is considered important (Beegle-Krause 2001). Experience has shown that it is difficult for even spill response experts to interpret uncertainty in the context of response decisions. It is complex enough that NOAA publishes an extensive interpretation guide for graphical oil spill trajectories.

Improvements in decision making can be achieved when expressions of uncertainty align with decision task demands. Stemming from these findings are several specific recommendations, in addition to the general recommendation to represent uncertainty:
Include numbers with verbal probability descriptions, if verbal descriptions are used at all. Adding numbers to verbal descriptions of uncertainty appears to improve meaningfulness and accuracy, at least marginally, despite that adding numbers involves increasing the amount and complexity of the information.
Use simple graphics when possible, bearing in mind that some kinds of graphical representations are more interpretable than others, and that this depends on context, as well as individual numeracy and graphicacy. Some studies suggest that it is better to avoid graphics unless those specific graphics have been tested and their interpretability and usefulness shown.

Be prepared for increased risk aversion and conflict when communicating uncertainties, as uncertainty can change responses to risk (i.e., risk avoidance or risk seeking behaviors); uncertainties give people more leeway to make choices on the basis of their values, which may conflict. One of the benefits of communicating uncertainty is the explicit acknowledgment of the roles of risk preferences in decision making under uncertainty.

Evaluate communications of uncertainty, as effects may not be predictable (see above).



Many environmental policy decisions are complex and characterized as "wicked, " including oil spill policy and response decisions (Machlis and McNutt 2011; Webler et al 2011), and managing coastal regions (Moser et al, 2012). Characteristics that typify wicked problems include persistence, deep scientific uncertainties, conflicting values, and competing definitions. Oil spills and other fossil fuel transport accidents as a class of problems share all of these characteristics. Specific oil spill events exhibit more uniformity of purpose (i.e., containing or cleaning up spills), but still entail deep scientific uncertainties and complexity, in part because they involve ocean ecosystems.
Complexity in decision making can refer to the number of decision attributes, the number of decision alternatives, or to other characteristics of the information available about the decision, for example, including the social or political complexity of the decision context or processes.

Strategies for making decisions under complexity include simplification, simulation, and partitioning or narrowing the scope of the problem. Simplification can be done analytically, through modeling, but is also is carried out though story telling (Kahneman 2011), or mental modeling (Morgan et al, 2002; Gentner and Stevens, 1983; Johnson-Laird 1983), which may mean using analogy.

When decisions are complex—with many attributes to consider and more than two or three alternatives to choose between—attributes may be considered one at a time and alternatives eliminated on that basis rather than according to an expected value calculation or other compensatory decision strategy (Payne 1976; Payne et al. 1992). On the other hand, training and experience in the field (10,000 hours plus, or about ten years of experience) create highly structured mental models that enable experts to recognize the essential features of decision situations immediately that may not be evident to those with less experience (e.g., Chi et al 1982, 1988; Ericsson & Lehmann, 1996; March, 1994). Awareness of these attributes of information processing and decision making is a first step toward using them to improve the design of communications processes and products.

Strategies for dealing with uncertainties

- Assess uncertainties.
- Acknowledge uncertainties up front and be clear about how they are being addressed.
- Develop templates for addressing uncertainties in spill events—to guide event responders.

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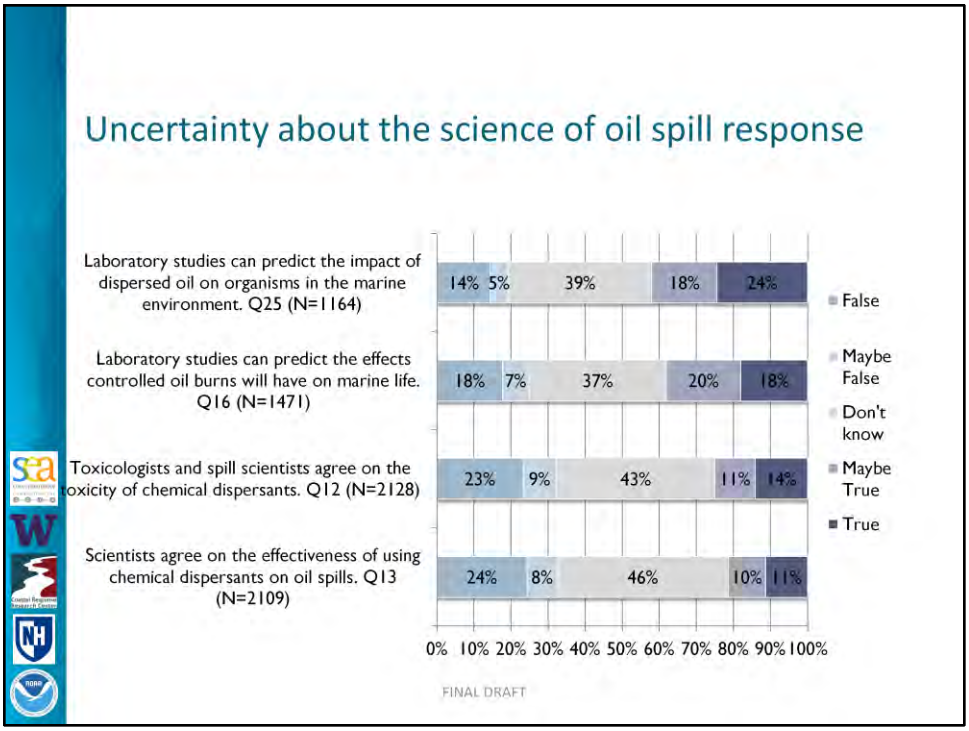

Although there is considerable uncertainty about all aspects of the science of oil spill response--with between a third and nearly half of respondents reporting they don't know-- People tend to think lab studies are predictive, they also tend not to think that scientists agree about the toxicity (32% respond False or Maybe false, vs 25% True or Maybe True) or effectiveness (32% F/MF vs 21% T/MT) of dispersants

Most of the scientists and professionals at the oil spill response experts meeting in August 2012 also judged that scientists do NOT agree on the toxicity of chemical dispersants.

Scientific certainties and uncertainties

1. Uncertainty is evident and runs through both expert and non-expert beliefs and concerns, as well as preferences.

2. A spill would likely amplify these.

3. To prepare to deal with these uncertainties, oil spill responders should consider which uncertainties they can address, and how.

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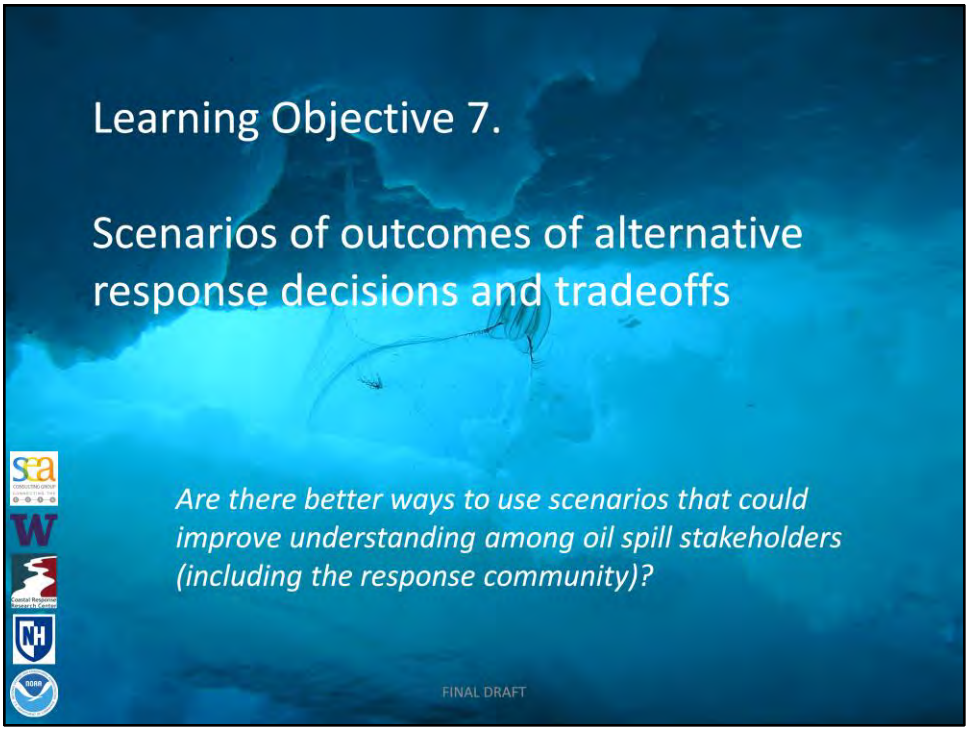
Methods to communicate scientific uncertainty and complexity about dispersants and identified challenges (Insights from behavioral decision research)

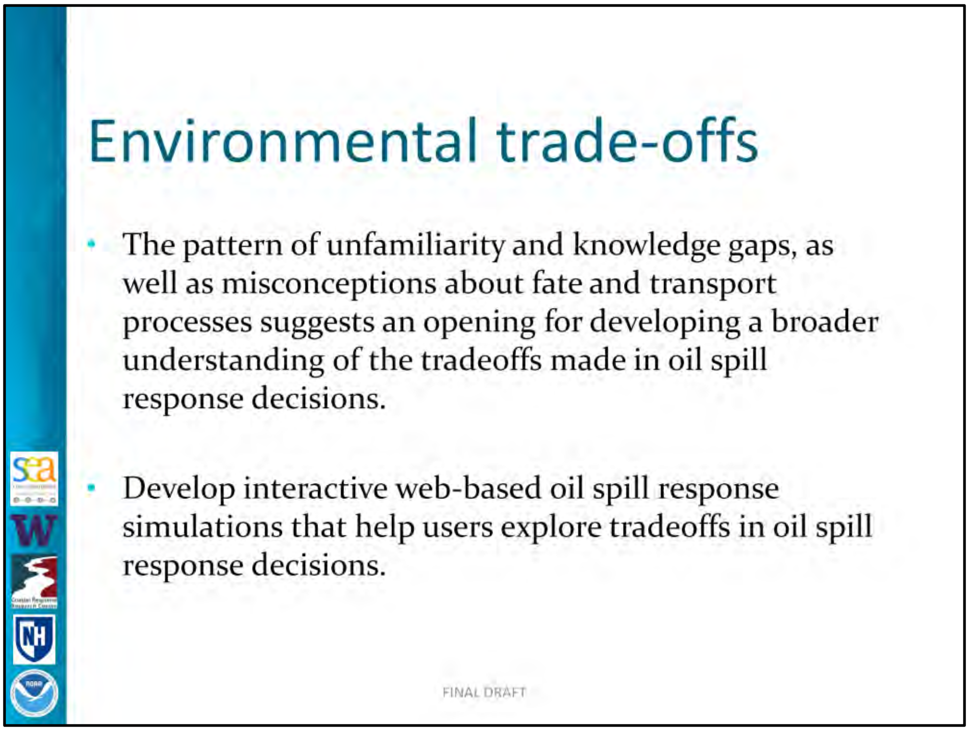
- Communicate uncertainties!
- Include numbers with verbal probability descriptions.
- Consider using simple graphics that have been tested with potential users to communicate probability and uncertainty. Test before using!
- Keep in mind that some kinds of graphical representations are more interpretable than others, and that this depends on context, as well as individual numeracy and graphicacy.
- Be prepared for differences in risk preferences when communicating uncertainties; uncertainties may be interpreted differently by people with differing values.
- Evaluate communications of uncertainty, as effects may not be predictable.
- Take how people simplify information into account in designing communications (and evaluate).

Add reader notes

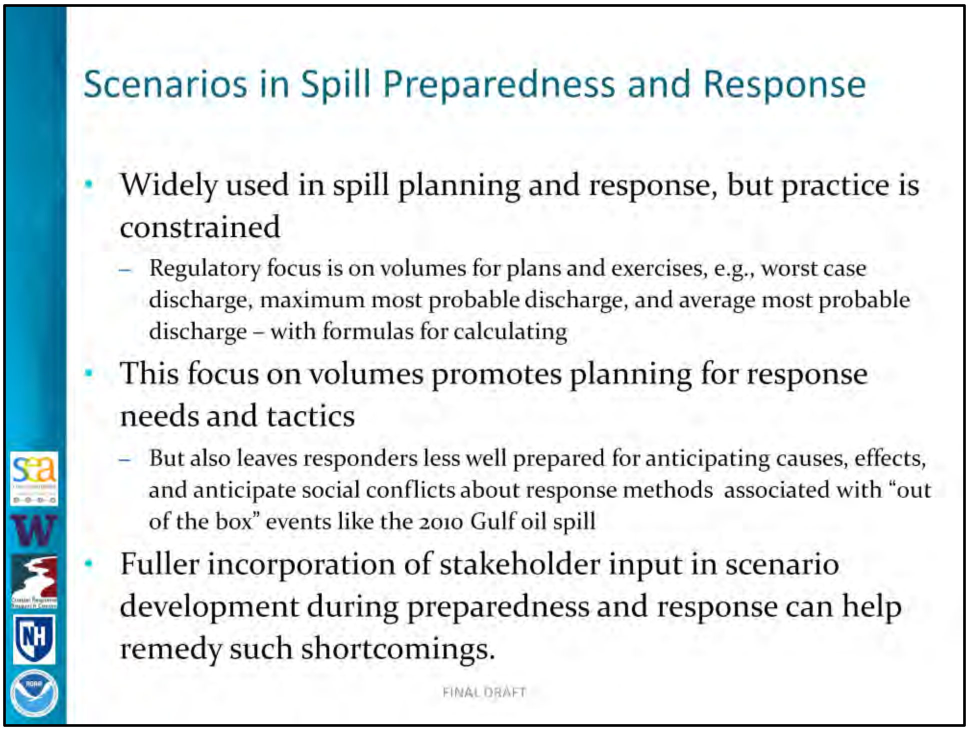


Scenarios are widely employed in oil spill contingency planning, generally taking one or the other of two distinctive forms: Estimated or simulated "worst case discharge" (WCD), or "worst case scenario" (WCS), understood to mean WCD with the addition of adverse environmental conditions at the time of the spill. With rare exception however, the use made of scenarios in preparedness and response planning falls well short of the fully evolved scenario analysis. In contrast to the way scenarios are developed through open and highly interactive group processes in SA approaches that have evolved outside the spill response community, highly prescribed and agency- and mode-specific definitions of "worst case", "average most probable" and "maximum most probable" discharge form the backbone of both the National Contingency Plan (NCP; 40 CFR Part 300) and the PREP exercises.

A review of published reports suggests that the framing and assessment of worst case is often dominated by technological and limited scientific considerations. The focus is typically on engineering and technical aspects of accident scenarios, conditions of wind and weather that can be either accident inducers or complicating factors to the response, potential oil outflow, and the means to contain or mitigate spills with available technologies. Absent or minimal is consideration of possible societal and ecological consequences of spills, their attendant complexities and linkages, and how such factors can or should feed back to the response itself. Plans that are dominated by procedural considerations or that are based on unrealistic or poorly thought through scenarios may prove of limited utility in actual use .



Simple linear models generally predict behaviors—such as human performance—as well or better than experts do, if the models incorporate those variables identified as key by experts. However even analytic linear models may fail nevertheless to explain or predict well, especially for systems such as environmental or ocean ecological systems that are complex and nonlinear. There are an increasing number of online simulators for complex systems, with which interested parties can play directly. Recently easily accessible web-based simulators have proliferated, which suggests there may be a role for an easily accessible simple web-interface simulator of spill response decisions that would illustrate response decision consequences and trade-offs. One such example is the Response Operations Calculator (ROC), an online tool that allows evaluation of response cleanup methods. ROC allows users to compare combinations of response methods, such as in situ burning, dispersants, and mechanical recovery, under simplified spill scenarios.
http://www.genwest.com/roc



In the broadest terms, scenario-based thinking can be applied to any of the three basic questions humans typically ask about the future:

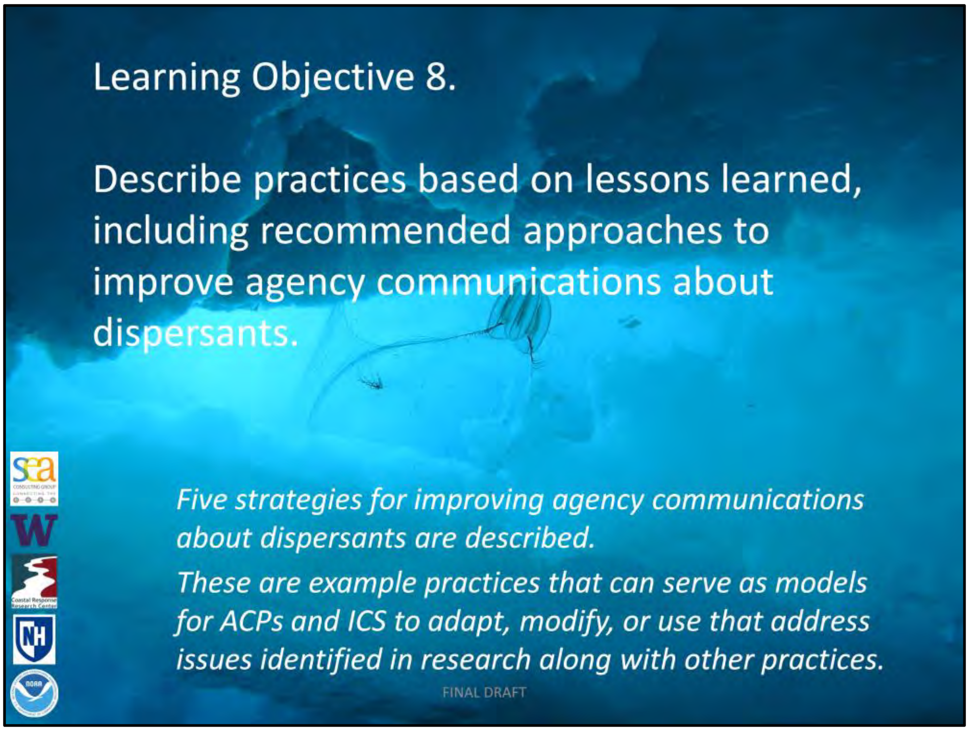
- What may happen? (possible futures)
- What is most likely to happen? (probable futures)
- What would we prefer to happen? (preferred futures)

Scenarios used widely in spill planning and response, but practice constrained by both regulation and politics. Scenario Analysis is by definition "what if" analysis. It focuses on the *plausible*, not necessarily on what is most likely to occur or on what might be most desirable, the idea of "visioning" the future. Analysts aim to develop coherent but deliberately varied alternative futures, typically through bounding assumptions about future states of a few key underlying *driving forces* and their interactions with the other important variables that define the system. Making these driving forces more explicit in spill communication could be very helpful in building trust. It is a way to communicate sources of uncertainty. Essential initial steps of a typical SA are first to identify the forces thought to be shaping the future in the domain of interest and then to select from these the primary driving forces (usually two). Uncertainties are the other key considerations in developing scenarios. Events are known with certainty because they are postulated to occur, indeed they are the backbone of the "what if" that drives SA; it's their coming about that is not yet known. Examples abound where the logic employed in developing scenarios proved too simplistic or too confining given events that actually later occurred, seen more clearly with the benefit of hindsight. The term "fantasy planning" characterizes the tendency of institutions and organizations to under-imagine and under-plan relative to events that actually transpire, a problem especially acute, when organizations formally set out to define and plan for "worst case" events. The two worst marine oil spill disasters in US history, *Exxon Valdez* and *Deepwater Horizon*, provide stark cases of this failure to imagine and plan for the worst, events that turned out to be all too realistic scenarios. More inclusive and participatory approaches to SA, rather than refinements of method, may in the long run be the best antidote to underperformance with respect to the selection of scenarios for consideration.

Thinking broadly, systematically and comprehensively about possible future spills, their management and the nature of recovery afterwards might also further the cause of more fully engaging the public in what is often seen as a technician's game up until the moment the oil enters the water.

Regulatory focus on defined WCD and WCS helpful in promoting common views of response needs and tactics across response community, but also biases thinking toward the familiar and controllable, leaving responders less well prepared for "out of the box" events like the DH spill.

Fuller incorporation of stakeholders in scenario-based preparedness planning can help remedy the problems identified.



Five example applications in this section focus on approaches that build resilience within the planning and response system through community engagement that allows for adaptive responses to unanticipated situations. They include recommendations for analytics and feedback that can empower consultation and participation as part of community engagement.

The five recommended practices are:

1. Structured Dialogues to Help Communities Understand Complex Science and Uncertainty
2. Adapting Scenarios to Strengthen Oil Spill Preparedness and Response
3. Outreach for Communicating Oil Fate and Transport Forecasts
4. Listening and Understanding Communities Through the Internet and Social Media
5. Participating With Digital Volunteers to Monitor Oil

Emerging Trends to Consider

1. Ninety percent of Americans have a great deal or some confidence in leaders of the scientific community
2. Universities, science museums, and government are highly trusted science information sources
3. The Internet is the primary source for information for Americans about science and technology
4. The primary Internet news sources is online newspapers, however 30% of Americans get news from Facebook and 8% from Twitter.
5. Internet based information will not reach everyone as 15% of Americans never access the Internet

National Science Foundation Science and Technology: Public Attitudes and Understanding report for 2014 (1,2,3,4)
PEW Research Internet Project:
Twitter News Consumers: Young, Mobile and Educated. November 2013 (4)
Who's Not Online and Why. September 2013 (5)

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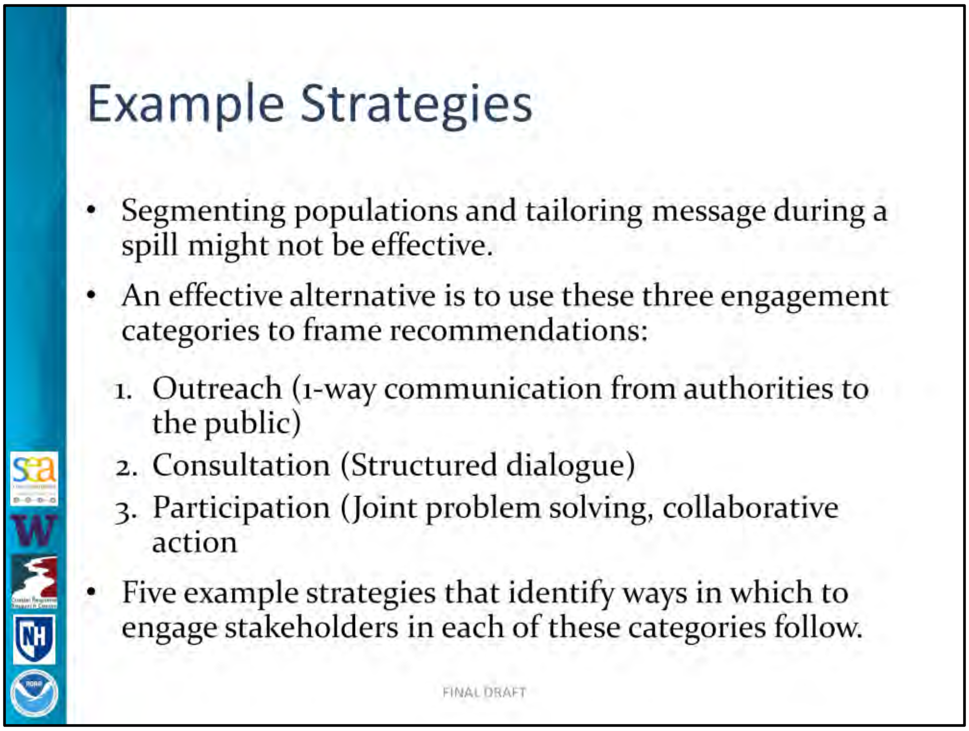
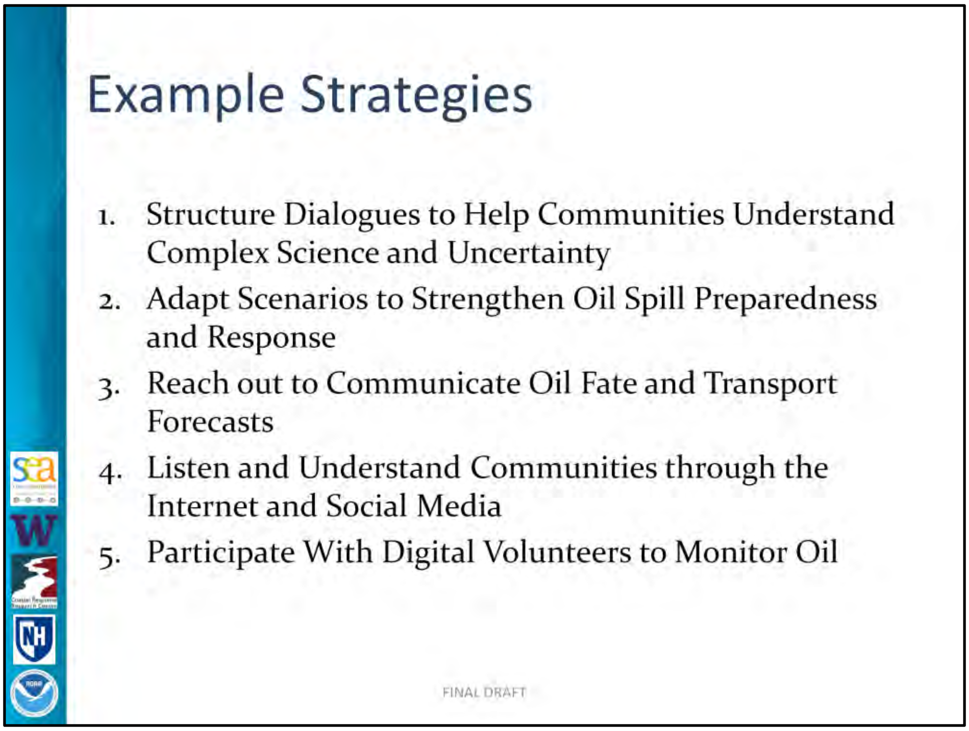
The ways in which people access scientific and technical information are changing dramatically. There are important trends to consider in who people seek out and trust as sources of scientific and technical information. These trends will affect developing opinions and beliefs.



Targeting and tailoring can have limited effectiveness. There can often be significant effort involved in segmenting populations of interest and tailoring messages, especially when the information available during a spill is limited and rapidly changing.

Participating in social media among some population segments is accelerating this process during disasters (see for example http://onlinempa.usfca.edu/social-media/). While targeting and tailoring can still be broadly applicable for spill response communications, the recommendations in this report focus on two groups beyond those directly engage in response efforts: (1) the public at large and (2) trusted sources of information who are subject matter specialists and experts about specific oil spill issues of concern.



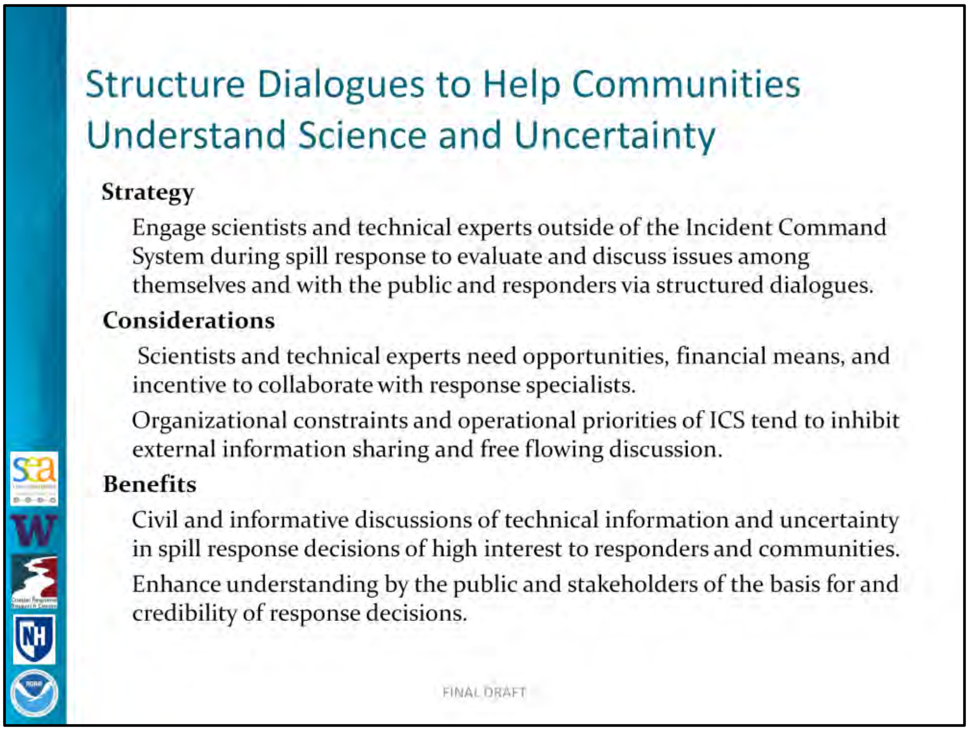
Each of the recommended practices contains 6 sections that taken together provide an outline for implementing the practice. The 6 sections are:

1. Strategy – describes the strategy for implementing the practice
2. Anticipated Benefit – outlines key benefits to preparedness or response that could come from the practice
3. Relevant Project White Papers – notes the project white papers most relevant to the strategy.
4. Problem Statement – identifies why the strategy is relevant in the context of preparedness or response.
5. Approach to Implementing – provides guidance and recommendations on how to implement the strategy, intended as a starting point for developing a more detailed strategy.
6. Obstacles to Implementing – Identifies policies and procedures, technical, and scientific issues that might need to be overcome to successfully implement the strategy.

Each of the strategies can be separately implemented, but several can benefit from implementation in conjunction with others. The 5 strategies are samples of what might be done to implement findings from this project. They were chosen for their relevance, utility, and feasibility.

Detailed implementation strategies for each of the five practices can be found in the white paper supplement to the project report. They are available through the Coastal

Response Research Center.



Problem Statement

- The complex scientific issues, their associated uncertainty, and differing viewpoints on the best response options warrant informed public discussion.
- The public is not a passive receptor for information issued by officials and channeled by mass media. The Internet allows l people much broader access to information and opinions on topics of concern to them.
- The public is also increasingly demanding transparency and openness about known and unknown information.
- Gaps in official information can sometimes lead to public speculation about potential scenarios with dramatic public consequences.
- Given the complexity and uncertainty associated with oil spills, it is reasonable for technical experts and scientists outside of the ICS to have varying insights and opinions on issues of public concern.

These circumstances can result in the public, trying to collectively process available, and likely disjointed, information and engage in “collective sensemaking” without the benefit and insight from those with key knowledge and understanding of the response situation, which is most relevant to the issues at hand. Technical experts outside the response also engage in collective sensemaking, sometimes in the media and other times in academic forums.

Approach to Implementing

- Multiple solutions are needed to help scientists and technical experts engage in dialogues that address gaps in the public's oil spill mental models and inform collective sensemaking. Social media can provide platforms for engaging scientists, technical experts, and other parties in civil and informative discussions of the complex issues and uncertain outcomes inherent in oil spill response.
- These practices can be undertaken before spills on topics of special interest, but are likely to generate the greatest interest and participation during spills. Implementation plans, policies, and procedures will need to be developed and tested during planning activities, including exercises, to ensure successful implementation during response.

While the social media platform can vary, there are four key elements that are likely to be key to a successful implementation.

1. Hosting organization - a group to invite participation, establish norms, guide discussions, and monitor pubic interests.
2. Process for participation – a transparent process for inviting participants and establishing discussion norms.
3. Social media platform – selecting a social media platform that both enables moderated interaction and encourages free flowing conversations.
4. Public concerns and information gaps – monitoring and moderating connections to the conversation by the public.

Obstacles to Implementing

Policy and Procedures

- Policy questions present the most significant obstacle for implementing this practice.
- A funding mechanism will be necessary to both support hosting the dialogues and perhaps offer a stipend to those who participate.
- Federal On-Scene Coordinators will need to use their discretion to validate the need for such expenses under the Oil Spill Liability Trust Fund.

Technical

There will be two main technical issues to address.

- Selecting the primary hosting platform.
- Integrating the dialogues into content streams of the response and participating agencies. Third will be connecting the dialogues to factual information about the situation.

Scientific

This practice does not present any fundamental scientific issues.

Problem Statement

Scenarios offer a realistic context to practice a variety of aspects of response and identify areas for future improvement.

Scenarios are used as an oil spill preparedness tool in PREP exercises, other exercises and training by various entities in the US response community. Scenarios generally use oil types and volumes that are in accordance with spill quantities outlined in OPA 90 and PREP for response plans (average most probable, maximum most probable and worst case discharge).

- Modifying the way oil spill scenarios are used during preparedness, beyond OPA 90-prescribed quantities, can expand awareness of oil spill risks that are generally beyond the current institutional scope of OPA 90 preparedness and response.
- Imagining situations and risks that are possible even if they seem unreasonable, we stand a better chance of preparing for catastrophic failures that can arise from complex oil spills.
- The US oil spill institutional framework currently does not support addressing the human dimensions of oil spills, especially those perceived by communities as disasters, and specifically with regard to social, economic, and cultural aspects of spills.

Approach to Implementing

This practice can be implemented when developing plans, and as a component of training and exercises.

- During response this practice can be used to evaluate conditions that could result from different response options, release conditions, or various weather conditions, for example.
- The involvement of stakeholder groups in scenario development can become an initial step in creating new oil spill partners and an investment in community resilience to oil spill impacts.
- Government leaders should conduct stakeholder and community resource mapping to identify a set of representatives to invite to participate in oil spill scenario planning.

The following attributes can be considered when identifying relevant stakeholders (AccountAbility, 2011):

- Dependency – those who are directly or indirectly dependent on the organization or those whom the organization is dependent upon for operation;
- Responsibility – those to whom the organization has, or in the future may have, legal operational, commercial, or moral/ethical responsibilities;
- Tension – groups or individuals who need immediate attention with regard to financial, wider economic, social, or environmental issues;
- Influence – those who can have an impact on strategic or operational decision-making; or
- Diverse perspectives – those whose different views can lead to a new understanding of the situation and identification of unforeseen opportunities.

Obstacles to Implementing

Policy and Procedures

There is sufficient discretionary space within the National Response System to broaden the traditional ways responders develop scenarios during preparedness and consider all identified potential event causes and risk perceptions about fate, transport and impacts. New stakeholders may begin to expect formal roles in response such as input into decision making and compensation for those roles.

- Some roles may be appropriate, such as helping set priorities for shoreline cleanup.
- It will be important to have explicit conversations with stakeholders who participate in expanded scenarios about existing funding constraints during response.

Private-sector plan holders and RPs are unlikely to embrace actions beyond compliance and implement this practice without an incentive to do so.

- Government leaders will need to motivate and initiate the process to begin adapting the way scenarios are developed.
- Government officials will need to demonstrate the rationale and expectation of plan holders to broaden the scope of scenario development in the training and exercises for which the plan holder pays.

Technical
No technical obstacles need to be overcome to initiate this practice.

Scientific
This practice does not present any fundamental scientific issues.

Reaching out to Communicate Oil Fate and Transport Forecasts

Strategy

Distribute interpreted oil fate and transport forecasts to the public and responders during response via interactive Internet publication.

Considerations

Few people are trained in interpreting model limitations and uncertainty and do not have access to technical experts responsible for forecasts.

Real-time distribution of trajectory forecasts will require Incident Command System guidance and training to allow trajectory forecasts to be shared outside the command post.

Benefits

Responders, stakeholders, and communities better understand the dynamic information space, deep uncertainty, and complex scientific content supporting oil fate and trajectory forecasts.

Clearer understanding of forecasts upon which many risk-based decisions are based could improve stakeholder and community understanding of decisions taken by the response

Problem Statement

A core component of uncertainty underlying spill response decision-making is understanding the fate and transport of the spilled oiled.

- The primary technology for addressing such uncertainty in decision making is oil weathering and trajectory forecast computer modeling.
- Computer forecasts are inherently uncertain due to both limitations in input data and the models themselves.
- Clearer explanations of the oil fate and trajectory forecasts upon which many risk-based decisions are based could improve stakeholder and community understanding of a tool that informs fundamental decisions taken by the response.
- Understanding the forecasts and their limitations however requires communicating the complex science underpinning the models and the inherent uncertainty associated with them.
- Forecasts are often not released to the public during a response and if they are, the information needed for understanding the science and uncertainty are disassociated from the forecast.

Approach to Implementing

Publish oil fate (including weathering information) and transport forecasts, in real-time during spills, on a public website in a way that allows the presentation of rich content while preserving the scientific integrity of the information.

Multiple components or layers of information, some static and some dynamic, in addition to the trajectory forecast itself, would be presented with interactive tools and other relevant content. The website would include these categories of content:

Static:
- Science behind oil trajectory forecasting including links to research supporting approaches for trajectory modeling.
- Explanations of how to interpret and use different types of trajectory forecasts.
- Links to allow sharing of the forecast information.
- Links to related oil spill response content.

Dynamic:
- Data used to initialize the model including oceanographic measurements, weather forecasts, oil properties and release rates, and oil location observations.
- Circumstances specific to the event that influence forecasts.
- Schedules for updates, archive or previous forecasts.
- Response to selected questions about the current forecast or related topics.
- Social media links to response relevant information.

Trajectory forecast:
- Central graphic(s) displaying oil fate and transport along with associated uncertainty.
- Interactive content to provide interpretative "hints" users as they view graphics.
- Keys (legend) to information content on the graphic(s).
- Verbal (written, podcast, video) explanation of the forecast information.

Obstacles to Implementing

Policy and Procedures

Real-time, Internet distribution of trajectory forecasts will require that Incident Command System guidance and training evolve to a more transparent system where critical information like trajectory are shared outside the command post.
- Policy and procedures on sharing these data will be necessary.
- These policies and procedures should acknowledge and prepare ICS for value conflicts and increased risk aversion when communicating uncertainties about response decision processes.
- During spills, the response organization setting up the ICS structure needs to anticipate these potential conflicts and be ready to implement appropriate actions.

Technical

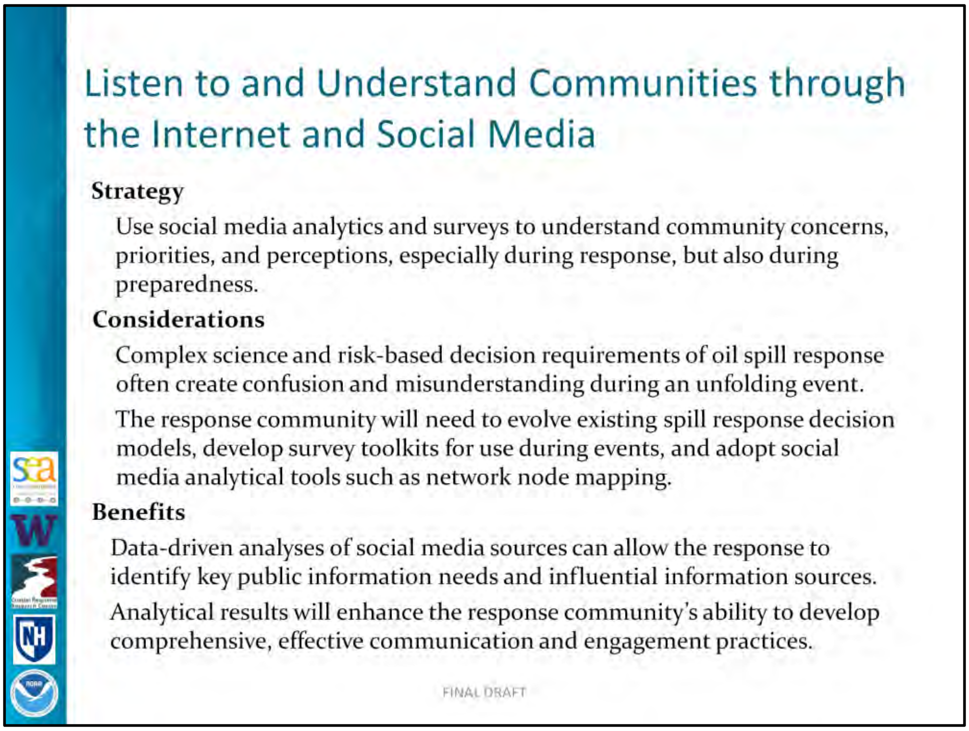
Technical challenges will fall into two broad categories: interface design and website programming.
- It might also be necessary to consult with outside experts to develop a practical, informative, and reliable approach for displaying trajectory uncertainty.

- It will be important to evaluate how this method for communication trajectory information is functioning to determine if modifications in the design are warranted before or during a response.

Scientific

Trajectory model forecasts and output methods are continually evolving on the basis of experience and feedback from modelers and those within response organizations.

- Little empirical research has been done on how trajectory forecast products affect decision making of responders, stakeholders, and communities.
- Mental shortcuts, biases, time pressures, and other processes affect decision processes dependent on trajectory forecasts.
- Research should be conducted to improve the design of communications processes and products.



Problem Statement

Real-time coordination and collaboration is necessary within the Incident Command System (ICS) to understand stakeholder and community risk perceptions about an incident,

- Complex science and risk-based decision requirements of oil spill response often create confusion and misunderstanding during an unfolding event.
- During a response, it is also important to identify those individuals and organizations that are most influential in shaping information and risk perceptions.
- Understanding key information needs, risk perceptions, influential sources, and analyzing communication effectiveness during a response is critical for developing comprehensive, understandable communication and engagement practices.

Approach to Implementing

- Evolve existing spill response decision models, develop a survey toolkit for use during events, and use social media analytical tools such as network node mapping.
- Begin before spills to develop more comprehensive decision models, survey strategies, and analysis methods.
- Evaluate aspects of this practice during the “plan” and “exercise” phases of the preparedness cycle such as regional dispersant planning workshops.
- Surveys conducted after an event can help to inform the “evaluate and improve” phase of the preparedness cycle.

Obstacles to Implementing

Policy and Procedures

The primary policy issues relate to integrating the active listening project into the ICS and obtaining clearance to conduct information collection activities by the Federal Government.

- The best point of ICS integration is not clear, assignment to the Situation Unit might also be considered.
- The Situation Unit is a focal point for gathering and processing information, so individuals with the necessary skill sets would fit in the Unit.
- Survey work could be contracted to outside researchers, they may also be subject to institutional review requirements, particularly at universities.

Technical

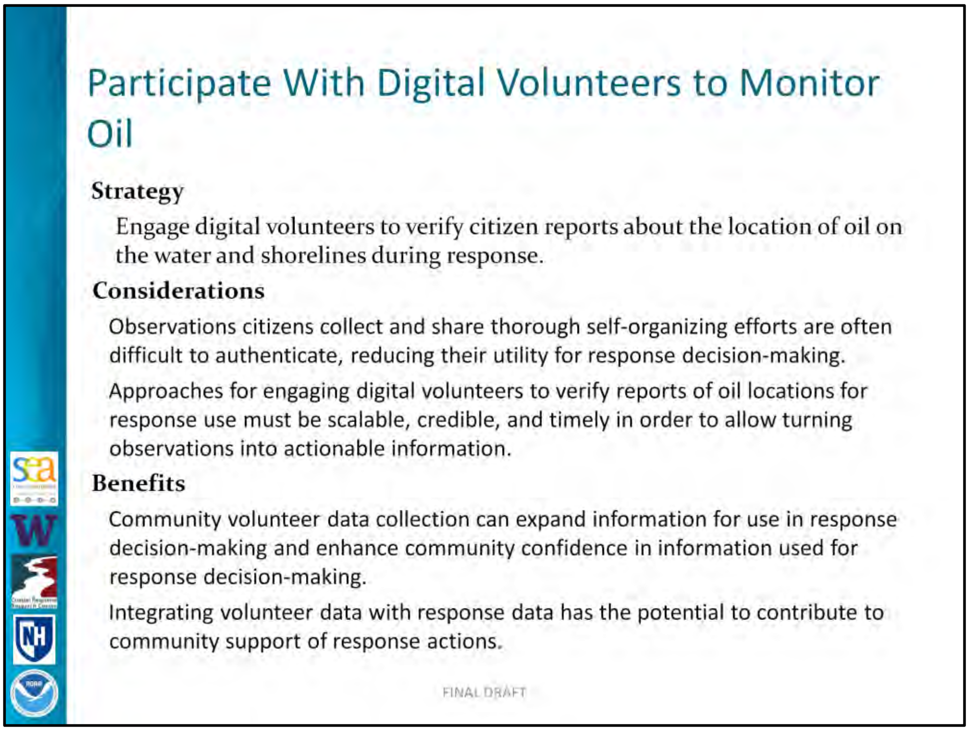
Existing social media search tools could be adapted for spill response application.

- Researchers with experience and knowledge to do real-time monitoring and analysis would be a great advantage during a response.
- It should be possible to build social media tools that would allow responders to undertake monitoring and analysis themselves during a response.

Scientific

Methods for conducting mental-model based surveys and social medial network analysis are being documented in the scientific literature.

- Published methods can provide the guidelines for collecting and analyzing data during spills in the near future.
- Tools and methods in this area of study are rapidly evolving, methods deployed during spills will need continual evolution to stay abreast of the scientific practice.
- Regardless of the methods deployed, proper interpretation and application of the resulting data needs to maintain scientific transparency and integrity.
- It is important that inferences from data analysis during spills be fully supported in the source data.



Problem Statement

Data concerning the location and quantity of oil on (in) the water and along shorelines are key elements of oil spill fate and transport modeling, decisions on deploying spill response equipment, and shoreline cleanup management.

- The public and media are deeply interested in oil location information and it's reporting.
- Connecting citizen observations with those of trained observing might increase public understanding and confidence in the data used for response decision-making.
- Crowdsourced location information, sometimes known as volunteer geographic information, can serve as a mechanism for building a common, validated set of oil location information that integrates citizen observations with those of trained observers.
- Engaging digital volunteers in collecting and validating geographic information provides an opportunity for overcoming these barriers to both expand information sources and build public trust.
- At present there are no consistent, viable mechanisms available during spills for validating volunteer citizen reports and integrating them with operational response information sources.

Approach to Implementing

This practice should be developed during the "planning phase" of the preparedness cycle.

- The “exercise” phase of the preparedness cycle can provide opportunities to test and evaluate the practice.
- There is no single technology or set of procedures for engaging citizens in collecting and verifying response data
- It is important when developing the approach for implementing this practice to consider both the social and technological characteristics of crowd work.
- The approach for engaging digital volunteers to verify reports of oil locations for use by the ICS must be scalable, credible, and timely in order to allow turning observations into actionable information.
- As part of validation, it might be possible to enable the “crowd” to detect and correct misinformation being reported by others.

Obstacles to Implementing

Policy and Procedures

There are two primary policy issues for this practice.

- The first relates to volunteers and the second relates to integrating volunteer data with operational response data.
- Policies being developed for the inclusion of volunteers will need to be adapted to consider the roles of digital volunteers and determine if there are any safety concerns associated with their activities.
- Data validation procedures will need to be developed for integrating volunteers’ data with operational data.
- Procedures to ensure the privacy of volunteer data providers and to prevent malicious attempts to misrepresent information will also be necessary. Technical
- Publishing timely, authenticated maps will require that the ICS be staffed to levels sufficient to process and publish these data quickly enough to keep official maps relevant.
- It will be necessary to develop an approach for determining the identity of those submitting data. Allowing anonymous reporting can promote a range of bad behavior including false data submission, trolling, and spamming.

Scientific

The key scientific question is whether the reliability, precision, and accuracy of citizen provided data can improve response decision-making.

- Testing and evaluation during spills will be necessary to validate the practice. It will be important to evaluate whether including volunteer observations affects public perception of the response.
- A user interface using Web pages or smartphone applications will be necessary to ensure standardized reporting of observations.
- It will also be necessary to compare aggregate volunteer observations with those from trained observers.

Take into account political perspectives

- Large or politicized oil spills involving dispersant use, benefit from collaborative decision making that moves beyond message mapping (Tierney, 2009)
- Collaborative decision-making involves both horizontal and vertical integration
- Critical strategic decisions can fall to elected or appointed leaders who are outside the ICS.
- ICS has its limitations when events become politicized(Buck et al., 2006).

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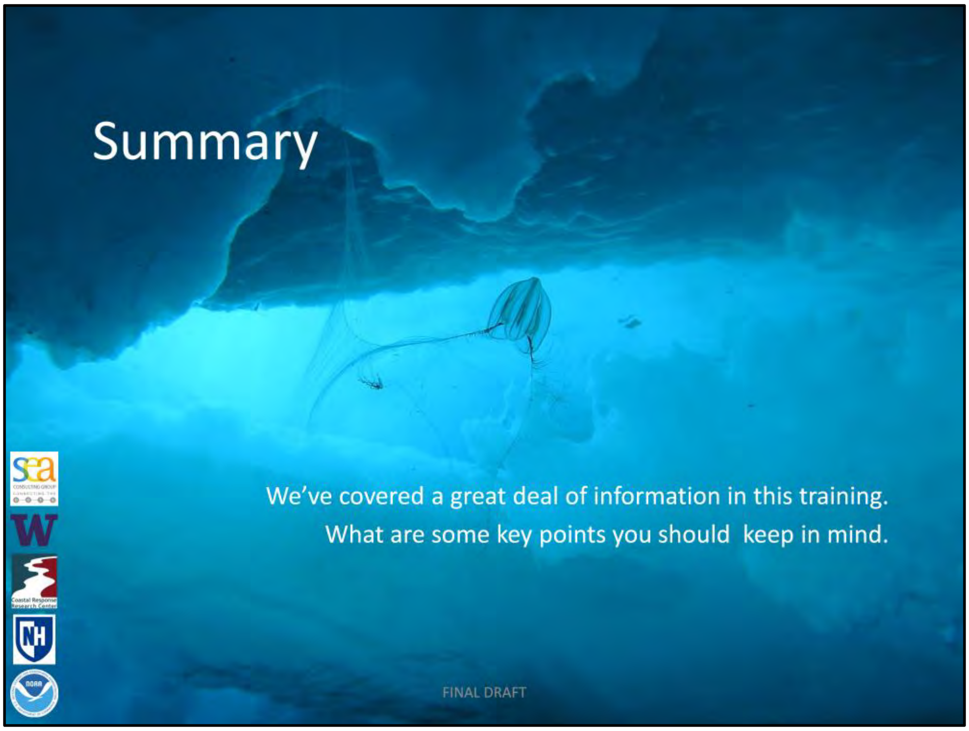
Summary
We've covered a great deal of information in this training.
What are some key points you should keep in mind.
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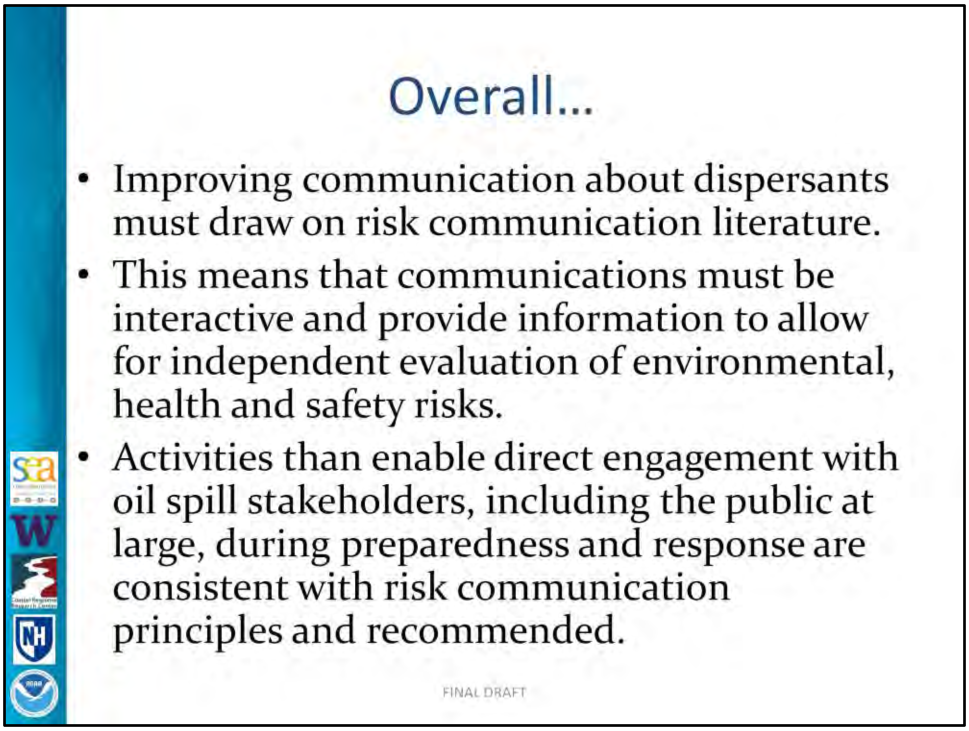

Two risk communication research projects have been conducted specifically on dispersants to inform these summary points. One analyzed decision maker information needs (1990s) and the current project focuses primarily on the public at large. The mental models approach was used in both projects and two team members were involved in both projects. The mental models approach reflects both the natural and engineering sciences of how risks are created and controlled, and the social, behavioral and decision sciences of how people comprehend and respond to such risks

Specifically …

- Response community must listen for stakeholder risk perceptions to inform risk communications.
- Risk communication messages and other information should be evaluated by the intended users of the information before distribution, and the effect of the information after use should also be evaluated.

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Key Considerations

- Stakeholders have knowledge gaps, as well as misconceptions about fate and transport of oil;
- The ways in which people access and process scientific information are changing rapidly;
- Community engagement and communication practices for dispersants need to occur across multiple time scales;
- Preparedness activities (training, changes in plans, and exercises) need to occur before they can be successfully implemented during response.

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Social Media

- Social media is interactional media. Responders should **engage - if they can do it well.**
- **Influencers can and should be identified.**
  - The social media crowd after a crisis event is a global one, but DWH research suggests that local voices are extremely important in shaping the conversation.
  - **NGOs (NWF and IBBRC) were significant influencers**
- Integrate online volunteers in a productive way into response; this builds community resilience. People want to help.
- Social media users communicate about scientific complexity.
  - Sophisticated sensemaking behavior may have design implications for future communication strategies around oil spills and oil dispersants
- Dispersant-related tweets were much more likely to refer to human health impacts than tweets that did not mention dispersants

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See section 6

Analysis of Deepwater Horizon Twitter usage was conducted and specifically looked at tweets about dispersants.

About uncertainty and complexity

- Stakeholders value scientific information.
- When possible, use simple graphics that have been empirically tested to communicate probability and uncertainty.
- Be prepared for value conflicts and differences in risk preferences when communicating uncertainties.
- Consider how people simplify information when designing communications (and evaluate!)

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Also …

- Scenarios based on worst case discharges leaves responders less well prepared for anticipating causes, effects, and anticipate social conflict
  - Fuller incorporation of a broad ranges of stakeholders in scenario-based preparedness planning can help remedy the shortcomings
- Research shows a pattern of knowledge gaps an opening for developing a broader understanding of the tradeoffs made in oil spill response decisions.
  - Develop interactive web-based oil spill response simulations that help users explore tradeoffs in oil spill response decisions.

See section __


Key sources
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Key sources:

Bostrom, A., S. Joslyn, R. Pavia, A.H. Walker, K. Starbird, T.M. Leschine. 2014. White Paper: Methods for communicating the complexity and uncertainty of oil spill response actions and the tradeoffs associated with various response options. Coastal Response Research Center (CRRC). University of New Hampshire. Durham, New Hampshire, January 2014.

Bostrom, A., A.H. Walker, T. Scott, R. Pavia, T.M. Leschine, K. Starbird. 2014. White Paper: Stakeholder and public mental models of and economic, environmental and public health concerns about dispersant and oil spill processes. Coastal Response Research Center (CRRC). University of New Hampshire. Durham, New Hampshire, January 2014.

Leschine, T. M., A.H. Walker, R. Pavia, A. Bostrom, K. Starbird. 2014. White Paper: What-If Scenario Modeling to Support Oil Spill Preparedness and Response Decision Making. Coastal Response Research Center (CRRC). University of New Hampshire. Durham, New Hampshire, January 2014.

Starbird, K. D. Dailey, A.H. Walker, T.M. Leschine, R. Pavia, and A. Bostrom. 2014. White Paper: Sense making through Twitter during the 2010 Gulf Oil Spill. Coastal Response Research Center (CRRC), University of New Hampshire. Durham, New Hampshire, January 2014.

Walker, A.H., R. Pavia, A. Bostrom, T.M. Leschine, and K. Starbird. 2014. White Paper: Engaging the Stakeholder Community in Oil Spill Preparedness and Response. Coastal Response Research Center (CRRC). University of New Hampshire. Durham, New Hampshire, January 2014.

References Cited:

- AccountAbility. 2011. AA1000 Stakeholder Engagement Standard: Final exposure draft. 52 pages. Available online from www.accountability.org/standards/aa1000ses/index.html.
- Alexander, R.J. 2013. Shaping and Misrepresenting Public Perceptions of Ecological Catastrophes: The BP Gulf Oil Spill. *CADAAD Journal,* 7(1):1-18. http://cadaad.net/2013_volume_7_issue_1/95-90.
- Buck, Dick A.; Trainor, Joseph E.; and Aguirre, Benigno E. (2006) "A Critical Evaluation of the Incident Command System and NIMS," Journal of Homeland Security and Emergency Management: Vol. 3 : Iss. 3, Article 1. DOI: 10.2202/1547-7355.1252
- Cheong, S. 2012. Community adaptation to the *Hebei-Spirit* oil spill. *Ecology and Society*, 17(3):26. Retrieved from: http://dx.doi.org/10.5751/ES-05079-170326.
- Morgan, M.G., B. Fischhoff, A. Bostrom and C.J. Atman. 2002. Risk Communication: A Mental Models Approach. Cambridge University Press.
- National Research Council, 1989. Improving Risk Communication. Washington DC: National Academies Press.
- Ropeik, D. "Risk Communication, More Than Facts and Feelings" PDF, IAEA Bulletin, vol. 50, no. 1, Sept. 2008, vol. 50, no. 1, pp 58-60.

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References cont'd

- Tierney, K. 2009. Disaster response: research findings and their implications for resilience measures. Retrieved from: http://www.resilientus.org/library/Final_Tierney2_dpsbjs_1238179110.pdf
- University of Washington, Program on the Environment Keystone Team. 2011. Snohomish County Oil Spill Preparedness and Response. Prepared for the Sonhomish County Marine Resources Committee. Available online from http://www.snocomrc.org/uploads/Oil%20Spill%20Project/Oil%20Spill%20Final%20Report_compressed_3-15-11.pdf
- Walker, A.H. and A. Bostrom. 2014 (in press). Stakeholder Engagement and Survey Tools for Oil Spill Response Options. In: *Proceedings 2014 International Oil Spill Conference* (IOSC). Will be available online from: www.ioscproceedings.com.
- Walker, A.H., G. Ott, and D. Scholz. 2014 (in press). Local Level Stakeholder Coordination and Communications to Support Oil Spill Preparedness and Response. In: *Proceedings 2014 International Oil Spill Conference* (IOSC). Will be available online from: www.ioscproceedings.com.
- Walker, A.H., D.K. Scholz, J.H. Kucklick, and R.G. Pond. 1999. Government and Industry Partnering: Nationwide Progress in Pre-authorization Agreements since 1994. In: *Proceedings 1999 International Oil Spill Conference* (IOSC), Paper ID# 271. 6 pages. Available online from: www.ioscproceedings.com.

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